THE LIGHT-FOOTED CLAPPER RAIL: DISTRIBUTION, NESTING STRATEGIES, AND MANAGEMENT

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ABSTRACT

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

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

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

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

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

INTRODUCTION

The light-footed clapper rail (Rallus longirostris levipes) is a secretive resident of coastal marshes, ranging from Santa Barbara County, California to San Quintin Bay, Mexico (Bent 1926). Destruction and degradation of habitat led to alarmingly small, isolated populations in California and prompted the listing of this race as endangered on both state and federal levels (CDFG 1972, USDI 1973).

Fostering the recovery of this rail has been difficult, in part because little is known of its habits. Jorgensen (1975) pioneered detailed research, particularly of the breeding habits, of R. l. levipes. His work in Tijuana Marsh demonstrated the rail's preference for nesting sites in tall, dense cordgrass (Spartina foliosa). In 1979, we embarked on a study of the light-footed clapper rail encompassing habitat characteristics, population levels, food habits, breeding biology, and more recently,movements and behavior through banding and telemetry. The purpose of this paper is to report our findings on the statewide distribution of R. l. levipes, 1980-1982, factors affecting nesting site selection and nesting success, and to suggest measures for marsh design and management for rails.

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METHODS

Southern California's breeding populations of clapper rails were censused by mapping spontaneous vocalizations during evening hours at the onset of the breeding seasons as described in Zembal and Massey (1981). At marshes with small or unknown populations, a taped recording of the clappering call was played to elicit responses. Only Anaheim Bay and Upper Newport Bay were censused in 1979. Fifteen marshes were censused during the spring and early summer of 1980; twenty-three marshes were censused in 1981; and twenty-nine were censused in 1982. All marshes with known or suspected rail populations were censused during each of the three years, 1980-1982.

Searches for nests were conducted at Anaheim Bay, Upper Newport Bay, and Tijuana (by Paul Jorgensen) Marshes throughout the breeding seasons, usually March or April through June, of 1979, 1980, and 1981. Six additional marshes, Carpenteria, Kendall-Frost Reserve, Sweetwater, E Street, Otay River Mouth, and South Bay Marine Reserve, were searched for nests once each during 1980. The population estimates obtained through vocalization censusing corresponded very closely with the numbers identified by nest searching (Zembal and Massey 1981). All of the marshlands were searched for nests at Anaheim Bay and Tijuana Marsh. A different portion of a marsh was covered on each of several visits and within a period of one to three weeks, the entire marsh had been searched. This was repeated from three to six times during each breeding season. At Upper Newport Bay, the abundance of tall cordgrass made coverage of the entire bay impossible. Consequently, nest searches there were confined to the three islands (representing 93 acres or about 37% of the saltmarsh vegetation in the bay) in 1979 and 1980, and to two of the islands (53.4 acres or 21% of the bay's marsh habitat) in 1981. Each island was completely covered from four to seven times during each breeding season.

For each incubation nest found, data were taken on nest location, the vegetation of the nesting site, composition of the nest platform, presence of canopy and ramp, and other aspects of nesting not presented herein (see Massey et al. in press). Egg nests were rechecked regularly to determine hatching success through the presence of shell fragments or chick down in the empty nest or by finding brood nests in the vicinity.

Brief descriptions of the 15 marshes censused in 1980 are available in Zembal and Massey (1981). These descriptions are mostly summaries of information contained in the Coastal Wetland Series published by the California Department of Fish and Game. Additional descriptions of some of the marshes referred to herein can be found in Mudie (1970) and Schulenburg (1979).

RESULTS

Vocalization censusing revealed a total population in Southern California of 203 pairs of clapper rails in 1980, 173 pairs in 1981, and 221 pairs in 1982 (Table 1). Rails were observed in 11 marshes in 1980, 15 marshes in 1981, and 18 marshes in 1982. The population at Upper Newport Bay accounted for 48%, 38%, and 47% (1980, 1981, and 1982 respectively) of the state's total. Light-footed clapper rails were concentrated in very few marshes during the three years of study. The populations at five marshes, Carpinteria, Anaheim Bay, Upper Newport Bay, Kendall-Frost Reserve, and Tijuana, combined accounted for 93%, 84%, and 82% (1980 through 1982, respectively) of the state's total.

Table 1. Census of the Light-footed Clapper Rail in California, 1980-1982[a] (- means no census taken).

