

**State of California
Natural Resources Agency
Department of Fish and Wildlife
Wildlife Branch**

**Light-footed Ridgway's (Clapper) Rail Management, Study, and
Zoological Breeding in California
2016 Season**

By

Richard Zembal, Susan M. Hoffman, Charles Gailband, and John Konecny

Final Report

To

State of California
Department of Fish and Wildlife
South Coast Region
3883 Ruffin Road
San Diego, CA 92123

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Clapper Rail Recovery Fund
Huntington Beach Wetlands Conservancy
24821 Buckboard Lane
Laguna Hills, CA 92653

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ABSTRACT

The thirty-seventh annual census of the Light-footed Ridgway's (formerly Clapper) Rail, *Rallus obsoletus levipes*, in California was conducted from 22 February to 25 June 2016. 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. For the fifth year in a row the California population of the Light-footed Ridgway's Rail exceeded 500 breeding pairs and for the second time in 40 years exceeded 600 pairs. A total of 656 pairs exhibited breeding behavior in 18 marshes in 2016. This is the highest count on record, representing an increase of 23 pairs from the breeding population detected in 2015, and 47.9% larger than the long-standing high count in 2007. The tally at Upper Newport Bay was the third highest recorded there at 202 pairs. The Newport subpopulation was once again the largest in California but with 13.7% fewer rails exhibiting breeding behavior than in 2015. Nesting habitat in Upper Newport Bay has been greatly degraded over the past three years as evidenced by fruitless nest searches; the habitat in the lower bay has been badly degraded. The calling in Tijuana Marsh NWR indicated breeding readiness of 127 pairs, a 29.6% increase over 2015 but subsequent anoxic conditions caused by closure of the river mouth may have greatly affected survival and reproductive activity. The Newport subpopulation comprised 30.8% of the state population in 2016 and the subpopulation in the Tijuana Marsh National Wildlife Refuge (NWR) comprised 19.4%, together accounting for 50.2% of the breeding population of this rail in California, as compared to 52.5% in 2015, 56.2 % in 2014, and 56.4% in 2013.

¹ Zembal, R., S.M. Hoffman, C. Gailband, and J. Konecny. 2016. Light-footed Ridgway's (Clapper) Rail Management, Study, and Zoological Breeding in California, 2016. California Department of Fish and Wildlife, Wildlife Branch, Nongame Wildlife Program Report, 2016-04. Sacramento, CA 44 pp.

Nine of the small subpopulations increased in size from the 2015 totals, by a combined total of 53 breeding pairs in 2016. In response to the development of cordgrass cover that is unsurpassed in the range of this rail, the San Elijo Lagoon subpopulation doubled to 60 pairs in 2015 and added at least 10 more pairs in 2016 to become the third largest subpopulation in California. The Seal Beach NWR subpopulation was down by six to 60 pairs, ranking it the fourth largest in the state. Batiquitos Lagoon was up to a high of 52 breeding pairs, ranking it as the fifth largest subpopulation in 2016. The University of California's Kendall-Frost Reserve nearly maintained its record high with 30 breeding pairs in 2016, a testament to strong management of this small Mission Bay remnant marsh. Nesting activity in Point Mugu was back up to 2014 levels with 16 pairs, after increasing steadily to a record high of 23 pairs in 2013 but dropping to 12 pairs in 2015. Declines totaling 26 pairs were noted in seven marshes including Seal Beach NWR (-8 pairs), Buena Vista Lagoon (-6 pairs), Agua Hedionda Lagoon (-4 pairs), and San Luis Rey River (-3 pairs). Excluding the two largest subpopulations, there were nine subpopulations in double figures, ranging from 16 to 70 pairs and totaling 296 breeding pairs or 45.1% of the state total. The remaining seven small subpopulations ranged from one to nine pairs and totaled 31 breeding pairs, or 4.7% of the total.

The annual increases in the population total of the Light-footed Ridgway's Rail between 2002 and 2007 gave encouragement that restoration and management including breeding in zoological facilities were contributing to the recovery of this endangered bird. The 2008 crash was presumably weather-related and a harbinger of what could be in store if wide weather fluctuations are the future norm. Record high counts of over 500 pairs in 2012 through 2014, and over 600 pairs in 2015 and 2016 is a manifestation of this subspecies' resiliency with consistent management, particularly population augmentation.

Evidence of breeding activity in addition to territorial manifestation by vocalizations was observed in 15 of the 16 breeding territories at Point Mugu. That evidence included: 21 nests, two with eggs, nine with evidence of hatches and 10 were brood nests; evidence of chick-feeding in 15 territories with chicks or chick sign observed in 13 of those and adults displayed chick-defense behavior in three. On the Seal Beach NWR there were 56 clutches of eggs laid on 36 rafts and 22 brood nests were built on 22 rafts. Overall nesting success was 96%. Nest searches at Upper Newport Bay revealed 14 incubation nests including 5 with eggs when discovered; 6 were predated. At the Kendall-Frost Reserve 11 of 21 rafts held nests with only 6 clutches of eggs and no second clutches on 6 rafts but at least 7 clutches off rafts; there were 4 additional brood nests on 4 rafts. In Sweetwater Marsh NWR there were 11 nests, 10 of them on the rafts; four clutches were seen and a total of 8 hatches/broods. Because Tijuana Slough NWR closed to the ocean for two weeks in early April, nest searches were conducted in June to verify activity.

Although artificial nesting platforms consumed many hundreds of field-hours in 2016, they have become increasingly important in the four wetlands where they have been deployed for multiple seasons and are critical for nesting rails in the Seal Beach NWR and Kendall-Frost Reserve. Raft use in the Sweetwater Marsh NWR reached an all-time peak in 2015 and 2016 and the decline in use at Kendall-Frost in 2016, coupled with low November high tide count indicates probable predator issues looming there again in spite of ongoing management. In recognition that the

importance of raft availability will increase as ocean levels continue to rise, 15 new rafts were deployed in Point Mugu and 12 rafts were built and placed in Upper Newport Bay in 2016. Rafts are essential as escape cover during extreme high tides; the 10 rails counted in the Kendall-Frost Reserve on 15 November, for example were all sequestered on rafts.

Two of five captive pairs laid viable eggs in 2016 and eight eggs were taken from wild nests. As a result, 11 rails were released to the wild: 6 into South San Diego Bay; 5 with a satellite tag; and 5 into Buena Vista Lagoon, each with a radio transmitter. This brings the total number of rails released to the wild since 2001 to 453. Prior to release to the wild each of these rails went from Sea World into acclimation pens on the Sweetwater Marsh NWR where they spent 4 – 6 weeks under conditions that more closely match those in the wild and being carefully evaluated to determine their readiness for release to the wild. Juveniles occupied the acclimation pens from 27 May to 5 October and were cared for and evaluated at least twice daily by one to three observers.

Ten of the 11 rails released to the wild in 2016 were well-tracked with either radio telemetry or satellite tags. Hundreds of field-hours were dedicated to the monitoring of the released rails in an effort to determine their site fidelity and fates. The rails released into Buena Vista Lagoon explored up to approximately 0.5 km from the release site and survived with radios attached for up to 38 days. Signals were lost on two rails while three continued to transmit but eventually these three rails also either slipped out of their harnesses or were depredated. All three of these radios continued to transmit and two were retrieved but the site evidence made it unclear whether either rail had been predated. The five rails released with satellite tags in south San Diego Bay on 27 September explored the south bay in five different directions. The maximum move by any was of a rail that expired 4.2 km from the release site. This bird was photographed alive on 6 October when rescued from a boat storage facility on Coronado Cays but found dead and decaying on 9 October. Signals were lost on two others of the tagged rails, one after 44 days and the other, a few days later. Because these satellite units require solar recharging over 48 hours and based upon signal weakening and precision loss over time, the lost signals could indicate dead batteries and not dead rails. Two of the tagged rails were still active within a km or so of the release site on 22 November.

Each of the rails bred in Zoological Facilities and released to the wild was banded; the annual code for 2016 was a gold anodized band on the left leg, Federal band on the right. There was one successful trapping session for adults in Upper Newport Bay in 2016.

INTRODUCTION

The Light-footed Clapper Rail (*Rallus longirostris levipes*) is a state- and federally- listed endangered species and state fully protected species that is resident in coastal wetlands in southern California and northern Baja, California, Mexico. This rail along with both of the other large rails of the western U.S. has been reclassified taxonomically and renamed by the American Ornithologist Union and ascribed to the Ridgway's Rail, *Rallus obsoletus* (Chesser et al. 2014). The common name for our southern California subspecies soon should be legally adopted by the wildlife agencies in recognition of this nomenclatural change. The Light-footed Clapper Rail will then be called the Light-footed Ridgway's Rail, *R. obsoletus levipes* (hereafter LFRR).

Loss and degradation of habitat threaten the continued existence of this bird, although recent management efforts are reversing those trends. 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. Since then, there were annual increases until the record high in 2007, when 443 breeding pairs were detected in 19 marshes. There was a population crash in 2008 followed by recovery of 37% in 2009 to 320 breeding pairs, and annual increases since then through 2015 when a new high total of 633 pairs was reached.

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 the small subpopulations and in supporting the expansion of many of them, particularly because of the release of captive bred rails. However, the benefits of the associated habitat restoration and management 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). Restoring and maintaining

the diversity and vital productivity of the coastal wetlands, while achieving the recovery of the LFRR, may only be possible in an environment that includes coastal southern California's complete wildlife heritage, fostered by a caring public who support the management necessary to maintain the interconnectedness and viability of the system.

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 rail may be quite marginal. All but a few of the current subpopulations of LFRR depend upon a marginal habitat base and are too small to be expected to maintain themselves without management, particularly population augmentation. Population monitoring is essential in understanding the effects of our management efforts and in stewardship of this critically endangered bird toward recovery. Reported herein are the results of the 2016 statewide survey and management of the LFRR.

METHODS

Population Monitoring

The thirty-seventh consecutive annual census of LFRR in California was conducted from February 22 through June 25, 2016. 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 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 four wetlands wherein such data were gathered in 2016 (Mugu, Seal Beach, Kendall-Frost, and Sweetwater) and a pre-nesting high tide count was accomplished on November 25, 2015 on the Seal Beach NWR; a post-nesting high tide count will be scheduled for fall/early winter 2016. This NWR is the only wetland inhabited by LFRRs that is currently inundated enough during a 6.7 ft. tide or higher to get a relatively complete visual survey.

In Upper Newport Bay and Tijuana Marsh, mapping spontaneous calls was the prevalent technique. In marshes with fewer 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 (the co-authors), but primarily the principal investigator. Additional observers participated primarily in three of the year 2016 counts, those at Seal Beach NWR, Tijuana Slough NWR, and Kendall-Frost Reserve.

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 the observer's hearing ability and experience with the calls, the stage of breeding of

individual pairs, rail density, and weather conditions (Zembal and Massey 1987). Many surveys attempted on stormy, windy days 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 from 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 (Zembal 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 Ridgway's Rails (*Rallus obsoletus yumanensis*) strongly suggests that this closely-related species can become conditioned to the tape if it is used excessively (B. Eddleman, pers. comm., July 1993). 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. When used only once per year at a given marsh and with minimal repetition, playbacks have yielded important results. Unmated LFRR, 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 "clappings" 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 2016 call counts were conducted on 40 dates and totaled approximately 414 field-hours, mostly from February 22 – June 25, 2016.

Management and Monitoring of Nesting Sites

Nest searching and monitoring were conducted at Upper Newport Bay, Mugu Lagoon, Seal Beach NWR, Kendall-Frost Reserve, and Sweetwater Marsh NWR. Observations were begun in March and continued into August 2016. The activities were conducted as they have been in the past (Massey and Zembal 1980, Massey et al. 1984). Visitation and disturbance were minimized. Nest searches at 3 of the 5 wetlands were focused mostly on the artificial nesting rafts deployed in them for the rails. Three other wetlands used to have rafts deployed, maintained, and monitored annually in each but the efforts were abandoned because of low use. Point Mugu was one such marsh; 25 floatable rafts were deployed there in 1988. However, there was never any evidence that

the rails used the rafts until recently. Although many marshes occupied by rails suffer from a poor supply of good nesting sites, artificial nesting rafts have been nested upon in only 4 of 7 marshes where they have been tried. Those four and the number of rafts in each during the 2016 season were Point Mugu with 25 rafts, the Seal Beach NWR with 89 rafts, Kendall-Frost Reserve with 21 rafts, and Sweetwater Marsh NWR with 18 rafts. The rafts were refurbished in February, March, and as needed and in Seal Beach visited approximately every 3 - 4 weeks during the breeding season into July. The rafts at Point Mugu, Kendall-Frost, and Sweetwater Marsh NWR were visited 3 - 6 times each. Raft maintenance and monitoring involved a minimum of 426 field-hours.

