STUDY OF BREEDING RAILS WITH RECORDED CALLS IN NORTH-CENTRAL COLORADO

JAMES F. GLAHN

The Sora (*Porzana carolina*) and Virginia Rail (*Rallus limicola*) are two of the most widespread species of rails in North America. Because of their secretive habits and dense habitats, estimating and studying their breeding populations has been a difficult task. The two most intensive field studies of Sora and Virginia Rail populations used nest surveys to estimate breeding populations (Pospichal and Marshall, 1954; Tanner and Hendrickson, 1954, 1956). These estimates are biased by the fact that rail nests are usually so well-concealed that some would be missed even after an intensive search. Direct counts or flushing counts, as used by Boeker (1954), have obvious disadvantages in species that are seldom seen and rarely flushed. In an attempt to improve censusing and study of rail populations, I used tape-recorded calls in marshes in north-central Colorado. My aims were two: to determine the distribution of nesting territories and breeding densities of Sora and Virginia Rails; and two, to evaluate elicited call counts as a census method and relative index for rail populations.

The calls of rails are probably the best indication of their presence in an area. In Alberta, Smith (1955) counted Soras by their *keek* (distress call) note, eliciting this by throwing rocks into potholes. Meanley (1957) studied the distribution of the King Rail (*R. elegans*) territories by the positions of their mating calls. Post and Enders (1970) spot-mapped the calls (and nests) of Virginia Rails to determine breeding densities of a saltmarsh population. Adams and Quay (1958) investigated using call counts of the Clapper Rail (*R. longirostris*), although they concluded that the calls were too variable in time and number to be useful as a census method. More recently, Tomlinson and Todd (1973) used recorded calls to study distribution in two western races of Clapper Rail and felt that the recorded call technique could be used to develop a population index for this species.

METHODS AND MATERIALS

Sora and Virginia Rails use two principal calls during the breeding season that seem to fit Meanley's (1969) functional scheme of classifying rail calls. The mating call of each species is probably used exclusively by the male to attract a mate (Bent, 1926). The primary advertising calls are given by both sexes throughout the breeding season and function as a territorial call and as a contact call between mated pairs (Kaufmann, 1971). The primary advertising call of the Sora is usually described as a "whinny," varying in number of notes and descending in frequency and amplitude. The primary

advertising call of the Virginia Rail is usually described as a "grunt," resembling the grunt of a domestic pig, which descends in frequency towards the end of the call.

Tapes were made of both types of calls from two Cornell University Records: American Bird Song Vol. 2 and Field Guide to Western Bird Songs. A Uher Model 4000 tape recorder was used to transcribe these calls and to broadcast them in the field. Amplitude measurements were made by playing back these recordings at full volume with the tape recorder 1 m from a sound level meter in the laboratory. The audible sound pressure produced ranged from 93 to 96 db. Several of these calls recorded locally in the field were compared by sonagraph analysis to those taped from records. There was some slight detectable variation, but no important change in the overall temporal or frequency patterns.

Preliminary trials with these tapes on four small marshes in the Fort Collins area, during spring 1968, indicated that taped calls consistently elicited more responses from rails than did disturbances, such as throwing rocks in the water. Rails would respond either singly or in duets of mated pairs. Kaufmann (1971) indicates that the male starts the call and may be joined by the female before he had finished his call. It definitely appears that this type of duet response could be used to locate positions of breeding pairs. Trials on ten Virginia Rails and six Soras during April and May 1968 indicated that both species would respond repeatedly to their primary advertising calls during the breeding season. I concluded from these preliminary investigations that it would be feasible to census these rails by conducting several response surveys during the breeding season.

Three marsh areas, surrounding Fossil Creek Reservoir, approximately eight miles southeast of Fort Collins, Larimer County, Colorado, were selected for intensive study during spring 1972. All three areas comprised approximately 10 hectares of type 3 and type 4 wetlands (Martin et al., 1953). A network of narrow channels flows from Fossil Creek and from other tributaries of the reservoir. Cattails (*Typha latifolia* and *T. angustifolia*) comprised approximately 90 percent of the emergent vegetation on all three study areas. Bulrushes (*Scirpus paludosus* and *S. fluviatilis*), threesquare (*Scirpus americanus*), spikerush (*Eleocharis obtusa*), and saltgrass (*Distichlis* sp.) dominated the drier peripheral zone around the cattail. Water depths in the emergent zone ranged from zero to approximately 80 cm, with fluctuations of 12 to 15 cm during the breeding season (April to June).

