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DISTRIBUTION, HABITAT, AND STATUS OF THE SORA AND VIRGINIA RAIL IN EASTERN KANSAS

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Both the Sora (*Porzana carolina*) and the Virginia Rail (*Rallus limicola*) are common transients in Kansas (Johnston 1965), but nesting records are few and largely limited to the western half of the state (Graber and Graber 1951, Parmelee et al. 1970, Tacha 1975), but 3 unpublished records are from the eastern third (Ottawa and Jefferson counties, E. R. Lewis; Pottawatomie County, S. D. Fretwell, pers. comm.). Kansas populations of both species are thought to be increasing (M. D. Schwilling cited by Odom 1977 and Zimmerman 1977), but no systematic survey has been conducted. My purposes in this study were to determine the time and intensity of spring migration and assess the nesting status of these species in the eastern third of Kansas (east of U.S. highway 81, approximately 97°30'W).

STUDY SITES AND METHODS

Study sites.—As a result of letters of inquiry to Kansas birders, 46 sites in 29 counties of eastern Kansas were identified and visited during the period from mid-April to mid-June 1980. Of these sites, 25 were considered unsuitable because of their being too small (estimated <.2 ha) or too ephemeral (standing water only after rainy periods). Of the remaining sites, 14 were censused, but rails were only found at 6. From this initial survey, however, 7 areas were chosen for more intensive work during the next 2 years (Fig. 1) and are described below.

Herington marsh. Dickinson Co., T16S, R4E, Section3.—This is a natural cattail (*Typha*)-sedge (*Carex*) marsh formed below active springs in rock outcrops immediately adjacent to the southern boundary of the site. Flow into this marsh was increased sometime in the 1930's by the drilling of an artesian well.

Milford. Geary Co., T11S, R5E, Section 21.—This site is a small cattail marsh formed in the old channel of the Republican River below the north end of the dam at Milford Reservoir. The water level is maintained by flow from springs and outflow from the reservoir.

Eureka Lake. Riley Co., R7E, T10S, Section 28.—A natural oxbow lake, this site was cut-off from the Kansas River around the turn of the century. Succession has led to one section becoming forested with typical riparian species, but standing water is present in most years in the lowest portion, while a shallow cattail-smartweed (*Polygonum*) marsh covers the remaining area. Woody invasion has apparently been retarded by periodic burning of the marsh. Water level is completely dependent upon rainfall and runoff from a relatively small basin, and the marsh is dry during low rainfall years (e.g., 1981).

River ponds. Pottawatomie Co., R7E, T9S, Section 24.—This is a pond

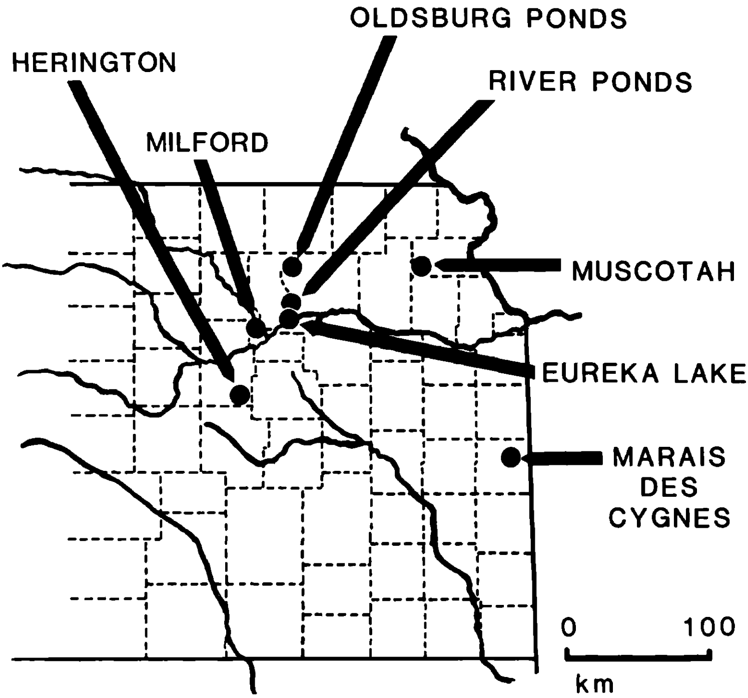

FIGURE 1. Study sites.

developed during the early 1960's by the building of a beaver dam in the old channel of the Big Blue River below the dam at Tuttle Creek Reservoir. The margin of this small lake now has a well-developed cattail stand, and the water level is maintained by runoff of seepage water from under Tuttle Creek dam.

