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RUFFED GROUSE (BONASA UMBELLUS).

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C. HART MERRIAM, *Chief*

THE GROUSE AND WILD TURKEYS OF THE UNITED STATES, AND THEIR ECONOMIC VALUE

BY

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U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., July 15, 1905.

Sir: I have the honor to transmit for publication as Bulletin 24 of the Biological Survey a report on the Grouse and Wild Turkeys of the United States, by Sylvester D. Judd. From the earliest settlement of the country to the present time these game birds have been of great economic consequence. Their value as food was early recognized, and they played an important rôle by furnishing the pioneers with no small part of their fare. When found by the Spaniards domesticated among the Indians of Mexico, the importance of the turkey was at once perceived, and the bird was soon carried all over the world. It is only in comparatively recent times, however, that the economic value of grouse and turkeys as insect destroyers has been recognized. The results of the present investigations should lead to a wider knowledge of the essential part these birds play in checking the increase of noxious weeds and insects and the importance of preserving them and of increasing their numbers.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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GROUSE AND WILD TURKEYS OF THE UNITED STATES, AND THEIR ECONOMIC VALUE.

INTRODUCTION.

From the early settlement of America until the present day the size, toothsome qualities, and handsome appearance of the grouse and wild turkeys have given them a place among the most widely known and appreciated of our native birds. Throughout the conquest of the continent they served to eke out the scanty larder of the pioneer, and under the changed conditions of more recent times have taken an established place among the most prized luxuries of the table. Their habits are interesting alike to the country boy and the city sportsman, and both share in the keen pleasure of their pursuit. Their presence on the farm or in woodland is directly beneficial, owing to their destruction of harmful insects.

Twelve species of grouse occur within the limits of the United States, including Alaska. They inhabit the most varied country, from the rich prairies of the Mississippi Valley, through the heavily forested areas of the Eastern and Northern States, to above timber line on the desolate summits of mountain ranges and over dreary wastes of arctic tundra. While less beautifully marked than some of the quails, all the grouse are adorned with pleasing colors, and the males of the two species, the prairie hen and ruffed grouse, wear curiously shaped ornamental tufts of feathers on the sides of the neck. Some species have sacs on the neck, which they inflate to make the love notes more sonorous. The males of several species have over the eyes fleshy combs that are concealed by the feathers except in the mating season, when they become brightly colored and are erected to form conspicuous and attractive ornaments. These combs are especially noticeable in both the dusky grouse and the ptarmigans.

The grouse may be arranged in three groups according to the kind of country they occupy. The group of the open plains or of regions covered with a growth of scrubby bushes includes the prairie hens of the western prairies, from Manitoba south to Texas and Louisiana; the lesser prairie hen of the Southwest; the heath hen, once of the Eastern States, from Massachusetts to Virginia, now limited to Marthas Vineyard; the sharp-tailed grouse of the Northwest; and the

sage cock of the sagebrush deserts of the Great Basin, a fine bird, nearly as large as a turkey.

Next are the species of the forested regions. The most notable of these, the well-known ruffed grouse, occurs in wooded areas all through the eastern and northern parts of the country from Maine to northern California, and north to Alaska. Within this wide range it varies sufficiently in color to be separable into four forms. The Canada grouse, which also has been separated into several local forms, has nearly the same range in the north as the ruffed grouse, but does not extend so far south. The Franklin grouse, closely related to the spruce grouse, occurs only from the Rocky Mountains west, and north to Alaska. The blue, or dusky, grouse, called 'fool-hen' in the Rocky Mountains, also varies in color in parts of its range so that it has been divided into several not strikingly different local forms. It is the largest of the forest-loving species and is found only in the wooded mountain areas of the West, from the Rocky Mountains and Sierra Nevada north to Alaska. The forest-inhabiting grouse are rarely near neighbors of man, and hence are of less consequence to agriculture than those of the open country.

The last group of grouse comprises the ptarmigans, which live above timber line on the high summits of the Rocky Mountains and thence north over suitable country to the arctic tundras of Alaska. The ptarmigans are remarkable for the way in which they meet the seasonal conditions of their arctic home by changing the grays and browns of their summer dress for the snowy-white of their winter one. The willow grouse, or common white ptarmigan, a circumpolar bird, is common on the tundras of Alaska and British America. With it occurs the rock ptarmigan, which is rather more of a hill bird, and which is represented on the Aleutian chain by four island forms that differ slightly in color from it and from one another. The white-tailed ptarmigan occurs above timber line in the Rocky Mountains from the northern part of New Mexico to British Columbia and Alaska. Owing to their arctic or subarctic homes the ptarmigans have practically no relations with agriculture. They are resident throughout the year and abound in many parts of Alaska, where they have long been prized as food by the natives, and now are a welcome addition to the fare of the more recent population, though, as a rule, their flesh is dry and without much flavor.

The common tame turkey is a descendant of birds taken to Europe from Mexico by the Spaniards early in the sixteenth century. The wild turkeys of the United States originally occupied a large area extending from the coast of Massachusetts west to Colorado and south to Florida and the Mexican border. While they are of the same species as the Mexican bird, they have been modified by the varying conditions of their environment into four forms, distinguished

by differences in color. The best known of these is the common wild turkey of the Mississippi Valley and the Eastern States. The others are the Florida wild turkey, the Rio Grande turkey, and the Merriam turkey of the southern Rocky Mountains from Colorado south through New Mexico and Arizona. These birds differ in color to a certain extent, but have a close general resemblance. Owing to their size and the value set on their flesh, wild turkeys have been hunted so persistently that they have been exterminated over much of their former range and have become the shyest of our game birds. There are remarkable exceptions to this rule, however, as their persistence up to the present day in parts of Virginia and Maryland, within a few miles of Washington City. This ability to maintain a foothold in long-settled parts of their old territory suggests the feasibility of restocking parts of their former range. In pioneer days they were often destructive to cornfields, and in remote places they still raid grainfields, but the damage is insignificant.

Unfortunately a number of our game birds are now gone or are fast disappearing from their former haunts. An awakening appreciation of the real value of some of the species and of the evident danger of their extermination is evinced by protective laws that have been enacted in recent years throughout the country. These laws are mainly the outcome of a realization of the value of the birds from the sportsman's point of view. The investigations upon which the present report is based show that the farmer has a vastly greater interest at stake in the increase and protection of some of these birds, notably the bobwhite, than has the sportsman. In view of the decrease of both bobwhites and prairie hens it is important to know that there is every probability that proper efforts to rear these birds for restocking purposes will be successful. The numbers of bobwhite may be readily increased by careful protection, but the heath hen is already extinct in the Eastern States, and the prairie hen is nearly or quite gone from large areas in the West where it was numerous a few years ago. The restocking of suitable places in the former range of the prairie hen and even in the former range of the heath hen in the coast region of Virginia and Maryland appears to be quite practicable. The significance of an experiment made by Audubon many years ago at Henderson, Ky., is of special interest in this connection. In the fall he secured 60 prairie hens and, clipping their wings, turned them loose in his garden and orchard which contained about 4 acres. The birds quickly became tame and "walked about the garden like so many tame fowls, mingling occasionally with the domestic poultry." The importance of the prairie hen as a destroyer of weeds and insects has been demonstrated, and its value as a food and game bird is well known. As the bird possesses such

good qualities and as proper efforts for its reintroduction into parts of its former range will almost certainly be successful, it is hoped that the undertaking will not long be delayed. It is unquestionable that the presence of this bird will add appreciably to the value of any farm.

THE PRAIRIE HEN.

(*Tympanuchus americanus.*)

The prairie hen, or 'prairie chicken,' inhabits the western prairies from Manitoba to southern Texas and Louisiana and from Ohio to Nebraska. The birds of southern Texas and Louisiana [a] are smaller and darker than the common bird. This big grouse, resembling a brownish-gray hen, adds animation to the western prairies and is as characteristic of them as the mockingbird is of the South. In the nuptial season the birds assemble every morning at daybreak on little hillocks on the plains, and the cocks strut about with wings drooping, tail spread, and the large orange-colored sacs on the sides of the neck fully inflated. At intervals they lower their heads and emit a singular booming love note that can be heard more than a mile, and is one of the most striking bird notes in the general spring chorus. The rivalry of the males at these gatherings often leads to fierce fights. Finally all find partners, separate into pairs, and make nests in grass-lined depressions among standing grass or similar shelter, where about a dozen eggs are laid to a clutch. Generally only one brood is raised in a season. The young, like those of other gallinaceous birds, leave the nest as soon as they are hatched and run about with the hen in search of food. In summer prairie hens roost on the ground in a family covey, as does the bobwhite, but in winter, in many sections, they roost in trees. In the fall several coveys congregate in a pack, after the fashion of ptarmigans and crested quail. Prof. F. E. L. Beal informs the writer that at Ames, Iowa, during the early eighties, he frequently found packs numbering as many as a thousand birds, and that they habitually roosted in the long grass beside sloughs. The prairie hen is migratory in the northern part of its range, and to a certain extent farther south also. The well-known authority on migration, Prof. W. W. Cooke, says: [b]

> In November and December large flocks of prairie chickens come from northern Iowa and southern Minnesota to settle for the winter in northern Missouri and southern Iowa. This migration varies in bulk with the severity of the winter.