In late March, all three areas were surveyed and a grid system set up, with flagging tape attached to dead vegetation at 30 m intervals. Gridded maps with a 1:1200 scale were made from surveying measurements. A fresh photocopy of these maps was used during each survey of the area to spot-map "vocal registrations" of responding rails. A standard route for each area was selected by following transect lines 60 m apart in a zig-zag pattern, with alternate starting points used during each successive survey. A 5-minute tape, consisting of 10 calls of each species, was played at stations 60 m apart along each of the routes. Approximately one-half of the total study areas was surveyed during the first three hours after sunrise and the other half during the last three hours before sunset of the same day. Morning and evening surveys were alternated between areas. Surveys were conducted only when wind velocities were less than 15 mph, under varying degrees of cloud cover. Ten semiweekly surveys were made from 26 April to 28 May, with an interval of at least two days between surveys. Terminology and procedures for evaluating census data followed the international standard for the mapping method in bird census work (Svensson, 1970).

As soon as rail territories were located, tests were made on single and paired rails to measure individual response to tape recordings. These tests were made with different

tapes from those used during censusing, some of which were recorded locally. Data were collected on the calling frequency in equal 5-minute periods—before, during, and after the playback of the taped calls. The estimated initial distance at which individuals responded and the number of taped calls to elicit the first response were also recorded. After most of the censusing had been completed and the distribution of territories was better known, trials were made from stations near the center of several territories to determine the percentage of territories responding to the taped calls during several 5-minute trials.

Nest surveys were made from approximately mid-May to mid-July. Systematic searches proved unrewarding, and later most nests were discovered by intensely searching areas where both rails were heard giving *keep*-like calls. Most nests were found while young were leaving them, although the adults were still on territory.

RESULTS AND DISCUSSION

Territory Formation and Breeding Densities.—In two field seasons, no responses were elicited from rails prior to mid-April, although initial surveys were started by 1 April. Earliest responses coincided with the first shoots of cattail emerging above the water. Both species are reported to arrive in this area in early April, but they may be silent for sometime after arrival (Niedrach and Rockwell, 1939).

The initial formation of territories was indicated by the mating calls of the males. *Tick-it* calling of the Virginia Rail was heard primarily from 13 April to 28 April, while the *ker-wee* call of the Sora was heard primarily from 13 April to 5 May. These periods seem to coincide with the arrival and brief courtship period of these two species. Mating calls elicited later in the breeding season could be attributed to unmated males, which formed "surplus registrations" from spot-mapping.

During the census period, 371 registrations were made, including 12 percent visual and 88 percent vocal. Based on maps of calling birds and 14 nest sites found, an estimated 18 pairs of Virginia Rails and six pairs of Soras were breeding on the 10-hectare study area. In 1968, with no distinction made between paired and unpaired rails, 10 Virginia Rails and six Soras were located with recorded calls. Annual spring counts and literature concerning this area do not reflect this almost three to one ratio in relative abundance of these species indicated from this study, although Neilson (1925) noted that Virginia Rails were about twice as common as Soras near Wheatland, Wyoming.

Distribution of Nesting Territories.—Spot-mapping (Figs. 1–2) indicated that, on the study areas, all six Sora territories apparently overlapped to some extent at least one Virginia Rail territory. Often these two species were spot-mapped concurrently less than 10 m from one another. In other observations,

