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SPATIAL AND TEMPORAL DISTRIBUTION OF RAILS IN COLORADO

HERMAN J. GRIESE, RONALD A. RYDER AND CLAIT E. BRAUN

Despite the nearly world wide occurrence of the Rallidae, many species are poorly known and most published data are based on local studies. Regional and statewide studies have been limited; consequently, uniform data concerning the biology of rails over large areas are lacking. Previous published reports of rails in Colorado refer to occurrence (Bailey and Niedrach 1965, Lane and Holt 1975) and censuses in limited areas (Boeker 1954, Glahn 1974).

In early 1975 we began to investigate occurrence, densities and migration of rails in relation to habitats in Colorado. Marshes, apparently suitable for rails, are restricted in size and distribution and occur between 1100 and 3200 m. Colorado marshes resemble those typical of the Great Plains and Intermountain West.

STUDY AREAS AND METHODS

Study areas were selected to represent wetlands in 4 regions of Colorado. Regions, locations of study areas and their elevations were: (1) North Central—Lower Latham Reservoir, Weld Co. (1422 m); (2) Southeastern—Fort Lyons, Bent Co. (1171 m); (3) South Central—Monte Vista National Wildlife Refuge, Rio Grande Co. (2326 m); and (4) Northwestern—Hayden, Routt Co., and Axial, Moffat Co. (1910 m). Water depths averaged 5–6 cm at study areas, except in the northwestern region (20 cm). Spring water level fluctuations were 63, 17, 15 and 130 cm, respectively. Water was uniformly basic (pH = 7.9–9.7) at all study areas.

Vegetation was described based on contribution to cover important to rails. *Typha* spp., *Scirpus acutus*, *Scirpus validus* and *Salix* spp. formed tall robust growth and dominated (74–95%) all but the south central study area (40%). Short fine types, *Eleocharis* spp., Poaceae, *Carex* spp., *Scirpus paludosus* and *Triglochin maritima*, comprised the remaining cover. In mixed stands, the most important contributor of cover was considered dominant.

Study areas were censused by playback of tape-recorded calls of rails at sunrise or sunset, April through October 1975 and 1976 (Tomlinson and Todd 1973, Baird 1974, Glahn 1974, Mangold 1974, Tacha 1975, Holliman 1976). Advertising calls of Virginia Rails (*Rallus limicola*) and Soras (*Porzana carolina*) taped from Peterson's record of western bird songs, were played on a portable Norelco cassette recorder (96 db at 1 m). Listening sites per region numbered 25–32, with 80–130 m between sites. A standardized sequence of alternating calls of both species was used, incorporating 1 min listening periods between each call. Calls of Black (*Laterallus jamaicensis*), Yellow (*Corturnicops noveboracensis*) and King (*Rallus elegans*) rails were occasionally played.

Breeding territory densities were estimated from spot-mapped responses (Glahn 1974) and mean number of responding rails in May and June. Results of the 2 methods were compared by regression analysis and were found to be significantly related ($\hat{Y} = 0.20 + 0.89x$, $r = 0.97$, $P < 0.05$). Compared separately, numbers of responding Soras were more poorly correlated ($\hat{Y} = -0.36 + 1.12x$, $r = 0.93$, $P < 0.10$) with results of spot-mapping than were numbers of responding Virginia Rails ($\hat{Y} = 0.16 + 0.95x$, $r = 0.97$, $P < 0.05$). Results of the averaged censuses for May and June were considered acceptable indices of breeding densities and were used during analysis.