The most recent raft design and cover were first deployed in 2008 and 2009. The raft looks like a small palette measuring 33 in X 24 in. The top is made of four 1 in X 6 in pine boards and the sides and two bottom slats are of 1 in X 3 in boards fastened perpendicular to the top and forming 3 compartments on the underside of the raft that hold Styrofoam for flotation. The raft is anchored in the marsh by $\frac{3}{4}$ in PVC fastened to the middle of the long sides and extending 62 in from each side to a cross bar of PVC that is anchored with two 70 in long pieces of $\frac{3}{8}$ in rebar driven at an angle into the mud. The covers were woven willows and reeds or constructed of a PVC and wire cage covered in quack grass or palm fronds. Some of the covers on the Seal Beach NWR are fiberglass and the rafts there still employ upright dowels. The cover was fastened with wood screws and plastic ties. This new design eliminates the upright dowels, potential raptor perching thereon, and renders the rafts less conspicuous in the marsh.

Nest searches at Upper Newport Bay totaled 6 field-days in April - June by two to eight observers resulted in 78 field-hours of nest searching and observation. Twelve nesting rafts were built and installed on Shellmaker (2 rafts) and Upper Islands (10 rafts) and checked four times through the season over 145 field-hours. There were 6 dates at Point Mugu by 1 - 2 participants and 78 field-hours. On the Seal Beach NWR 1 - 2 observers accumulated 178 field-hours over 21 dates, March 29 - August 15. There were 122 field-hours spent at the Kendall-Frost Reserve by 2 - 28 observers over 7 dates, 5 March - 15 July; 19 of the rafts needing repairs were refurbished for winter use on 9 October 2016. Lastly, 39 field-hours were expended by 1 - 5 observers over 5 dates at Sweetwater Marsh NWR, 23 April - 24 August 2016.

The nesting and other activities of the rails held in zoological facilities at the Living Coast Discovery Center (LCDC), Sea World, and the Safari Park were monitored daily by one to seven observers totaling many hundreds of hours. Observations and care of young rails held in enclosures on the Sweetwater Marsh NWR in preparation for release to the wild by mostly one or three observers from 27 May to 5 October, over 132 days when rails were present for three or more hours twice or more daily.

Breeding in Zoological Facilities

A wetland aviary was developed at the Chula Vista Nature Center (currently, the Living Coast Discovery Center or LCDC), adjacent to the Sweetwater Marsh NWR with acclimation enclosures on the Sweetwater Marsh to house LFRRs and develop a protocol for breeding in zoological facilities (Bayfront Conservancy Trust 1995). The first pair of rails was taken into the facility in

December 1998. The second pair was taken in November 2000 and young LFRRs were fledged in Zoological facilities for the first time in 2001. Any eggs produced by these captive rails were to be used in the egg translocation efforts or hatched and reared in zoological facilities, preferably by the parents and released into Point Mugu. However, because 28 of 60 captive-reared and released rails had been from one breeding pair, 2001 – 2003, care had to be taken not to genetically swamp the Mugu rails. Consequently, there were 9 other marshes added to the sites where zoologically bred young could be released in 2004 and 2005 (Zembal et al. 2005), and eventually it was agreed that all of the smaller subpopulations except those with insurmountable issues (like Carpinteria Marsh with its red foxes) were candidates for releases.

There were nine potential breeding pairs in zoological facilities in 2011 and 2012; two pairs at Sea World, four pairs at the Safari Park, two at LCDC, and one in a proving enclosure on the Sweetwater Marsh NWR. There were seven pairs set up for breeding in 2013, down to six pairs in 2014 and early 2015 and five pairs in 2016 while the program continued to work toward official status. Sea World went into the 2016 breeding season with #586/595 and 608/637; the San Diego Zoo Safari Park held #605/385, 612/633, and 396/638; the LCDC housed only LFCR #362. The male 586 was hatched at Sea World on 11 May 2014 of wild lineage and was mated to 595, also of wild lineage from a Newport egg, hatched at Sea World on 30 May 2014. The male #608 was hatched at Sea World on 27 June 2014 from a Newport egg and mated to #398 (deceased), then to female #637, hatched at Sea World from a Newport egg on 31 May 2015. The male #605 was hatched at Sea World on June 24, 2014 from 359/218 lineage and mated to female #385, hand-reared from a Newport egg that hatched at Sea World 19 June 2010. The male #612 was hatched at Sea World from a Newport egg on June 12, 2014 and mated to female 633, a 2015 hatch. The male 396 was of 219/217 lineage hatched at Sea World on June 22, 2010 and mated to female 638, hatched from a Newport egg on 31 May 2015 at Sea World. The male #362 was hatched on 19 June 2009 at Sea World from a Newport egg.

We attempt to mix the genetic stock of the breeders by adding new rails hatched from Newport eggs collected annually when possible. Sometimes adults are trapped from Newport and added to the rails housed in zoological facilities.

All hand-reared chicks in the program are hand-reared at Sea World. They are transferred from the hatcher to a brooder box in which the temperature is maintained at 88 – 90° F for the first week, then gradually decreased to ambient. A recording of outdoor marsh sounds was played in the background. Chicks are fed with a puppet to avoid imprinting. Food items include small cut up pieces of lettuce, cricket abdomens, graduating to whole live crickets as the chicks grow, guppies, herring filets, pieces of capelin without bones or scales, krill with tails and heads removed, live meal worms with heads removed, live wax worms with heads removed, live black worms, pinkies, live red worms, mussels, and “rail mix”. Rail mix was composed of Mazuri waterfowl starter, soaked dry dog food, and hard-boiled eggs. Food items were sprinkled with vitamins and fed hourly. As the chicks grew, the commercial diet was phased out and replaced with live foods plus thawed frozen fish and krill. At 8 – 10 days the chicks were moved from the brooder boxes to the indoor runs. The runs were lined with dirt and planted with plenty of cover. At one month the young rails were moved to the “conditioning” pens on the Sweetwater Marsh NWR to prepare for

release into the wild. The acclimation enclosures are designed to closely replicate the coastal salt marsh environment of rails and isolated to reduce exposure to human activities that could affect rail behavior. The acclimation process provides the opportunity to evaluate young birds' behaviors relative to the presence of predators and for young rails to safely forage and function in a natural salt marsh environment. The ideal duration for birds in the proving system has been shown to be four to six weeks. At least four weeks is needed to make the transition from parent-assisted living to fully independent; however, six weeks may be needed given that there is individual variability of behavior and timing of behavior development. The Sea World diet and protocol was appended to the 2005 annual clapper rail report (Zemba et al. 2005); there are minor refinements made to the protocol annually.

In 2016, 1 - 2 observers monitored the breeding rails daily at the Living Coast Discovery Center (had only a single rail in 2016 but a pair was transferred for 2017 breeding season), Sea World, and Safari Park. Thousands of visitors were given the opportunity to view the rail at the Discovery Center, hear about their plight, and the importance of their ecosystem. The rails at Sea World were incorporated into the educational program curriculum there in 2007 and approximately 15,000 students observed and studied them; the rails at the Safari Park and Sea World are currently isolated from visitors but the story of the rail's plight and importance of its' ecosystem are related through interpretive displays and presentations. Sea Rescue, a national television series produced in cooperation with Sea World featured the rail story in 2015.

Banding and Tracking

Each of the 11 Clapper Rails held in zoological facilities and released to the wild in 2016 was banded just prior to release (see Zemba and Massey 1983 for a full discussion of trapping and banding techniques). The annual code for 2016 was an anodized gold metal band on the left leg and the USGS band on the right leg. Five rails were released into the Buena Vista Lagoon Ecological Reserve, three on July 6 and two more on October 5. Each of the rails released into Buena Vista Lagoon was also outfitted with a telemetry radio secured with a Teflon ribbon backpack harness. The radio transmitters are Model R1-2C from Holohil Systems Ltd., weighing 7.5 gm with an average battery life of one year. The 0.25" harness teflon was from Bally Ribbon Mills and fastened above and below the wings through slits in a small neoprene pad on the upper belly. The Teflon ends were tied, burnt, and/or glued to keep the ends from fraying. The July rails were banded 1065-3996, 0945-54562, and 0945-54563 with radio frequencies of 150.320, 150.301, and 150.276 Mhz, respectively; the rails released in October were banded 0945-54570 and 0945-54571 with radio frequencies of 150.241 and 150.220 Mhz, respectively. The telemetry receivers were R-1000s, with RA-150, 3 element Yagi Antennae, and RA-9 Mag Mount Antennae from Communication Specialists, Inc. Six rails were released into the South San Diego Bay NWR on September 27, banded 0945-54564 – 0945-54569; all were harnessed as above but with satellite tags except for 0945-54567. The satellite tags were 9.5 gm PTT-100 solar transmitters from Microwave Telemetry Inc., monitored through the Argos Satellite System via CLS America. Hundreds of hours were spent in these wetlands seeking observations of rails, particularly by the Buena Vista Audubon partners. Two trapping sessions were held in Upper Newport Bay involving 5 – 9 participants with 12 traps.

Study Areas

Descriptions of all the marshes recently occupied by LFRR are available (U.S. Fish and Wildlife Service 1985 and Zembal and Massey 1981). Four of the current principal study areas are at the Naval Air Station Point Mugu (NASPM, also Point Mugu), the Seal Beach NWR, Upper Newport Bay Ecological Reserve, and Tijuana Slough NWR. In addition, rails were released into Buena Vista Lagoon and South San Diego Bay NWR in 2016.

The marsh at Point Mugu is located in southeastern Ventura County on the 1,821 ha (4,500 acre) Naval Base Ventura County (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 LFRR potential habitat base. The marsh is subject to nearly full tidal action in the central and eastern arms with a tidal amplitude of about 9 ft. The tides are dampened by constrictions at Laguna Road and farther west, resulting in an 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 Wildlife (CDFW), 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.

The Buena Vista Lagoon Ecological Reserve is 206 acres of coastal freshwater marsh habitat located between the cities of Oceanside and Carlsbad. There is an abundance of open water with emergent cattails. The cattails have a tendency to invade what has become a scant veneer of halophyte dominated edge. Although minor in acreage the pickleweed and associated plants growing along trails and other edges provide important foraging for the rails inhabiting the lagoon environs. Buena Vista Lagoon was acquired to preserve, protect and maintain coastal wetland habitat and associated wildlife species. The property was designated as an ecological reserve by the Fish and Game Commission in 1968 and is currently managed by the CDFW. The lagoon is also home to the Buena Vista Audubon Society and Nature Center.

San Diego Bay NWR is located in south San Diego Bay and part of the San Diego NWR Complex which includes four distinct refuges, all managed by the USFWS. Completed in the fall of 2011, the South San Diego Bay Wetlands Restoration Project has successfully reintroduced tidal action from San Diego Bay into 220 acres of former solar salt ponds located on the refuge. The project also restored and enhanced an additional 80 acres of sensitive coastal habitats managed by the Port of San Diego at the Chula Vista Wildlife Reserve and along the edge of Emory Cove. It was through a cooperative partnership between Federal, State, and local agencies, as well as several nonprofit organizations, that this vital restoration project was funded and completed. The NWR incorporates the mouth of the Otay River where salt marsh habitat is much more well-developed and formerly supported a small but consistent population of rails.