From a gastronomic point of view the prairie hen deserves high praise; it is larger than the ruffed grouse, sometimes weighing 3 pounds, and has a delicious flavor. The flesh of young birds is light-colored, of old ones dark. The estimation in which the bird is held

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[a] *Tympanuchus americanus attwateri* (Bendire).

[b] Bul. 2, Div. Econ. Ornith., Dept. Agri., p. 105. 1888.

may be realized from the fact that in 1902 the supply at from $3 to $5 a brace nowhere met the demand. Years ago prairie chickens were shipped east by carloads, but to-day scarcity of birds and a commendable stringency of laws practically preclude shipments.

Many sportsmen declare that there is no better sport than 'chicken' shooting. The bird unquestionably is one of the noblest of game birds. Though in speed of flight it by no means equals the ruffed grouse or the bobwhite, it furnishes fine sport when hunted with dogs. Early in the season, in suitable cover, it lies to a dog like a stone. So reluctant occasionally is it to fly that it can hardly be put up, and Professor Cooke informs the writer that several times while hunting in northern Minnesota he saw a pointing dog jump and catch a three-fourths grown prairie hen. Late in the fall, however, when gathered in large packs, they do not lie well.

Early in the season—that is, during the last two weeks of August and the first part of September—the prairie hen affords a better test of a dog's ability to hunt fast and to range out a mile or more from the gun than does the bobwhite. It is for this reason that field trials on 'chickens' are always well patronized, and the dogs that win are highly valued. So highly esteemed is the prairie chicken as the quarry of 'racing' dogs that abundant means for the restocking of suitable places with the species is likely to be forthcoming from field-trial patrons. The ideal conditions for 'chicken' shooting are realized in a fenceless country, where it is possible for the hunter to drive, while the dogs range from a quarter of a mile to a mile away from the wagon. As soon as they point game the sportsman hurries up and shoots. The driver 'marks down' the birds that escape and perhaps fly half a mile before alighting. Then the wagon advances to where they dropped, and shooting is again in order. In some parts of the country the sport stops at 10 or 11 o'clock in the morning, because of the intense heat during the middle of the day, when the birds are resting in places difficult of access, and is not resumed before 3 or 4 o'clock in the afternoon.

PRESERVATION AND PROPAGATION.

The prairie hen deserves well of man. It is beneficial to agriculture, is one of the best table delicacies, and its booming call is the dominant spring note of the plains, as the bird is their most characteristic resident. Furthermore, the number of entries to the yearly field trials on 'chickens' speak for it as an object of sport. In view of all the good qualities of the bird, the causes of its diminished numbers should be sought, and adequate means applied to preserve it from extinction.

At the beginning of the nineteenth century the prairie hen was

extremely abundant throughout Ohio and Kentucky. It is now rare in both States. A part of the ground it has lost in the East it has gained by a westward and northward movement. It has followed the grain fields of the pioneers of the plains, and with the extension of grain culture into Minnesota and Manitoba it has become plentiful there. According to Doctor Hatch, it was by no means common when the white man first came to Minnesota, and he says that in Illinois as late as 1836 a hunter was extremely lucky if he could bag a dozen in a day. Some years later, with much less effort, one could have shot 50 in a day, and there were records of 100 to a single gun.[a]

The former status of the bird in the East is well indicated by Audubon's classic observations at Henderson, Ky., in 1810. Audubon says:[b]

> In those days during the winter the Grous would enter the farm-yard and feed with the poultry, alight on the houses, or walk in the very streets of the villages. I recollect having caught several in a stable at Henderson, where they had followed some Wild Turkeys. In the course of the same winter, a friend of mine, who was fond of practicing rifle shooting, killed upwards of forty in one morning, but picked none of them up, so satiated with Grous was he, as well as every member of his family. My own servants preferred the fattest flitch of bacon to their flesh, and not unfrequently laid them aside as unfit for cooking. * * * They could not have been sold at more than one cent apiece. * * * So rare have they become in the markets of Philadelphia, New York, and Boston, that they sell at from five to ten dollars the pair.

So far as the sportsman is concerned, the prairie hen is now extinct in Kentucky, and nowhere is the royal game bird even approximately so abundant as it formerly was in that State. There is little good chicken shooting east of the Mississippi. The best now to be had is in Kansas, Nebraska, Minnesota, the Dakotas, and Manitoba. Fortunately many people are actively interested in the protection and preservation of the prairie hen and excellent laws in its behalf already exist. There is a constantly growing sentiment in favor of nonresident hunting licenses and a legal limit to the day's bag, while some States afford the bird absolute protection for a period of years,[c] and their example should be followed wherever it is growing scarce. The passage of nonexport laws in most of the States has been productive of much good. These State laws have been made effective by a recent Federal law—the Lacey Act—which prohibits interstate commerce in game killed in violation of local laws. Through its operation the sale of the prairie hen was virtually stopped in 1902 and 1903 in all the large cities of the East. Absolute enforcement of this law and successful prohibition of local sales must be effected before

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[a] Birds of Minnesota, p. 163, 1892.

[b] Ornith. Biog. II, p. 491, 1835.

[c] Illinois, Louisiana, and Oregon protect prairie hens until 1909, and Michigan and the Province of Ontario until 1910.

the safety of the bird is assured. The laws relating to the close season have been greatly improved, but in some States the open season (four months in Oklahoma and South Dakota) is still too long.

The preservation of the prairie hen is far more difficult than that of the bobwhite. The bobwhite is more prolific and does not require so extensive a range. Moreover, it is swifter of wing and habitually dives into the woods to escape the hunter. Before the hammerless gun and the wide-ranging bird dog the grouse of the open prairie falls an easy victim. It has to contend also with the trapper, besides predatory birds, reptiles, and mammals. Its most deadly enemy, however, is the prairie fire in spring, which destroys every nest within its sweep. E. W. Nelson informs the writer that in the early seventies in northwestern Illinois the farmers in many places burned the prairies in spring after the prairie hens nested, and often gathered for household use large numbers of the eggs thus exposed. Were it possible for stockmen to burn the grass a little earlier it would result in the saving of thousands of birds.

The prairie hen has the advantage, however, of yielding more readily to domestication than the bobwhite, and strong efforts should be made to establish preserves of domesticated birds for restocking country where the species is extinct. Successful enterprises of this kind would be profitable. That such domestication is possible and even feasible, the appended quotation from Audubon implies:[a]

> The Pinnated Grous is easily tamed, and easily kept. It also breeds in confinement, and I have often felt surprised that it has not been fairly domesticated. While at Henderson, I purchased sixty alive, that were expressly caught for me within twelve miles of that village, and brought in a bag laid across the back of a horse. I cut the tips of their wings, and turned them loose in a garden and orchard about four acres in extent. Within a week they became tame enough to allow me to approach them without their being frightened. * * * In the course of the winter they became so gentle as to feed from the hand of my wife, and walked about the garden like so many tame fowls, mingling occasionally with the domestic poultry. * * * When spring returned they strutted, 'tooted,' and fought, as if in the wilds where they had received their birth. Many laid eggs, and a good number of young ones made their appearance.

There is great probability of success in the restocking of much of the former range of the prairie hen if undertaken in the proper way and properly sustained by adequate protective laws. Successful results would materially add to the assets of every farm.

FOOD HABITS.

For the purposes of this report the contents of 71 stomachs of prairie hens have been examined. Fortunately this material represents not only the shooting season, but all other months except July. Most of the stomachs came from the Dakotas, Minnesota, Iowa, Wis-

[a] Ornith. Biog. II, p. 495, 1835.

consin, Nebraska, and Texas; Illinois and Ontario furnished the rest. The food consisted of 14.11 percent animal matter and 85.89 percent vegetable matter. The former was insects; the latter seeds, fruit, grain, leaves, flowers, and bud twigs.

Insect Food.

The insect food included 12.78 percent of grasshoppers, 0.48 percent of beetles, 0.39 percent of bugs, 0.12 percent of ants and other Hymenoptera, 0.29 percent of other insects, and 0.05 percent of spiders. The ruffed grouse takes about one-sixth less and the bobwhite about one-third more of insects than the prairie hen. Although the bobwhite destroys injurious grasshoppers, the relative proportions of grasshoppers and beetles consumed by it and by the prairie hen are notably different. In the food of the bobwhite the grasshoppers are to the beetles as 3.71 to 6.92; with the prairie hen the ratio stands as 12.78 to 0.48. Indeed, grasshoppers constitute the bulk of the prairie hen's animal diet, the reason being probably that on the prairies the grasshoppers vastly outnumber all other sizable insects. For a gallinaceous bird the prairie hen is highly insectivorous from May to October, inclusive, insects constituting one-third of the fare of the specimens shot during this period. The species is particularly valuable as an enemy of the Rocky Mountain locust. During an invasion by this pest in Nebraska, 16 out of 20 grouse killed by Prof. Samuel Aughey from May to October, inclusive, had eaten 866 locusts—a creditable performance, economically rated. Some ornithologists believe that the diminution in the number of prairie hens is in a measure responsible for the ravages of certain insects. Farmers who know these facts must regret the extinction of the bird in States where it once thrived, and they may well support measures for reintroducing and protecting it.