Oldsburg Ponds. Pottawatomie Co., T6S, R7E, Section 14.—This is an artificial impoundment constructed by the Kansas Fish and Game Commission in the mid-1960's after the filling of Tuttle Creek Reservoir to provide additional habitat for fall waterfowl hunting. The vegetation is primarily smartweeds with cattails in a few areas. In the spring the habitat becomes wet only through high water in the upper reaches of the reservoir and direct flooding from the Big Blue River. Thus in dry years (e.g., 1981), this site is not suitable for rails.

Muscotah marsh. Atchinson Co., T6S, R17E, Section 16.—A cattail-sedge-bullrush (*Scirpus*) bog fed by artesian springs. This site dates from the post-Pleistocene (Horr 1955, McGregor 1968) and is probably the oldest, permanent marsh in eastern Kansas.

Marais des Cygnes. Linn Co., T21S, R25E, Section 6.—In 1955 the Kansas Fish and Game Commission constructed several shallow impoundments to form the Marais des Cygnes Wildlife Areas. Cattail and sedge margins along the western border of one of these ponds provide suitable rail habitat, but water level is entirely dependent upon rainfall and runoff.

Method of rail detection.—The presence of rails was determined by their responses to the playback of tape-recorded advertisement calls of both species within 3 h of sunrise and 2 h of sunset. This survey technique appears to have been first used for rails by Tomlinson and Todd (1973), and since that time has become the standard method for determining presence (Baird 1974, Glahn 1974, Tacha 1975, Holliman 1976) and of indexing densities (Griese et al. 1980).

Sampling stations were selected along the margins of the study sites in a quasi-random manner in that they were located adjacent to suitable habitat and far enough apart so that rails responding there were unique to that sampling station (at least 100 m, see Glahn 1974 for maximum response radius). Tapes were broadcast using a Uher Model 4400, battery-powered player.

On the basis of the results of Glahn's (1974) work, a sampling session consisted of 5 min of tape, either the Sora call or one of 2 Virginia Rail calls, followed by 5 min of silence. Then 5 min of the other rail species was played, followed again by 5 min of silence. Thus each sampling period covered 20 min of elapsed time. Responses by each species of rail were counted and recorded according to the 5 min period in which they were heard, and the number of different individuals of each species was estimated for the whole sampling period.

Audio tapes of Sora and Virginia Rail calls were obtained from the Library of Natural Sounds, Laboratory of Ornithology, Cornell University, Ithaca, New York 14850. The Sora tape consisted of a 10 sec song bout of 4 "whinny" calls followed by a 20 sec pause, a pattern that was repeated 10 times for a total song period of 5 min. Two different Virginia Rail calls were used. The first type was a more or less constant bout of repeated "tick" and "tick-it" calls for a period of 48 s followed by a pause of about 15 s which was then repeated 4 more times to make a total of 5 min. The second Virginia Rail call was the "kicker" (Reynard 1974), and the 5 min call period was composed of 3 bouts of 9 calls, each bout lasting 70 s, followed by a 15 s pause, and a final bout of 5 calls lasting 44 s. Kansas Virginia Rails were heard to give both calls as well as the "grunt" call, and the call given did not always match the call being played.

Habitat analysis.—When rails were detected at any sampling station at a site, the habitats at all the sampling stations at that site were analyzed in order to compare habitat variables between stations with and without rails. Habitat data were collected along a transect beginning at the point where the tape was played and directed along the same azimuth that the loudspeaker was pointed if no rails were heard at the station. If rails were heard at that station, the transect was directed towards the point at which rails were heard (or middle point, if several different rails were

TABLE 1. Mean number of Sora and Virginia Rails detected per station. Numbers of stations are in parentheses.