Tijuana Slough NWR consists of 427 ha (1,056 acres) of open water, tidal salt marsh, beach dune, riparian, and maritime scrub habitats in the City of Imperial Beach in the extreme southwest corner of the U.S. The NWR is part of the 1,024 ha (2,530 acre) Tijuana River National Estuarine Research Reserve (NERR), one of only 26 such NERRs in the country. The fully tidal coastal salt marsh (influenced by a 7 ft tide MLLW) comprises 159 ha (392 ac) of the total area along with 41 ha (101 ac) of tidal creeks and mudflat. Tijuana Slough is the only coastal wetland in the southern California Bight that is not bisected or greatly impacted by a major paved road or the coast railroad.

RESULTS and DISCUSSION

Population Monitoring

A total 656 pairs of LFRR exhibited breeding behavior in 18 marshes in 2016 (Table 1). This is the highest count on record, representing a 23 pair increase over the breeding population detected in 2015 (Zembal et al. 2015), and 47.9% larger than the former high count of 2007 that stood as the high for 31 years until 2012. Upper Newport Bay with 202 pairs was once again the largest subpopulation in California although reduced by 20 – 30 pairs from two consecutive years of record high counts, still with 16% more rails than the long standing former high count of 174 pairs in 2005.

For the sixth time on record there were more than 100 pairs calling in the Tijuana Marsh NWR and this subpopulation was at its second highest level. The 2016 count was a 29.6% increase over 2015 and only 10.6% lower than the record high of 142 pairs in 2007. The Newport subpopulation comprised 30.8% of the state population in 2015 and the subpopulation in the Tijuana Marsh comprised 19.4%, together accounting for 50.2% of the breeding population of this rail in California. In addition, nine subpopulations ranged in size from 16 to 70 pairs, totaling 296 breeding pairs or 45.1% of the state total. These nine included: Mugu Lagoon; Seal Beach NWR; Huntington Beach Wetlands; Batiquitos Lagoon; San Elijo Lagoon; San Dieguito Lagoon; Los Penasquitos Lagoon; Kendall-Frost Reserve; and the San Diego River. The smaller 7 subpopulations ranged from 1 to 9 pairs and totaled 31 breeding pairs (4.7% of the state total).

Table 1. Census of the Light-footed Ridgway's Rail in California, 1980-2016.

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 Ridgway's Rail in California, 1980-2016.
(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

Table 1. Census of the Light-footed Ridgway's Rail in California, 1980 - 2016.
(continued) Part III: 2000 - 2010.

Location	Number of Pairs Detected In:										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Santa Barbara County											
Goleta Slough	-	0	0	0	-	-	-	-	0	0	0
Carpinteria Marsh	1#	1#	2	0#	0#	0	0	0	0	0	0
Ventura County											
Ventura River Mouth	-	-	0	0	-	-	-	-	0	-	-
Santa Clara River Mouth	-	-	0	0	-	-	-	-	0	-	-
Mugu Lagoon	7#	7#	10#	14#	19#	14#	17#	15#	5#	9#	12#
Los Angeles County											
Whittier Narrows Marsh	-	-	0	-	-	-	-	0	-	0	0
Orange County											
Seal Beach NWR	10#	11#	24#	23#	16#	15#	21#	24#	17#	19#	25
Bolsa Chica	0	0	0*	0	0	0	*	*	*	*	1
Huntington Beach Wetlands	-	0	0	0	0	0	4#	4	1#	5#	6#
Upper Newport Bay	150#	124#	129#	144#	165#	174#	158#	165#	88#	148#	131#
San Joaquin Reserve	0	0	0	0	-	0	0	0	*	0	#
Carlson Rd Marsh	0#	0	0	0	-	0	0	0	0	0	0
San Diego County											
San Mateo Creek Mouth	0	0	0	0	0	-	-	-	0	-	-
Las Flores Marsh	0	0	0	0	0	-	-	-	0	-	-
Cocklebur Canyon Mouth	0	0	0	0	0	-	-	-	0	-	-
Santa Margarita Lagoon	0	0	1	2	1	2	1	1	1#	-	-
San Luis Rey River Mouth	0	0	0	0	0	0	0	0	0	0	2#
Guajome Lake Marsh	0	-	-	0	-	-	0	0	0	-	-
Buena Vista Lagoon	5#	3#	6#	5#	5#	6#	8#	8#	9#	9#	6
Agua Hedionda Lagoon	2	2	1	4	5	4#	7#	4	7	6	2#
Batiquitos Lagoon	2#	3#	3#	5	11	16#	19#	22	22	26#	36#
San Elijo Lagoon	1#	1#	2	7#	7#	6#	15#	12#	5#	8	15#
San Dieguito Lagoon	0#	0#	0	0#	6	12#	31#	15#	21#	12#	28#
Los Penasquitos Lagoon	1	1	2	1#	2#	2	7#	12#	2#	4#	9#
Kendall-Frost Reserve	4	4	5#	6#	14	14	5#	4#	2#	7	10#
San Diego River	3#	4	6	6#	8#	5	4	6	4#	3	7#
Paradise Creek Marsh	0	0	0	0	0	0	0	0	0	-	0
Sweetwater Marsh	2	3#	3#	1#	3#	1	4#	4#	3	5	6#
E Street Marsh	2	0	1	1	0	0	2	1	0	0	2
F Street Marsh	0	0	0	0	0	0	0	0	0	0	0
J Street Marsh	1	0	0	1	0	0	0	0	0	0	0
Otay River Mouth	1	1	1	0	0	1	2	1	0	1	1
South Bay Marine Reserve	0	0	0	0	0	0	1	2	0	1	1
Dairymart Ponds	-	-	-	2	1	1	0	1	-	0	0
Tijuana Marsh NWR	61#	52#	78#	64#	87	87#	102#	142#	47#	57#	76#
Total: pairs	253	217	274	286	350	360	408	443	234	320	376
marshes	16	14	16	16	15	16	18	19	15	16	19

Table 1. Census of the Light-footed Ridgway's Rail in California, 1980 - 2016.
(continued) Part IV: 2011 - 2016.

Location	Number of Pairs Detected In:						
	2011	2012	2013	2014	2015	2016	
Santa Barbara County							
Goleta Slough	-	0	0	0	0	0	
Carpinteria Marsh	0	0	0	0	0	0	
Ventura County							
Ventura River Mouth	-	0	0	0	0	0	
Santa Clara River Mouth	-	0	0	0	0	0	
Mugu Lagoon	16#	22#	23	16	12	16	
Los Angeles County							
Ballona Wetlands	-	-	-	-	-	#	1KB
Orange County							
Seal Beach NWR	34#	42#	40	49	66	60	20K
Bolsa Chica	*	*	1	2	7	9	
Huntington Beach Wetlands	6#	6	7	9	12	12	2K
Upper Newport Bay	137#	165#	191	222	234	202	13K
San Joaquin Reserve	2#	1#	2	1	1	#	1K
Carlson Rd Marsh	0	0	0	0	0	0	
San Diego County							
San Onofre Creek Mouth	0	-	1	-	0	-	
Las Flores Marsh	0	-	0	-	0	-	
Cocklebur Canyon Mouth	0	-	0	-	0	-	
Santa Margarita Lagoon	2	0	0	-	3	-	
San Luis Rey River	3	3	4	5	3	0	
Guajome Lake Marsh	-	-	-	-	0	0	
Buena Vista Lagoon	3#	9#	2	4	10	4	3K
Agua Hedionda Lagoon	7	9	8	6	8	4	
Batiquitos Lagoon	43#	43#	45	40	45	52	
San Elijo Lagoon	15#	31#	20	30	60	70	2K
San Dieguito Lagoon	12#	45#	37	23	15	15	21K
Los Penasquitos Lagoon	12#	11#	12	5	5	21	2KB
Kendall-Frost Reserve	19	16#	8	23	33	30	3K
San Diego River	6#	6#	10	9	11	20	2KB
Paradise Creek Marsh	0	0	0	0	0	-	
Sweetwater Marsh	7#	4#	4	4	5	7	
E Street Marsh	1	1	1	1	1	1	
F Street Marsh	0	0	0	0	0	-	
J Street Marsh	1	1	1	1	1	2	
Otay River Mouth	1	1	1	1	1	0	
South Bay Marine Reserve	1	3	2	2	2	4	
Dairymart Ponds	-	0	-	0	-	-	
Tijuana Marsh NWR	113#	101#	105	75	98	127	20K
Total: pairs	441	520	525	528	633	656	
marshes	21	20	22	21	22	18	

- indicates that no census was taken.

* indicates a fall or winter occurrence.

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

K = Kecking by advertising male; KB = keck-burr by advertising female.

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

Breeding subpopulations in 2016 were male-skewed in 9 marshes and female-skewed in three marshes. Brief female advertising in a marsh where male calling is consistent will usually result in an additional pair. A minimum of 85 unmated males and five females were heard during the call counts including: a female in Ballona; 20 single males at Seal Beach; two males in Huntington Beach Wetlands; 13 males in Upper Newport; one male in San Joaquin Reserve; three males in Buena Vista Lagoon; two males in San Elijo Lagoon; 21 males in San Dieguito River Valley; two females in Los Penasquitos Lagoon; three males in Kendall-Frost; two females in the San Diego River; and 20 males in Tijuana Marsh. The usual condition has been a slight male bias during most years in most marshes. An extreme male skew or a slight female skew could indicate major issues, possibly due to heavy depredation.

Four Principal Study Areas; Largest Subpopulations and/or Habitat Acreage

Upper Newport Bay

The 2016 Newport count was taken on 10 dates in February and March following four years of drought in what was predicted to be a wet year due to El Nino. The rails were responding to neighboring calls in enthusiastic fashion, yielding the third highest count ever tallied in a single wetland. High winter rail survival in recent years may be one positive effect of having no winter storm flows ripping through the marsh. Nest searching has been done after the call counts in order to re-verify the one to one relationship documented in the 1980s between calling and nesting; a pair's duet means there is, or shortly thereafter, will be a nesting attempt in close proximity. However, nest searching in Upper Newport Bay has been very unfruitful in recent years compared to earlier years. Four to six nests were found annually 2009 – 2013 with 60 field-hours or more of effort but few egg nests were discovered before hatching (none in 2013) and many had been depredated by raccoons, *Procyon lotor*. Raccoon sign is abundant throughout the marsh, apparently the result of rehabilitated animals having been released around the bay without permits. In 2014, we found a total of eight nesting sites on Upper Island in about 30 hours of searching over eight dates; 18 pairs of rails had vocalized from this same area earlier in the spring. The cordgrass on Upper Island was stunted; tall enough patches to support a rail nest have been scarce in recent years and in the lower reaches were reduced to barren mudflat in 2016. Even the bulrush cover was mediocre and late sprouting probably due to the lack of rain and runoff. With the threat of raccoon depredation, adequate nest cover in flotsam, wrack, or on high marsh berms, places that have been used in the past as nest cover, were not used in recent years. Below the old salt dike, nesting rails have been forced to the marsh edge. For example, the call count between the 23rd Street Drain and Delhi Channel yielded six pairs of rails calling from thick stands of quail bush, *Atriplex lentiformis*, on the marsh edge and two additional pairs calling from bulrush stands no larger than four square meters each.

The El Nino mass of warm water that pushed tides a foot or more higher than predicted in 2016, drowned lower marsh cordgrass stands that had been in place for many decades below the obstruction of the old salt dike across the bay. Berms that formed by sediments trapped in the once lush cordgrass lay barren during the 2016 rail nesting season. Lands that held rail nests just a few years ago were mudflats in 2016. The old salt levee however, appeared to be enough of a tidal obstruction that the cordgrass above it was far less affected and a nest search there yielded six nests along a 500 m belt, three hatched and three with eggs on 8 June.

With so little nesting activity on Upper Island we searched additional areas and found nest numbers closer to the expectations resulting from earlier call counts in those same areas particularly higher up the bay. Over three dates in May and early June 2015 we found 12 nests just below the old salt dike, four with eggs and four that had been predated. Nesting rails in Upper Newport Bay are being increasingly affected by tidal wash with limited alternatives because of predator abundance, particularly raccoons. Due to limited nesting habitat availability, we deployed 12 nesting rafts in Upper Newport Bay in 2016 but have had no nesting rails on them so far probably because of disturbance by raccoons. It is doubtful that rails have moved and packed in further up the bay to nest; it may be that some lower bay birds are not nesting. Predator management appears essential to the future well-being of the largest subpopulation in California.

