

## A VIEWPOINT CONCERNING THE SIGNIFICANCE OF STUDIES OF GAME BIRD FOOD HABITS

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In the past six or seven decades there have been numerous studies concerning the food habits of North American game birds. However, in recent years food studies have become somewhat passé, partly as a result of the belief that little useful information is gathered that can be used in the development of wildlife management plans (Kalmbach, 1954). In place of understanding game bird food requirements, wildlife managers have turned to various forms of habitat manipulation to increase populations, and too often have found their efforts to be futile.

I can cite two examples from personal experience. First, an extensive water development ("gallinaceous guzzler") program in southern Nevada in the late 1940's failed to provide a hoped-for population expansion in Gambel's Quail (*Lophortyx gambelii*) because much of the area affected by development lacked an adequate food resource, and food is even more important than water to the desert quail. These quail can exist quite well in the proper environments without preformed drinking water but not without food (Gullion, 1960; Hungerford, 1962; Gullion and Gullion, 1964).

Second, we still apparently know too little about the food requirements of Ruffed Grouse (*Bonasa umbellus*), the voluminous studies of Bump *et al.* (1947) and others, notwithstanding, to understand fully the reasons for the periodic drastic fluctuations of population size, or to develop effective forest management plans that have resulted in significant, sustained increases in Ruffed Grouse populations.

Three basic factors are believed to be responsible for this situation. First, most game bird food studies have been based on samples obtained in the fall from hunter-killed birds, and therefore represent items taken at the time of year when the greatest amount of food is normally available, both in quantity and variety. These fall-taken samples are often comparatively meaningless, even if carefully evaluated in terms of the variety and abundance of foods locally available to the birds (and this frequently is not done). Second, most studies are short-term, representing one or two years' thesis research, or a short-lived (2 or 3 years) intensive state game research project. Third, seldom are the food studies related to the status of the population of birds being sampled; that is, the investigators do not specify whether the population is static, rising, or falling; the density of the species (for comparison with other areas); and how the physical condition of the birds sampled compares with a normal or standard condition. With these shortcomings it is hardly surprising that little has been learned that can be used significantly in developing long-range management programs for many native game birds. Indeed, there have been some published food studies of imported game birds that, in view of the species' failures to become established, can best be interpreted as reflecting diets that could not sustain the birds.

Food studies are needed that critically sample local game bird populations during times of stress as well as during periods of population upswing as was done by Lehmann (1953). Too often it has been assumed that a wide diversity of foods available, and taken, represents a desirable and adequate food situation, at least among the gallinaceous game birds. As Errington (1936:356) pointed out long ago, "The feeding tendencies of vertebrates generally may be rather indiscriminate . . . ." The presence of certain food items in the digestive system, even in abundance or with

considerable frequency over a span of a year or two, is not prima facie evidence that the food items concerned were nutritious or even desirable. I have noted elsewhere (Gullion, 1964a:iv) that the thrift of a number of game animals depends largely upon the availability of a single species of plant, or at most a very few species. For these animals many other food items provide diversity, but lacking the critical plant species the game populations would be nonexistent, or in very low densities.

Among the North American grouse, for example, fall food intake of most species is similar, varying from area to area according to the species of plants locally available. Sage Grouse (*Centrocercus urophasianus*), Spruce Grouse (*Canachites canadensis*), Blue Grouse (*Dendragapus obscurus*), Sharp-tailed Grouse (*Pedioecetes phasianellus*), and Ruffed Grouse all feed in the fall on a large assortment of berries and succulent, green leaves. On the basis of fall food habits Sage Grouse should do as well in Spruce Grouse habitat as Spruce Grouse should do in Sharp-tailed or Ruffed Grouse habitat. It is not until the critical winter period that the availability of sagebrush leaves (*Artemisia* spp.) limits the distribution of Sage Grouse in the Great Basin; jack pine (*Pinus banksiana*) needles the distribution of Spruce Grouse in Ontario; limber pine (*Pinus flexilis*) needles the distribution of Blue Grouse in the Great Basin ranges of Nevada; and the availability of aspen (*Populus* spp.) catkins restricts the range of Ruffed Grouse in northern Minnesota.