Date	Soras/station	Va. Rails/station	Site
12 April 1981	1.00 (2)	0 (2)	Muscotah
15 April 1982	0 (4)	0.25 (4)	Eureka Lake
16 April 1982	0 (3)	0.67 (3)	Muscotah
17 April 1982	0.60 (5)	0.20 (5)	Marais des Cygnes
20 April 1980	0.20 (5)	0.40 (5)	Herington
23 April 1981	0 (1)	1.00 (1)	River Ponds
23 April 1982	0 (4)	0.25 (4)	Eureka Lake
10–23 April	0.25 ± 0.12[a] (24)	0.33 ± 0.12 (24)	
24 April 1981	0.33 (3)	0 (3)	Muscotah
29 April 1982	0.25 (4)	0 (4)	Eureka Lake
29 April 1982	0.67 (3)	0.33 (3)	Oldsburg Ponds
30 April 1982	0.67 (3)	0.33 (3)	Muscotah
1 May 1982	2.60 (5)	0.80 (5)	Marais des Cygnes
2 May 1982	1.00 (2)	0 (2)	Herington
4 May 1980	0.50 (2)	0 (2)	River Ponds
5 May 1980	0.75 (8)	0.25 (8)	Eureka Lake
6 May 1982	0.60 (5)	0 (5)	Eureka Lake
7 May 1982	0.50 (2)	0 (2)	Milford
24 April–7 May	0.86 ± 0.18 (37)	0.27 ± 0.08 (37)	
12 May 1982	0 (2)	0.50 (2)	Herington
14 May 1982	0.33 (3)	0.33 (3)	Oldsburg Ponds
18 May 1982	0 (3)	0.67 (3)	Oldsburg Ponds
19 May 1982	0.33 (3)	1.00 (3)	Muscotah
19 May 1981	0.50 (2)	0 (2)	River Ponds
8–21 May	0.23 ± 0.12 (13)	0.77 ± 0.22 (13)	
22 May 1981	0 (2)	1.00 (2)	Milford
27 May 1982	1.50 (2)	0 (2)	Oldsburg Ponds
2 June 1982	0 (3)	0.33 (3)	Muscotah
3 June 1980	0 (4)	0.25 (4)	Muscotah
22 May–4 June	0.27 ± 0.19 (11)	0.36 ± 0.20 (11)	

[a] Standard error.

heard). Data were collected at 4 points along this transect, separated by distances determined by pacing, the number of paces selected in sequence from a table of random numbers. At each of these points the water depth in centimeters was measured and the percentage cover in a 1 m radius circle was estimated in terms of "open" and major plant types (e.g., *Typha, Carex, Scirpus, Polygonum,* other forbs, woody plants, and grass). Vegetation height for each of these 4 points along the transect was determined by measuring the height of the vegetation above water level at 10 randomly selected points 1 m from the sampling point and computing a mean. The data from the 4 points along the transect were used to calculate mean water depth, mean percentages of cover, and mean vegetation height for each rail sampling station.

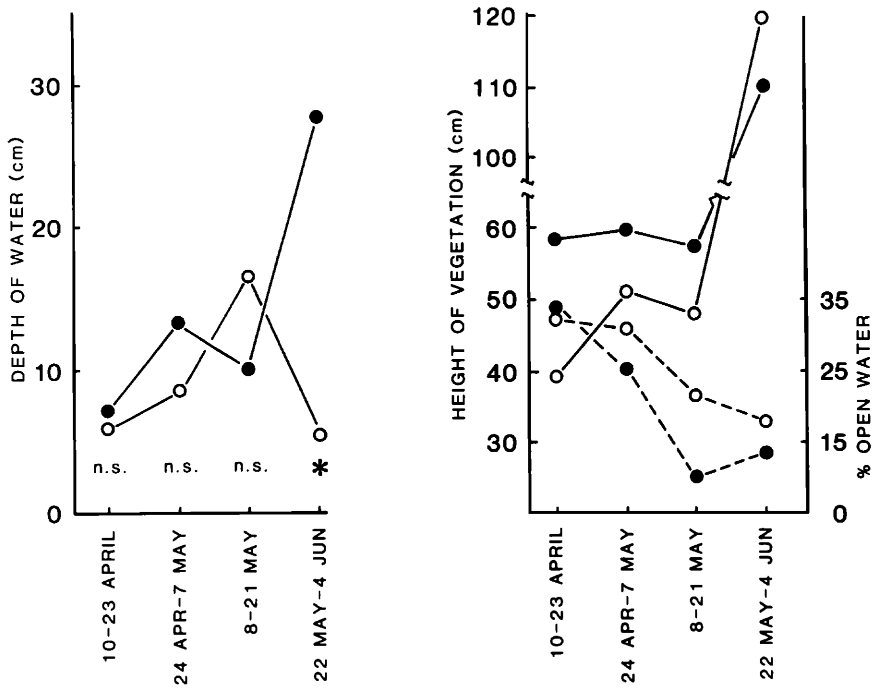

FIGURE 2. Habitat variables at stations with rails (solid circles) and without rails (open circles) during the period of rail occurrence. An asterisk indicates a significant difference ($P < .05$).