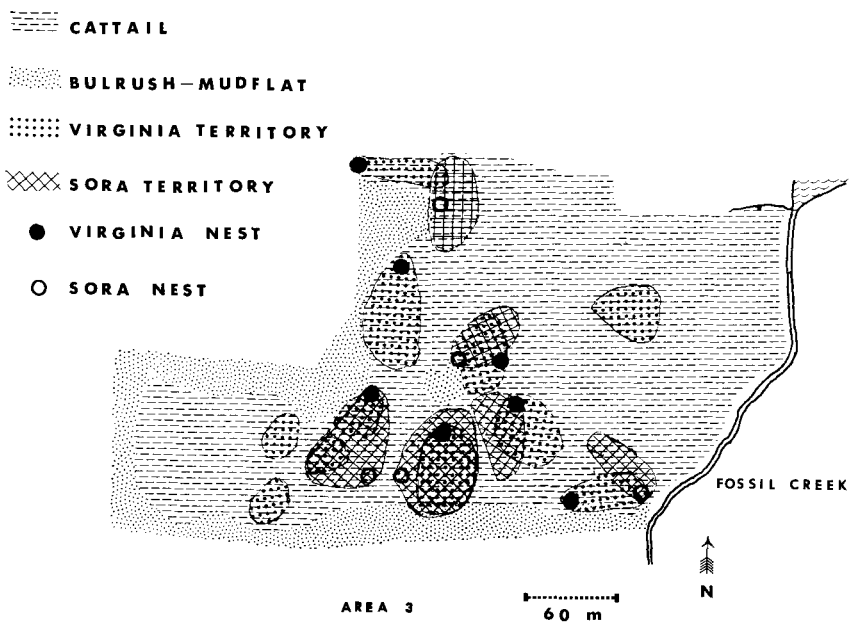

FIG. 1. Distribution and habitat association of Sora and Virginia Rail territories on area 3.

Sora and Virginia Rails were seen using the same feeding areas, and on one occasion, were observed feeding side by side.

All of the nest sites found were within the territories defined by spot-mapping responses. The least distance between occupied Sora nests was 12 m, between Sora and Virginia nests 25 m, and between two Virginia nests 28 m. This may indicate more intraspecific tolerance between Soras than Virginia Rails. Others (Pospichal and Marshall, 1954; Tanner and Hendrickson, 1954) have reported larger nesting distances between Virginia Rails than Soras, but attributed it to the lower breeding densities of Virginia Rails.

The relative position of nest sites in habitat types appeared to be an important aspect of the requirements of breeding rails (Figs. 1–2). Although cattail formed the dominant cover in all territories, 83 per cent of Virginia territories and all of the Sora territories were bordered by bulrush, spikerush, saltgrass, and by mudflats. Both rail species were often observed feeding in these edges, but they sought dense cattail cover when disturbed. Although all nests were constructed of cattails and located or supported in these plants, 77 percent of the Virginia nests and all of the Sora nests were within 15 m of edge vegetation bordering each territory. Allen (1934) stated that both rails

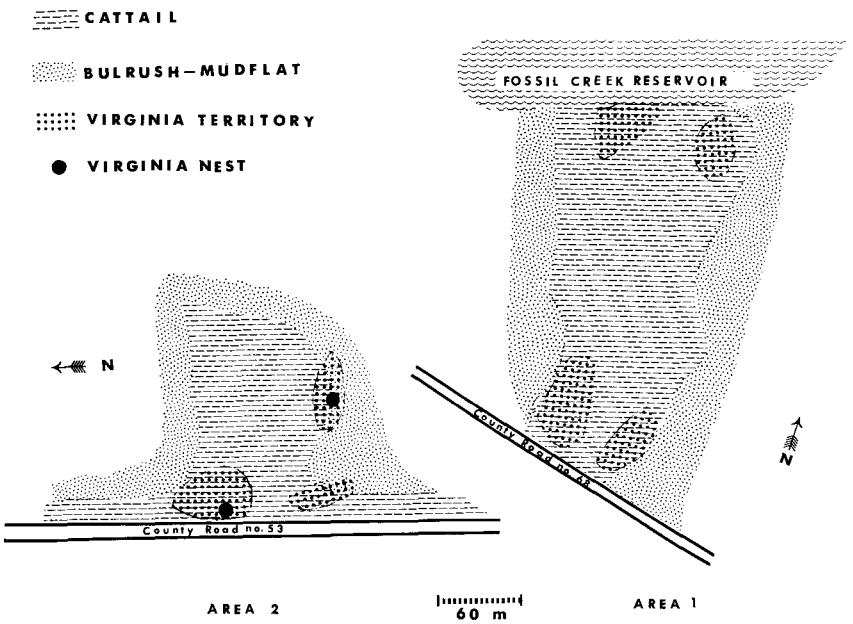

FIG. 2. Distribution and habitat association of Virginia Rail territories on areas 1 and 2.

prefer nesting near the borderline between sedges and cattails. Later Pospichal and Marshall (1954) found a similar relationship between nest location and edge of heavy cover.