Almost every kind of grasshopper and locust appears to be acceptable to the prairie hen. In the following list are named the species of short-horned grasshoppers identified in its food:

Opomala sp.
Mermiria alacris.
Philibostroma quadrimaculatum.
Leptysma sp.
Psolæssa sp.
Agencotettix scudderi.
Spharagemon sp.
Schistocerca americana.
Cordillacris occipitalis.
Stenobothrus curtipennis.
Melanoplus femur-rubrum.
Melanoplus atlanis.
Melanoplus bivittatus.

The prairie hen eats also long-horned grasshoppers (*Xiphidium* sp., *Conocephalus* sp., and *Orchelimum* sp.) and crickets (*Gryllus* sp.) and tree crickets (*Œcanthus* sp.).

In its beetle diet the prairie hen makes up in variety what it lacks in quantity. Unlike our common small passerine birds, but like our other gallinaceous birds, it feeds on the harmful leaf beetles. It

destroys also the potato beetle (*Leptinotarsa decemlineata*), in both adult and larval stages, and the injurious 12-spotted cucumber beetle (*Diabrotica 12-punctata*). The stomach of a bird collected by H. P. Attwater, November 7, 1893, in Aransas County, Tex., contained 16 of these latter insects. Among other leaf-eating beetles eaten may be mentioned *Chrysomela pulchra*, *Chrysomela suturalis*, *Disonycha quinquevittata*, *Monoxia puncticollis*, and *Graphops pubescens*. The injurious May beetles (*Lachnosterna* sp.) also are destroyed, as well as weevils (*Thecesternus humeralis* and other species). Like many other birds, the prairie hen is partial to ground beetles. It has been known to take such kinds as *Anisodactylus rusticus*, *Agonoderus pallipes*, *Amara* sp., and *Chlænius* sp. It probably feeds also on the different abundant species of *Harpalus*. Ladybirds are at times destroyed, as was attested by remains of *Hippodamia convergens* contained in one stomach.

Miscellaneous insects are eaten in small numbers, but are interesting because they include a number of the worst insect foes, such as the cotton worm (*Alabama argillacea*),[a] the army worm (*Heliophila unipuncta*), several species of cutworms, the yellow bear caterpillar (*Diacrisia virginica*), cankerworms (*Geometridæ*), the Angoumois grain moth (*Sitotroga cerealella*), and the chinch bug (*Blissus leucopterus*). The bird's habits of eating chinch bugs has been reported by B. F. Gault, of Chicago, and Prof. F. M. Webster, of the Bureau of Entomology. Other bugs, including stink bugs (*Euschistus* sp.) and the tree hoppers (*Stictocephalus* sp.) make part of the food. In addition to ants, such as *Formica exsectoides*, the prairie hen occasionally eats other Hymenoptera, including *Tiphia inornata* and gall insects contained in the galls of Cynipidæ. In its liking for galls and their contents the bird resembles the ruffed grouse and the British pheasant.

Further study of the food habits of the prairie hen will unquestionably add largely to the foregoing enumeration of insects, but our present knowledge, incomplete as it is, shows the general character of its insect food, and establishes the value of the species as a destroyer of insect pests.

Vegetable Food.

From October to April, inclusive, the prairie hen takes little but vegetable food. This element amounts to 85.89 percent for the year. Fruit constitutes 11.79 percent; leaves, flowers, and shoots, 25.09 percent; seeds, 14.87 percent; grain, 31.06 percent, and miscellaneous vegetable material, 3.08 percent.

Like the bobwhite and the ruffed grouse, the prairie hen is fond of rose hips, and the abundant roses of the prairie yield 11.01 percent

[a] Fourth Rep. U. S. Ent. Commission, p. 88, 1885.

of its food. This fact perhaps may be a useful hint to anyone who attempts to introduce the bird or to improve its environment. The other fruit found was of little importance—merely 0.78 percent. It was made up of domestic cherries, woodbine berries, sumac, poison ivy, huckleberries, strawberries, partridge berries, mistletoe, wild grapes, the berries of *Solanum* and *Symphoricarpus*, and cornel (*Cornus asperifolia*). Of the frugivorous habits of the prairie hen Audubon writes:[a]

> In the western country, at the approach of winter, these birds frequent the tops of the sumach bushes, to feed on their seeds, often in such numbers that I have seen the bushes bent by their weight.

It is important to note that often when deep snow causes scarcity of other supplies the sumac affords both the prairie hen and the bobwhite abundant food. As with the insect food, further investigation undoubtedly will extend the fruit list.

The prairie hen eats a much smaller proportion of seeds, with the exception of grain, than the bobwhite, and in this respect is less useful than the latter bird. It is, however, a better weeder than any other grouse, and its services in this particular are worthy of consideration. As before stated, seeds make 14.87 percent of the annual diet. Of these, grass seeds form 1.03 percent; seeds of various polygonums, 8.49 percent, and miscellaneous weed seeds, 5.35 percent. When the nature of the prairie hen's habitat is recalled it seems strange that the percentage of grass seed is so small. The bobwhite, in contrast, takes 9.46 percent of grass seed. Like the bobwhite and other granivorous birds, the prairie hen often eats the seeds of the various species of panicums, the paspalums, and pigeon grass (*Chætochloa viridis*).

The seeds of different polygonums, or smartweeds, play an important part in the economy of the prairie hen. They form 8.49 percent of the food. These plants grow profusely where illy drained regions of the plains are under water for a few months in the year. Black bindweed (*Polygonum convolvulus*) and smartweed (*Polygonum lapathifolium*), with the closely related dock (*Rumex crispus*), are included in the bill of fare. Of the 5.35 percent of remaining miscellaneous seeds, ragweed (*Ambrosia artemisiæfolia*) is the most important element, but is insignificant in amount when compared with the same element of the bobwhite's food. Other compositæ are eaten by the prairie hen—wild sunflower, coreopsis (*Coreopsis cardaminefolia*), and others. The prairie hen has a liking for legumes, reminding one again of the bobwhite. It selects two of the latter's favorites—cassia, and the hog peanut (*Falcata comosa*). It takes also the seeds of a closely related plant, the prairie mimosa (*Acuan*). It has been known to feed on seeds of water willow (*Dianthera* sp.), the yellow false garlic (*Nothoscordum bivale*),

[a] Ornith. Biog., II, p. 501, 1835.

blue-eyed grass (*Sisyrinchium graminoides*), shepherd's purse (*Bursa bursa-pastoris*), mercury seeds (*Acalypha* sp.), croton seeds (*Croton* sp.), and seeds of purslane (*Portulaca oleracea*), the seeded pods of the latter being plucked.

GRAIN.

As a grain eater the prairie hen heads the native gallinaceous birds. Everybody who has gone 'chicken' shooting knows how closely the bird is associated with stubble fields. The stomachs and crops examined in the investigation contained 31.06 percent of grain. The bobwhite, another busy stubble feeder, takes only 17.38 percent. The stomach of a grouse shot in June in Nebraska contained 100 kernels of corn and 500 grains of wheat. J. A. Loring, formerly of the Biological Survey, during December in Nebraska found prairie hens feeding in wheat stubble, about straw stacks, and along the edges of cornfields. Doctor Hatch, in writing of their granivorous habits, says:[a]

> The grain fields afforded both food and protection for them, until the farmers complained of them bitterly, but not half so bitterly as they did afterwards of the bird destroyers who ran over their broad acres of wheat, oats, and corn in the order of their ripening.

Buckwheat, barley, oats, and millet are relished, but corn appears to be the favorite cereal, amounting to 19.45 percent of the annual food. Other grain, principally wheat, was in the ratio of 11.61 percent. Amos W. Butler reports that in Indiana, during September, fields of ripening buckwheat are favorite feeding grounds.[b] There is reason to believe that sprouting grain is sometimes injured. Audubon speaks of such injury in Kentucky, where the bird was extremely abundant.[c]

Like other gallinaceous birds, the prairie hen likes mast, though naturally it obtains much less than the ruffed grouse. The stomach contents showed the beaked hazelnut (*Corylus rostrata*) and acorns, including, among others, those of the scrub oak (*Quercus nana*) and the scarlet oak (*Q. coccinea*). Like the ruffed grouse, it swallows acorns whole. A bird shot in Minnesota in March had bolted 28 scarlet-oak acorns.

LEAVES, FLOWERS, AND SHOOTS.

Like other grouse the prairie hen is an habitual browser, to the extent of 25.09 percent of its food. This is divided as follows: Twigs

[a] Birds of Minnesota, p. 163, 1892.
[b] Ann. Rept. Dept. Geol. Ind., 1897, p. 758.
[c] Ornith. Biog., II, p. 491, 1835.

or shoots, 0.55 percent; flowers, 9.34 percent, and leaves, 15.20 percent. This is only half the amount of similar food taken by the ruffed grouse. Naturally the prairie hen is much less given to budding than the ruffed grouse, but it has been known to pluck buds of poplar, elm, pine, apple, dwarf birch (*Betula glandulosa*), and black birch (*B. lenta*). "I have counted more than 50 on a single apple tree," writes Audubon,[a] "the buds of which they entirely destroyed in a few hours. * * * They were, in fact, looked upon with more abhorrence than the crows are at present in Massachusetts and Maine, on account of the mischief they committed among the fruit trees of the orchards during winter, when they fed on their buds, or while in the spring months, they picked up the grain in the fields." This mischief was due largely to the abundance of the birds, a condition never likely to return.

