

however, by actually measuring the volume of the food items by their displacement of water. Proportions of rice and weed seeds arrived at by the former procedure were 48 and 52, and by the latter, 43 and 57, respectively. Selection of food depended much on availability, as birds collected in rice fields had fed largely on the grain, while those taken at a distance had consumed chiefly weed seeds. The species is almost exclusively a seed-eater, even the young being reared on a diet of weed seeds. The large amount of weed seeds destroyed does not appear significant to the author considering the tremendous annual crop. Experiment indicated that seeds are not passed through the alimentary tract in viable condition. The author concludes that: "The species is harmful to a certain degree when the rice is in head, but otherwise of neutral importance" (p. 417).—W. L. M.

Gorsuch's 'Life History of the Gambel Quail in Arizona.'—This is a condensed report¹ of the information gathered during one of the game bird studies financed by the Sporting Arms and Ammunition Manufacturers' Institute.

Although the Gambel's Quail lives in a widely different habitat from that of the Bobwhite, the findings of Gorsuch are much similar to those obtained by Stoddard in his well-known study of the latter bird.

First, the great esthetic and sporting value of Gambel's Quail is discussed, followed by a brief account of plumages and distribution and an extended account of its life history, the early winter being taken as the starting point.

The appearance of winter annuals in limited exposed areas causes the Quail to congregate temporarily in winter flocks of 30 to several hundred birds and unlike the Bobwhite, this species has a resting and a feeding period both in the morning and late evening.

At least four and a half months are required for mating, nesting, and rearing of the young; hence there cannot be two broods a year per pair as has been supposed. Selection of nesting site and nest construction requires about ten days; egg laying and incubation, 38 to 42 days; and rearing of young, two and a half to three months. After this, attention to the young decreases, and the family blends into the covey.

The report on food habits of Gambel's Quail is of especial value, being the first comprehensive one for the species. In the contents of 178 stomachs of adults, vegetable matter comprised 91.6 per cent of the food. Seeds and herbage of mesquite were first in importance, making 22.21 per cent; members of the pea family second, 16.73 per cent; and a wild mustard third, 9.04 per cent. The amount of animal matter, 6.99 per cent, is less than half that taken by the Bobwhite. Grasshoppers were first in importance followed by ants and bugs. Salt was frequently eaten by adults and drinking water is not necessary to the bird's existence.

Gambel's Quail is as sedentary as the Bobwhite, if not more so, moving from its territory only in winter flocks or when pressed by enemies.

Parasites and diseases were found to be of little consequence. Nest losses however, constitute a strong limiting factor. In only 11 of the 44 nests observed did eggs reach the hatching stage.

Ground squirrels, cotton rats, house cats, skunks and ants are the chief enemies of the nests, while Cooper's and Sharp-shinned Hawks are the chief enemies of the adults.

Overgrazing and clean farming are strong checks to the birds' increase. Heavy rains and low soil temperatures during the nesting season are adverse climatic factors.

¹ Life History of the Gambel Quail in Arizona. By David Gorsuch. University of Arizona Bulletin, Vol. V, No. 4, Biological Science Bulletin, pp. 1-89, pls. I-V, figs. 1-4, tables 1-4, May 15, 1934.

While not now facing extermination, the present numbers of Gambel's quail do not compare with those of the past. The rehabilitation of old and creation of new habitats, prevention of overgrazing, less clean farming, less game hoggishness, and scientific game laws are recommended for preservation and increase of the species.

This study is of an ecological type, but it emphasizes, rather than minimizes, the need of taxonomic work. Specific identification of stomach contents (for which there was no space in the report) would have been greatly facilitated if even a complete state or local list of the seed plants or insects of the locality had been available.

The plates, figures, and tables add to the value of the work. From the standpoint of the ornithologist, the conservationist, or the ecologist, this is perhaps the best study on any western game bird that has yet appeared.—LEON KELSO.

Whitehead on 'The Effect of Arsenic, as Used in Poisoning Grasshoppers, upon Birds.'¹—During the past few years increase in grasshopper-control operations has resulted both in apprehension as to the security of bird life and controversy over the effects of arsenical poison on wild birds and domestic stock. Ornithologists and conservationists in general are greatly indebted to Prof. Whitehead for his careful and exhaustive study of this problem.

In this timely publication the author briefly summarizes the history of grasshopper depredations and campaigns for their control in relation to bird life. It is clearly brought out that all who have had much experience with use of the customary arsenical baits are convinced that the poison, when made according to approved formulas and properly applied, can cause little or no injury to bird life.

Prof. Whitehead conducted a number of experiments extending from 10 to 66 days on 144 birds, including Chickens, Turkeys, Ducks, Quail, and nestlings of ten species of song birds. Poisoned bran bait of various strengths and more than seventeen thousand poisoned and unpoisoned grasshoppers were fed the birds. It was found that 3.36 mgs. per ounce of bird weight constituted a slightly toxic dose for a Chicken.

Numerous tables give the results of the various experiments. Domestic Fowl and Quail were confined in pens and left without food for 24 hours. Poisoned bran was then scattered in the pens at the rate of 100 pounds per acre and the birds left another 24 hours without other food. As no indication of poisoning appeared, it was concluded that birds are not injured through picking up well-scattered poisoned bran.

In other experiments grasshoppers dead from poisoning were fed the birds. As a sidelight on such experiments, it is evident from studies made by the Biological Survey that insectivorous birds rarely pick up dead insects but choose live and active individuals. It is apparent therefore that poisoning under natural field conditions is much less likely than under laboratory conditions where the birds were allowed no choice of foods.

It is significant that none of the Domestic Fowls died from eating poisoned grasshoppers even though they fed on them for periods of 66 days and, exclusively in some cases, for 10 days. Lack of other foods forced the Chickens at all times to consume the poisoned grasshoppers on an empty crop. It is generally understood that the poison is more likely to have toxic or fatal results when taken on an empty stomach. Furthermore, it should be pointed out that at least in part of the experiments the birds were fed upon poisoned food over a much longer period of time than poisoned grasshoppers would be available under field conditions.

¹ The Effect of Arsenic, as Used in Poisoning Grasshoppers, upon Birds, by F. E. Whitehead, Okla. Exp. Sta. Bul. 218, June 1934, 54 pp., 8 figs., 11 tables.