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Evaluation of call-response surveys for monitoring breeding Yuma Clapper Rails (*Rallus longirostris yumanensis*)

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ABSTRACT. During March–June 2000 we evaluated the use of call-response surveys to monitor breeding Yuma Clapper Rails (*Rallus longirostris yumanensis*) at the Ciénega de Santa Clara, Colorado River Delta, Sonora, Mexico. We assessed the effect that time of day, stage of breeding season, and number of survey periods had on the average number of rails detected at a station. Conducting call-response surveys resulted in a significant increase in the number of detected rails and reduced the coefficient of variation of the average number or rails per station, which increases the statistical power to detect population trends. Using this technique also appears to reduce the variation of rates of responses by rails through the breeding season when compared to passive listening. There was no difference between the number of rails detected during morning and afternoon surveys. The established protocol developed by the U.S. Fish and Wildlife Service for Yuma Clapper Rail surveys is adequate for monitoring, and it should continue to be implemented on a yearly basis at the Ciénega de Santa Clara and other wetlands of the Colorado River Delta in Mexico.

SINOPSIS. **Evaluación de los muestreos con llamadas-respuestas para monitorear individuos de *Rallus longirostris yumanenesis***
Durante Marzo–Junio del 2000 evaluamos el método de muestreos por llamado-respuesta para monitorear poblaciones de Palmoteador de Yuma (*Rallus longirostris yumanensis*) durante la época reproductiva en la Ciénega de Santa Clara, Delta del Río Colorado, Sonora, México. Evaluamos el efecto que la hora del día, la etapa de la época reproductiva y el número de periodos de muestreo tuvieron sobre el promedio de individuos detectados. Utilizar muestreos por llamado-respuesta resultaron en un incremento significativo en el número de palmoteadores detectados y en una reducción del coeficiente de variación en el número promedio de palmoteadores por estación de muestreo, lo que incrementa el poder estadístico para detectar tendencias poblacionales. Esta técnica aparentemente también reduce la variación en las tasas de respuesta de los palmoteadores a través de la temporada reproductiva, en comparación con los muestreos pasivos. No encontramos diferencia entre el número de palmoteadores detectados durante muestreos matutinos y vespertinos. El protocolo desarrollado por el Servicio de Pesca y Vida Silvestre de Estados Unidos para el muestreo de Palmoteador de Yuma es adecuado para el monitoreo de la subespecie, y su implementación anual debe continuar en la Ciénega de Santa Clara y otros humedales en el Delta del Río Colorado, México.

Key words: Ciénega de Santa Clara, Clapper Rail, Colorado River Delta, endangered species, marsh birds, population trends

Call-response surveys are a common and useful tool for monitoring secretive waterbirds in North America (Ribic et al. 1999). This survey technique has been shown to increase the detection rates of marsh-breeding birds (Gibbs and Melvin 1993), and for some species it has been described as the only practical way for estimating population size (Marion et al. 1981). This is the case for rail species, which are elusive, inhabit dense vegetative cover, and tend to vocalize and respond to taped bird calls (Marion et al. 1981; Johnson and Dinsmore 1986; Eddleman and Conway 1998). Monitoring of endangered rails in the western United States, including the Yuma Clapper Rail (*Rallus longirostris yumanensis*), is based on call-response surveys (Eddleman 1989; Eddleman and Conway 1998; Spear et al. 1999).

Call response surveys have been used to

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study Yuma Clapper Rail populations since the 1970s (Anderson and Ohmart 1985; Todd 1986; Eddleman 1989). In the early 1990s, a protocol was established for monitoring the subspecies. The protocol specifies survey dates (15 March–15 May), timing of broadcasts of taped calls (two periods of 2-min rail calls with 2 min of listening), and time of day (from 30 min before sunrise until no later than 3 h after sunrise), among other parameters (Yuma Clapper Rail Recovery Team 2000). The establishment of a standard survey protocol has been the result of multiple studies in the Lower Colorado River in the U.S. (Eddleman 1989; Conway et al. 1993), and has facilitated the estimation of population trends (Powell 1990; Piest and Campoy 1999).

