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SEASONALITY OF VOCALIZATIONS BY LIGHT-FOOTED CLAPPER RAILS

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Abstract.—Weekly monitoring of the spontaneous evening vocalizations of Clapper Rails at two marshes in southern California was carried out for one year. Information resulted concerning the relative use of the common calls, and the frequency and seasonality of calling. The most commonly heard calls were the *clapper, kek,* and *agitated kek.* Vocalizing showed a bimodal curve over the year, with strong peaks during the spring breeding season and again in late summer when juveniles join in the calling.

ESTACIONALIDAD EN LA VOCALIZACIÓN DE *RALLUS LONGIROSTRIS LEVIPES*

Sinopsis.—Durante un año y en dos anegados del sur de California, se estudio semanalmente la vocalización vespertina de *Rallus longirostris levipes.* Se obtuvo información concerniente al uso de las llamadas comunes o usuales, la frecuencia y la estacionalidad de estas. Los tipos de llamadas más comunes resultaron ser el "*clapper,*" "*kek*" y el "*kek*" alborotado. La vocalización en estas aves mostro una curva bimodal a través de todo el año, con picos marcados durante la época de reproducción en la primavera y luego al final del verano cuando los juveniles se unen a los adultos en sus llamados.

The limited information available on the vocalizations of *Rallus* spp. leaves many questions concerning call function and seasonality (Kaufmann 1983, Manolis 1981, Meanley 1969, and Tomlinson and Todd 1973). With the advantage of individually color banded as well as telemetered birds (Zembal and Massey 1983), we have accumulated many observations of situations in which the commoner calls of the Light-footed Clapper Rail (*Rallus longirostris levipes*) are used (see Zembal and Massey 1985a). In this paper, we relate our observations on the seasonality of the common calls and the frequency of calling.

STUDY AREA AND METHODS

Call counts have been conducted each spring since 1980 in all marshes in southern California with known or suspected populations of Light-footed Clapper Rails (Zembal and Massey 1981, 1983b, 1985b). Detailed studies were concentrated at Upper Newport Bay and Anaheim Bay, Orange County, California.

Upper Newport Bay is a state ecological reserve under jurisdiction of the California Department of Fish and Game. The total area of the reserve is about 288 ha with healthy saltmarsh vegetation over about 111 ha (California Department of Fish and Game 1984). The marsh has

supported the single largest population of Light-footed Clapper Rails in the state for the past 5 yrs (Zembal and Massey 1981, 1983b, 1985b).

Anaheim Bay is contained within the Seal Beach National Wildlife Refuge under the jurisdiction of the U.S. Fish and Wildlife Service and the U.S. Navy. The refuge includes about 440 ha, of which 226 ha are covered with saltmarsh vegetation (California Department of Fish and Game 1976). The bay's clapper rail population has fluctuated from the second to the fourth largest in the state over the past 5 yrs (Zembal and Massey 1985b).

Spontaneous vocalizations were monitored about once per week at both Anaheim Bay and Upper Newport Bay beginning 22 November 1981 and ending 17 November 1982. The specific monitoring sites were Upper Island, a 12 ha peninsula of saltmarsh in Upper Newport Bay, and approximately 25 ha of saltmarsh off Nasa Island in Anaheim Bay. Monitoring was accomplished in the evening, usually from 30–40 min before sunset, to 20–30 min after. At Upper Newport Bay there were 50 monitoring sessions averaging 85 min each; at Anaheim Bay 48 sessions averaged 62 min each. Excess time at Upper Newport Bay was used to examine the frequency of vocalizations up to 1 h before and 15 min after the usual 60 min period. During each 1-h session, call types (as described by Tomlinson and Todd 1973), their frequency, locations of vocalizing rails (points of calling), number of rails calling at each point (usually single or pair), and times of call delivery were recorded on a map. *Keking* was quantified by counting the number of *keking* individuals every 2 min. This was done in the field at Upper Newport Bay and later from notes for Anaheim Bay. Weather conditions were noted including temperature, relative humidity, and wind speed, all of which were measured.

RESULTS AND DISCUSSION

The common calls and frequency of calling.—Clappering and *keking* were the most frequently heard calls during evening monitoring sessions (Table 1). At Anaheim Bay only one additional call was heard, the *agitated kek*. In contrast, at Upper Newport Bay, *chase-squeals* and *churring* were heard in addition to the above 3 calls.