Patterson (1952:201) lists 14 genera of plants utilized by Sage Grouse on a year-around basis, but in Great Basin areas where big sagebrush (*Artemisia tridentata*) or other closely related species of *Artemisia* are absent Sage Grouse are virtually nonexistent.

Alcorn and Richardson (1951), Christensen (1954), and Harper *et al.* (1958) list more than 100 plants utilized by Chukar Partridges (*Alectoris graeca*) in Nevada and eastern California; but the abundance and availability of cheatgrass (*Bromus tectorum*) on these cold desert ranges, more than any other single factor in their environment, determines the thrift of these partridge populations.

Koskimies (1955) notes that herbivorous species living in more extreme environments tend to specialize in the utilization of single species of plants. Recent studies of Capercaillie (*Tetrao urogallus*) and Black Grouse (*Lyrurus tetrrix*) in Finland (Seiskari, 1962) have shown a dependence by these species upon the needles of Scots pine (*Pinus sylvestris*) and the aments of silver and white birch (*Betula verrucosa* and *B. pubescens*), respectively, even though the total list of food items taken includes many other species of plants and animals. Jenkins *et al.* (1963:318) discuss in detail the dependence of Scotland's Red Grouse (*Lagopus lagopus*) upon heather (*Calluna vulgaris*). Crichton (1963) recently showed the importance of jack pine needles in the diet of Spruce Grouse in Ontario, as Hoffmann (1961) had done earlier for needles of white fir (*Abies concolor*) in the diet of Blue Grouse in California.

Recently (1964a) I have listed some 91 species of plants that are taken by Gambel's Quail on the desert ranges of southern Nevada. Yet of all these plants, the availability of only three small groups (*Lotus* spp., *Astragalus Nuttallianus* and closely related forms, and *Erodium cicutarium*) largely determines the abundance of quail on these desert ranges (Gullion, 1956:33).

I believe that much of our failure to understand many fluctuations of game bird populations has been the result of inadequate knowledge concerning food habits of the species involved during critical periods, and of improper interpretation of information that is available.

A study of Gambel's Quail in southern Nevada can be used to illustrate this point (Gullion, 1956). In 1950 and 1951, when quail populations were at a low level, the seeds taken as food represented a wide range of the species of plants growing on the desert. Particularly abundant among the items taken were crucifers, borages, and the Caprifoliaceae. Following a wet fall and winter in 1951-1952, the desert "bloomed," and a tremendous quantity of seeds were produced during March and April 1952. With a wide selection of seeds available the desert quail concentrated on those produced by the genera *Lotus* and *Astragalus* (and some *Lupinus*) and *Erodium cicutarium*, almost to the exclusion of all other plant genera. This selection of the seeds of a few species from among all those present continued through 1953. In 1954, when the stockpile of preferred seeds produced in the spring of 1952 began to diminish, a wide diversity of seeds again appeared in the crops of fall-taken quail. Seeds of red brome (*Bromus rubens*), although totally ignored by these quail in 1952, and used only sparingly in 1953, became a prominent item in these crops in 1954. Other seeds not previously utilized that began to appear in quantity included those of *Phacelia* and various crucifers. Also the consumption of dried cat-claw (*Acacia Greggii*) leaves, pieces of dried grass leaves and stems, rodent feces, and other "stuffing" items became prevalent. By the spring of 1955, desert quail populations had dropped far below their 1954 levels.

Although there is a tremendous production of seeds on the southern Nevada desert when conditions are correct, the quail thrive only in those regions where the ephemeral legumes and filaree are abundant. The seeds of the many Compositae, Cruciferae, Onagraceae, Plantaginaceae, Cactaceae, and Gramineae that dominate the other desert areas will not sustain high-density populations of Gambel's Quail.