Location	No. of Pairs Detected 1980	1981	1982
Santa Barbara County			
Goleta Slough	0	0	-
Carpinteria Marsh	16	14	20
Ventura County			
Ventura River Mouth	-	-	0
Santa Clara River Mouth	-	-	0
Mugu Lagoon	-	0	-
Orange County			
Anaheim Bay	30	19	28
Bolsa Chica	0	0	0
Huntington Beach Strand	-	0	-
Upper Newport Bay	98	66	103
San Joaquin Marsh	-	-	5
San Joaquin-Carlson Rd. Marsh	-	-	5
San Diego County			
San Mateo Creek Mouth	-	-	0
Los Pulgas Canyon Mouth	-	-	0
Las Flores Marsh	-	-	0
Cocklebur Canyon Mouth	-	-	1
Santa Margarita Lagoon	0	0	2
San Luis Rey River Mouth	-	-	0
Guajome Lake Marsh	-	-	0
Buena Visa Lagoon	0	0	0
Agua Hedionda Lagoon	1	2	1
Batiquitos Lagoon	0	0	0
San Elijo Lagoon	-	5[a]	4
Los Penasquitos Lagoon	-	0	-
Kendall-Frost Reserve	18	16	6
San Diego River Flood Control Channel	-	3	1
Paradise Creek Marsh	1	2	3
Sweetwater Marsh	4	5	7
E.Street Marsh	3	1	3
F Street Marsh	-	1	1
J Street Marsh	-	1	0
Otay River Mouth	3	4	5
South Bay Marine Reserve	3	3	1
Tijuana Marsh (Oneonta Lagoon)	26	31	25
Totals: No. of pairs	203	173	221
No. of marshes	11	15	18

a. Data from P. Jorgensen, unpubl. field notes.

We found a total of 221 nesting sites (not counting renests) in Anaheim Bay, Upper Newport Bay, and Tijuana Marsh during the 1979 through 1981 breeding seasons combined. A total of 205 nesting sites (doesn't include data from Tijuana Marsh in 1979 since no vocalization census was taken) compares well with the total of 219 pairs estimated over the same period through vocalization censusing at these marshes.

Of the total 221 nesting sites, we identified the incubation nests in 208 cases. Nesting activity at several sites was not discovered until the brooding stage, by which time one to four brood nests had already been constructed per site and in 13 cases we were unable to distinguish the original egg nests. Whereas brood nests were nearly always built in cordgrass (often on wrack or debris) and constructed of dried cordgrass stems, incubation nests were not as confined to cordgrass habitat. A total of 152 incubation nests (73% of all nests) were built in cordgrass and of dried cordgrass stems. Forty-two of these (20% of all nests) were built in tumbleweeds or masses of wrack that had lodged securely in living cordgrass. A total of 50 egg nests (24% of all nests) were built in higher marsh vegetation in plants such as pickleweed (Salicornia virginica), saltgrass (Distichlis spicata), and Frankenia grandiflora. Such nests were often made of dried cordgrass but were occasionally constructed entirely, or in part, from dried stems of nearby higher marsh plants. Of these 50 nests, 40 (19% of all nests) were located on small hummocks or sections of berms that were well isolated from upland access in the lower marsh. The remaining 6 nests (3% of all nests) were discovered in freshwater reeds (Typha or Scirpus spp.) fringing the saltmarsh at Upper Newport Bay and were built of dried reeds.

All of the nests discovered early in the incubation period had canopies associated with them,although the canopies often disappeared as the time of hatching drew near. In all cases, the canopies were provided by the living plants or dead plant material within which the nests were situated. The rails often helped form the canopies by pulling the living stems above the nest down toward the nest center and somewhat entwining the stem tips. Formed canopies were most conspicuous over nests built in living cordgrass, the results were umbrella-like.

The light-footed clapper rails studied, utilized lower marsh nesting locations most heavily (we are differentiating between low and high saltmarsh only - see Zedler 1982). Of the 208 incubation nests found in 1979 through 1981, 198 or 95% were built directly in or isolated by lower marsh habitats. The disproportionate utilization of lower marsh was also manifest at those marshes where one-time searches for nests were done and at all marshes censused during the study as indicated by the specific locations of vocalizing pairs.

