OBSERVATIONS ON THE EFFECT OF A SPRING DROUGHT ON REPRODUCTION IN THE HUNGARIAN PARTRIDGE

By PAUL L. ERRINGTON and F. N. HAMERSTROM, JR.

Our data on the introduced Hungarian Partridge (*Perdix perdix*) in northwest Iowa were secured incidental to studies of other wild species and hence have their expected shortcomings. Even so, they may be of interest from the standpoint of natural history, particularly in view of the fact that one of the three breeding seasons (1934) during which notes were taken was characterized by extreme spring drought that continued until early June.

Totals of 26 partridge nests and 25 broods of young birds were observed chiefly in Clay and Palo Alto counties, although data on 14 of the broods were contributed from neighboring counties by John F. Holst, Jr., and by other deputy game wardens. Contemporaneous data on other ground nesting birds and on the food habits of avian and mammalian predators were gathered in the same general area and serve to supplement the limited data we have on the partridges themselves. The work was carried on in connection with the cooperative research program of Iowa State College and the Iowa Fish and Game Commission, 1932–1935, with the aid of financial contributions from J. N. Darling.

The spring drought of 1934 naturally was attended by scanty growth of ground cover. Dry grass and weed clumps of the previous year afforded initial concealment for many nests, but "short pastures" forced the farmers to graze their stock along roads, fence rows, and borders of marshes, with resulting detriment to the nesting habitats of the birds frequenting such places. Midsummer rainfall was followed by some recovery of vegetation and improvement of environmental conditions for the partridges.

The season of 1933 may be judged "normal" and that of 1935 was unusually wet. The data on partridges for these two years may for purposes of this paper be handled collectively. Seven of 15 nests were known to have been successful and these were all begun in May. In contrast, only one of 11 nests observed in 1934 was known to have produced young and this was begun about the middle of June. The success or failure of two of the 1934 nests was not determined, but circumstances indicated that they probably failed.

Although data from only 26 nests may not provide the most representative basis for an evaluation of nesting losses, the ratios of different types of losses to each other did not seem to vary significantly in the years with which we are concerned. Aside from losses that may be classed as miscellaneous, for example, the intentional breaking up of a nest by a farmer who claimed that partridges had taken some of his young chickens the year before, nest failures in drought and non-drought seasons had much in common. Ten of 14 fence row and roadside nests failed, as did 6 of 8 hayfield (mostly alfalfa) nests. Two nests situated in pastures failed, while two in barley fields succeeded. There were the usual losses from abandonment or destruction of nests after disturbance or exposure by mowing machines or livestock and the usual pilfering by such egg-eaters as the crow (*Corvus brachyrhynchos*) of eggs thus made conspicuous and easily available.

So far as we can see, the nesting losses of 1934 differed from those of 1933 and 1935 principally in the increased scale upon which they occurred, and this in turn may be attributed in large measure to the exceptionally unsatisfactory status of nesting habitats during the period of drought. Hungarian Partridge nests were placed in roughly the same types of cover as were chosen by the Blue-winged Teal (*Querquedula discors*) and the Ring-necked Pheasant (*Phasianus colchicus torquatus*); Bennett (Trans. 21st Am.

Game Conference, 1935, pp. 277–282) described a striking rise in rates of loss in 1934, for duck nests in comparable localities, but Hamerstrom (Iowa State College Jour. Sci., vol. 10, 1936, pp. 173–203) did not find this to be true for pheasant nests.

Seven of the 26 partridge nests contained pheasant eggs, and all of these mixed clutches were begun either very early in the nesting season or at other times when the prevailing cover conditions were decidedly inferior. Of the 11 partridge clutches observed in 1934, 5 were thus mixed, compared with 2 of 15 clutches for 1933 and 1935. Bennett (Iowa State College Jour. Sci., vol. 10, 1936, pp. 373–375) found between 40 and 50 partridge nests in the course of his duck studies in northwestern Iowa in the years 1932 to 1935, and he lists four of these as containing pheasant eggs. In the 10 mixed clutches (including Bennett's data) for which we have fairly complete figures was a total of 33 pheasant and 114 partridge eggs. We do not feel entitled to draw many conclusions as to the significance of pheasants and partridges laying in each others nests, but the incidence of this "parasitism" in 1934 may in itself reflect an unusual shortage of acceptable nesting sites and a consequent increase of interspecific competition and desertions.

Approximate ages of partridge broods were calculated from field notes and with the help of Yeatter's (Univ. Mich. School Forestry and Conserv., Bull. 5, 1934, p. 37) growth curve. For 1933 and 1935, the data show that 9 of 11 broods were hatched between the latter part of May and the middle of June and that the other two may have hatched not much later. In 1934, the hatching dates of 6 of 14 broods fell in the middle of June, 6 from late June to early July, and 2 nearer the middle of July.