Chase-squeals and *churrs* may have been undetectable rather than absent at Anaheim Bay. The *churr* is inaudible from more than 20–30 m, and the chances of hearing it at Anaheim Bay were less because of lower bird density than at Upper Newport Bay (see below). *Chase-squeals* are also relatively inconspicuous since they are usually uttered only once per agonistic encounter. Additionally, fewer aggressive encounters would result in less use of this call where rails occur in lower density, as at Anaheim Bay.

The total number of calls heard at Upper Newport Bay was almost double (1.86 times) that at Anaheim Bay, probably reflecting the greater density of Clapper Rails there. In the spring of 1982 we counted 103 breeding pairs at Upper Newport Bay, a density of 1 pair/0.97 ha of

TABLE 1. Number of Clapper Rail calls heard during 1 yr of weekly monitoring of late evening vocalizations.

Location	*Clapper*	*Kek*	*Agitated Kek*	*Chase-squeal*	*Churr*	Total
Anaheim Bay	504 (39.5%)	749 (58.7%)	24 (1.9%)	0	0	1277
Upper Newport Bay	1432 (60.4%)	467 (19.7%)	409 (17.3%)	60 (2.5%)	3 (0.1%)	2371

saltmarsh; in Anaheim Bay there were only 28 pairs, or 1 pair/8.07 ha of saltmarsh. Thus, density over the entire marsh at Upper Newport Bay was eightfold that at Anaheim Bay. The peak number of points detected during a single evening was about the same for the two small pieces of marsh studied during this investigation; 16 at Anaheim Bay and 17 at Upper Newport Bay. Consequently, the number of pairs using the two small study plots was about the same, although the study plot in Anaheim Bay was twice the size of that in Upper Newport Bay. That the frequency of vocalizing is density-dependent has been very much in evidence during our annual censusing of Southern California marshes over the past 5 yrs. At marshes with small populations of Clapper Rails, we have had to use taped calls to elicit responses, because spontaneous vocalizations were not dependable every evening (Zembal and Massey 1985b, Zembal et al. 1985). Additionally, rail densities determined by vocalizing corresponded closely with those determined from nest searches (Massey et al 1984, Zembal and Massey 1983b).

The greater use of *keking* at Anaheim Bay, along with the behavior of some of the *keking* rails, led us to suspect a skewed sex ratio there. From 3–6 individuals *keked* incessantly during successive monitoring sessions through the peak breeding season at Anaheim Bay, as compared to usually two birds at Upper Newport Bay. These individuals appeared to be unmated males that roamed the marsh, attempting to attract females.

A shortage of females at Anaheim Bay would contribute to our inability to detect the *churr* and *chase-squeal.* With fewer mated pairs, *churring* would occur less frequently. Additionally, reduced production of young would result in less agonistic behavior during the late summer and reduce the amount of associated calling, including *chase-squeals* (see below).

Seasonality of the common calls.—Clappering was heard throughout the year with peaks in calling during mid-February to mid-April and again in September–October at both bays (Fig. 1). The number of rounds of vocalizing (two or more pairs in apparent response to one another) and of individuals calling followed similar patterns. The initial peak of calling corresponded with the onset of the breeding season and the second peak with its finish. Of 7 nests found on Upper Island, 5 had hatched by 19