RESULTS AND DISCUSSION

Status.—Virginia Rails and Soras are widely distributed in Colorado from late April through early October in suitable habitats. Occurrence paralleled major drainage systems (i.e., Colorado, South Platte, Arkansas and Rio Grande rivers), water storage impoundments and associated irrigation districts at lower elevations. Rails used wet meadows and irrigated hayfields in lieu of marshes, generally above 2600 m. Elevational extremes of documented breeding were 1120–3140 m and 1120–2730 m, respectively, for Soras and Virginia Rails. Bailey and Niedrach (1965) previously documented Soras breeding to 3231 m and Virginia Rails to 2323 m in Colorado. Binford (1973) recorded Virginia Rails breeding at 2090 m in Mexico. A paucity of suitable habitat above 3200 m in Colorado probably precludes higher elevational records. Of 252 townships (<10% of Colorado) surveyed with seemingly suitable habitats for rails, Soras were detected in 125 (49.6%), Virginia Rails in 100 (39.7%), with at least 1 species being documented in 153 (60.7%). Other apparently unoccupied marshes in the remaining 99 townships may be used periodically. While accurate surveys of the extent of wetlands in Colorado are not available, it is conservatively estimated that over 50% of the townships in Colorado with large (>1 ha) wetlands below 3600 m were examined.

Although positive breeding records are not available for King or Black rails in Colorado, both were noted during this investigation. Single King Rails were recorded at Bonny Reservoir, Yuma Co., on 25 May 1975 (this study), and near Pueblo, Pueblo Co., on 12 June through 3 July 1976 (Griffiths 1976). We found a Black Rail at Ft. Lyons on 11, 18 and 25 June 1975. Black Rails were also reported by birders twice in 1976 in northeastern and north central Colorado. Breeding activities (courtship vocalizations) were exhibited by Black and King rails at Ft. Lyons and Pueblo, respectively. King and Black rails breed at Cheyenne Bottoms, Barton Co., Kansas, 122 km east of Colorado (Parmelee et al. 1970, Baird 1974, Tacha 1975). A Yellow Rail has been recorded in Colorado (Bailey and Niedrach 1965), but breeding is unlikely.

Wintering (30 November–31 March) rails were concentrated primarily in the Arkansas and South Platte drainages below 2100 m, in association with warm water sloughs. We estimated the total rail population for winter 1975–76 to not exceed 200 individuals, of which 80–90% were Virginia Rails.

TABLE 1

INDICES OF BREEDING DENSITIES OF RAILS IN 4 REGIONS OF COLORADO, 1975 AND 1976

Region	Study area size (ha)	Density (responding rails/ha)[1] 1975 Sora	1975 Virginia Rail	1975 N	1976 Sora	1976 Virginia Rail	1976 N
Southeastern	14.5	0.5 ± 0.6	4.2 ± 1.1	7	0.4 ± 0.3	4.7 ± 0.7	4
North central	13.1	1.1 ± 0.8	3.5 ± 0.8	5	0.9 ± 0.6	3.8 ± 1.0	3
South central	14.3	2.2 ± 0.2	1.9 ± 0.6	3	2.5 ± 1.2	1.6 ± 0.2	3
Northwestern[2]	6.1	1.6 ± 0.7	0.2 ± 0.3	3	0.8 ± 0.5	1.0 ± 0.1	3

[1] Mean of N censuses ± 1 SD.
[2] Additional 4.8 ha marsh averaged into 1976 results.

Breeding densities.—Assuming population normality, Virginia Rails had a higher (parametric *t*-test, $P < 0.10$) breeding density index (2.6 ± 1.7 SD) than that of Soras (1.3 ± 0.8) (Table 1). Indices for Virginia Rails were higher (parametric *t*-test, $P < 0.01$) in eastern than in western Colorado. Soras exhibited no difference (parametric *t*-test, $P > 0.10$) between eastern and western Colorado. Virginia Rails appeared to occur more frequently and at higher elevations in 1976; however, neither species had significant changes in indices between years.

Results of this study are within extremes in average breeding densities reported in other studies. Virginia Rails ranged from 0.9 in Iowa (Tanner and Hendrickson 1954) to 4.3 pairs per ha in Kansas (Tacha 1975). Soras exhibited lowest densities in Kansas with 0.3 pairs per ha (Tacha 1975) and highest densities in Minnesota with 4.1 pairs per ha (Pospichal and Marshall 1954). Glahn (1974) ascertained breeding densities for Virginia Rails and Soras in north central Colorado to be 1.8 and 0.6 pairs per ha, respectively. While we used census methods similar to those of Glahn (1974), we cannot explain the higher densities found in north central Colorado in 1975–1976 (Table 1). Unfortunately, statistical comparisons with other studies are not possible because of differences in census techniques. Obviously, census techniques for rails should and can be standardized.