Nevertheless, the assessment of the effectiveness of call-response surveys as a method for determining relative abundance, distribution, and population trends has been identified as a research need for marsh birds in general (Ribic et al. 1999) and for the Yuma Clapper Rail in particular (Eddleman and Conway 1994). Two important aspects to evaluate for the Yuma Clapper Rail protocol are the effectiveness per field effort, the effectiveness of the protocol under different wetland conditions, and its precision as a monitoring tool.

During the breeding season of 2000, we conducted call-response surveys for Yuma Clapper Rails at the Ciénega de Santa Clara, in the Colorado River Delta, Sonora, Mexico, the wetland that supports the majority of the breeding population of the subspecies (Hinojosa-Huerta et al. 2001). Our objective was to evaluate the protocol at the Ciénega de Santa Clara, as well as to contribute information on the general effectiveness of call-response surveys for monitoring elusive marsh birds. This research was part of a bi-national effort to determine the abundance, distribution, and habitat use of the Yuma Clapper Rail in the Colorado River Delta, Mexico (Hinojosa-Huerta 2000).

METHODS

Study area. We conducted the study at the Ciénega de Santa Clara, the largest marsh wetland in the Colorado River Delta, which covers about 5800 ha of cattail (*Typha domingensis*) dominated areas interspersed with open lagoons (Glenn et al. 1996). The main source of water supporting the ciénega is agricultural run-off from the Yuma Irrigation Valley, which arrives through the Wellton-Mohawk canal and attains salinity of >3 ppt.

Survey methods and assessment. We conducted call-response surveys following the protocol established by the U.S. Fish and Wildlife Service for Yuma Clapper Rails (Piest and Campoy 1999). Survey stations were circular plots (100-m radius) located at least 200 m apart, and grouped in mini-routes (five stations per mini-route) (Bystrak 1980). We conducted surveys at 35 stations (seven mini-routes). We used a Geographic Information System (GIS) (Arc View 3.1 NT) and an existing database for the Colorado River Delta (Valdés-Casillas et al. 1998) to randomly select the location of each mini-route in the Ciénega de Santa Clara, based on a stratified random design (as suggested by Gibbs and Melvin 1997) to include the general kinds of marsh habitat types available in the ciénega.

We collected data to evaluate the effect that time of day (morning and afternoon), stage of breeding season (early breeding season [10 March–25 March] and late breeding season [10 May–25 May]), and number of survey periods (passive listening, one period, and two periods) had on the average number of rails detected at a station. We visited each station during the early breeding season, and during the late breeding season, conducting morning surveys (between 05:00 and 10:30) and afternoon surveys (between 17:00 and 19:30) of the same day, with a total of four visits at each station.

At each station we added a period of passive listening of 2 min before playing the taped vocalizations, during which we recorded all responding rails. We then conducted an initial survey period (2 min playing and 2 min listening), recording the number of rails responding, and finally a second survey period, in which we recorded new individuals responding to the taped calls. We assumed rails to be different individuals when responses came from a location separated by a $\geq 30°$ bearing. We treated the passive listening survey and the call-response surveys independently, recording all individuals responding to the tapes even if they were calling before and detected during the passive listening period.

Statistical analysis. We conducted a multivariate analysis of variance (MANOVA) based

Table 1. Average number of Yuma Clapper Rails detected per station with each survey technique at the different stages of the breeding season and times of day on the Ciénega de Santa Clara, Sonora, México. Silence = passive listening; One period = taped calls for one period of 2 min; Two periods = taped calls for two periods of 2 min. Coefficients of variation are shown in parenthesis.