The prairie hen shows a marked taste for flowers. A delicate pink rosebud had been plucked by a bird shot at Omega, Nebr., in June. More than a thousand golden-rod heads were found in another. Additional composite flowers devoured were Amphiachyris (*Amphiachyris dracunculoides*), sweet balsam (*Gnaphalium obtusifolium*), and others. The flower and leaf buds of birch and apple also are taken. Small green ovaries of *Ruellia* and blue-eyed grass were noted in a few cases. These birds eat leaves, including those of the buttercup, everlasting (*Antennaria*), red and white clover, and the interesting water milfoil (*Myriophyllum*), often grown in goldfish globes.

Food of the Young.

The economic value of the prairie hen is due mainly to its destruction of weeds and harmful insects, the latter constituting almost the sole food of the downy chick. Unfortunately only two stomachs of young birds were to be had for examination. The chicks were recently hatched Texas prairie hens (*Tympanuchus americanus attwateri*). They had eaten 1 tree cricket, 5 undetermined caterpillars, 1 imago of the very destructive Angoumois grain moth, 1 leaf beetle (*Monoxia puncticollis*), and 19 12-spotted cucumber beetles (*Diabrotica 12-punctata*), which do not always confine themselves to cucumbers, but injure more than a dozen other cultivated plants.

THE HEATH HEN.

(*Tympanuchus cupido.*)

The heath hen, which, to casual view, appears like a small-sized prairie hen, inhabits the scrub oaks of the island of Marthas Vineyard, on the coast of Massachusetts. It was formerly abundant in

[a] Ornith. Biog., II, pp. 491 and 501, 1835.

Connecticut and the eastern parts of New York, New Jersey, Pennsylvania, and Virginia.

As no stomachs of this now rare bird were to be had for examination, we must depend on the work of other investigators for knowledge of its food habits. Audubon[a] quotes David Eckley as follows:

> The bayberry, which abounds in many parts of Martha's Vineyard, is the principal food of the Grous particularly such as grows on low bushes near the ground, and is easily reached by the birds. They also feed on the boxberry, or partridge berry, the highland and lowland cranberry, rosebuds, pine and alder buds, acorns, etc.

William Brewster in 1890 ascertained that, all told, there were probably only about 200 heath hens, and that they were confined to about 40 square miles of the island of Marthas Vineyard. In speaking of their habits, he says:[b]

> At all seasons the heath hens live almost exclusively in the oak woods, where the acorns furnish them abundant food, although, like our ruffed grouse, they occasionally, at early morning and just after sunset, venture out a little way in the open to pick up scattered grains of corn or to pluck a few clover leaves, of which they are extremely fond. They also wander to some extent over the scrub-oak plains, especially when blueberries are ripe and abundant. In winter, during long-continued snows, they sometimes approach buildings to feed upon the grain which the farmers throw out to them.

If this bird can be saved from extinction and introduced into many of the Eastern States, it will be much more likely to succeed, on account of its woodland habits and narrow range, than the prairie hen, which requires a more open country and usually does not take refuge in woods from its enemies. Experiments with the heath hen must be made soon, however, or it is likely to become extinct.

THE LESSER PRAIRIE HEN.

(Tympanuchus pallidicinctus.)

The lesser prairie hen is a smaller bird than the common species of the Mississippi Valley and is found from western Texas north to western Kansas. But little of its life history is known. It has been found breeding abundantly the first of June at Fort Cobb, Ind. T., and William Lloyd observed this grouse wintering in Concho and Tom Green counties, Tex. H. C. Oberholser, of the Biological Survey, found them common in August, 1901, in Wheeler County, Tex., where they frequented rolling plains overgrown with oak brush from 1 to 4 feet high. These oaks are evergreen, and the prairie hen feeds upon the buds and young shoots. At the time of Oberholser's visit the birds were in coveys of from

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[a] Ornith. Biog., II, p. 500, 1835.

[b] Forest and Stream, XXXV, p. 188, 1890.

15 to 20, but, according to the people of that section, the prairie hens gather in flocks of hundreds in the late fall. At this season they are destructive to unthreshed wheat and oats, tearing off the surface of the stacks. In winter they visit cattle pens and corrals in search of food. During severe winters they are sometimes so numerous that they become a nuisance. Some idea may be had of their abundance during winter from the information secured by Oberholser that one man shipped 20,000 of them from this section in a single season.

THE SHARP-TAILED GROUSE.

(*Pediœcetes phasianellus.*)[a]

The sharp-tailed grouse is about the same size and has the general appearance of the prairie hen. Its range is wide, extending from Lake Michigan to northeastern California, and from northeastern New Mexico to Alaska. In the northern part of the Mississippi Valley its range overlaps that of the prairie hen, and mixed flocks are sometimes seen, but the 'spike tail' is seldom found in such large numbers as that species. It shows also much less adaptability to changed conditions and disappears more rapidly after the subjection of its range to agriculture. In regard to its curious courtship, Professor Macoun writes of the Columbian sharp-tailed grouse:[b]

> The males collect in large numbers on some hill about the end of April or beginning of May to have their annual dance, which they keep up for a month or six weeks. It is almost impossible to drive them away from one of their hills when they are dancing. One day about the middle of May, I shot into a dancing party, killing two, and wounding another, which flew a short distance. I went to get it, and before I got back to pick up the dead birds, the others were back dancing around them.

About a dozen eggs generally make a clutch, and but one brood is reared in a season. The eggs vary from buff to olive-brown and are usually lightly spotted with brown.

From two to three months after hatching, the young are full grown and afford quite as good if not better sport than the prairie hen. They lie well to the dog and usually rise with a noisy, clucking cry; after a short distance the flight changes to an alternation of rapid vibrations of the wings and gliding or sailing on stiffly outspread pinions. The flesh of the young, like that of young prairie hens, is

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[a] The sharp-tailed grouse varies in different parts of its range, and has been divided into two geographic forms in addition to the typical bird. These are the Columbian sharp-tailed grouse (*Pediœcetes phasianellus columbianus*), occupying the western part of the bird's range in the United States, and the prairie sharp-tailed grouse (*Pediœcetes phasianellus campestris*) which covers the plains east of the Rocky Mountains.

[b] Cat. Can. Birds, pt. 1, p. 212, 1900.

light colored and deliciously flavored. After the birds begin to pack they afford little sport to the hunter.

The sharp-tailed grouse are partly migratory. In winter they take refuge in the highest trees, walking among the branches almost as nimbly as the ruffed grouse. Like the latter, the present species has a habit of plunging into the snow to spend the wintry night. It has many natural enemies in the winter, and in summer the golden eagle has been known to feed its young very largely upon its flesh. Its struggle for existence is unusually severe. Wherever it abounds, in accessible districts, it is pursued relentlessly by the sportsman; but where diminished to a certain point, as on its western and northern ranges, hunting it is largely abandoned. Probably some decades will pass, therefore, before it will be in danger of total extinction. As it does not readily accept civilization, it is not likely to become a popular bird in our growing game preserves, which each year become of greater economic importance.

FOOD HABITS.

The food habits of the sharp-tailed grouse have been studied in connection with the present paper by the examination of 43 stomachs. These were collected in every month of the year except January and March; most of them in Nebraska and the Northwest Territories, but some in Minnesota, North Dakota, and Manitoba. The investigations showed that animal matter (insects) formed only 10.19 per cent of the food, while vegetable matter (seeds, fruit, and 'browse') made 89.81 percent. If subsequent study proves that these figures apply generally to the species, the sharp-tailed grouse is to be classed among the birds most largely vegetarian.

INSECT FOOD.

The insect matter consists of bugs, 0.50 percent; grasshoppers, 4.62 percent; beetles, 2.86 percent, and miscellaneous insects, 2.21 percent in a total of 10.19 percent of the food. Vernon Bailey, of the Biological Survey, found that three birds shot by him in Idaho August 29 had eaten chiefly insects, including grasshoppers, small bugs, and small caterpillars. Baird, Brewer, and Ridgway state that the Columbian sharp-tailed grouse has been known to feed on caterpillars and other insects that have been scorched by prairie fires.[a]

The young of the sharp-tailed grouse, like those of other gallinaceous species, are highly insectivorous. A downy chick from 1 to 3 days old, collected on June 27, in Manitoba, by Ernest Thompson Seton, had eaten 95 percent of insects and 5 percent of wild straw-

[a] Hist. N. A. Birds, Land Birds, III, p. 439, 1874.

berries. The insect material consisted of a lepidopterous chrysalis and the remains of beetles and black ants (*Camponotus pennsylvanicus*). Another young bird, about 8 days old, taken by the same collector, had been exclusively insectivorous. It had eaten such beetles as weevils, ground beetles (*Harpalus herbivagus*), the ladybird (*Anisosticta seriata*), and the click beetle (*Dolopius lateralis*), also 2 cutworms, 9 sawfly larvæ, such leaf hoppers as *Tettegonia* sp. and *Helochara communis*, and 1 leaf spider. The sharp-tailed grouse is fond of grasshoppers. Vernon Bailey shot 3 birds at Elk River, Minn., September 17, 1894, which had eaten, respectively, 7, 23, and 31 grasshoppers. The species is a destroyer also of the Rocky Mountain locust. Of 9 birds collected by Professor Aughey from May to October, inclusive, 6 had eaten 174 of these pests.[a] The bird eats also a few crickets and, like other gallinaceous game birds, devours the Colorado potato beetle (*Leptinotarsa decemlineata*). It has been known to feed on the bugs *Oncometopia lateralis* and *Oncometopia costalis*. The lack of sufficient material to determine exactly the bird's relation to insects is to be regretted, but enough is at hand to demonstrate the fact that its insect food is much like that of its relatives.