In this study, species composition of breeding rails appeared related to ambient air temperatures during early migration (Fig. 1). This significant ($\hat{Y} = 7.25e^{-1.96x}$, $r = -0.94$, $P < 0.01$) relationship indicates that Soras occurred most frequently in marshes in regions with mean April air temperatures less than 5.6°C, while Virginia Rails predominated in marshes with air temperatures greater than 5.6°C.

Additional factors such as topography, marsh conditions, such as

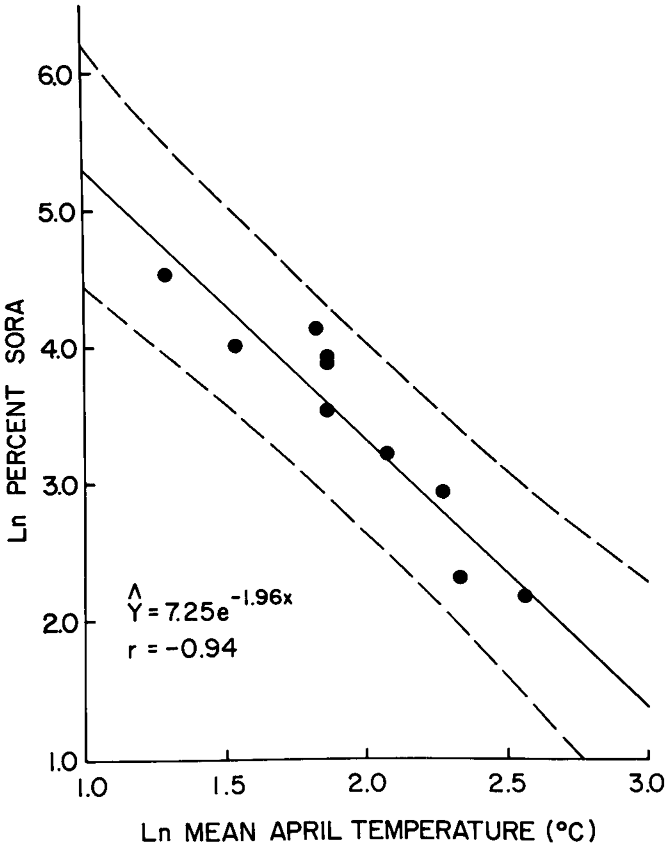

FIG. 1. Relationship between mean April air temperature (°C) near study areas and percent composition of the breeding population, 95% confidence intervals for future Y at given X ($\hat{Y} = 7.25e^{-1.96x}$, $r = -0.94$, $P < 0.01$).

burned or unburned, differential migration dates, or inter-specific competition may further affect composition.

Rapid water level fluctuations disrupted breeding activities. Desertion of 13 of 15 established territories and 1 Sora nest with 7 eggs was observed when water levels rose (rate unknown) more than 20 cm in northwestern Colorado. Decreasing water levels in south central Colorado prevented renesting and apparently caused chick mortality in an extreme case.

Habitat use.—Chi-square analyses of data from 174 marshes revealed no significant ($\chi^2 \geq 6.01$, df = 2, $P > 0.05$) relationship between distribution of rails and cattails within and among regions and elevations. While