Tijuana Marsh

Tijuana Marsh's subpopulation was 87 pairs for two consecutive years prior to the 2006 count of 102 breeding pairs, followed by the record count of 142 pairs in 2007. That 40-pair increase in 2007 was unprecedented in any marsh except Upper Newport Bay; the 95 pair crash in 2008 was totally unprecedented. This subpopulation had not been that small since 1991. LFRR numbers increased annually to more than 100 pairs by 2011 – 2013 and probably stayed near there since. The 2014 call count was shown to be low by comparing nest search results; calling was not great in 2015 either but good enough in 2016 to yield the second highest recorded total. The Tijuana Marsh subpopulation came back from a crash in 1985, suffering the effects of prolonged ocean inlet closure. Today, this is the second most secure and resilient subpopulation in California but still threatened by inlet closure which happened again in 2016. Unlike the earlier disaster, mechanical opening of the ocean inlet happened quickly. The mouth closed a few days before March 30th, went anoxic April 8 – 11th and was reopened. We examined a small piece of Oneonta Slough for rail nesting activity on 21 June and were pleased to discover 20 hatched nests and ample evidence of chick care. Call count results were comparable for that same area.

Observed differences between habitat conditions and nest placement in the Tijuana Marsh and Upper Newport Bay in recent years have been compelling. Most of the nests in Tijuana Marsh were in cordgrass but some also were in rank pickleweed, isolated out in the marsh with little indication of tidal over-wash. There was also little evidence of predation or raccoon presence and encounters with adult rails, adults displaying in defense of chicks, and adults with young of the year were very common in Tijuana Marsh but rare in lower Upper Newport Bay.

Seal Beach

The Seal Beach NWR subpopulation was 20 pairs or slightly more for most of the 2000s until 2011 and 2012 when 34 and 42 pairs bred there, respectively. The 2012 total was the highest since 1996 and the fifth highest count ever. The 2013 total was just two pairs short of the 2012 counts with 40 pairs tallied combining the nesting rafts and call count data. The 2014 total of 49 pairs was the new high count since 1996 and the 66 pairs documented in 2015 ties for the highest count on record, last observed back in 1994. The 60 pairs reported for 2016 is a mix of call count results and raft nesting data. Evening call count results have generally been poor and we have had to rely upon nesting data obtained through monthly visits to the nesting rafts, upon which most of

this subpopulation nests. The 2016 call count was conducted on 9 March by 10 observers and 46 pairs and 20 males were in evidence. The rise in the Seal Beach subpopulation and probably Bolsa Chica as well, has been aided over the years with augmentation from the breeding program; a total of 72 rails have been released there, starting with six in 2002 and a total of 43 over five consecutive years, 2011 – 2015.

With ample habitat available to the rails on the Seal Beach NWR and strong monitoring and management programs in place, a large, resilient breeding population has been expected to develop. Raptor predation is suspected to be limiting rail survival in part because the marsh cover has been short; the cover, particularly of cordgrass has improved over time. Ongoing raptor monitoring has documented very high raptor numbers particularly in winter; seasonal high tide counts of rails and raptors have also continued. A rail kill by a Red-tailed Hawk, *Buteo jamaicensis*, was observed in 2015; the Red-tailed Hawk was nesting on the edge of the NWR in a eucalyptus (*Eucalyptus* sp.) apparently left for such purpose. The most recently observed rail kill by a Northern Harrier (*Circus cyaneus*) in the NWR was in 2013, witnessed by Kirk Gilligan. Many more raptor kills than observed undoubtedly occur.

Seal Beach is one of few marshes currently occupied by LFRR that gets fully inundated during a high tide of about 6.7 ft (MLLW), or higher. Tides of this height occur regularly in the late summer, usually in darkness, and in the fall and 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 predation and vehicle collision. For example, a juvenile rail was found dead on the edge of Pacific Coast Highway (PCH) just off the NWR in September 2015 by Bob Schallman. However, the completeness of inundation also allows fairly dependable surveying of the subpopulation outside of the breeding season. Accordingly, the rails were counted from canoes after the 2015 breeding season, but before the 2016 breeding season and the post-breeding high tide count was done on November 14, 2016. The pre-nesting high tide count of 144 rails in 2015 was the fourth highest on record (Table 2).

Since 120 paired rails and 20 males made it into the breeding season, at least 4 rails hid without being counted during the high tide survey. Potential rail predators were out in abundance during the winter count, hunting the marsh and edges, including Red-tailed Hawks, Northern Harriers, Peregrine Falcon (*Falco peregrinus*), Cooper's hawk (*Accipiter cooperi*), American kestrels (*Falco sparverius*), and Short-eared Owls (*Asio flammeus*). 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. More than half of the rails observed during winter high-tide counts are sequestered on the rafts.

Table 2. High Tide and Call Counts of Light-footed Ridgway's Rails on the Seal Beach National Wildlife Refuge, 1975 - 2016

Date	Tidal Height	Ridgway's Breeding Pair			Notes
		Rails Counted	Members Before	Members 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 Ever
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	

Table 2 (continued). High Tide and Call Counts of Light-footed Ridgway's Rails on the Seal Beach National Wildlife Refuge, 1975 - 2016.

Date	Tidal Height	Ridgway's Rails Counted	Breeding Pair Members		Notes
			Before	After	
23 Nov 1999	7.0	17	30	20	
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	34	
12 Nov 2008	6.9	20	34	38	
01 Dec 2009	6.8	50	38	50	
05 Nov 2010	7.0	51	50	68	
26 Oct 2011	6.9	96	68	84	
14 Nov 2012	7.1	145	84	80	
04 Nov 2013	6.7	121	80	98	
07 Nov 2014	6.8	102	98	132	
25 Nov 2015	6.8	144	132	120	
14 Nov 2016	7.0	119	120	-	

Point Mugu

Since doubling in size between 2001 and 2003, the Point Mugu subpopulation fluctuated between 14 and 19 pairs, from 2003 - 2007. It had been much smaller, 3 - 7 pairs for nearly 20 years until augmentations with captive-bred rails fostered its growth. There was a crash in 2008 back to 5 pairs, but the subpopulation was back up to 9 pairs in 2009, 12 pairs in 2010, a minimum of 16 pairs in 2011, 22 pairs in 2012, an all-time high of 23 pairs in 2013, at least 16 pairs in 2014, 12 pairs in 2015, and back to 16 pairs in 2016. There is an efficient predator management program in place, consistent rail and marsh management, but issues, perhaps mostly raptor predation, prevent this subpopulation from exploding into full occupation of the largest contiguous patch of potential habitat in southern California. There was no activity detected in the eastern arm/central lagoon and only one pair attempted to breed in freshwater marsh vegetation on the west side along Perimeter Road. Raptor depredation appears to have been a long standing issue in Point Mugu. Consequently, the rails depend upon the heavy cover provided by spiny rush but many of the spiny rush stands are greatly degraded by competing vegetation that should be weeded out of these stands. In addition, the freshwater marsh dewateres in dry years and could be kept viable through the entire breeding season with flood irrigation, if possible. A couple of the nesting rafts are being used consistently and two *Spartina* sp. nests were found in the marsh for the first time.

There were regular re-sightings of banded rails at Point Mugu up until 2008 when captive-bred rails were no longer released there. Although some of the captive-bred rails appeared to have stayed in Point Mugu, some definitely left after release. For example, a female banded 1035-

8878, was photographed in Upper Newport Bay on December 12, 2004 by Steve Metz. This female was 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 shattered the old long-distance movement of 13.5 miles recorded for the subspecies *levipes* (Zemba et al. 1983). The distance from Point Mugu to Upper Newport Bay is approximately 90 miles along the coast. The long distance record, 160 miles was traveled by a female banded 1065-39863 (“Amelia”), released at Point Mugu August 25, 2009 and recaptured November 4, 2010 at the Chula Vista Nature Center (now Living Coast Discovery Center). Amelia had returned to the facility where she was hatched and reared.

Sixteen Additional Study Areas, North to South

Carpinteria Marsh

The last known LFRR 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. Occasional reports of LFRR vocalizations have been investigated in 2005 through 2016 but could not be corroborated. This northern wetland is plagued with domestic cats in the marsh and other predators of concern, most notably red fox. At least one red fox den location is still located on the very edge of the marsh. Without consistent predator management, the chances for the reoccurrence of a viable subpopulation in Carpinteria Marsh are poor.

Ballona Wetlands

The historic wetland area is bisected by Ballona Creek and totals about 600 acres; only a small portion of that area is tidally influenced today. A LFRR was photographed in the tidal marsh by Rachel Woodfield in 2008 but further investigation of that incident led to no additional encounters. Vocalizing rails were reported in 2015 and 2016 in the privately-owned freshwater marsh near the corner of Jefferson and PCH. The call was that of an advertising female, perhaps the same individual for two years now. Attempts to observe her for bands were unsuccessful. Because the marsh awaits a big “restoration” project, there will be no additional rails officially moved into Ballona in the immediate future.

Bolsa Chica

Attempts to elicit responses to a tape-playback of a duet were unsuccessful at Bolsa Chica in 2011 and 2012, when only males were detected. However, LFRR breeding behavior was observed in 2010, 2013, 2014, and particularly 2015 and 2016 when record counts of seven and nine pairs, respectively, were documented. The rails adjacent to the boardwalk and along the trail were extremely visible throughout the season. The CDFW Reserve Manager Kelly O’Reilly forwarded multiple photos of the adults and young. The highly visible and often photographed rails of Bolsa Chica in 2015-2016 have been the best known ambassadors for endangered species that have ever emerged in Orange County. There were four pairs of rails near the boardwalk; one to the north in the big patch of marsh around the first trail bend; and four to the south along the dune edge. Seven of nine territories abut the dune along PCH. The habitat is close enough to PCH, to be of major concern for collision hazard with vehicles (see 2015 recovery of a dead rail from PCH at Seal Beach NWR). The near constant noise masks predator cues and the fast

moving vehicles would dispatch any rail that flushed that way. Recent reports of rails vocalizing from south Bolsa Chica below the bluffs in the freshwater reed stands again could not be corroborated.

Huntington Beach Wetlands

One of the highlights of the 2006 survey of LFRR was the discovery of yet another breeding location in the Santa Ana River Marsh, also previously known as Newport Slough and listed in Table 1 under the Huntington Beach Wetlands (HBW). Four pairs were detected there in 2006 and 2007, up to six pairs in 2010 – 2012, a record nine pairs in 2014 (again including one pair in the Brookhurst Marsh), and the new high of 12 pairs in 2015 and 2016. The Santa Ana Marsh is at the southern terminus of the Huntington Beach Wetland Complex, comprised of 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. This cordgrass marsh is extremely well-developed and patches have grown into the main marsh as well. Although the main marsh area is heavily impacted by human residents and their dogs from just across the main channel, one of the detected pairs called from the largest patch of cordgrass in the center of the main marsh.

Restoration of the HBW is continuing and one of the pairs counted in the tally for this marsh complex was actually in the Brookhurst Marsh in 2010. Lena Hyashi reported a pair on April 19, 2010 vocalizing and observed along the larger stand of spiny rush near the dunes and PCH. This was the first record for LFRRs potentially breeding in the HBW Complex outside the Santa Ana River Marsh since the 1970s. Unfortunately, late in the 2010 season and in 2011 we were only able to elicit “kecking” from a male, so breeding was not confirmed. However, a pair was back again in the Brookhurst Marsh in 2012 – 2016 with a second pair in the Talbert Marsh in 2015.

San Joaquin Reserve

LFRR vocalizations were reported for the San Joaquin Reserve in 2010 - 2016. Nancy Kenyon reported and Jeff Bray photographed an adult there on 30 March 2015. The calling reported in the Reserve was likely an unmated male in 2010 but in 2011 breeding was documented by Barry Nerhus. A 9-egg nest was found in the southwest corner of cell 6 in bulrush in April; it subsequently hatched and chicks were observed. At least two pairs bred in the Reserve in 2011 and 2013 along with advertising males; one pair was detected in 2012; a pair and advertising female were detected in 2014; a pair and at least one male were detected in 2015; but only a kecking male was heard in 2016. With increased management for edge foraging habitat, this extensive freshwater marsh system has good future potential for rails, marauding raccoons notwithstanding.