Index Value of Response Behavior.—From 13 April to 25 June, approximately 50 hours of observation were spent in studying responses to tape recordings of Sora and Virginia Rails. Playback of taped calls significantly increased the rate and frequency of calling. During 50 trials of five minutes per period, the playback of taped recordings increased the frequency of calls from 31 prior to playback to 134 during the playback period. The non-elicited calling rate during these trials was less than six calls per hour of observation, while the elicited calling rate was greater than 25 calls per hour of observation.

At an amplitude between 93 and 96 db at 1 m, responses were obtained from both rails up to approximately 80 m, but 90 percent of the responding rails were located within 60 m of the speaker. Within this radius, the number of individuals responding varied from trial to trial, but all individuals appeared to respond after a total of three consecutive 5-minute trials. Responding individuals called at a rate of one to three times during a 5-minute

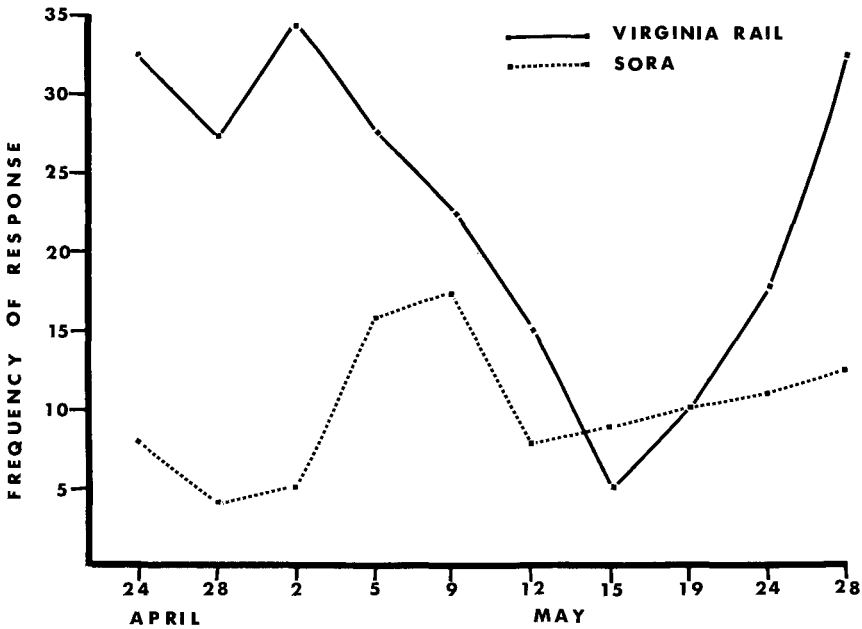

FIG. 3. Frequency of response to taped calls during 10 semiweekly surveys.

playback. At low density levels, individuals only responded once during a 5-minute trial. A previous response or non-elicited call by an individual reduced the chance of that individual responding again during the same trial. The number of taped calls needed to elicit the first response ranged from one to a total of 10 calls on the tape, although 79 percent responded during the first five calls and 35 percent responded after the first call. Sora and Virginia Rails responded as readily to each other's calls as they did to their conspecific calls, with no apparent difference between the number of recorded calls to elicit intra- and interspecific responses. Duet recordings of breeding pairs for both species appeared to be more effective than tapes of single birds in eliciting responses from rails during the nesting period. During this period, rails responded to duet tapes immediately after failing to respond to a single rail tape.

Fluctuations in the frequency of response were found during 10 semiweekly surveys of the study areas (Fig. 3). Although all breeding pairs were estimated to be on territory by 5 May, the calling frequency of Virginia Rails fluctuated considerably after this time, while the frequency of Sora calling began to stabilize a week later. Kaufmann (1971) indicated that normal calling activity of both species fluctuated during the breeding cycle, forming two