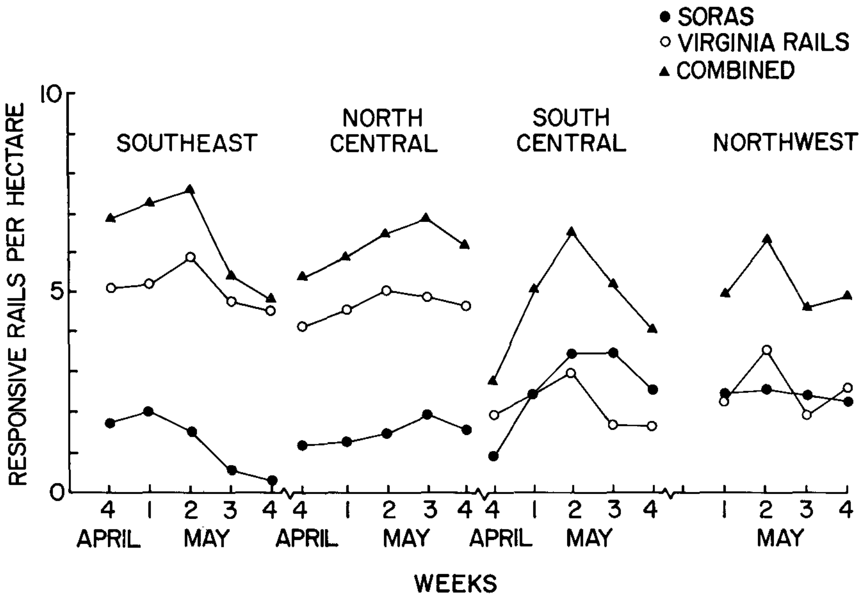

FIG. 2. Densities of rails responding to tape-recorded calls at regional study areas during spring censuses, 1975–1976. (Data from both years were averaged.)

distribution of *Typha*-dominated marshes did not control distribution of rails, both Virginia Rails and Soras appeared to prefer *Typha*-dominated marshes with shallow water (<15 cm in depth) for breeding. Breeding densities were highest in these sites and 20 of 25 nests located were in *Typha*. Water depths at nests of both species averaged 8.2 cm. *Typha* was the cover preferred by chicks of both species prior to fledging. The importance of *Typha* appeared related to its value as cover. Whenever a choice was present within a marsh, rails selected *Typha* for nesting and escape. During fall migration Soras used short emergents such as *Eleocharis, Carex* and some species of *Scirpus*, while Virginia Rails generally remained in tall dense vegetation such as *Typha*. These differences are probably related to differences in food habits between the species.

Migration.—Responses to taped calls were used in establishing dates of peak migration or maximum rail concentrations. Migration into Colorado for both species began during the first or second week of April, however, Virginia Rails appeared to be more abundant during early stages of migration. Peak concentrations for Virginia Rails were consistently recorded during the second week of May (Fig. 2). While peak concentrations of

Soras were erratic, they too peaked on, or near, the second week of May. In other studies (Pospichal and Marshall 1954, Tanner and Hendrickson 1954, Baird 1974, Glahn 1974), a 1–3 week period of no vocalization occurred after the arrival of rails. Although a silent period was not obvious during this study, such a period possibly obscured earlier peak concentrations in late April to early May. In either case, spring migration did not appear to differ greatly between plains and intermountain valleys.

Highest rail concentrations (>50 rails/ha) occurred locally in July in Colorado. At the south central study area decreasing water levels reduced the quantity of suitable habitat by 95% in July and early August. As a result, rails became concentrated and were easily observed and trapped. On successive visits noticeable reductions in numbers were apparent. Tracks along adjacent ditches indicated an ambulatory dispersal by flightless individuals. Bent (1926) mentioned a late summer movement of rails to more open marshes and implied that high concentrations resulted from the abundance of food. In Colorado, irrigation practices promoted midsummer drying of wetlands and caused premature concentrations and dispersal.

As responses were difficult to evoke in August and September and due to the masking effect of late summer movement, fall migration was not distinct. Soras appeared to have a more lengthy migration than Virginia Rails, beginning earlier and ending later. Time of peak concentrations of both species ranged from the second week in August in northwestern Colorado to the third week in September in south central Colorado. Responses per ha reached a maximum fall value of 7.1 (3.7 Virginia Rails, 3.4 Soras) on 20 September 1975, in southeastern Colorado.