Santa Margarita River

The salt marsh at the mouth of the Santa Margarita River typically held a single pair of nesting rails for many years and occasionally there have been two pairs. These pairs are invariably in the same spots from year to year; at the river mouth in freshwater marsh in the Sweetwater Marsh

section of the estuary and/or between Stuart Mesa Road and the railroad tracks on the north side of the river in the freshwater marsh that rims a pond. Unusually, in 2008 a single pair was located on the channel surrounding the least tern island at the junction of the inlet channel. We did not gain access to do surveys in 2009 or 2010 but did a base-wide survey of the potential habitat on base in 2011. Once again, John Konecny found two nesting pairs in the Sweetwater Marsh section of the river mouth and nothing in the many little pocket wetlands scattered along the Pendleton coast. The Sweetwater Marsh Complex was checked once by Barry Nerhus in 2012 with negative results. Tom Ryan checked the Pendleton coast in 2013 and reported three points of calling to the state. Two points were south of the river along the little channels in the vicinity of the tern island and were described as a “purr” which must mean two advertising females; the third rail apparently uttered a single clapping at the mouth of San Onofre Creek. Access was again not gained in 2014 or 2016. In 2015, Tom Ryan reported two points of calling from the usual places and John Konecny’s assistant found a pair inland of the 5 freeway.

San Luis Rey River

Historic detections of LFRRs on the San Luis Rey River have been rare and mostly confined to the freshwater marsh at the river mouth in Oceanside. Past reports of inland sightings could not be corroborated until recently when John Konecny found two pairs defending inland freshwater marsh habitat in 2010, three pairs in 2011 and 2012 (Richard Zembal), four pairs in 2013, a record five pairs and a male in 2014, and three pairs in 2015. The freshwater marsh is being invaded by willows and will probably not survive many more years unless the hydrology changes with higher flows. Unfortunately, in 2016 the river was dry and no habitat for rails survived the drought.

Buena Vista Lagoon

As in San Dieguito, rail numbers in the freshwater marsh habitat of Buena Vista Lagoon have fluctuated widely over the years. The past high count was nine pairs in 2008, 2009, and 2012 but only two pairs in 2013, four pairs in 2014, a new high of 10 pairs in 2015, down to four pairs again in 2016. One pair was detected in the western lagoon between the railroad tracks and the coast route; two pairs were detected in the big central lagoon east of the Nature Center; and one pair was in the eastern lagoon. Although the creek held a pair last year and was checked three times, there were no detections there in 2016. The habitat on the creek comes and goes with flood control maintenance and high winter flows. Half of it had been mowed, apparently just after last year’s detection. There had been a four-acre fire in the marsh adjacent to the interpretive center in 2013 but the vegetation recovered; the entire wetland abounds with extremely abundant raccoon sign. The many management issues at this little marsh are shared with most of the other coastal wetlands including abundant non-native trees and shrubs that harbor perching predators and homeless people. The reed beds have become extremely thick and there is little remaining side story of native marsh halophytes to support foraging rails. In order to potentially bolster the subpopulation in this freshwater system, there was a release of 15 rails bred in zoological facilities on July 19, 2011 into the central lagoon. The CDFW allowed a release of three additional rails carrying telemetry backpacks on July 6, 2016.

Agua Hedionda Lagoon

The marsh at Agua Hedionda Lagoon previously held a maximum of seven pairs in 1983 followed by a development project that greatly affected the drainage that used to support the brackish marsh and rails were barely detected in the 1990s. The numbers built slowly but fluctuated widely to a former high again of seven pairs in 2006, 2008, and 2011. The count hit the all-time high of nine pairs in 2012 and was just under that in 2013 and 2015 with eight pairs but in 2016 plummeted to only four pairs. 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 2012. More recently, the drought has taken a toll on the habitat. The salt marsh on the eastern rim of the inner lagoon has developed some nice cordgrass stands from which four of the rail pairs were calling in 2015 and one in 2016. Unfortunately, two of the regularly inhabited marsh patches are being regularly impacted by paddle boarders, beach goers, and their dogs accessing the marsh off the sand spit at Bayshore Drive. This subpopulation was augmented with the release of five rails from the breeding program in 2004, six in 2011, 16 in 2012, and nine in 2013.

Batiquitos Lagoon

The rails increased gradually in Batiquitos Lagoon as the wetland habitat continued to improve over time following the major restoration project implemented there by December 1996. The lagoon has remained mostly tidal and rail habitat has been generally 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. LFRR numbers grew to 22 pairs in 2007 and 2008 and Batiquitos Lagoon was the third largest subpopulation in the state 2008 - 2010. New annual high counts continued into 2011 and 2012 with 43 pairs detected each year, a new high of 45 pairs was documented in 2013 and 2015, and the new record of 52 pairs was set in 2016.

We covered this marsh over multiple visits, usually with two observers using duet playback. The use of multiple observers on a single count was attempted in 2013, mostly without playback and few pairs were documented. The multiple-observer approach to surveying is very dependent on conditions on the day of the survey and the results might be greatly enhanced with playback. In 2016, there were nine breeding pairs vocalizing from habitat adjacent to and south of the western tern island; 20 pairs along the north edge of the inner lagoon; 21 pairs along the southern edge but with no advertising females this year or last; a pair in the northeast corner of the middle basin just west of the freeway in the extensive reed stand there; and a pair on the creek off Levante and El Camino Real in the freshwater reeds on the creek. The cordgrass in the west basin is extensive and looks vigorous, although most of it is too submerged during higher tides to provide adequate nest cover. Batiquitos Lagoon received rails bred in the zoological facilities in 2004 and 2005 (8 rails each year), again in 2013 (6 rails), 2014 (12 rails), and 2015 (7 rails).

San Elijo Lagoon

The San Elijo Lagoon subpopulation was back up to its former record high level of 15 nesting pairs in 2010 and 2011; the former high was more than doubled in 2012 with the detection of 31 breeding pairs; was down to 20 pairs in 2013; back up to one pair shy of the record high in 2014 with 30 pairs; doubled to 60 pairs in 2015; and then 70 pairs in 2016, the record high count for

this wetland and third largest subpopulation in California. San Elijo Lagoon has had major efforts to maintain tidal function and suitable rail habitat in the central lagoon has expanded greatly; the cordgrass there is as lush as can be found anywhere in the California range of this rail. However, the lagoon does still close off to the ocean regularly resulting in poor hydrologic conditions for variable periods of time. The area inland of the weir becomes a lake during high rainfall years. Of the total, 27 pairs were in the east basin with a male with no clear detections along the creek; 35 pairs were in the central basin, mostly in great cordgrass; and eight pairs were in the west basin, also mostly in lush cordgrass. San Elijo received an augmentation of eight rails bred in zoological facilities in 2004, five in 2006, four in 2007, 16 in 2009, and seven in 2012 mostly at the weir in the inner lagoon. One of the 2004 rails was re-sighted near the railroad tracks in the central lagoon on December 13, 2004, six months following release, and one of the 2006 rails was observed repeatedly over six months off of the Rios Avenue trail. However, there have been no reported re-sightings of live banded rails since then. A dead rail was retrieved from San Elijo in May of 2010 that was banded and released into San Elijo on June 16, 2009.

San Dieguito River Valley

The subpopulation of LFRR discovered in the San Dieguito River Valley in 2004, inland of the lagoon and El Camino Real, was first reported at six breeding pairs and then conservatively, at 12 pairs in 2005. In 2006, there was abundant calling indicative of at least 31 breeding pairs ranking this as the third largest subpopulation that year and the largest ever reported in a freshwater marsh system. This freshwater marsh fared better than the tidal marshes in the crash year of 2008 and reached its height in 2012 at 45 pairs. The 2015 and 2016 counts of 15 pairs each were partial counts because the golf course on the south side would not allow access. However, doing playback along the south side generally adds only about 5 pairs. The surveys here are generally high one year and low the next and counts invariably include a lot of advertising males, particularly in low pair count years. In 2011, for example, there were 12 pairs and 33 advertising males. Such an abundance of unmated males is indicative of female-skewed predation, probably suffered during egg depredation. These widely fluctuating annual totals and abundance of males indicate a general lack of stability, probably due to extreme vulnerability to predators in this type of wetland; raccoon sign is very abundant along the marsh. Usually, at least one pair is detected in habitat on pond edges in the golf course; perhaps a disincentive for allowing the survey. Additional rail detections are still being reported from the San Dieguito Creek Watershed but have yet to be corroborated since they would not respond to callback. Reported locations have included Lusardi Creek, the pond at 4S Ranch Community Park on Dove Creek Road, and at 4 Gee Road just north of Camino Del Sur.

The freshwater marsh system in San Dieguito Creek above El Camino Real is enigmatic in the broad swings in rail abundance. However, it is paramount to maintain this important freshwater marsh system for the rails. When the largest rail subpopulations crashed in 2008, the one in San Dieguito went up 40%. The current hydrologic regime provides the conditions sustaining this one-of-a-kind wetland; the current hydrology needs to be understood and maintained. The invasion of non-native plants should be managed; the marsh is succeeding slowly to a woodland. The most pervasive invader is *Tamarix* sp., occurring along with pampas grass (*Cortaderia* sp.), eucalyptus, palms (mostly *Washintonia* sp.), and more limited giant reed (*Arundo donax*), and

castor bean (*Ricinus communis*). The tamarisk in particular provides cover, shelter, and perch sites for raccoons; it needs to be removed. The restoration area between El Camino Real and the freeway has developed good cordgrass cover that appears of suitable quality for rails and finally in 2016, one of the reported pairs was calling from the cordgrass off San Andres Drive.

Los Penasquitos Marsh

Los Penasquitos Marsh is dominated by vegetation indicative of prolonged closure to the ocean, particularly pickleweed. However, freshwater influence and freshwater marsh edge are increasing and the rails currently appear to be using mostly the freshwater marsh habitat. The detection of 12 pairs was a record high for this wetland in 2007. The number plummeted to only two pairs in 2008; built back gradually to 12 pairs by 2011 and 2013 (four of which were on the creek above the lagoon in both years); decreased in 2014 and 2015 to just five pairs including one on the creek in both years; and exploded to 21 pairs in 2016 including 10 pairs on the creek. In most years but particularly wet ones like 2011, the lagoon fills with runoff and much of the marsh remains inundated until late spring. Under these conditions, the rails do not call much and are difficult to detect until the marsh drains, later in the season; the conditions are too lake-like for breeding and foraging for a good part of the spring and early summer. With the prolonged drought over recent years, an additional problem has been extreme dryness in most areas untouched by the tides. In 2016 there was heavy inundation of the marsh caused by railroad bridge repair work. Four rails bred at the zoological facilities were released into Los Penasquitos in 2004, four more in 2007, and nine in 2009. Again, population augmentation has been curtailed for fear of interference with pending marsh restoration plans. There was a re-sighting of a banded female hatched at the Wild Animal Park and released in 2007 at Los Penasquitos. She was photographed with her mate and three downy chicks on the edge of the pond below the San Diego Water Utilities Pump Station on Sorrento Valley Road on July 10, 2009 by Eric Kallen.

Kendall-Frost

The annual subpopulation total in the University of California Reserve at Kendall-Frost has fluctuated widely. The rails struggled there in the 1990s with a high of 11 pairs in 1992 and mostly two to five pairs annually. In the early 2000s this subpopulation hit a low of two pairs in 2008, following two years of 14 pairs in 2004 and 2005. The former high count was 24 pairs in 1984, a count nearly reclaimed in 2014 with 23 pairs but also with 16 males advertising. In 2015, a new all-time high of 33 pairs was recorded and nearly maintained with 30 pairs in 2016. This is as densely packed as rails get in a southern California wetland. This marsh is small, very isolated, and bordered by urban housing, but it is also well managed under the University of California Reserve System. The stewardship includes appropriate predator management, habitat restoration, and research management to assure minimal human disturbance to the rails and their habitat. Additionally, nesting rafts have been provided (21 rafts in 2016) and are used heavily by the rails there since 1987. There have also been translocations of eggs and adults bred in zoological facilities (five rails in 2003, seven in 2009, and 14 rails were released there in 2013). Additional monitoring of this remnant Mission Bay wetland is planned using winter high tide counts with the aid of the San Diego Audubon Society. A count conducted from kayaks on December 4, 2013 revealed 28 LFRRs, at least two of which were banded, undoubtedly in 2013; a banded rail was observed during high tide in December 2015; and banded rails were seen with chicks in 2014.