	Silence	One period	Two periods
Early breeding season	1.11 (86.71)	1.30 (55.87)	2.04 (51.83)
Late breeding season	0.65 (67.97)	1.24 (51.73)	2.00 (38.23)
Morning	0.75 (93.35)	1.14 (50.17)	1.82 (51.63)
Afternoon	1.01 (83.10)	1.40 (54.32)	2.21 (38.72)
Average	0.89 (87.43)	1.27 (52.99)	2.02 (44.84)

on a repeated-measures experimental design with the mini-routes (Ramsey and Schafer 1996), fitting a model with the average number of rails detected per station for each of the survey techniques, and a distinct model with the difference of rails detected between the survey techniques. We used the coefficient of variation (CV) as a measure of the precision of the techniques, testing for a difference between the CVs of passive listening and two survey periods calculating a Z statistic (Zar 1996). We used JMP IN 3.2.6 (Sall and Lehman 1996) to perform the statistical analysis.

RESULTS

Number of survey periods. Conducting two survey periods resulted in a significant increase in the number of rails detected over conducting one survey period and passive listening (MANOVA F-test, $F_{1,25} = 102.99$; $P < 0.001$; Table 1). The estimated difference between two survey periods and passive listening was 1.14 rails detected/station (± 0.24, 95% confidence interval). This represents a 128% increase in the number of rails detected over all stations (estimated difference of average number of rails detected between two survey periods and passive listening divided by the average number of rails detected with passive listening). The estimated difference between two survey periods and one survey period was 0.75 rails detected/station (±0.17, 95% confidence interval), representing a 59% increase in the number of rails detected. Conducting one survey period resulted in an estimated increase of 0.39 rails detected/station over passive listening (±0.22, 95% confidence interval), representing an increase of 44%.

Table 2. Estimated differences of Yuma Clapper Rails detected between survey techniques at different stages of the breeding season and times of day on the Ciénega de Santa Clara, Sonora, México. The pooled standard error for the analysis was 0.12.

	2P–Silence[a]	2P–1P[b]	1P–Silence[c]
Early breeding season	0.92	0.74	0.19
Late breeding season	1.34	0.75	0.59
Morning	1.07	0.68	0.39
Afternoon	1.20	0.81	0.39
Average	1.14	0.75	0.39

[a] 2P–Silence = difference of rails detected between two survey periods and passive listening.

[b] 2P–1P = difference of rails detected between two survey periods and one survey period.

[c] 1P–Silence = difference of rails detected between one survey period and passive listening.

More important, the average number of rails detected per station during call-response surveys had a smaller CV than the average number of rails obtained with passive listening surveys (a reduction of 42.59%), during both seasons and times of day ($Z = 5.06$, $P < 0.0001$; Table 1).

Stage of the breeding season. There was no difference between the number of rails detected during the early breeding season and late breeding season for any of the survey techniques (MANOVA, $F_{1,25} = 0.4578$; $P = 0.51$; Table 1). However, there is suggestive evidence that the estimated difference between rails detected during call-response surveys (one and two periods) and passive listening was higher during the late breeding season (MANOVA, $F_{1,25} = 2.94$; $P = 0.09$; Table 2). The estimated difference between performing two periods and one period was almost the same for the early breeding season and late breeding season (Table 2). This was related to a higher number of rails detected with passive listening during the early

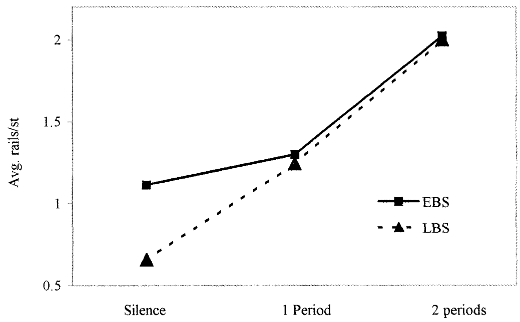

Fig. 1. Average number of Yuma Clapper Rails detected per station with each survey technique during early and late breeding season on the Ciénega de Santa Clara, Sonora, México. Silence = passive listening; 1 Period = taped calls for one period of 2 min; 2 Periods = taped calls for two periods of 2 min. EBS refers to early breeding season; LBS refers to late breeding season.