Current studies of the management of Ruffed Grouse in northern Minnesota indicate that the abundance and nutritional quality of the male aments of the aspens (*Populus tremuloides* and *P. grandidentata*) may be as important in determining the density of grouse populations as any other factor (Gullion, 1964b; Brander, 1965; Marshall, 1965). On the Cloquet Forest Research Center in northern Minnesota the Ruffed Grouse population has continued to decline during the past decade in spite of forest-cutting practices that conform with the widely prescribed recommendations for management (cf. Gullion *et al.*, 1962). Only one consistent change in the forest environment can be correlated with this decline in bird abundance, and that is the widespread elimination of mature aspen from the forest as the result of extensive selective cutting beginning in 1958-1959.

Moreover, there appears to be a definite pattern of *preferential feeding* by Ruffed Grouse wherein only certain male aspen trees or clones are repeatedly selected from among the many male trees available in a forest stand. In most instances the selected trees are the older, decadent, injured, or diseased trees that Grange (1949:220) recommended be cut in favor of younger, thriftier aspen. Nevertheless, we have been unable to document the use of young, thrifty aspen as food by grouse.

It appears likely that one reason game biologists have been unable to explain the basis of changes in Ruffed Grouse populations has been a result of the popular misconception that food is no problem for grouse in hardwood forests since grouse eat buds and twigs (Edminster, 1954:216). Failure to recognize a more restricted food requirement has led to dismissal of these population changes as "cyclic," implying an extraterrestrial influence, or some intrinsic factor (cf. Keith, 1963).

At least with respect to Ruffed Grouse, I feel that the belief that their winter

diet is of low nutritional quality is probably incorrect. Although it is true that twigs and leaf buds are taken as food, it is also apparent that a major portion of the winter diet consists of male catkins of birch, alder (*Alnus* sp.), hazel (*Corylus cornuta*), and especially aspen. These catkins cannot be considered low-quality food items (Leopold, 1933:69), since they contain the organic and mineral nutrients necessary to produce flowers early the next spring. Probably the fact that Ruffed Grouse (and most other tetraonids, too, according to Kuzmina, 1961) do not put on a layer of fat in the fall reflects the richness of this winter diet. We suspect the grouse that cannot avail themselves of sufficient catkins and turn to leaf buds and twigs as stuffing represent a major portion of the 50 to 60 per cent of the population that has normally been lost during the winter.

Although we strongly believe that variation in the food supply is a major influence on Ruffed Grouse populations in northern Minnesota, we can not yet conclusively demonstrate this relationship. It will undoubtedly take many years of intensive study to demonstrate clear-cut relationships since various other factors tend to cloud the issue. There is possibly a periodic fluctuation in the nutrient content of the tree catkins (as postulated by Lauckhart, 1957), and there is possibly a periodicity in the quantity of catkins produced. However, records of the Lake States Forest Experiment Station, U.S. Forest Service, do not show a definite periodicity in this factor (Zazada, personal correspondence).

Also, the severity of winter weather may override favorable food conditions, or a period of cold, wet weather in June may cause heavy losses among newly hatched chicks, resulting in a population decline at a time when food conditions indicate the probability of an increase.

Wildlife managers have long regarded inadequate food as the most prevalent factor limiting the size of big game herds, and extensive management efforts have been directed toward the alleviation of this problem. But biologists dealing with the small game species seldom consider food resources as being limiting. Yet, intensive studies of several species in recent years (Patterson, 1952; Koskimies, 1955; Gullion, 1956; Seiskari, 1962; Jenkins *et al.*, 1963) clearly indicate that lack of a single critical food resource is as important in limiting small game populations as it is in the big game species.

To understand these relationships and to be of significance in developing long-range management policy, studies of food habits must deal with the critical period of each year; they must compare the foods and feeding habits of birds living in populations showing increasing densities as well as stable and declining numbers; and they must deal with individuals known to be successful in surviving in their native habitats.

#### ACKNOWLEDGMENTS

This is paper no. 5781 of the Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul, Minnesota 55101. It is a contribution from Minnesota's Federal Aid to Wildlife Restoration Project W-35-R, Forest Wildlife Relations, the Minnesota Department of Conservation, Division of Game and Fish, and the University of Minnesota Agricultural Experiment Station.

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