The 2016 high tide count on 15 November was a disappointment with only 10 rails counted and all sequestered on rafts.

San Diego River

Cordgrass continues to dominate a significant portion of the western end of the San Diego River at the bay and a high count of eight pairs of breeding LFRR were there in 2004. The numbers varied since then with seven breeding pairs detected in 2010; six pairs in 2011 and 2012; a record 10 pairs in 2013; nine pairs in 2014; a new record of 11 pairs in 2015; and an all-time high of 20 pairs in 2016. One to two of these breeding pairs (only a female in 2016) continue to be detected in little Famosa Slough most years, south of the 8 Freeway; one of the adults seen with chicks in 2015 was banded, reported by Jim Peugh. One of the pairs detected in 2010 was well west of the others, close to the ocean at the dog park. A previously unknown population of salt marsh bird's beak, *Cordylanthus maritimus maritimus*, was also discovered there in 2010 just off one of the foot trails. There were several hundred plants but unfortunately they are being smothered out by the clumped invasive Algerian sea lavender, *Limonium ramosissimum*. LFRR bred in the zoological facilities have been released in the cordgrass marsh to potentially spawn a larger, more viable subpopulation. Five rails were released in each of three years, 2005, 2007, and 2010; 11 rails were released in 2011 including five females; and nine more were released in 2012. One of these more recently released rails was likely the banded rail observed with chicks in Famosa Slough.

The habitat in the river west of the 5 Freeway appears quite suited for rails but management may be required to reach full potential. There are large rat and ground squirrel populations inhabiting the riprap along the channel, a known drop and feeding station for bolstering the tortured lives of feral domestic cats, and a large raccoon population. A great restoration project there would involve filling the riprap with soil and planting pickleweed and other upper marsh species; this would limit habitat suitability for egg-eating rats and expand native salt marsh for Belding's Savannah sparrows (*Passerculus sandwichensis beldingi*). Also, the river is operated in part for flood control and regular high flows in wet years could greatly affect the rails therein; having high marsh habitat on the upper edges of the channel could be very beneficial.

Sweetwater Marsh

None of the breeding pairs of LFRRs reported for the Sweetwater Marsh NWR were inland along the Sweetwater River in 2013, 2015, or 2016. They had been detected annually for many years along the river above 2nd Street and a single pair was there again in 2014. In 2016, there was one pair in the main marsh near the bay; five pairs in Vener Pond marsh; a pair below the rail enclosure near the pond; and a pair in the E Street Marsh parcel. There were nests on 10 rafts in 2016 with signs of at least partial hatches or brood use as of mid-June in at least five of those, plus a successful nest in *Spartina* sp. The Sweetwater Marsh Complex is endowed with a thriving raptor population, fully in evidence on every visit with ample good hunting perches spaced regularly along the marsh edge. The marsh growth is low and the rails are quite vulnerable. Four captive-bred LFRRs were released into Sweetwater in 2002, 11 in 2005, six in 2008, 14 in 2010, three in 2011, nine in 2012 (eight of nine in Paradise Marsh), and one in 2015 but none have been re-sighted.

J Street Marsh

The J Street Marsh parcel is the marsh just north of the former power plant site and South Bay Salt Works, dominated by cordgrass, and probably has regular presence by LFRRs but is difficult to access and survey. Single pairs were detected annually in 2011 - 2015 and two pairs were there in 2016 next to the small park at the north terminus of the marsh. This little wetland currently sports some of the most vigorous cordgrass growth in the south bay and should be a focus site for future management.

Otay River

The Otay River is channelized, typically 100 ft wide or less where it runs under the 5 Freeway, coursing northwest for about 3,200 ft to the Salt Works. Most of the vegetation along this stretch is dominated by cattails with willow over-story near the freeway. The channel continues another 10,200 ft until it opens to south San Diego Bay. This latter, longer stretch is dominated by upper salt marsh plants. Single pairs of rails were detected in 2011, 2012, 2014, 2015, and in many previous years calling from the vicinity of the bike trail overcrossing of the channel just south of the Salt Works. No presence was detectable there in 2013 or 2016 but a single clapping and a male were heard on Otay Lake on a north finger near Route 9 and Otay Lake Road in 2013 and the Otay system has undoubtedly retained minor rail presence somewhere along its course. The lake is lined with a narrow fringe of reeds that may harbor more rails than detected but the habitat is narrow and marginal. Reports of rails have been annual in recent years on a developing marsh portion of the river where it flows into the Salt Works; the area is most easily accessible by kayak. A juvenile was reported from the newly-restored western ponds in south San Diego Bay by Robert Patton on June 17, 2015. This older chick was still darkly-colored and so hatched very nearby.

South Bay Marine Reserve

An adult LFRR and a chick were observed in the South Bay Marine Reserve in 2005 after the survey report had already been finalized. There have been one to three pairs detected annually 2005 – 2016, except in the 2008 crash; two pairs have been reported for the past three years and in 2016, there were four pairs. This small isolated marsh is not so isolated anymore with the restoration of the two ponds to the south where a young rail was observed in 2015 and a pair was vocalizing in 2016 (that pair is included in the Marine Reserve total).

Sex Ratio

Nine of the 20 marshes with vocal rails in 2016 were male-skewed and three were female-skewed. Minimum totals of 85 unmated males and five females were heard during the call counts including: 20 single males on the Seal Beach NWR; 13 males in Upper Newport Bay; 21 males in the San Dieguito River Valley; and 20 males in Tijuana Marsh (see Table 1 for all records). The marshes at Ballona Wetlands, Los Penasquitos, and the San Diego River held advertising females. The usual condition has been a slight of males during most years and in most marshes. An extreme male skew or even a slight female skew could indicate major issues, unfortunately of an unknown nature but probably involving heavy depredation. The ratio of males to pairs is of concern in the San Dieguito freshwater marsh, for example.

Additional Rail Sightings

The continued annual release of captive-bred LFRR is co-occurring with increased detections of rails in new locations, particularly inland sites on creeks, rivers, and lake edges. Some of the recent detections of interest are as follows. There have been repeated sightings on the edge of Point Mugu at Ormond Beach since 2009. Sue Hoffman flushed a single LFRR adjacent to the mouth of the Santa Ana River in the plover yard at the Huntington State Beach California Least Tern nesting colony in 2008; a dead rail was reported between PCH and the Tern colony in July 2009. A rail was reported from the lake at Laguna Niguel in 2011. LFRRs are still reportedly vocalizing in the reeds at Kumeyaay Lake on the San Diego River including at least one advertising female in 2011. LFRRs are reported annually in the San Dieguito River Watershed well inland of the Polo Club. Paul Lehman and others reported seeing a LFRR at the northern end of Upper Otay Lake on April 20, 2009 and there have been reports there almost annually. Phil Unitt reported a dead rail retrieved on July 15, 2015 from the south side of a large building at 9791 Towne Center Drive near Los Penasquitos Lagoon. Finally, Bob Schallman recovered a dead rail from the edge of PCH near the Seal Beach NWR in September 2015.

Survey Conclusions

The LFRR population in California increased annually beginning in 2001, coincidental with the first release of captive-bred rails into the wild, to a high count of 443 pairs in 2007 followed by the crash of 2008. The state population recovered from the crash with a 37% increase in 2009, growing annually thereafter to within two pairs of the 2007 record by 2011. In 2012, it reached a new high, for the first time exceeding 500 pairs statewide and has maintained 500+ breeding pairs annually for five consecutive years, exceeding 600 pairs for the first time in 2015 and 650 pairs in 2016. However, many of the extant LFRR subpopulations today remain too small for long-term viability; 10 of 18 subpopulations were 16 pairs or fewer in 2016. On the other hand, two subpopulations exceed 100 pairs, one of those has exceeded 200 pairs for three years; three subpopulations are greater than 50 pairs each; and several subpopulations are either expanding, holding, or fluctuating but at relatively high totals compared to the past, particularly in the Seal Beach NWR and Kendall-Frost Reserve. Additionally, there is greater evidence than ever before of movement between marshes. The future outlook for the Light-footed Ridgway's Rail is stronger now than it has been in decades.

Management and Monitoring of Nesting Sites

Nest platforms were refurbished, moved, newly constructed, and monitored in four marshes during the 2015 and 2016 breeding seasons including Point Mugu, Seal Beach NWR, Kendall-Frost Reserve, and Sweetwater Marsh NWR. In 2016, 12 rafts were built and deployed in Upper Newport Bay where marsh cover, particularly cordgrass has been depleted in the lower bay. Older rafts measure about 3' X 5' and incorporate PVC tubes for flotation required little more than enhanced cover but several were moved to better locations. Many of the newer platforms made of 2" X 4" sections or solid marine plywood and placed on foam block for flotation, needed replacement tie-downs. Replacement nest platform covers included grass mat, burlap, and palm fronds over a PVC and wire frame or large tumbleweeds secured with nylon cord. Many

hundreds of hours were spent constructing, refurbishing, and monitoring the nesting rafts. That refurbishment work is completed for 2016, although there is always maintenance required (raft cover is important in winter high tides, as well); monitoring will be ongoing through 2016, particularly during extreme high winter tides to document flotation and any issues.

Upper Newport Bay

Nest searches at Upper Newport Bay revealed 14 incubation nests in 2016, 5 of those held eggs when discovered and 6 were predated. Two nests with 8 and 7 eggs were discovered on May 4 in bulrush thickets directly adjacent to a paved road in the north narrows. One of these was subsequently depredated by a raccoon. Nest searches above the old salt dike on the northwest side of the bay on June 8 revealed six nests, three with clutches of 7, 7, and 10 eggs. The other three nests had already hatched. The six nests were packed in along a belt of good cordgrass, cordgrass of a stature that does not currently exist below the salt dike. The two furthest apart of the six nests were separated by less than 500 m.

Nest searches again in 2016 revealed that most lower bay nests were on the edge of the marsh, adjacent to the road in the fresh or brackish marsh belts there; even in the cattails on the upland side of Back Bay Drive; in the uplands bordering the marsh, mostly in large, twiggy saltbushes; on higher marsh berms isolated well out in the marsh but highly subject to depredation; and concentrated above the old salt dike. Tall enough patches of cordgrass to support a rail nest were very scarce below the salt dike. Even the bulrush cover in many stands was mediocre and late sprouting probably due to the lack of rain and runoff and at least 6 of 14 nests were depredated.

There are clearly problems for nesting rails at Newport but they must be localized based upon the huge winter rail survival into spring of 2016, a positive aspect of having no winter storm flows ripping up the marsh. However, the lack of rain may also have been the principle cause of the poor nesting cover in parts of the bay, like Upper Island. The local cover was in better shape further up the bay on the eastern side opposite the new island and above the old salt dike. Nesting rails at Upper Newport Bay are being increasingly affected by tidal wash with limited alternatives to reduced quality low marsh sites because of predator abundance, particularly raccoons.

Seal Beach NWR

On the Seal Beach NWR there were 56 clutches of eggs laid on 36 rafts in 2016. This compares to last year's 76 clutches and 63, 42, 35, 41, 25, 19, and 17 clutches found on rafts in 2014 – 2008, respectively. There were an additional 22 brood nests built on 22 rafts in 2016. Overall nesting success was 96%, leading hopefully to a high rail count during the November high tide count. Rail nesting and other activities were noted on 78 of the 89 available rafts. Although most of the estimated 60 pairs in the NWR nested and brooded on rafts, at least 13 clutches probably hatched in the marsh off of rafts. The proportion of the population nesting in natural cover may continue to rise as the cordgrass vigor continues to increase (see Hoffman 2016).