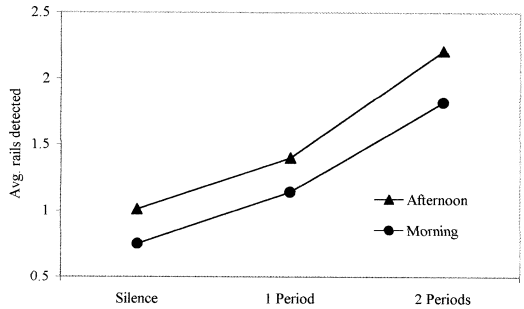

Fig. 2. Average number of Yuma Clapper Rails detected per station with each survey technique during morning and afternoon surveys on the Ciénega de Santa Clara, Sonora, México. Silence = passive listening; 1 Period = taped calls for one period of 2 min; 2 Periods = taped calls for two periods of 2 min.

breeding season (an average of 1.11 during early breeding season versus 0.66 during late breeding season). Although this difference was not significant (MANOVA, $F_{1,25} = 2.56$; $P = 0.12$), it suggests that the variation of responses of rails between seasons is reduced by call-response surveys, especially when compared with the average number of rails detected with one and two survey periods for the two seasons, which were very similar (Table 1, Fig. 1).

Time of day. The number of rails detected during the afternoon surveys was consistently higher for all the survey techniques and both breeding seasons (Fig. 2); however, the differences were not statistically significant (MANOVA, $F_{1,25} = 1.1945$; $P = 0.28$).

DISCUSSION

Call-response surveys improved the detection of Yuma Clapper Rails over passive listening, and having two survey periods is worth the extra time spent in the field. The technique also provided a more precise index of rail abundance, which is a critical parameter in improving the power to detect population trends (Gerrodette 1987; Gibbs and Melvin 1997). Using call-response surveys appears to reduce the variation of rates of responses by rails through the breeding season when compared to passive listening. Other studies have found significant variation of response rates of Yuma Clapper Rails through the breeding season, with peaks between mid-April and mid-May (Anderson and Ohmart 1985; Todd 1986; Eddleman 1989). Our results for passive listening are consistent with this variation, but our results using call-response surveys did not vary through the period of study. This consistency in the response rate might be the result of higher densities of clapper rails in the Ciénega de Santa Clara (Hinojosa-Huerta et al. 2001), as response rates have been found to be increased by higher rail densities (Zembal and Massey 1981). The fact that we started surveys in March, compared to April in past studies, was possibly also a factor (see Anderson and Ohmart 1985).

Our detection rates of clapper rails between morning and afternoon surveys contrasts with other studies, which have found higher detection rates during morning than afternoon for marsh birds (Gibbs and Melvin 1993) and with recommendations for conducting call-response surveys (Ribic et al. 1999). However, for the purposes of adapting a standardized monitoring program, conducting surveys at just one time of day would be preferable (Conway et al. 1993; Gibbs and Melvin 1997). Because the established protocol for Yuma Clapper Rail surveys in the Lower Colorado River recommends surveys during the morning (Yuma Clapper Rail Recovery Team 2000), monitoring at the Colorado River Delta in Mexico should also follow the same criterion. For circumstances in which evening surveys would be more feasible (e.g., volunteer programs; see Ribic et al. 1999), results would probably not yield fewer rails detected. Further issues to study are the vocalizing behavior of rails throughout the day and the response rates of clapper rails at different population densities.

Conclusion. Improved detection rates and precision, and reduction of variation through the breeding season of the number of rails found per station obtained with call-count surveys showed that this technique should continue to be used for monitoring breeding Yuma Clapper Rails. The established protocol for Yuma Clapper Rail surveys is adequate for monitoring purposes, and it should continue to be implemented on a yearly basis at the Ciénega de Santa Clara and other wetlands of the Colorado River Delta in Mexico.

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