RESULTS

Sampling for rails began as early as the third week in March and continued until the fourth week of June. Detection of rails, however, was limited to the period 12 April through 3 June with the highest relative densities (total rails/station) occurring in late April and early May (Table 1). There were no significant differences in the mean number of total rails of both species combined among the 2-week periods of 10–23 April, 24 April–7 May, 8–21 May, or 22 May–4 June. Furthermore, there were no significant differences among these periods in the numbers of Virginia Rails alone. The number of Soras, however, was greater during the fortnight of 24 April–7 May, and this mean was significantly different from the mean number of Soras for 10–23 April (Student's $t = 2.48$, df = 59, $P < .02$) and the 8–21 May period that followed (Student's $t = 2.03$, df = 48, $P < .05$) as well as for the number of Virginia Rails in the same 24 April–7 May period (Student's $t = 3.12$, df = 72, $P < .01$).

The only significant difference in the habitat variables between sampling stations with rails and those without rails was that mean water

TABLE 2. Mean ± SE of habitat variables at sampling stations with rails and at those without rails.

Date	n	Water depth (cm)	Vegetation height (cm)	Percent open
With Rails				
10–23 April	11	7.0 ± 1.4	58.1 ± 9.9	33.9 ± 6.2
24 April–7 May	21	13.3 ± 2.2	59.2 ± 5.3	25.0 ± 4.0
8–21 May	5	10.0 ± 1.7	56.9 ± 9.0	9.8 ± 3.6
22 May–4 June	6	27.7 ± 10.7	109.8 ± 54.1	13.0 ± 5.3
All dates	43	13.3 ± 2.0	65.7 ± 5.4	23.8 ± 2.9
Without Rails				
10–23 April	13	6.0 ± 0.5	39.2 ± 6.6	32.4 ± 6.0
24 April–7 May	15	8.5 ± 1.6	50.5 ± 8.7	30.5 ± 5.6
8–21 May	3	16.4 ± 3.7	47.4 ± 22.7	21.3 ± 6.1
22 May–4 June	7	5.2 ± 1.4	119.1 ± 17.8	17.3 ± 13.0
All dates	38	7.7 ± 0.9	59.0 ± 7.1	28.0 ± 3.8

depth across all dates was significantly greater at stations with rails than at stations where no rails were detected (Table 2; Student's $t = 2.46$, df = 79, $P < .02$). This overall result arose from the very large difference measured in the 2-week period of 22 May–4 June (Fig. 2). The high mean depth for this period was due to high water at two new stations at the Oldsburg ponds site, which up to this time had been dry but now harbored Soras. If these 2 stations are deleted from the analysis, the mean water depth for this set drops from 27.7 ± 10.7 to 11.3 ± 4.2 and is no longer significantly different from the mean water depth for this period at stations without rails (Student's $t = 1.70$, df = 9, $P > .05$).

Table 3 presents the mean water depths for sampling stations according to the numbers of rails of both species recorded there (and excludes the high water values from the Oldsburg ponds site mentioned above). Highest water depths were associated with 2 and 3 rails/sampling station, and both of these means were significantly different from the water level at stations with no rails (Student's $t = 3.30$, df = 45, $P < .01$ and Student's $t = 2.50$, df = 41, $P < .02$, respectively), but not significantly different from the mean water depths at stations with 1, 4, and 5 rails.

The mean water depth at stations with only Soras ($\bar{x} = 11.7$, SE = 2.36, n = 17) is not significantly different from the mean water depth at stations with only Virginias ($\bar{x} = 9.9$, SE = 2.58, n = 14) or from stations where both species occurred ($\bar{x} = 11.5$, SE = 1.16, n = 10). These results are similar to those reported by Rundle and Fredrickson (1981).

There were no differences in mean vegetation height or mean percent "open" between stations with rails and those without rails (Table 2). Nor were there any differences when vegetation indices calculated from the product of the height and mean percentage of cover were compared.

TABLE 3. Mean water depth at stations with different numbers of rails.

No. of rails	n	Mean water depth (SE) (cm)
0	38	7.7 (0.9)
1	25	9.2 (1.7)
2	9	14.0 (1.5)
3	5	15.5 (6.1)
4	2	9.6 (2.2)
5	1	12.0

Figure 2 does, however, demonstrate the seasonal increase in vegetation height and cover.

DISCUSSION

The pattern of rail occurrence during the spring described in this study is characteristic of arrival in Colorado (Griese et al. 1980), Minnesota (Pospichal and Marshall 1954) as well as farther east (Walkinshaw 1937, 1940, Andrews 1973). Tacha (1975), however, obtained responses as early as 10 March for Virginia Rails and 5 April for Soras in the western half of Kansas. Peak numbers of both Soras and Virginia Rails occur in the second week of May in Colorado (Griese et al. 1980). Although in eastern Kansas the maximum number of Virginia Rails also occurred at this time, none of the means for this species in any of the 2-week periods was significantly different from any other mean. For Soras, on the other hand, there was a peak in abundance that was significantly different from the numbers during the other 2-week periods, but this occurred about 2 weeks earlier than the peak in Colorado but similar to that determined for both species in central Kansas by Tacha (1975). Billard (1948) also observed a difference in the timing of migration in these 2 species in Connecticut, but in Billard's study it appeared that Soras migrated slightly later than Virginia Rails.