VEGETABLE FOOD.

The vegetable food of the sharp-tailed grouse, so far as ascertained in the laboratory, comprises weed seeds, 7.39 percent; grain, 20.50 percent; fruit, 27.68 percent; leaves, buds, and flowers, 31.07 percent, and miscellaneous vegetable food, 3.06 percent; making a total of 89.81 percent. The weed-seed element consists of the seeds of black bindweed (*Polygonum convolvulus*) and other polygonums, wild sunflower (*Helianthus* sp.), ragweed (*Ambrosia artemisiæfolia*), peppergrass (*Lepidium*), blue-eyed grass, sedge, and catchfly (*Silene antirrhina*). The seeds of a number of leguminous plants are eaten, including those of alfalfa. Like many other game birds, the species feeds on mast (largely acorns), including acorns of the scarlet oak (*Quercus coccinea*). Corn is eaten, but wheat is the favorite grain. It formed 17.21 percent of the food. A thousand kernels of wheat were sometimes found in one stomach.

The sharp-tailed grouse is a great browser. It makes 31.07 percent of its food of leaves, buds, and flowers. Ernest Thompson Seton found it eating the buds of willow and birch. It feeds on the leaves of cottonwood, alder, blueberry, juniper, and larch; also leaves of quillwort (*Isoetes*), vetch, dandelion, grass, and rush (*Juncus*). Hearne says that in winter it eats the tops of the dwarf birch and the buds of poplars. Flowers form 19.90 percent of its diet, the species

[a] First Rep. U. S. Entom. Comm., Append. II, p. 47, 1877 (1878).

leading all other birds in this respect. A half pint of the showy, bluish blossoms of the pasque flower (*Pulsatilla hirsutissima*) which brightens the western prairie are often taken at a meal, and those of the dandelion also are eaten. Inflorescence of grasses, alder, willow, maple, and canoe birch are plucked along with leaf buds.

Like the prairie hen and the ruffed grouse, the sharp-tailed grouse is frugivorous, and fruit forms 27.68 percent of its diet. Hips of wild rose alone form 17.38 percent. Ernest Thompson Seton, who examined hundreds of stomachs of the sharp-tailed grouse, says that he can not recollect an instance in which they did not contain the stony seeds of the wild rose (*Rosa blanda* [?]).[a] The Biological Survey has found rose seeds in many of the stomachs examined, but in numerous instances it has recorded their absence. The fruit of both prairie rose and the sweetbrier (*Rosa rubiginosa*) are eaten. Mr. Seton states that in places in Manitoba where he has collected during the winter, gravel to pulverize the food is not to be had, and the stony rose seeds act in its stead. Rose hips appear difficult to digest, and, furthermore, are sometimes thickly set with bristles that would irritate the human stomach, but appear to cause no inconvenience to the grouse. The persistent bright-colored hips are readily seen above the snow, and they are a boon to the birds in wintry northern regions, where the struggle for existence is bitter. Other plants of the rose family furnish food for the sharp-tailed grouse, such as the thorn apple (*Cratægus* sp.), the wild strawberry, and the wild black cherry (*Prunus serotina*). It feeds on blueberries and cranberries and on the snowberry (*Symphoricarpus racemosus*), various species of manzanita, bearberry (*Arctostaphylos uva-ursi*), buffalo berry (*Lepargyrea argentea*), juniper berries, huckleberries, and arbutus berries. It takes also the partridge berry (*Mitchella repens*), a favorite with the ruffed grouse. Like many other species, it eats with relish the fruit of cornel (*Cornus stolonifera*) and poison ivy (both *Rhus radicans* and *Rhus diversiloba*).

THE SAGE GROUSE.

(*Centrocercus urophasianus.*)

With the exception of the wild turkey, the sage grouse is our largest game fowl. It is a fine-looking bird, with gray back, black breast, and long tail, and attains a maximum weight of 8 pounds. It breeds on the sagebrush plains of the Upper Sonoran and Transition zones, from the east slope of the Sierra Nevada and Cascade mountains in Nevada, California, and British Columbia, east to Assiniboia, Dakota, Nebraska, and Colorado. At mating time the cock inflates the sacs

[a] Proc. U. S. Nat. Mus. XIII, p. 519, 1890 (1891).

on the sides of his neck until they look like small oranges, and then goes through a droll performance, throwing himself forward on his breast and plowing along the ground until the breast feathers are almost completely worn away. The hen is captivated by these grotesque antics, and in due time chooses a mate and nests in a small depression in the ground under the shelter of a bush, where she lays about ten olive-buff eggs with chocolate markings. The cock leaves her before incubation begins, and in about three weeks the chicks are out. A young covey roosts in a circle on the ground, bobwhite-fashion. In winter, coveys unite in packs which sometimes number a hundred or more.

FOOD HABITS.

The feeding habits of the sage grouse are peculiar, and its organs of digestion are unlike those of other grouse. The stomach is not differentiated into a powerful grinding gizzard, but is a thin, weak, membranous bag, resembling the stomach of a raptorial bird. Such an organ is evidently designed for the digestion of soft food, and we find that the bulk of the sage grouse's diet consists of leaves and tender shoots. A stomach collected September 7, 1890, in Idaho, by Dr. C. Hart Merriam, contained leaves of sage and other plants, seeds, and a ladybird beetle (*Coccinellidæ*). Four birds shot in Wyoming during May and September by Vernon Bailey had gorged themselves with the leaves of sagebrush (*Artemisia tridentata*). This and other sages, including *A. cana* and *A. frigida*, furnish the bulk of the food of the sage grouse. Other food is taken, but it is comparatively insignificant. B. H. Dutcher, formerly of the Biological Survey, examined a stomach which, besides sagebrush leaves, contained seeds, flowers, buds of *Rhus trilobata*, and ants and grasshoppers. Three birds collected by Vernon Bailey on September 5, in Wyoming, had varied their sagebrush fare with ladybird beetles, ground beetles (*Carabidæ*), fly larvæ, ants, moths, grasshoppers (*Melanoplus* sp.), and the leaves of asters and yarrow. Of two birds killed in May, one had fed wholly on the leaves of sagebrush (*Artemisia tridentata*), while the other in addition had taken insect galls from sagebrush and the flowers and flower buds of a phlox (*Phlox douglasii*), together with some undetermined seed capsules, pieces of moss, and several ants. A third bird, killed in July, had eaten a few plant stems and numerous grasshoppers.

Major Bendire writes that the diet of the sage grouse includes grass spikes, the tops of leguminous plants, including blossoms and pods of vetch (*Vicia*) and astragalus; also, that the bird eats goldenrod, and will go far to get a morning feed of wheat. He notes that also berries, grasshoppers, and crickets (*Anabrus simplex*) are eaten.[a]

[a] Life Hist. N. A. Birds, [I], pp. 107–108, 1892.

SAGE GROUSE (CENTROCERCUS UROPHASIANUS).

Sage grouse have been known to eat rose hips, greasewood leaves, and the buds and foliage of the pulpy-leaved thorn.[a]

The young, of course, are more highly insectivorous than their parents. A half-grown bird shot by Vernon Bailey had eaten, in addition to vegetable food, some 300 ants.

Much remains to be learned about the diet of the sage grouse, but enough is known to show that the bird lives principally on sagebrush, and does no harm to agriculture. The value of the flesh as food has been much discussed, but the general opinion is that when the birds have not been feeding much upon sage the flesh is excellent. A long-continued diet of sagebrush imparts to it a bitter, sagy flavor. Hon. Theodore Roosevelt says:[b]

> However, I killed plenty of prairie chickens and sage hens for the pot, and as the sage hens were still feeding largely upon crickets and grasshoppers, and not exclusively on sage, they were just as good eating as the prairie chickens.

Sage grouse should be drawn as soon as they are killed, to prevent the food in the stomach and intestines from tainting the flesh. The sage grouse is of very gentle disposition, and probably would thrive in captivity. Should it be domesticated, its size would make it a most valuable fowl. E. S. Cameron, of Terry, Mont., writes to the Biological Survey that he has made a beginning in this direction. He secured eggs of the sage grouse, hatched them under a domestic hen, and some of the chicks survived.

THE RUFFED GROUSE.

(*Bonasa umbellus.*)[c]

The ruffed grouse is widely distributed over the wooded parts of the United States and Canada, and ranges from northern Georgia, Mississippi, and Arkansas north to Hudson Bay and central Alaska, and from Maine to the coast of Oregon. The different conditions of environment prevailing over this great range have had their effect in modifying the colors of the ruffed grouse so that several forms may be distinguished. The color differences between the bird of the southern Rocky Mountains and the Oregon ruffed grouse of the humid west coast are especially marked. The latter is the most richly colored of the North American grouse, and is notable for its handsomely

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[a] Wilson and Bonaparte, Am. Ornith., IV, p. 214, 1831.

[b] The Wilderness Hunter, p. 99, 1893.