SUMMARY

Distribution, breeding densities, habitats and timing of migration of rails were investigated in Colorado between May 1975 and October 1976. Major study areas in the Arkansas, South Platte, Rio Grande and Yampa river drainages were censused by playback of taped rail calls.

Soras bred from 1120–3140 m elevation and Virginia Rails from 1120–2730 m. No other rails bred in Colorado. Statewide, Virginia Rails exhibited higher breeding density indices (2.6 responding rails/ha) than Soras (1.3). Indices for Virginia Rails ranged from 4.7 in southeastern Colorado to 0.2 in northwestern Colorado. Indices for Soras ranged from 2.5 in south central to 0.4 in southeastern Colorado. Mean April air temperatures, a function of topography, influenced species composition. Soras were more abundant than Virginia Rails when mean April air temperatures were 5.6°C, or below.

Both species preferred marshes dominated by *Typha* with water depths less than 15 cm. Short emergents attracted Soras during fall migration. Peak concentrations of migrating rails occurred during May and from mid-August through September. Greatest concentrations (>50 rails/ha) occurred locally in late July as the result of irrigation practices. Virginia Rails and Soras wintered in Colorado in small numbers.

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LITERATURE CITED

BAILEY, A. M. AND R. J. NIEDRACH. 1965. Birds of Colorado. Vol. 1. Denver Mus. Nat. Hist., Denver, Colorado.

BAIRD, K. E. 1974. A field study of the King, Sora, and Virginia rails at Cheyenne Bottoms in west central Kansas. M.S. thesis, Fort Hays Kansas State Coll., Hays, Kansas.

BENT, A. C. 1926. Life histories of North American marsh birds. U.S. Natl. Mus. Bull. 135.

BINFORD, L. C. 1973. Virginia Rail and Cape May Warbler in Chiapas, Mexico. Condor 75:350–351.

BOEKER, H. M. 1954. A census of populations of the Wilson's Snipe and Sora Rail in the Yampa River Valley, Colorado. Condor 56:105–106.

GLAHN, J. F. 1974. Study of breeding rails with recorded calls in north central Colorado. Wilson Bull. 86:206–214.

GRIFFITHS, D. 1976. King Rail—first Colorado record. Colo. Field Ornithol. J. 28:17.

HOLLIMAN, D. C. 1976. Clapper Rail (*Rallus longirostrus*) studies in Alabama. U.S. Fish and Wildl. Serv. Accel. Res. Prog. Project Final Rep. Contract No. 14-16-0008-793.

LANE, J. A. AND H. R. HOLT. 1975. A birder's guide to eastern Colorado. L. and P. Press, Denver, Colorado.

MANGOLD, R. E. 1974. 1974 Final report: research on shore and upland migratory birds in New Jersey, Clapper Rail studies. U.S. Fish and Wildl. Serv. Accel. Res. Prog. Contract No. 14-16-0008-937.

PARMELEE, D. F., M. D. SCHWILLING AND H. A. STEPHENS. 1970. Gruiform birds of Cheyenne Bottoms. Kans. Ornithol. Soc. Bull. 21:25–27.

POSPICHAL, L. B. AND W. H. MARSHALL. 1954. A field study of the Sora Rail and Virginia Rail in central Minnesota. Flicker 26:2–32.

TACHA, R. W. 1975. A survey of rail populations in Kansas, with emphasis on Cheyenne Bottoms. M.S. thesis, Fort Hays Kansas State Coll., Hays, Kansas.

TANNER, W. D. AND G. O. HENDRICKSON. 1954. Ecology of the Virginia Rail in Clay County, Iowa. Iowa Bird Life 24:65–70.

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.

DEPT. FISHERY AND WILDLIFE BIOLOGY, COLORADO STATE UNIV., FORT COLLINS, COLORADO 80523 (HJG AND RAR) AND COLORADO DIV. OF WILDLIFE, RESEARCH CENTER, FORT COLLINS, COLORADO 80526 (CEB). (PRESENT ADDRESS HJG: P.O. BOX 306, APO, SEATTLE, WASHINGTON 98733.) ACCEPTED 22 JAN. 1979.