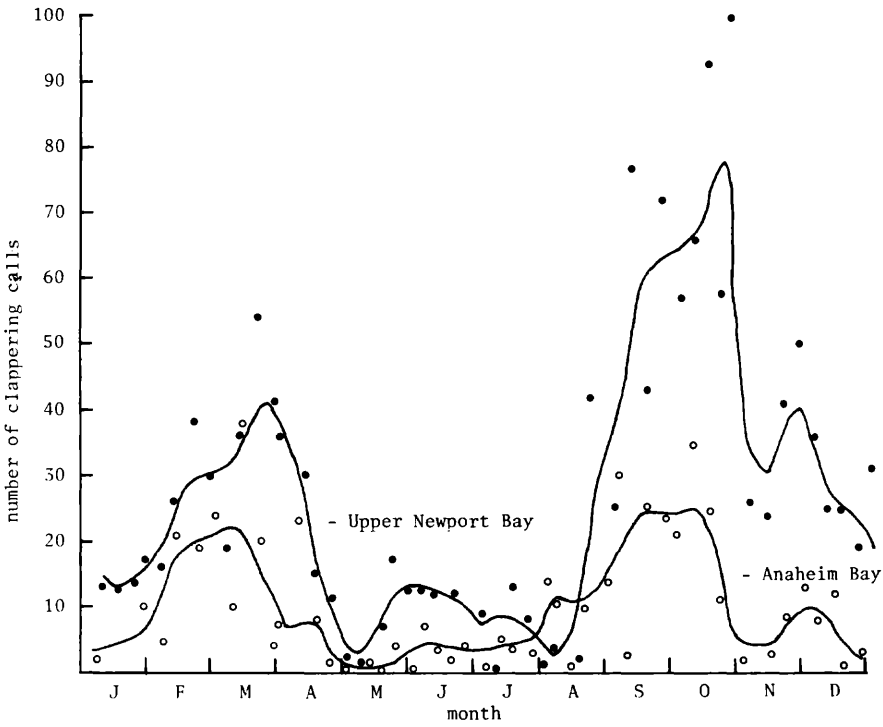

FIGURE 1. Number of *clappering* calls per monitoring session at Anaheim Bay (O) and Upper Newport Bay (●). The curves were smoothed by three-point median smoothing followed by hanning.

June. The somewhat greater heights of the second peaks were probably attributable to the additional calling contributed by first-year birds. This was most obvious at Upper Newport Bay where the peaks corresponded with a maximum of 11 points or pairs of rails in March and 17 in October. At Anaheim Bay, 15 points were detected in March with an increase to only 16 by October. Just as the mapping of spontaneous vocalizations at the onset of breeding has been used to estimate sizes of breeding populations (Zembal and Massey 1981, 1983b, 1985b), similar call counts late in the season might serve as an indication of fledging success. If this were repeated annually, a reliable index could be developed.

In contrast with *clappering*, the occurrence of *keking* was highly seasonal and primarily confined to the breeding season (Fig. 2). Approximately 96% of all *keking* calls were heard in March through June. The incidence of *keking* built to a fairly well defined peak at Upper Newport Bay and involved usually two rails engaged in intermittent prolonged *keking* throughout a given evening session. Furthermore, the locations of

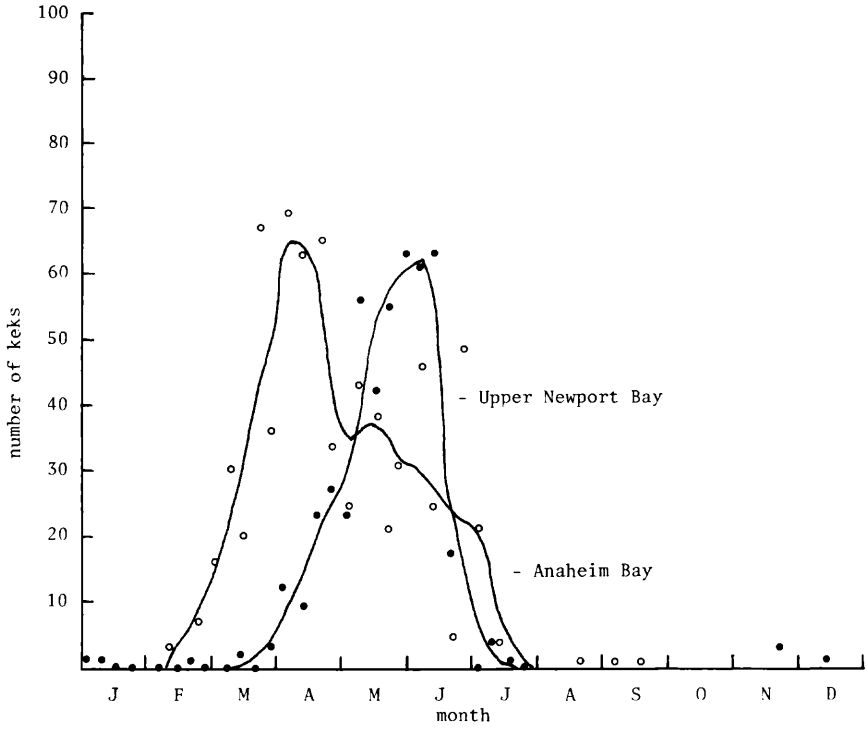

FIGURE 2. Number of *keks* per monitoring session at Anaheim Bay (O) and Upper Newport Bay (●). The curves were smoothed by three-point median smoothing followed by hanning.

keking rails did not vary much, indicating that the same birds may have been calling during successive monitoring sessions. At Anaheim Bay, prolonged *keking* began slightly earlier in the season and continued later. Additionally, *keking* often involved twice to three times the number of individuals at Anaheim Bay as at Upper Newport Bay, and some of the calling locations varied greatly. This indicates that there was probably movement of birds into and out of the study area, involving an unknown number of birds and an unknown acreage of contiguous marsh.