[c] The ruffed grouse is separable into four forms: The common bird of the Eastern States (*Bonasa umbellus*); the Canadian ruffed grouse (*B. u. togata*) of the spruce forests along the northern border, from Maine to British Columbia; the gray ruffed grouse (*B. u. umbelloides*) of the Rocky Mountains, north to Alaska; and the Oregon ruffed grouse (*B. u. sabini*) of the humid west coast, from northern California to British Columbia.

contrasted black and reddish brown colors, set off by immaculate white.

The ruffed grouse is one of the most highly prized of American game birds. It is known in New England as the 'partridge,' but in the Southern States it is usually called 'pheasant.' It is distinctly a bird of the woods, imparting the spirit of the wilderness to every sylvan retreat that it inhabits. In Virginia and Maryland, near the city of Washington, the species is, or was until recently, not uncommon along the rocky palisades of the Potomac and in deep gorges lined with laurel thickets. In Essex County, N. J., it frequents the crest of a wooded basaltic dike known as the Orange Mountains, where the picturesque rocky woods with a good stand of deciduous trees and an undergrowth of blueberry, second-growth white oak, wild grape and bittersweet vines, and beds of partridge berry (*Mitchella repens*) furnish a congenial home. That ruffed grouse usually prefer deciduous to evergreen growths was particularly noticed by the writer in 1892 and 1898 at Chocorua, N. H., a hamlet between Lake Winnepesaukee and the White Mountains. On his tramps through heavy spruce forests remote from houses or clearings he seldom came across grouse. He frequently met them, however, in woodland near farms or in clearings, and particularly along wood roads. A favorite ground in August was the clearing of an abandoned farm, 200 feet above Chocorua Lake, which lies at the foot of Chocorua Mountain. The fields are separated from one another by little trout brooks and have grown up to young spruces. Here in bowlder-strewn pastures was an abundance of blackberries, blueberries, and grasshoppers, with old apple trees, birches, and poplars for winter budding. On this old farm the writer never failed to flush from three to eight grouse, and on several occasions he saw hen birds with young. In a sandy spot of the road leading up to the house the grouse had dusting wallows, which they used habitually. During October birds were often found in hemlock woods with an undergrowth of osmunda ferns or other vegetation.

The ruffed grouse does not congregate in large coveys, like the plumed quails or the prairie chicken, but is found in companies of from two to eight, usually members of a single brood. It does not spend the night on the ground, but perches on a tree. When the weather is very cold, however, it often plunges into the snow and passes the night as snugly as an Eskimo in his igloo.

The bobwhite whistles, the prairie chicken booms, and the blue grouse hoots, but the ruffed grouse drums. The drumming is one of the most interesting and attractive of all bird performances. It may be heard at every season, but is at its best in spring. The cock, then in full vigor, mounts his drumming log, droops his wings, raises his fantail, and struts along the log with his crest and glossy black neck

tufts erect. He begins beating his wings slowly; then faster and faster, till their rapid reverberation becomes a tattoo, rolling out a challenge to rival cocks and a love call to the hens.

Nesting takes place in the latter part of April, or more often early in May. In a makeshift nest scratched in a hollow are laid ten or a dozen or even more creamy white or buffy eggs, usually unspotted, but sometimes with fine specks of brown. The young look like little brown leghorn chicks. Only one brood is raised in a season. On July 4, in New Jersey, the writer has seen young birds as large as woodcock. The cock grouse assist neither in incubation nor in rearing the young, but after the eggs are laid assemble in small companies by themselves. The hen is amply able to care for her little family, and Mr. Sandys tells how a mother forced to headlong and unvalorous flight a young pointer that had designs on her brood.[a] The notes of the grouse during the breeding season are interesting. When the brood is surprised the hen utters several clucking sounds, one of which may be described as 'quit, quit, quit.' Mr. Sandys, in writing of the call of the parent birds to scattered chicks, says:[b]

> In about ten minutes there sounded a low musical chirruping, very like the sound emitted by a red squirrel between the coughing, sputtering notes.

Major Bendire, quoting Doctor Ralph, says that a disturbed mother grouse utters a sound like the whine of a young puppy.[c]

Of the habits and general attractiveness of the ruffed grouse Major Bendire writes as follows:[d]

> The Ruffed Grouse is naturally tame and unsuspicious, and let it once realize that it is protected, it becomes almost as much at home in the immediate vicinity of man as a domestic fowl, and quickly learns to know its friends. At the fine country residence of the Hon. Clinton L. Merriam, near Locust Grove, N. Y., especially during the winter, it is not an unusual sight to see several of these handsome birds unconcernedly walking about the shrubbery surrounding his home, and even coming on the veranda of the house to feed. They, like many other animals about the place, have learned that here at least they are among friends, and plainly show their full confidence in them. Even during the mating season a cock Grouse may frequently be seen in the act of drumming within 50 yards of some of the outbuildings.

Bird Lore, for May–June, 1904, has an account of a wild hen grouse which was so tame that it would come out of the woods at call and allow itself to be picked up, thus displaying the most unbounded confidence in its human neighbors. To lovers of nature the æsthetic value of this beautiful bird is very great, and its value is none the less, although it can not be measured in cash.

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[a] Upland Game Birds, pp. 118–119, 1902.

[b] Ibid., p. 119, 1902.

[c] Life Hist. N. A. Birds [I], p. 62, 1892.

[d] Ibid., p. 60, 1892.

The ruffed grouse affords grand sport; indeed, with not a few sportsmen it holds higher place even than bobwhite. In flight it is one of the swiftest of upland game birds, and considerable skill, a quick eye, and a steady hand are needed to shoot it on the wing. Most shots must be made in cover, and the bird's habit of putting a tree between itself and the sportsman as it flies away adds to the difficulty. As a rule it does not lie nearly so close to a dog as bobwhite, but before a well-trained, cautious animal it lies fairly well. When brought to bag the grouse is a noble prize. From six to nine birds may be called a good day's bag, worth more than several times as many bobwhites. The excellence of this grouse as a table delicacy causes the market supply generally to fall far short of the demand, and the price is always high. If the bird could be successfully bred in captivity, it would furnish a most valuable food.

PRESERVATION AND PROPAGATION.

The ruffed grouse has a number of potent enemies. Most dangerous of all is probably that destructive biped, man. Writing from Minnesota, Dr. P. L. Hatch says:[a]

> Nowhere was the ruffed grouse more abundant than in all the deciduous forests of this State, until mercilessly slaughtered by the pot hunters. * * * But their glorious day is passing away as fast as about 300 dogs and 700 double-barreled breech-loading shotguns can accomplish their annihilation.

Many market hunters of the grouse use a little cur dog trained to tree the game and to bark until the gunner approaches within range. Of the numerous natural enemies, hawks, owls, crows, skunks, minks, wild cats, and foxes are very destructive, and in certain localities a species of tick often infests the birds. Among the birds of prey, the Cooper hawk, goshawk, red-shouldered hawk, barred owl, and great horned owl are their worst enemies. At Marshall Hall, Md., the writer found a crow plundering the nest of a grouse. Almost everybody who is personally familiar with the habits of the fox has found it feeding on game birds. At Chocorua the writer came upon the den of a red fox about which were strewn tail feathers of the ruffed grouse. Owners of shooting preserves will do well to destroy systematically all vermin injurious to game. The bird should have better protection also from man. Massachusetts still permits landowners to snare grouse on their own lands during October and November. Such destructive and unsportsmanlike practices should be prevented everywhere by well-enforced laws. The abominable practice by summer campers of potting grouse when they have young should also be punished by a strict enforcement of the law. In sections

[a] Birds of Minnesota, p. 160, 1892.

where grouse are decreasing under persistent gunning the open season should be further limited or even eliminated for a period of years[a] until the birds have recovered something of their former numbers. A reasonable limit to the day's bag should be set by law. Kansas, Maine, and Wisconsin restrict the number to 15; Montana and Oregon to 10, and Ohio to 6. Vermont, Pennsylvania, and Connecticut have a limit of 5 grouse per day to a gun, and in the latter State, as well as in New York, no more than 36 can be taken in a year. By similar laws other States can aid in the preservation of the bird.

The grouse in captivity often becomes tame. Sometimes, indeed, it takes kindly to the henhouse. It has laid in captivity, and its eggs found in the woods have been hatched under domestic hens, but thus far nothing like successful grouse culture has been approximated, though there appears to be no reason why under proper conditions it should not be successful. Comprehensive knowledge of the bird's food habits should assist in solving the problem.

FOOD HABITS.

The food habits of the ruffed grouse have been investigated in connection with the present paper by the examination of 208 stomachs and crops. This material represents food taken in every month, but chiefly in the colder half of the year. New York supplied more material than any other section; Canada, Pennsylvania, and Massachusetts came next; and Nebraska, Virginia, Maryland, Kentucky, New Hampshire, Iowa, Illinois, Minnesota, Michigan, Wisconsin, and South Dakota each contributed a smaller part. Analysis of the food showed 10.92 percent of animal matter and 89.08 percent of vegetable matter. The animal food is almost all insects. The vegetable food consists of seeds, 11.79 percent; fruit, 28.32 percent; leaves and buds, 48.11 percent, and miscellaneous vegetable matter, 0.86 percent. The insect food proper includes grasshoppers, 0.78 percent; caterpillars, 1.15 percent; beetles, 4.57 percent, and miscellaneous insects, 3.86 percent. Some miscellaneous animal matter, made up of spiders and snails, is also eaten. The ruffed grouse eats a somewhat smaller proportion of insects than the bobwhite, but, like it, feeds on them to a large extent in the breeding season.