Our observations also confirm the rail's heavy utilization, first documented by Jorgensen (1975), of the nesting substrate provided by cordgrass. Tall, dense cordgrass was most heavily utilized but where cordgrass alone did not provide ample cover, tumbleweeds or wrack lodged in shorter or less dense cordgrass were used. Nests placed in higher marsh vegetation were most abundant when, and at saltmarshes where, cordgrass was in shortest supply. The typical site for such a nest was on a mound of higher marsh plants that was isolated in lower marsh from direct access to upland predators. Such sites were not abundant at any of the marshes inhabited by rails, but were utilized instead of the many more available sites with similar vegetation and direct upland connection. Isolated mounds are utilized almost exclusively at saltmarshes where cordgrass is lacking, at Carpinteria Marsh for example, where nearly 10% of the entire state's known population nested in 1982. Nesting locations in fringing stands of freshwater reeds were available only at Upper Newport Bay of the three marshes studied in greatest detail and they were utilized consistently there. The reed cover closely mimics that provided by luxuriant cordgrass. Since 22% of all the rails documented through vocalization censusing in 1982 were detected in fringing stands of reeds or in fresh to brackish water marshes, we expect that up to 22% of the state's population nested in such habitat in 1982.

High intensity storms and the associated massive freshwater runoff can lead to heavily damaged lower marsh and reduce the availability of the most heavily utilized nesting habitat. Such was the case at the three largest population centers just prior to the breeding season in 1980 (Massey et al., in press). Many stands of dense cordgrass were left matted and rendered useless for rail nesting. The result was a shift in 1980 toward nest placement in upper marsh vegetation but the most heavily utilized upland-isolated sites were in short supply at all three marshes. In 1979 only 7 of 75 nests (9%) were built in upper marsh plants whereas in 1980, 34 of 90 nests (38%) were so located. All of the suitably isolated sites available in the three marshes were utilized in 1980.

Repeated nest checks at Upper Newport Bay and Anaheim Bay during 1979-1981, allowed us to document hatching success at 130 nests. Overall hatching success (at least one egg hatched) was 81% and was similar for the two bays and all nest types other than nests in non-isolated patches of upper marsh vegetation. The hatching success for 7 such nests was 57% and significantly lower than for other nest types (Fisher's exact probability test, $p = 0.065$ that difference was significant).

Causes of nest destruction were observed for 15 nests. Nine nests in cordgrass were destroyed by high tides and 6 nests in upper marsh vegetation on sites not isolated from direct upland predator access were destroyed by predators.

Additional data and a rigorous analysis of the nesting strategies of the light-footed clapper rail are available in Massey et al. (in press).

DISCUSSION

In the three years we have conducted the state census, fluctuations in the breeding population have been marked (Table 1). From 1980 to 1981 the number of pairs dropped from 203 to 173, even though four small populations were newly detected. The major changes were in Anaheim Bay and Upper Newport Bay, the two largest population centers, where reductions were over 30%. By 1982 those populations were back to 1980 levels, four more sites were found, and both the number of breeding pairs and the number of sites were the highest so far.

Wide fluctuations in numbers have also been noted in the past (Wilbur 1974, Wilbur et al. 1979) and population crashes may have been natural phenomena in the life history of the clapper rail. However, with the reduced population of rails now in existence and with the birds concentrated in so few marshes, population crashes are cause for alarm. It is our hope that continued censusing and study will eventually give us the insights needed to interpret population shifts and lead to additional sound management for clapper rails such that any catastrophic shifts are avoided. After three seasons of censusing light-footed clapper rails and more detailed study at the three largest population centers, certain habitat requirements have become apparent.

Some of our preconceptions about rail habitat have changed dramatically. While it is certain that the single most heavily utilized habitat is tall, dense cordgrass, we have found rails nesting in marshes with little or no _Spartina_, from systems dominated by _Typha_ spp. and _Scirpus_ spp. to nearly monotypic expanses of pickleweed. The most productive combination of habitats in the state was that found in Upper Newport Bay, as indicated by the number and density of rails residing there.

The most urgent need of the light-footed clapper rail is expansion of its habitat. Creation of new marshes and alteration of existing ones are prominent features of the recovery plan. Designs for new or restored marshes should be based on the habitat characteristics found in Upper Newport Bay. A large tidal prism in the bay is manifest in the striking zonation of the saltmarsh vegetation and thriving invertebrate populations. Lower tides expose expansive mudflats, feeding grounds that support thousands of wintering shorebirds and waterfowl and provide an important portion of the clapper rails' fare as well. Freshwater enters the bay at several locations, not only supporting intermittent fringing stands of _Typha_ spp. and _Scirpus_ spp., but also contributing to increased plant productivity in the saltmarsh (Barbour and Davis 1970) including, most importantly for the clapper rail, the vigor of the _Spartina_ (Phleger 1971). The clapper rails in the bay commonly nest in the freshwater reeds and feed in the freshwater ponds and ditches. A narrow belt of dense cordgrass comprises the lower marsh over nearly the entire bay and is the single most heavily used nesting habitat of the resident rail population. Well developed tidal creeks throughout the saltmarsh provide important rail foraging habitat along with protection from predators via the topographic relief and cover along the creeks. The marsh above the *Spartina* belt provides additional important foraging habitat and a few alternative nesting sites in several parts of the bay that are high enough to be tide-protected, and isolated enough to afford some protection from predators.