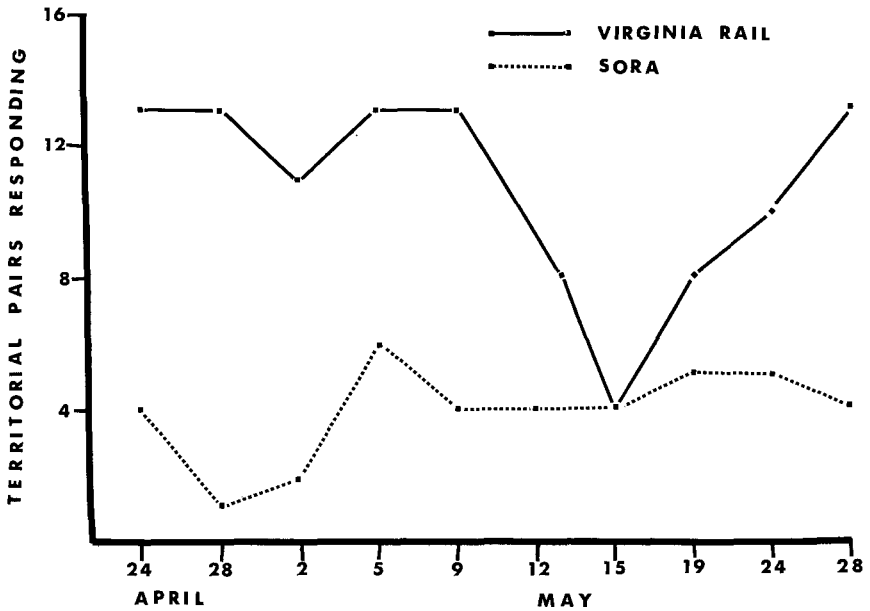

FIG. 4. Number of territorial pairs responding to taped calls during 10 semiweekly surveys.

peaks coinciding with the start of egg laying and with hatching. These fluctuations appeared to be primarily a function of the percentage of territorial pairs responding during each survey (Fig. 4). During all 10 surveys the frequency of territorial pairs responding was estimated to range from 20 to 100 percent for Soras and from 22 to 72 percent for Virginia Rails. From 5 May to 28 May, the estimated percentage of territorial Virginias responding ranged from 22 to 72, while the percentage of Soras responding varied only from 67 to 100. Although both species of rails responded to taped calls as late as mid-August, only a small percent of those observed to be present responded after the last part of June.

Higher breeding densities appeared to increase the frequency of responses from Virginia Rails. Kaufmann (1971) noted that Sora calling increased greatly with an increase of breeding pairs on one study area over several years of observation. Table 1 summarizes responses obtained from Virginia Rails during the census of three separate study areas, and similar data are presented on Sora Rails which bred on only one of the study areas. As these data indicated, both the mean calls per hectare and mean calls per territory increased with the breeding densities of Virginia Rails on each study area. The disproportionately high frequency of Sora calling on area 3 may have

TABLE 1

RESPONSE CALLING AND BREEDING DENSITIES OF RAILS FROM 10 SURVEYS OF THREE STUDY AREAS IN COLORADO

Species and area	Calls per hectare ($\bar{x}$)	Territories per hectare	Calls per territory
Virginia Rail			
Area 1 (2.9 ha)	1.5	1.4	1.1
Area 2 (1.3 ha)	3.0	2.3	1.3
Area 3 (5.8 ha)	2.4	1.9	1.3
Sora			
Area 3 (2.9 ha)	1.6	1.0	1.6

been influenced by the large number of Virginia Rails on this same area. Dow (1970) indicated that responses of certain individuals to recordings may increase the stimulus value of recordings for other conspecifics within hearing range. This was apparently true of Virginia Rail responses and is further confounded by the fact that rails respond interspecificially to each other's calls.

Although individual response counts would appear too variable in time and number to be used as an index in themselves, recorded calls did increase rail calling to a predictable level where censusing by spot-mapping response was practical. Censusing with recorded calls provided a good estimate of population densities, and in comparison with nest surveys, increased the number of territories located by 71 percent. This technique appears to provide a more accurate appraisal of the relative abundance of each species with respect to more conspicuous species, and it could be used in obtaining annual indices of Sora and Virginia Rail populations.

SUMMARY

A method of estimating Sora and Virginia Rail populations by spot-mapping responses to tape recordings of their primary advertising calls was devised and tested in north-central Colorado. Individual response counts appear to be affected by stages of the breeding cycle and relative breeding densities on each area. Within the response radius of 60 m, a 5-minute playback period, preceded by five minutes of no calling, appeared to be adequate in eliciting responses from a large percentage of rails without counting a single individual more than once. The recorded-call technique provided a satisfactory means of censusing and studying territory distribution of breeding rails.

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DEPARTMENT OF FISHERY AND WILDLIFE BIOLOGY, COLORADO STATE UNIVERSITY, FORT COLLINS, COLORADO (PRESENT ADDRESS: BUREAU OF SPORT FISHERIES AND WILDLIFE, WILDLIFE RESEARCH CENTER, BUILDING 16, DENVER, COLORADO 80225). ACCEPTED 5 MARCH 1974.