INSECT FOOD.

Grouse shot by the writer at Chocorua, N. H., in September, 1898, were feeding largely on the red-legged grasshopper (*Melanoplus*

[a] In Ohio the season has been closed until 1908, in Illinois until 1909, and in Missouri until 1910.

femur-rubrum), which was unusually abundant in pastures where the birds foraged. They had picked up also long-horned grasshoppers (*Xiphidium* sp.) and a few black crickets. Crickets often swarm in fields during fall, and offer tempting morsels to birds. The ruffed grouse occasionally eats such caterpillars as cutworms, army worms, cotton worms (*Alabama argillacea*), the red-humped apple worm (*Schizura concinna*), and the oak-leaf caterpillar (*Symmerista albifrons*). A number of observers, among them Doctors Fisher and Weed, report that it feeds on oak caterpillars.

The ruffed grouse, like the bobwhite, prefers beetles to any other insects. It takes almost as many of them as of all other kinds put together, including even such small ones as the clover weevil (*Sitones hispidulus*). It likes also the injurious leaf-eating beetles (*Chrysomelidæ*), destroying even the notorious potato beetle (*Leptinotarsa decemlineata*). It eats the pale-striped flea beetle (*Systena blanda*), as well as many other leaf beetles, including *Systena hudsonias*, *Disonycha caroliniana*, *Chætocnema* sp., *Galerucella sagittariæ*, and the grapevine pest, *Adoxus vitis*. By scratching, the grouse unearths many pests not found by other birds, notably beetle larvæ, click beetles, and May beetles, including *Lachnosterna hirsuta*. It also consumes another injurious beetle, *Dichelonycha* sp., closely related to the May beetles and resembling them in habits and appearance. It scratches up many ground beetles belonging to *Pterostichus*, *Anisodactylus*, *Harpalus*, and other genera. Beetles of other families also—fireflies (*Lampyridæ*), metallic wood borers (*Buprestidæ*), and *Calitys scabra* (*Trogostidæ*)—are in the food list.

The grouse feeds also on such miscellaneous insects as flies, bugs, ants, and such other Hymenoptera as sawflies and ichneumon flies. A large proportion of the flies are slow-flying species, like crane flies, which are preyed upon by many other kinds of birds. Bugs, however, are much more often destroyed by bobwhite and the ruffed grouse than by other birds. The ruffed grouse has been known to prey on the chinch bug, which at times is the most injurious insect in our country, and seldom destroyed by any except gallinaceous birds. Farmers who permit market hunters to rob them of their game should remember this fact. The grouse picks up also many other bugs, among them predaceous species like the ambush bug (*Phymata* sp.) and the assassin bug (*Reduviidæ*). They eat also homopterous insects, including leaf hoppers (*Jassidæ*) and buffalo tree hoppers (*Membracidæ*).

Like many other birds, the ruffed grouse eats ants, frequently including such large species as *Camponotus pennsylvanicus*. Among small ants may be mentioned the pavement ant (*Tetramorium*

cæspitum). Several species of the useful parasitic ichneumons are occasionally taken, and as an offset such foliage-destroying insects as sawflies, including adult forms of *Nematus* sp. and larvæ of *Lophyrus* sp. A peculiar long-bodied hymenopteron (*Pelecinus* sp.) also has been noted. The queerest article of food, perhaps, is the galls produced by insects (*Cynipidæ*). The ruffed grouse shows a marked liking for these odd growths, which contain a few tiny larvæ. The common semidomestic pheasant of England has the same taste. The grouse usually selects galls growing on oaks, often those produced by species of the genus *Amphibolips*. A bird shot in Lunenburg, Mass., in October had eaten 12 of these oak galls, although at that time other food was abundant.

Few invertebrates other than insects were found in the investigation of the food of the grouse. The miscellaneous animal food, however, included representatives of such Myriapoda as the thousand-legs, of the order *Diplopoda*, and such Arachnida as harvest spiders (*Phalangidæ*), jumping spiders (*Attidæ*), and ground spiders (*Lycosidæ*); snails of the genus *Helix*, and also shell-less snails, or slugs, including *Limax* sp. and *Tebennophorus carolinensis*.

Vegetable Food.

The vegetable food examined consisted of 11.79 percent of seeds, 28.32 percent of fruit, 48.11 percent of buds and leaves, and 0.86 percent of miscellaneous vegetable matter. Grain was not found, though no doubt it would be eaten if obtainable. In fact, Major Bendire says that grouse procure it along roads from the droppings of horses.[a]

The seed element of the food is mast and miscellaneous seeds. The mast—5.33 percent—consists of hazelnuts, beechnuts, hornbeam seeds, chestnuts, and acorns. The last, furnishing by all odds the largest supply, includes those of the scrub oak (*Quercus nana*), scrub chestnut oak (*Q. prinoides*), white oak (*Q. alba*), and red oak (*Q. rubra*). Acorns are often swallowed whole, half a dozen to a dozen at a meal being not uncommon. Beechnuts also are taken whole, and from 20 to 60 are sometimes found in a crop.

Miscellaneous seeds make up 6.46 percent of the entire food. Like many other gallinaceous birds, the ruffed grouse takes some leguminous seeds, though fewer than might be expected. The kinds known to have been eaten are the tick-trefoil (*Meibomia* sp.), so abundant in the edge of woods frequented by grouse, and vetch (*Vicia caroliniana*). Winged seeds are often sampled, such as those of the hem-

[a] Life Hist. N. A. Birds, [1], p. 62, 1892.

lock, the pitch pine, and the maple. The following miscellaneous seeds are taken by the ruffed grouse:

Blackberry lily (*Belamcanda chinensis*).
Beggar-ticks (*Bidens frondosa*).
Chickweed (*Alsine media*).
Sheep sorrel (*Rumex acetosella*).
Sedge (*Carex lupulina*).
Sedge (*Cyperus* sp.).
Violet (*Viola* sp.).
Witch-hazel (*Hamamelis virginiana*).
Beech-drops (*Leptamnium virginianum*).
Avens (*Geum* sp.).
Persicaria (*Polygonum pennsylvanicum*).
Frost weed (*Helianthemum canadense*).
Jewel weed (*Impatiens* sp.).

The list is interesting mainly for what it does not contain. Further investigations may show that the ruffed grouse, like the bobwhite and other so-called granivorous species, is fond of ragweed, sunflower, and grass seed. A grouse taken in British Columbia during October showed a peculiar liking for the apparently dry husks of geum seeds, no fewer than 500 appearing in its crop.

BUDS AND LEAVES.

The ruffed grouse spends most of its feeding time in browsing and berry picking. It thus secures, respectively, 48.11 percent and 28.32 percent of its food. The country boy knows where it resorts for budding, and often bags it without the aid of a dog or hammerless gun. The buds and foliage of poplar, birch, and willow form 20.20 percent of the entire food. Budding is most practiced in winter and early spring, when many other kinds of food are buried in snow. Birch and poplar buds afford by far the largest share of this cold-weather diet. Edward A. Preble says that in Canada in spring the sitting hen grouse leave the nest, fly to poplar trees, rapidly fill their crops with buds, and then hurry back to their eggs. He thinks that the males, having plenty of time to spare at that season, prefer to search for choicer food. The crop of a hen bird that he shot at Fort Chipewyan, Athabasca, May 29, 1901, was filled with young leaves of poplar (*Populus balsamifera*). The number of buds to a meal is surprising. A grouse shot at Palmer, Mich., December 15, 1894, contained 300 poplar buds. When engaged in budding, grouse take both flower buds and leaf buds; grown leaves of poplar also are eaten, and, not infrequently, the flattened petioles that catch the wind and give the leaves their characteristic quiver. *Populus balsamifera*, *P. tremuloides*, and *P. grandidentata* are among the species on which they feed. Birch buds also are a staple; they are taken from the canoe birch (*Betula papyrifera*), the gray birch (*B. populifolia*), the yellow birch (*B. lutea*), and the black birch (*B. lenta*). Everybody who is familiar with New England woods has seen the

grouse at dusk balancing on the ends of birch branches and snipping off buds. As with the poplar, both leaf buds and flower buds are taken. A grouse shot in Quebec December 18, 1896, had filled its crop with 200 catkins of the canoe birch. As a rule birds appear to prefer the male to the female flowers. Baird, Brewer, and Ridgway are authority for the statement that in Maine the buds of black birch are so freely eaten that they impart to the bird's flesh a distinctive and agreeable flavor. The ruffed grouse feeds also on the buds and leaves of different species of willow, as Major Bendire[a] and other authors have reported. A bird shot on Roseau River, Minnesota, October 20, 1896, had eaten 20 willow flowers. In budding, the grouse often clips from a fourth to half an inch of a twig which bears two or three buds.