The importance of tall, dense cordgrass is well documented (Jorgensen 1975, Massey and Zembal 1980). Ongoing research (Zedler et al. 1979) is adding substantially to our knowledge of the autecology of *Spartina* and has led to some successful transplantings. Transplant operations should certainly be included in marsh restoration projects, although successful establishment of *Spartina* of the desired stature and density is yet far from guaranteed. *Spartina* stands are used year-round by rails for cover and foraging, and seasonally for the placement of brood nests, even where the vigor of *Spartina* growth has not been great enough to protect incubation nests from inundation.

There may be years in any marsh when the *Spartina* belt does not provide the number of nest sites needed, as in Tijuana Marsh and Upper Newport Bay in 1980 and continually in Anaheim Bay due in part to subsidence (Massey et al., in press). Consequently, even in saltmarshes where *Spartina* normally thrives, good alternative nesting sites are occasionally necessary and should be provided where feasible. Such sites could include both protected upper marsh locations and fringing stands of freshwater reeds. Existing upper marsh locations could be made suitable for rail nesting in several marshes, for example; Mugu Lagoon, Anaheim Bay, and the Sweetwater complex, by providing greater predator protection. Two approaches could be used: 1) Extensions of tidal creeks and narrow mudflats to surround and isolate islands or strips of upper marsh vegetation; and 2) Removal of sections of berms, dikes, or old roads to create a series of isolated islands of upper marsh vegetation. Creation of new higher marsh nest sites could be accomplished by: 1) Building small hummocks of upper marsh habitat in existing low marsh with very small fills and plantings of upper marsh plants; and 2) raising the level of existing hummocks of isolated upper marsh by hand-carried fill to a safe elevation. Models for high marsh nest sites can be found at Carpinteria and the South Bay Marine Reserve, where rails are reproducing in marshes comprised almost entirely of high marsh vegetation. A network of meandering tidal creeks, particularly at the Marine Reserve, has created isolated high spots in the marsh that are exemplary for rail nesting.

Providing clapper rails with additional protected nesting locations could also be accomplished through the establishment of stands of freshwater reeds along the margins of existing saltmarshes. Favorable existing situations, such as in Upper Newport Bay, again should be looked to for guidance. Introduction of a correctly designed, small freshwater seep would probably be the only requirement at most marshes, since *Typha* spp. and *Scirpus* spp. are self-establishing where conditions are suitable. Expansion of small existing seeps and their associated stands of reeds would also benefit the clapper rail and might be accomplished rather inexpensively.

Until recently it was assumed that coastal marshes dominated by freshwater marsh vegetation were unsuitable as year-round habitat for the light-footed clapper rail, although the birds have been known to use them in the winter. Recently, however, nesting populations have been documented at five such places, San Joaquin Marsh Complex, Cocklebur Canyon, Agua Hedionda Lagoon, San Elijo Lagoon, and the San Diego River Flood Control Channel. Others, like Buena Vista and Batiquitos Lagoons do not appear to support rails continuously. By comparing the habitat characteristics of freshwater marshes that do support clapper rails with those that do not, we found several apparently significant differences. The five inhabited marshes have: 1) Fringing and intermixed higher ground, covered mostly by plants of the upper saltmarsh, and used by rails for foraging, loafing and roosting; 2) adjacent mudflats and creeks for foraging that also operate as deterrants to predators, and 3) a proper mixture of wet and dry habitats to insure good production of invertebrates along with the year-round persistence of enough water-free habitat on a daily basis to allow adequate foraging time.

The persistence of deep water for days or weeks at a time may have been the major bane to clapper rails at marshes like Goleta, Los Penasquitos and San Elijo. Restoration of tidal influence on a permanent basis at such marshes should take precedence over lesser, more interim measures there. Large, healthy populations of clapper rails once thrived at Los Penasquitos and outer San Elijo Lagoons; maintenance of permanent ocean entrances should result in reestablishment of rail populations in both places. Given the large acreages of saltmarsh at Goleta, San Elijo, and Los Penasquitos, if tidal influence could be reestablished and permanently maintained at those marshes alone, we would be taking a giant step toward the recovery of the light-footed clapper rail.

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