Rafts were instrumental in the rebounding of the Seal Beach NWR subpopulation in the early 1990s. For example, in 1993 there were 79 nests, 73 clutches of eggs, 9 additional brood nests, and 79% hatching success on the 100 rafts available in the NWR. However, since the mid-1990s

until recently, the number dropped from unknown causes but heavy raptor predation is suspected. The FWS continues to modify the raft design in Seal Beach for better durability and function and to provide more rafts than there are nesting pairs to give them choices. The rafts are heavily monitored and there have been no indications of unusually severe problems or extremely high predation rates during the nesting season. Post-breeding season survival has been the issue on the NWR, perhaps due in part to the huge wintering raptor population. Continued efforts to provide enhanced cover, natural and artificial will perhaps make a positive difference over time. Cordgrass cover was greatly enhanced in years following unusually high rainfall as in the winter of 2004/2005 and 2010/2011. This may have added enough additional predator-protection to increase rail survival and productivity starting in 2006.

UC Kendall-Frost Reserve

At the Kendall-Frost Reserve there were 11 nests on the 21 rafts but only 6 clutches of eggs and no second clutches but at least 7 clutches off the rafts in the marsh (Table 3). This compares poorly with 2015 when 17 of 21 rafts held nests and only one raft had no rail activity; 14 clutches included 6 second clutches on 12 rafts and 7 additional nests in the marsh with a minimum total of 30 broods of chicks produced. In 2014 there were 19 nests on the 21 rafts and 11 clutches of eggs on 7 rafts with at least 3 clutches of eggs in nests off rafts. In 2013, 9 of the 21 rafts held nests with only 3 clutches of eggs. Although the egg clutches observed in 2016 all appeared to have hatched, the low number of clutches and abundance of raccoon sign is disturbing. Consistent management of Kendall-Frost will hopefully keep this little population thriving.

Kendall-Frost is small, extremely isolated, and therefore regularly plagued by mesopredators. It is imperative that predator management be continued annually, commence prior to rail nesting each year, and that a reliable source of funding be found for the program. Even with active predator management, there were fresh tracks of raccoons (*Procyon lotor*) observed far out in the marsh. This little wetland has high potential and should be a focus of management efforts for rail recovery. Critical elements would be the addition of substantial contiguous wetland acreage and the restoration of native habitat, particularly upper marsh pickleweed along the marsh edges.

Table 3. Light-footed Ridgway's Rail Breeding Activities on Rafts in UC Kendall-Frost Reserve, 2016.

Raft #	5April	23April	18 May	17 June	15 July	24 Aug
1	-	-	-	-	-	-
35m S1	-	-	-	-	-	Sp N H
2	Nb	-	Inc	Inc	H cf	Bn
3	-	5e	H cf	H cf	Bn	Bn
4	-	-	-	-	-	-
20m E4	-	-	-	Sp N H	Bn	-
5	Nb	-	Nb	Bn	dish	dish
6	-	N	N	N cf	Bn	Bn
15m W6	-	-	-	Sp N H	Bn	-
7	Nb	N	Inc	H 1e	Bn cf	Bn wet
8	-	N	Inc	H	Cf 1e	Bn wet
9	N	dish	N	N cf	dish	Bn wet
10	-	-	-	-	-	-
11	-	-	-	R Pel	-	-
35m N11	-	-	-	-	Inc-Bn	-
15m S11	-	-	-	-	Inc-Bn	-
12	-	-	-	-	-	-
13	ro	-	-	-	-	-
14	-	-	-	R	-	-
15	Nb	5e	H	N	Cf	Bn wet
16	cover	-	N	N	Def	N wet
17	Pel	Pel	-	Pel	-	-
18	-	-	-	-	-	-
19	N	N	8e	H 1dc	Inc 6e	H Bn
30m S19	-	-	-	H Bn	Bn	-
35m N19	-	-	-	H Bn	Bn	-
20	Nb	-	Bn	N	dish	N wet
21	-	Pel	-	-	-	-

Bn = Brood Nest; cf = Chicks being fed; cover = cover repair needed; dc = dead chick; Def = Defensive behavior by adult(s), protective of nearby chicks; dish = disheveled nest; #e = Number of eggs; H = Hatched Eggs; Inc = Incubating or Brooding adult on nest; N = Nest; Nb = Nest beginnings; Pel = Pellets; R = Raccoon activity/prints; ro = Ripped Open (raccoon?); Sp N = Spartina Nest; TN = Tumbleweed Nest.

Sweetwater Marsh NWR

In Sweetwater Marsh NWR there were only three nests with eggs on the nesting rafts in 2014. One of them hatched and another had at least a partial hatch, with evidence of nest building on 7 of the 10 rafts. Activity increased in 2015: 11 nests were found, 5 of them on rafts; 4 clutches were observed; and there were at least 10 hatches/broods, marsh-wide. Activity was similar in

2016 (Table 4) with 10 nests on rafts; 5 clutches observed, including 2 second clutches; brooding of chicks on 7 rafts; and 2 separate broods associated with the Spartina nest.

Sweetwater Marsh is largely high marsh that used to be influenced mostly by the extreme high tides, particularly when storm-driven. Most of this marsh was high and dry enough to provide excellent foraging opportunities for predators and many species of raptors and terrestrial predators took full advantage, as evidenced by the high rate of depredation observed of released rails there in 2005 (Zemba et al. 2005). Rails documented in the marsh in recent years were in those parts of the wetland most regularly influenced by tidal inundation or on an island surrounded by ponded water. As our wetlands become soggy with rising ocean waters, perhaps there will be additional acreage of suitable nesting habitat for a time in some of these higher marshes (already happening in Sweetwater?). It is also evident that a full assessment of the Sweetwater subpopulation is tough without well-timed nest searching. Calling frequency and reliability for population estimations appears to be very density-dependent across the range of this Light-footed Rail. For example, Sweetwater Marsh supported 7 or 8 breeding pairs in 2015 and 2016 when fewer were in evidence through vocalizations.

Table 4. Light-footed Ridgway's Rail Breeding Activities on Rafts in Sweetwater Marsh NWR, 2016.

Raft #	23 April	18 May	17 June	15 July	24 Aug
1	N	Bn	N	Bn cf	N
2	loose	repaired	-	-	-
3	N	Bn	N	Bn cf	Bn cf
4	-	-	-	-	-
5	-	-	N	Bn?	Bn
6	-	-	N	N	Bn
Spartina N	-	Inc	H+Bn	Inc	H+Bn
7	N	N	Bn	dish	N
8	-	repaired	-	-	-
9	-	-	N	dish	N
10	-	-	-	-	-
11	-	-	-	pel	-
12	Inc	H cf	Inc	H cf	Bn
13	N	N	Inc	H cf	N
14	repaired	N	N	N	dish
15	N	-	N	N	dish
16	-	-	Ad	-	-
17	-	-	repaired	-	-
18	-	-	repaired	-	-

Ad = Adult displaying in defense of nearby chicks; BN = Brood Nest; cf = Chick feeding; dish = Disheveled Nest; H = Hatched; Inc = Incubating or Brooding adult on nest; N = Nest.

NBVC Point Mugu

Evidence of breeding activity in addition to territorial manifestation by calling was observed in 15 of the 16 breeding territories at Point Mugu in 2016. That evidence included: 21 nests, nine of

which were incubation nests that contained evidence of hatching; two nests contained four and seven eggs, respectively and later hatched; 10 nests were active brood nests with evidence of chick presence; there was evidence of chick-feeding in 15 territories; chicks were directly observed in five territories; and adults were directly observed in eight territories. In 2010 rails were discovered nesting in a previously unoccupied area along a fresh water ditch and largely in reeds in the far western arm where 3 of the 11 pairs bred. In 2015, two pairs were detected calling in the freshwater marsh habitat there but only one pair in 2016.

Although natural nesting cover was thought to be a limiting factor for the rails at Point Mugu, artificial nesting rafts placed there in 1988 were not used over the several years they were maintained and monitored; the marsh was simply so high that there was significant acreage of natural cover that is not inundated by high tides. However, artificial rafts were tried again in 2008 and one was used successfully by a nesting pair with some evidence of partial use of two others. Given the years of experience at Point Mugu with the rails, the new rafts were placed more strategically. Because of the use observed in 2008, 5 additional rafts were added in 2009 bringing the current total to 10 rafts. The same raft as was used by a nesting pair in 2008 was used again in 2009. An 8-egg clutch hatched but 4 of the chicks were discovered dead in or near the nest; analysis by the Contaminants Division of the US Fish and Wildlife Service, Carlsbad Field Office is still pending. At least two of the original 10 rafts in Mugu Marsh held evidence of rail use in 2016 with signs of active chick feeding and brood nests inside. The Navy placed 15 additional rafts with motion-triggered cameras inside in 2016 and documented rail visitation to three of those with photographs. Perhaps next year visitation will escalate to breeding activity.

Tijuana Slough NWR

The ocean inlet to the Tijuana Slough had closed off again by 30 March 2016. The FWS had it mechanically reopened and functioning by 11 April but not before conditions went anoxic enough to be of heavy concern for the rails in Oneonta Slough. Seven of us checked about 25 acres of the marsh and found 20 nesting sites, all with evidence of hatches and chick brooding on 21 June. The rails appeared to have survived and in full breeding mode in spite of the temporary closure of the ocean inlet.

Breeding in Zoological Facilities

The LFRRs housed at the former Chula Vista Nature Center (currently, Living Coast Discovery Center or LCDC herein) bred successfully for the first time in 2001, after we brought in a second pair of rails and switched their mates. Each pair laid a single clutch, one of 8 and the other of 7 eggs. The 8-egg clutch was taken to Sea World to be hatched and reared, hoping that the pair would lay another clutch. They did not. Seven rails bred in Zoological Facilities were released into Mugu Marsh that first year. Additional rails have been added to the breeders in Zoological Facilities and their progeny have been released to the wild annually ever since.

There were five potential breeding pairs in zoological facilities in 2016, two pairs at Sea World California (SWC) and three pairs at San Diego Zoo Safari Park (SDZSP); the LCDC held only a retired male; see Methods for the identities of the breeding pairs. Reintroductions to the wild in

2016 resulted in the release of 11 rails into two wetlands, Buena Vista Lagoon and South San Diego Bay NWR (Table 5). Five of these rails were 2016 offspring produced at SWC; one was a retired breeder, and five were rails hatched at SWSD from Newport eggs. This brings the total number of rails released to the wild since 2001 to 453.

Eight eggs were taken from four nests in Upper Newport Bay to be hatched at Sea World in 2016. All eight eggs hatched and made it into the acclimation pens but three disappeared prior to release to the wild. It is unknown if the disappearances were mortalities or escapes. The hatchlings were rails # 654 – 660, including five males and three females; the disappearing individuals were rails # 655 (disappeared just after a squirrel gnawed a hole in the vinyl enclosure top); 657 (limp noted two days before disappearance, probable mortality), and 650.

Table 5. Number of Zoologically Bred Light-footed Ridgway’s Rails Released into Target Marshes 2001 – 2016.

Marsh	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	Sum
Carpinteria	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2
Point Mugu	7	11	20	12	17	3	5	27	5	-	-	-	-	-	-	-	107
Seal Beach	-	6	-	5	-	-	-	13	5	-	15	5	9	5	9	-	72
Buena Vista	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	5	20
Agua Hedionda	-	-	-	5	-	-	-	-	-	-	6	16	9	-	-	-	36
Batiquitos	-	-	-	8	8	-	-	-	-	-	-	-	6	12	7	-	41
San Elijo	-	-	-	8	-	5	4	-	16	-	-	7	-	-	-	-	40
Penasquitos	-	-	-	4	-	-	4	-	9	-	-	-	-	-	-	-	17
Kendall-Frost	-	-	5	-	-	-	-	-	7	-	-	-	14	-	-	-	26
San Diego R	-	-	-	-	5	-	5	-	-	5	11	9*	-	-	-	-	35
Paradise	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	8
Sweetwater	-	4	-	-	11	-	-	6	-	14	3	1	-	-	1	-	40
So SD Bay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	6	9
Total	7	21	25	44	41	8	18	46	42	19	50	46	38	17	20	11	453

Breeding pairs at SeaWorld were managed in a very densely planted aviary with minimal contact/exposure to animal caretakers. Minimal nest checks were performed and eggs were not candled during the 2016 season. Monitoring of nests was difficult and eggs were not individually accounted for. We have discussed a more hands-on approach for the 2017 season, necessitating reduction in pen cover and other modifications. However, no modifications were made to the hand-rearing guidelines established at SWC for the 2016 season.