Increases in the calls associated with aggression during the late breeding season at Upper Newport Bay (Fig. 3) corresponded with observations of abundant aggressive interactions amongst fledglings. Newly independent young presumably interact with others in the process of establishing their social statures. The young congregated in various parts of the marsh and were much less wary about being out in the open. As many as 9 youngsters were observed at a single time walking about or dashing across the mudflats during bouts of interaction.

The increased *squealing* and *agitated keking* at Upper Newport Bay

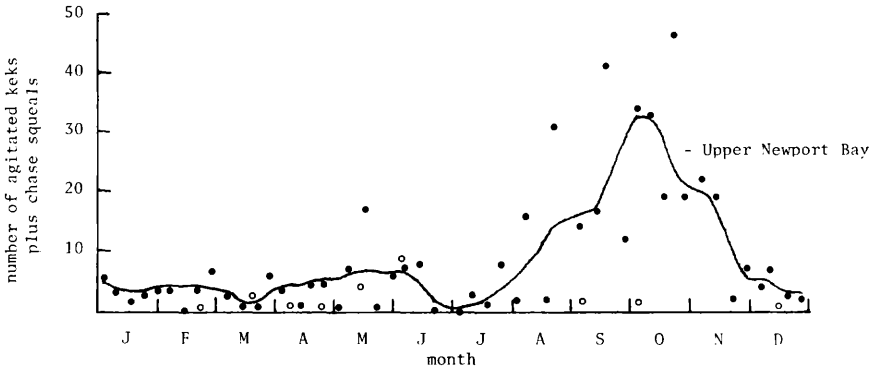

FIGURE 3. Number of *agitated keks* and *chase-squeals* combined per monitoring session at Anaheim Bay (O) and Upper Newport Bay (●). The curve was smoothed by three-point median smoothing followed by hanning.

corresponded with increased *clappering* by pairs. Whereas a maximum of 11 pairs was detected in March, 16 pairs were heard in September.

From the lack of similar observations of increased agonistic behavior at Anaheim Bay, it appears either that fledging success was poor on the study plot or that congregating areas for newly independent young were located out of the audible and visual range of the observer. Based upon the relative abundance of apparently unmated males and observations elsewhere in the bay, poor fledgling production appears to be the more likely explanation.

Other factors that affect the frequency of vocalizing.—Time of day, tidal height, and weather conditions also influenced the amount of calling heard on any given evening. The abundance of vocalizing on different days, under apparently similar conditions, however, was sometimes inexplicably variable.

Although vocalizing was heard at nearly any time of day, particularly during the peak seasons, calling was most intense in the evening and early morning. The morning calling period appeared to be briefer than the evening with fewer rounds of vocalizing and less opportunity to decipher individuals by mapping. During the daily coverage of our most recent telemetry session, 10 April–21 May 1983, for example, the maximum number of *clappering* calls heard from the telemetered bird in the first hour of daylight was 4, whereas 10 calls were heard in the closing hour of daylight. In the months of heaviest vocalizing (see Figs. 1–3), there was also a tendency for more calling to occur earlier in the evening at least at Upper Newport Bay, as documented through sporadic checks of over an additional 1 h of listening. Each locale or point of calling was always redocumented later, however, during that evening's formal 60 min session at both bays. Additionally, it was always necessary to stay on until dark in order to document with certainty the maximum number

TABLE 2. Evening call count totals for Clapper Rails and corresponding tidal heights.[1]

Dates	Highest tides (m MSL [ft MSL])	Total calls		
	Anaheim Bay			
13 June, **20 June**, 27 June	1.0 (3.3) **2.1** (**6.8**) 1.0 (3.3)	28	**7**	53
8 Aug, **15 Aug**, 22 Aug	0.9 (3.0) **2.0** (**6.4**) 0.8 (2.5)	11	**1**	11
5 Sept, **13 Sept**, 19 Sept	0.6 (2.0) **1.8** (**6.1**) 0.8 (2.5)	33	**3**	26
	Upper Newport Bay			
16 May, **22 May**, 30 May	1.2 (3.8) **1.8** (**6.0**) 1.3 (4.3)	66	**72**	82
10 July, **18 July**, 25 July	1.0 (3.4) **2.1** (**6.9**) 0.7 (2.3)	7	**14**	16
25 July, **2 Aug**, 7 Aug	0.7 (2.3) **1.8** (**6.0**) 1.3 (4.2)	16	**4**	19
7 Aug, **17 Aug**, 23 Aug	1.3 (4.2) **2.1** (**6.9**) 0.6 (2.0)	19	**4**	73