Despite the adverse nesting conditions and the high rate of nesting failures observed in 1934, we believe that by virtue of continued re-nesting later in the season the partridges succeeded eventually in raising a substantial number of young birds. It is our impression from casual field observations and consideration of data on general predation that population levels of the Hungarian Partridge in northwestern Iowa were somewhat lower in the winter and spring of 1934–1935 than in 1934 at the beginning of the drought, but that they were still materially higher than they were in 1932–1933.

In the case of the Ring-necked Pheasant, successful re-nesting seemed to compensate for the nesting losses suffered from 1933 to 1935 in the areas under observation (Errington and Hamerstrom, Jour. Wildlife Management, vol. 1, 1937, pp. 3–20). While the pheasant broods for 1933 and 1934 show uniformity in average number of young per prood at comparable ages, those data that we have for the partridges give an average of 5.5 young at an average age of 7.6 weeks for 1933 and of 4.9 young at 5 weeks for 1934. If 11 broods in 1933 and 14 in 1934 represent a large enough number of samples for comparison, it becomes questionable whether the smaller brood average in 1934 may be more correctly ascribed to the drought than to a possible rise in rates of juvenile mortality accompanying greater population densities. The latter phenomenon has been reported for the Bob-white (*Colinus virginianus*) in Wisconsin (Errington and Hamerstrom, Iowa Agr. Exper. Sta., Research Bull. 201, 1936, pp. 420–422) and probably relates to many other wild species.

Consulting the available data on food habits of local predators, we find no significant change in pressure of the Marsh Hawk (*Circus hudsonius*) on partridges in the summers of 1933 to 1935. Partridges (mostly young birds) constitute a total of 9 or 1.62 per cent of 557 items of prey (Errington and Breckenridge, Amer. Midl. Nat., vol. 17, 1936, pp. 831–848).

Unpublished data from analyses of Great Horned Owl (*Bubo virginianus*) pellets from "partridge country" reveal that for the spring and summer of 1933, only 1 or 1.5

per cent of 65 pellets contained partridge remains; for winter, 1933–1934, 11 or 5.9 per cent of 185; spring and summer, 1934, 14 or 10.5 per cent of 133; winter, 1934–1935, 8 or 4.1 per cent of 195; spring and summer, 1935, 11 or 7.3 per cent of 151. The heavier pressure of Horned Owls in the spring and summer of 1934 does not necessarily point to an increase of vulnerability of partridges because of the drought, in as much as the pressure during the preceding winter was correspondingly heavy.

The partridge carcasses found as food items at dens of the red fox (*Vulpes* sp.) rose from 8 or 0.79 per cent of 1010 in 1933 to 59 or 2.07 per cent of 2848 in 1934; only 1 or 0.09 per cent of 1175 spring and summer fecal samples for 1933 contained recognizable partridge remains, compared with 18 or 1.93 per cent of 935 samples for 1934 (Errington, Ecology, vol. 18, 1937, pp. 53–61). The increase in 1934 in representation in the diets of the foxes was thought to be associated both with higher population densities of the partridges and with greater vulnerability due to the drought.

On the whole, we doubt that the adverse conditions of 1934 resulted in any drastic change in the population of the Hungarian Partridge in northwestern Iowa, though they were not without effect. The ecological picture seems to be essentially one of retardation and decreased productivity of the nesting season rather than one of ultimate failure.

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THE STATUS OF THE FOX SPARROW OF SOUTHWESTERN OREGON

WITH TWO ILLUSTRATIONS

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In May and June of 1936, I collected a number of Fox Sparrows (*Passerella iliaca*) in the mountains of southwestern Oregon. On Onion Mountain, 15 miles west of Grants Pass, Josephine County, the birds were plentiful and twenty-six were taken. Near Bolan Lake, Josephine County, and close to the California line, four more were collected. As far as can be told from my reconnaissance of this part of the state, the breeding range of the species probably extends northward along the coastal mountains to the vicinity of Powers, Coos County. The purpose of this paper is to determine the status of the above mentioned specimens and to see if they throw any light on the problem of the summer home of *Passerella iliaca megarhynchus*.

I wish to thank Mr. James Moffitt of the California Academy of Sciences and Dr. Alden H. Miller of the University of California for their valuable suggestions and help in the preparation of this paper. In fact, Mr. Moffitt's advice that I collect Fox Sparrows while in Oregon served to initiate this study.

In identifying the Onion Mountain birds, skins representing the following races were used: *P. i. brevicauda, mariposae, fulva* and *megarhynchus*. These were in the collections of the Museum of Vertebrate Zoology at Berkeley, and in the California Academy of Sciences, San Francisco. Only adult males were considered, and effort was made to compare birds taken under similar seasonal conditions. Of *megarhynchus*, only winter birds were examined, for breeding individuals, as far as known, have never been collected.

The first character to be considered is that of color. The striking feature of the Onion Mountain birds is their dark pigmentation. Though taken at the end of June, when their feathers were considerably worn, these skins are darker than those of all