In Colorado the distribution of *Typha*-dominated marshes is not associated with the distribution of rails, but both species preferred cattail marshes with shallow (<15 cm) water for breeding (Griese et al. 1980). Vegetative cover and the height of the vegetation in my study showed no differences when sampling stations with rails were compared to stations without rails and thus does not appear to affect rail distribution either. Tacha (1975) also concluded that neither the distribution of dominant plant species nor plant species composition affected whether rails were present or not.

All the mean water depths for sampling stations with rails in eastern Kansas fell within the 15 cm maximum suggested by Griese et al. (1980). My analysis shows, however, that there was no distinct selection by these rails of habitats according to water depth. Sites without rails were no different in water depth than sites with rails. This result could have been obtained simply because there were not enough rails present to occupy all suitable habitat rather than because of a lack of discernment by the rails. When water depths of stations with different numbers of rails were compared to stations without rails, some significant differences did appear. Of all the habitat variables considered, sufficient water depth seems to be the only factor that has some relationship to rail distribution during the migratory period.

Both species of rails begin nesting in May throughout eastern North America (Berger 1951, Pospichal and Marshall 1954, Tanner and Hendrickson 1956, Berger 1957, Post and Enders 1970, Irish 1974). Since individuals of both species were regularly recorded through May and into early June in eastern Kansas, Soras and Virginia Rails could have initiated nesting at some of these sites. But by mid-June, no rail responses were obtained at any site. Glahn (1974), however, noted that after the last of June in Colorado, very few rails that were known to be actually present responded to played-back calls and Tacha (1975) could get no response after the end of May. So the lack of response in my study may not be indicative of the absence of rails.

Yet, it is my opinion that neither of these species regularly breeds in eastern Kansas. Aware that responses might wane during the summer, I played calls of both species on the morning of 9 July 1982 at Cheyenne Bottoms, where these species are known to nest (Parmelee et al. 1970, Tacha 1975). Virginia Rails, but no Soras, responded to the taped calls. During the migration period, rails of both species were flushed when walking to sampling stations and especially when conducting the vegetation surveys. Similar disturbances in these marshes later in the season when no rails were heard, however, did not flush any rails.

Since Kansas was largely ice free during Pleistocene glaciation, there have been no natural lakes in the state for a long time. Before the advent of man-made impoundments, the only rail habitat in eastern Kansas must have been a few oxbows formed during flooding of the major rivers (e.g., Eureka Lake) and sites like Herington and Muscotah where the flow of large springs could maintain marsh vegetation. Thus suitable habitat space in eastern Kansas was probably never adequate to sustain a large, regularly breeding population. Both Virginia Rails and Soras do breed from time to time in the eastern third of the state, Muscotah marsh being a highly likely site in my opinion, but never in even moderate numbers. Whether the filling of numerous reservoirs in recent years will permit a more regular and more dense breeding population in the future depends upon the development of cattail marshes and the maintenance of a sufficient, relatively stable water level at these locations.

SUMMARY

The presence of Virginia Rails and Soras was determined in eastern Kansas by noting the calls of these species made in response to the playback of their taped advertisement calls. After an initial survey in the first year, 7 study sites were selected for more intensive study during

1981 and 1982. Sampling for rails began in the third week of March and continued until the end of June, but rails were only detected during the period 12 April through 3 June. Highest densities occurred in late April and early May. Numbers of Virginia Rails showed no significant differences throughout the migratory period, but Soras reached a significantly different peak during the period of 24 April–7 May. The higher number of Soras during this period was also significantly different from the number of Virginia Rails.

There were no differences in the percent of open water or in the height of the vegetation between sampling stations with rails and those without rails. Deepest water was associated with stations having 2 and 3 rails of both species and was significantly different from stations without rails but not from stations with 1, 4, or 5 rails. Of the habitat variables measured, sufficient water depth appears to be most important, but there was no difference between the species.

It is probable that neither species regularly nests in eastern Kansas, and even when they do, breeding densities are low. That this part of the state is outside the denser breeding range of both of the species is probably a reflection of the historic lack of dependable habitat.

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