[1] Reading across the table, the dates, tides, and total calls detected are bold face for the evenings of highest tides. The figures before and after the bold face numbers are given for comparison and are the dates, tides, and total calls for the monitoring sessions immediately before and after the sessions of highest tides, respectively. Tidal heights are in meters (ft) relative to mean sea level (MSL).

of points of calling obtainable during evening sessions. At Upper Newport Bay, for example, the final point to be documented during each of the 50 sessions was heard an average of 10.4 min after sunset.

In heavy rains, high winds, and extreme high tides vocalizing was reduced. High wind and rain operated as temporary deterrents, since once the heaviest part of a squall passed or the gusts subsided, bursts of calling might break forth from the marsh. Consequently, call totals were only partially affected, since the weather conditions associated with reduced vocalizing were never prevalent for an entire monitoring session.

High tides, on the other hand, prevailed during entire sessions, and at Anaheim Bay resulted in detection of far fewer calls than during sessions when much lower tides prevailed (Table 2). This trend was less clear at Upper Newport Bay, where reduced vocalizing was observed for only 2 of 4 counts taken during moderately high tides. A marked difference in the elevations of the 2 bays is probably the underlying cause. Subsidence at Anaheim Bay has been an intermittent phenomenon for over 25 yrs, so that a 1.8 m (6 ft, MSL) tide now inundates the entire saltmarsh, leaving the rails no vegetational cover. In contrast, a moderate amount of vegetation remains above water even during the highest tides (2.2 m, 7.3 ft, MSL; see Massey et al. 1984) in Upper Newport Bay.

The loss of cover by complete inundation of the marsh vegetation results in the rails moving to the periphery of their territories or out of their more usual haunts entirely, even into uplands in search of cover. Occasionally, rails were observed standing on debris floating in open water, or crouched on exposed nests. Under such circumstances, territoriality apparently breaks down and several adults were often observed within relatively close quarters, in small patches where enough vegetation remained to provide substrate for evening foraging as well as conceal-

ment. Excessive vocalizing during extreme high tides, in territorial pronouncement or even in greeting, would seem counter-productive when concealment appears to be the major consideration and the habitat comprising a territory is underwater.

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LITERATURE CITED

CALIFORNIA DEPARTMENT OF FISH AND GAME. 1976. The natural resources of Anaheim Bay and Huntington Harbor. Coastal Wetland Series No. 18. Sacramento, California. 68 pp.

———. 1984. Upper Newport Bay management plan. Calif. Dep. Fish and Game, Long Beach, California.

KAUFMANN, G. W. 1983. Displays and vocalizations of the Sora and the Virginia Rail. Wilson Bull. 95:42–59.

MANOLIS, T. 1981. The "kicker" song—new synthesis of an old mystery. Am. Birds 35: 261–263.

MASSEY, B. W., R. ZEMBAL, AND P. D. JORGENSEN. 1984. Nesting habitat of the Light-footed Clapper Rail in southern California. J. Field Ornithol. 55:67–80.

MEANLEY, B. 1969. Natural history of the King Rail. Bureau of Sport Fisheries and Wildlife. North Am. Fauna 67. 107 pp.

TOMLINSON, R. E., AND R. L. TODD. 1973. Distribution of two western Clapper Rail races as determined by responses to taped calls. Condor 75:177–183.

ZEMBAL, R., AND B. W. MASSEY. 1981. A census of the Light-footed Clapper Rail in California. West. Birds 12:87–99.

———, AND ———. 1983a. To catch a Clapper Rail—twice. N. Am. Bird Bander 8: 144–148.

———, AND ———. 1983b. The Light-footed Clapper Rail: distribution, nesting strategies, and management. Cal-Neva Wildlife Transactions, 1983:97–103.

———, AND ———. 1985a. Function of a rail "mystery" call. Auk 102:179–180.

———, AND ———. 1985b. Distribution of the Light-footed Clapper Rail in California, 1980–1984. Am. Birds 39:135–137.

ZEMBAL, R., J. M. FANCHER, C. S. NORDBY, AND R. J. BRANSFIELD. 1985. Intermarsh movements by Light-footed Clapper Rails indicated in part through regular censusing. Calif. Fish Game 71:164–171.

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