Pair LFCR586/LFCR595 (Hand rearing Pen 2 at SeaWorld) was observed with a nest around 3/5/16. Four chicks (LFCR650, LFCR651, LFCR652, and LFCR653) hatched on 4/1/16 and were transferred to the Acclimation Pens on 5/27/16 where LFCR650 quickly disappeared.

Two wild eggs, collected from Upper Newport North Narrows were transferred to SeaWorld and incubated in a Humidair Incubator. Chicks LFCR654 and LFCR655 hatched on 5/18/16 and 5/19/16.

A second set of six wild eggs was transferred to SeaWorld on 6/10/16 from Upper Newport Bay

north and were incubated in a Humidaire incubator. All six eggs hatched and chicks were assigned studbook numbers LFCR656 (RD R, hatch 6/13), LFCR657 (OR R, hatch 6/14), LFCR658 (YE RT, hatch 6/14), LFCR659 (GN r, hatch 6/19), LFCR660 (BL R, hatch 6/23) and LFCR661 (PR R, hatch 6/23). The chicks were transferred to Acclimation Pens on 8/12/16.

Pair LFCR586/LFCR595 (Hand rearing Pen 2 at SeaWorld) produced two chicks, 662 and 666 on approximately 5/21/16. LFCR662 was transferred to the acclimation pens on 8/12/16 but was removed from the transport crate with a broken leg and euthanized by SeaWorld veterinarians on the same day. LFCR666 was actually a younger hatch, transferred to acclimation on 8/26/2016, and released in south San Diego Bay on 9/27/2016.

Pair LFCR608/637 (SWC Polar Aviary) hatched four chicks LFCR 663,664, 665, and 667. Three chicks were sent to the acclimation pens on 8/12/16. Chick 667 was transferred to acclimation two weeks later; this last chick was significantly behind developmentally and presumed to be from a second clutch of eggs. LFCR663 was released in south San Diego Bay on 9/27/2016; 664 was released in Buena Vista Lagoon on 10/5/2016; 665 sustained a foot injury, transferred to SWC on 9/22/2016 and later euthanized; 667 disappeared in acclimation. The Safari Park held 3 pairs of LFRR for the 2016 breeding season: 612/633; 396/638; and 605/385.

Pair 612/633 was introduced on 29 Oct 2015. The introduction went smoothly. A couple of nests were built throughout the season but no eggs were laid as far as is known. The male was observed feeding the female insects daily for a couple of months. They vocalized throughout the season.

Pair 396/638 was introduced on 6 Oct 2015. Their introduction also went well. They vocalized regularly throughout the season and a nest was built inside the hut provided for cover but eggs were never observed. One copulation event was observed. In July, the female fractured her leg and underwent surgery. Unfortunately, her leg never healed properly and the decision was made to humanely euthanize her. A broken egg was found in the pool when we caught the female to move her to the hospital but no signs of a nest.

Pair 605/385 was introduced on 2 Mar 2015. Initially, the female was very pushy and the male spent most of the time in a tree. They settled down after about a month. They never built a nest but we found a broken egg in their pool in March and July. This female has been at the SDZSP since 2010 and has had chronic foot issues including partial digits, bumbles and fused joints in both feet. This pair also vocalized throughout the season.

The rails are fed in the morning and then again with a fresh diet in the afternoon. We give them 4 live fish each once a day in their water dishes or pools. We also toss live insects into their pens - am only in the off season and am/pm during the breeding season (mealworms, crickets and waxworms). Pairs #1 and 2 have food doors built into the pen doors so we do not need to enter the pens unless absolutely necessary. Their food is placed on the concrete pad and they are provided a large round dish for water. They have large pools with a constant flow of water. We

do need to bleach the pools ~ every 3-4 weeks. The enclosure for pair #3 is a little bit different. They have a smaller pool close to the front of the pen and are fed on a food stand in the pool. Their pool is also on a constant drip but does need to be cleaned weekly.

All 3 pairs have multiple cameras in their pens that record day and night. We review the footage daily to make sure all of the rails appear healthy. During the off season, we spend ~ 30 minutes reviewing video and that increases to 60+ minutes during the breeding season.

During the off season, we do pen maintenance. This includes trimming the trees and grasses, checking misters, camera maintenance and fixing up the nest hut. We add lots of eel grass and other cut grasses to the pen. We also play recordings of LFRR vocalizations daily at the beginning of the season until they begin vocalizing on their own.

The LCDC housed only a retired male in 2016 but work is in progress to get them a pair for 2017.

The current proposal for 2017 is for each of the three facilities to house two breeding pairs. Sea World will have #586/595 and #605/wild; the Safari Park will have #612/633 and #608/637; and LCDC will house #362/385 and #396/wild.

The acclimation enclosures and process, located on the Sweetwater Marsh NWR were managed by staffs funded through the Huntington Beach Wetlands Conservancy Clapper Rail Recovery Fund and Living Coast Discovery Center. Management staffs spent few – 5 hours daily when rails occupied one or more of the three enclosures. The enclosures were occupied by rails on 27 May through 5 October 2016 and monitored for a total of 132 days. Staff closely watched each of the rails to assess their readiness for release to the wild. Readiness for release is judged on the basis of appropriate wariness and flight to cover from raptors in the vicinity, hunting behavior and ample food consumption, and in general, behaving like a rail. In addition to managing the rails in the existing enclosures, staffs continued construction of a fourth enclosure on the outlet stream from the LCDC aviary.

This year only two of the three available enclosures were utilized, Middle Proving and East Proving. The third enclosure was not needed due to the reduced breeding production this year. All of the enclosures need repairs and vegetation removal before the 2017 season. The most significant repairs include replacement of the vinyl top net for East and Middle Proving, door repair and replacement for each enclosure, and vegetation removal to improve water flow for each of the three enclosures.

One new challenge we observed this year was a circulation issue involving feet and toes of three rails. Several rails developed small lesions on their feet that became necrotic within about a week and ultimately resulted in tissue death in the entire foot or feet of the birds. Upon necropsy, no gross lesions were noted, but histology is pending. Cause of the foot pathology is unknown at this time. The acclimation process and evaluation under careful scrutiny is critical in determining the readiness of the rails bred in zoological facilities for release to the wild; there is work to be done to the pens and flow-through prior to the 2017 season. The birds must be able to feed

themselves properly and generally behave in a wary enough manner that their behavior is that of a typical rail and not that of a conditioned animal, likely to perish in the wild.

We have been waiting for several years now for official adoption of the Population Management Plan for Light-footed Rails and the slow pace of progress have wreaked havoc with the planned systematic rotation of breeders. We have stepped up the effort in Newport to regularly cycle breeders and will continue that as if the program is already actually official so as not to get too far out of sync in the required rotation of breeders in the Zoological Facilities. Ultimately, we will return breeders to the wild with their progeny after two or three years in zoological facilities. The poor and potentially worsening conditions for rail breeding in Upper Newport Bay has also led to the official request of the Agency permit administrators to add Tijuana Slough as a donor site for eggs and/or adults for the Breeding Program.

Banding and Tracking

There were two trapping attempts made in Upper Newport Bay in 2016; a male, a female, and a Red-winged Blackbird were caught on 27 October. The male was released at the capture site with only a Federal band, 0945-554573 on the right leg to distinguish him from a rail that might be seen having traveled to the bay after being released elsewhere in 2016. The female was banded 0945-554572 right, anodized gold left #74, and taken to Sea World for breeding. Also, each of the 11 rails introduced into the wild in 2016 was banded; band numbers are noted in the Methods section herein.

The rails released into Buena Vista Lagoon were radio-tracked by the Audubon members and their movements reported regularly. All five of the radio-harnessed rails stayed close to the release site and then gradually explored. The furthest travel documented was across PCH to the basin between PCH and the railroad tracks and to the northeast shore of the Central Basin. Three rails released in July: Rail #1's signal became stationary after 3 days, about 100 m north of the release site; Rail #2's signal was lost after one week; and Rail #3 was last detected 38 days after release. Rail #3 had settled into a very small territory around the release site and was observed a couple of times foraging along the edge of the path through the thick cattails. The two rails released in October moved into the basin west of PCH by 11 October then back to Central. Their signals both became immobile by 23 October, one on the edge of PCH by the fishing bridge and one on the south shore opposite Jefferson. Lost signals were investigated by searching up and down coast to no avail. An immobile radio signal from the marsh means that the rail slipped the harness and dropped the radio, or the bird was depredated. Lost signals could be due to either one of these outcomes as well; the radio potentially dropped and submerged; or the rail and/or radio are far-removed or damaged by a predator. Two of the three immobile but transmitting radios were retrieved by CDFW staffs on 11/4/2016. The third remains active near the fishing bridge and was not found (Figure 1). Observations at the sites of the dropped radios were inconclusive as to the disposition of the rails formerly wearing them; they could be out there still, fully assimilated into the BV subpopulation.



Figure 1. Last known locations and two radio retrieval sites for five telemetered Light-footed Ridgway's Rails in Buena Vista Lagoon, 2016.

The rails released into south San Diego Bay in September explored the south bay north to Coronado Cays where one (160343) expired of unknown causes about 4.2 km north of the release site. The documented distances traveled by the others are well less than that. The other four rails were still transmitting signals and mobile as of 1 November. They have settled into three different south bay areas, none more than 2.3 km from the release site. Two (160344 and 160346) are very near and just north of the release site which was on the tip of a berm into the bay north of the terminus of 8th St, to a maximum distance of 0.5 km north of the release site. This pair appears to be utilizing the Otay River Channel and the adjacent pond edges, particularly 160346 in the southeast corner of Pond SW10. Rail 160345 moved east along the river and south pond edges about 1 km from the release site in the vicinity of south Pond SW 22 and environs. Rail 160437 moved about 2.3 km to east and slightly north to the vicinity of the tidal channel near the northwest corner of the salt production ponds (Figure 2). By mid-November two of the satellite tags (on 60344 and 60346) stopped transmitting. However, the way that the tags stopped transmitting, slowly losing frequency of transmission and accuracy makes equipment failure highly suspect since the satellite tags require 48 hours of sun exposure to recharge the batteries. However, the loss of transmission coincided with extreme high tides that undoubtedly added to the rail's exposure to potential depredation.



Figure 2. Locations of four Light-footed Ridgway's Rails based on satellite data in South San Diego Bay, 2016.

Whether or not any of the harnessed rails make it into local populations may not be determined with certainty in 2016 but may be determined eventually with ongoing observations. Attempting to gather better data on rail survival and assimilation with advanced technology is important but straps them with an additional encumbrance. Furthermore, it remains uncertain whether satellite tags comprise good technology for use on a secretive bird, a shadow dweller, when the unit requires regular prolonged exposure to the sun for proper battery charge and operation. We have some data from occasional recent sightings of banded rails; some moved, some died, and some assimilated. For example, banded rails were re-sighted in the UC Kendall-Frost Reserve in 2013 – 2015 and in Famosa Slough in 2014 and with chicks in 2015. Amelia, #343, after a prolonged stay in captivity was released from the Acclimation Pens on 9 June 2015 and re-sighted in the company of an unbanded rail in Sweetwater Marsh by Joy Parkes on 21 July 2015. Finally and newly reported in 2016, a banded rail was found deceased in Fillmore on 8 October 2015, two weeks after release in the Seal Beach NWR; why the report was not filed until one year later is undetermined since the person reporting the sighting has been unreachable. The distance travelled by this rail was under 75 miles straight line but over 100 miles if the coastline was followed to the Santa Clara River and then inland. This is the first long distance northward move recorded of a rail bred in zoological facilities and released to the wild; perhaps in search of a cooler climate?

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