In addition to the buds and leaves of willow, birch, and poplar, browse from miscellaneous plants provides the bird with 27.91 percent of its food. Such relatives of the willow as the alder, hazel, beech, ironwood, and hornbeam furnish a part of the above. Apple trees on outlying parts of farms are favorite sources of supply. This fact, noted by many observers and confirmed by the present investigation, has given rise to considerable discussion as to whether or not the trees are seriously injured by the budding. Dr. Clarence M. Weed says:[b]

> The ruffed grouse, however, is capable of inflicting real damage by a too close pruning of buds, and cases are known where apple orchards located near woods have been rendered useless by them.

Mr. C. J. Maynard states that he took 180 apple buds from one crop, and says that in Massachusetts at one time a bounty of 25 cents was offered by certain towns for the birds' heads.[c] Miss M. E. Paine, of Royalston, Mass., in a letter to the writer describes her observations on the budding of apple trees by grouse as follows:

> The ruffed grouse eats the buds of apple trees, but it is a help rather than a damage. Last year a wild apple tree on top of a hill, between pasture and mowing, was almost entirely budded. I thought entirely at first, but the terminal buds were almost always left uninjured, also many minute buds on each limb. The result was the terminal buds were pushed out and grew rapidly and strongly. The tree blossomed abundantly and the fruit hung in clusters toward the ends of the branches. The tree is of medium size and the branches droop to the ground. In the fall the golden apples occupied fully as much room as the green leaves, and as one looked at the tree a few rods away—a perfect picture, barrels of apples on it, all nearly perfect and fair, just the result of a vigorous trimming. This year it was not so badly budded—less snow in winter. Many small buds farther back in the branches have started again this

[a] Life Hist. N. A. Birds, [1], p. 66, 1892.

[b] Birds in Their Relation to Man, p. 40, 1903.

[c] Birds of Eastern N. A., p. 353, 1881.

year and grown, and it is well fruited, owing to the budding two years in succession. No tree could have been more entirely budded, but the grouse can not stand so as to reach the outmost terminal buds, as a rule; their weight is too great.

The present investigation of stomachs revealed only an insignificant percentage of apple buds, probably because most of the grouse examined were shot in places remote from orchards. The bird has been known to eat also pear and peach buds, and probably would not refuse cherry buds. From one crop, leaves of blackberry or raspberry (*Rubus* sp.) were taken, and bud twigs of blueberry (*Vaccinium pennsylvanicum*) and other species were not at all uncommon. The twigs severed by the sharp-edged bill of the grouse are all about the same length, one-third of an inch. They appeared in the stomachs as little whitish sticks, from which digestion had removed the bark. The extent to which the ruffed grouse browses on leaves and twigs suggests an herbivorous mammal rather than a bird.

The ruffed grouse feeds on leaves and buds of the mayflower (*Epigæa repens*), and likes exceedingly the leaves of the partridge berry (*Mitchella repens*). It nips off also leaves of both red and white clover, to the extent of 1 percent of its food. It is partial to the leaves of sheep sorrel (*Rumex acetosella*), which it cuts across as sharply as if by a pair of scissors, but it eats yellow sorrel (*Oxalis stricta*) with less relish. It appears to like dandelion greens, and has a queer taste for the fronds of ferns (*Dryopteris spinulosa*, *Botrychium obliquum*, and *Polypodium vulgare*). In its relation to conifers it differs widely from the spruce grouse, for it derives therefrom only an insignificant percentage of its food, while the spruce grouse obtains nearly 50 percent. Spruce needles and foliage of arborvitæ (*Thuja occidentalis*) have been seen in several stomachs. Edward A. Samuels believes that the ruffed grouse will eat leaves of evergreens only when all other food is lacking.[a] In Alaska, E. W. Nelson found the bird feeding exclusively on spruce buds. He states that the flesh becomes disagreeable from this pitchy diet.[b] The effect of highly flavored food on the flesh of game birds has already been referred to.

The ruffed grouse buds the highly poisonous laurel (*Kalmia latifolia*). On this subject Alexander Wilson writes:[c]

During the deep snows of the winter, they have recourse to the buds of alder, and the tender buds of the laurel. I have frequently found their crops distended with a large handful of these latter alone; and it has been confidently asserted, that, after having fed for some time on the laurel buds, their flesh becomes highly dangerous to eat, partaking of the poisonous qualities of the plant.

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[a] Our Northern and Eastern Birds, p. 387, 1883.

[b] Nat. Hist. Coll. in Alaska, p. 131, 1888.

[c] Am. Ornith., vol. II, p. 319, 1831.

Dr. John H. Brinton, of Jefferson Medical College, has known several cases of glossitis (inflammation of the tongue) caused by eating grouse that had fed on laurel,[a] and Dr. N. Shoemaker has also known of serious illness from the same source.[b] V. K. Chestnut, Department specialist on poisonous plants, gave an extract made from laurel leaves to a chicken, which he subsequently killed and fed to a cat. The cat was seriously affected, but ultimately recovered. In Philadelphia in 1790 the public was alarmed over the possibilities of laurel poisoning, and the sale of these birds was for a time forbidden. Dr. B. H. Warren shot 10 birds when the ground was deeply covered with snow, and found their crops stuffed with laurel buds.[c] Not more than half a dozen stomachs of the 208 examined by the Biological Survey contained fragments of this plant, the explanation probably being that only a few stomachs were collected in late winter, when birds most resort to it. Four of the birds that contained laurel were used for food, with no evident ill effect. One of these had eaten 14 grams of laurel, nearly all leaves, with only a few buds. The leaves had been clipped into bits as if by scissors. Investigation of this habit of the grouse, known to be a common one, is much needed. The maple is often selected for budding, and sometimes the spicebush. Flowers are sometimes plucked by browsing grouse. Asters and red clover have been identified in their food, and the green ovary of bloodroot (*Sanguinaria*) was found in a bird's crop by Amos W. Butler.

The following plants also are in the list of browse of this bird:

Heuchera (*Heuchera americana*).
Chickweed (*Alsine pubera*).
Catnip (*Nepeta cataria*).
Cinquefoil (*Potentilla argentea*).
Buttercup (*Ranunculus bulbosa* and *R. acris*).
Speedwell (*Veronica officinalis*).
Saxifrage (*Saxifraga* sp.).
Live-forever (*Sedum* sp.).
Meadow rue (*Thalictrum* sp.).
Smilax (*Smilax glauca*).
Horsetail rush (*Equisetum* sp.).
Azalea (*Azalea* sp.).
False goat's beard (*Astilbe* sp.).
Aster (*Aster* sp.).
Cud weed (*Gnaphalium purpureum*).

FRUIT.

The ruffed grouse is preeminently a berry eater. Not only does it consume more fruit than the bobwhite, but it is our most frugivorous game bird. More than one-fourth of its yearly food—28.32 percent—consists of fruit, distributed as follows: 3.82 percent rose hips, 2.46 percent poison ivy and sumac, 3.01 percent grapes, and 19.03 percent miscellaneous fruits.

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[a] Warren, Birds of Penn., p. 108, 1890.
[b] North Am. Med. Journ., I, pp. 321–322, 1826.
[c] Birds of Pennsylvania, p. 108, 1890.

The taste for rose hips, seedy and husky as they are, and often beset with fine bristles which irritate the human skin and would seem really dangerous to internal tissues, is one of the singular freaks of bird feeding. It reminds one of the cuckoo's liking for caterpillars which are so bristly that its stomach becomes actually felted and sometimes pierced by the stiff hairs. Rose hips hang on the bushes throughout the winter, accessible to the hungry grouse as they journey about in the snow for food, and are usually swallowed whole.

The bird likes grapes also. No less than 3.01 percent of the year's diet consists of them, and in November they make 17.2 percent of the total food for the month. All experienced sportsmen know of this taste, and during this month they always count on getting their best shooting in the vicinity of heavily fruited grapevines. The wild grapes with small berries, such as *Vitis cordifolia*, are especially liked, but also large grapes are greatly relished. The species from which cultivated varieties have been derived (*Vitis labrusca*) appears to be commonly selected. Thirty to forty grapes are often swallowed at a meal. From this taste one might expect the grouse to commit depredations on cultivated grapes, but no reports of such damage have come to the Biological Survey.

Like many other birds, the ruffed grouse eats the berries of sumac and other species of *Rhus*. This food contributes 2.46 percent of the year's diet. Among the nonpoisonous sumacs selected are the dwarf sumac (*Rhus copallina*), the staghorn sumac (*R. hirta*), and the scarlet sumac (*R. glabra*). Not uncommonly from 300 to 500 berries of the dwarf sumac are swallowed at a meal. This liking for the dry and apparently nonnutritious sumac is another curious freak of bird appetite. Probably, as with the bobwhite, the seeds are broken up in the gizzard and the inclosed meat, or endosperm, set free for digestion. The immunity of the bird from poisoning by poison sumac and poison ivy, which also it eats, is interesting. That these seeds retain their virulence after being eaten was shown in the case of an investigator in the Biological Survey who was poisoned while examining stomachs of crows that had fed on poison-ivy berries. At times the ruffed grouse eats many of these berries, as proven by one collected by Prof. S. A. Forbes, at Jackson, Ill., December 9, 1880, which had eaten 280 of them. Where grouse are numerous, poison sumac is usually less abundant than poison ivy, and consequently it appears less frequently in stomach examinations. One hundred and sixty poison-ivy berries were taken from the crop of a ruffed grouse shot by Dr. A. K. Fisher at Lake George, N. Y., October 24, 1892.

Miscellaneous fruits amount to 19.03 percent of the annual food. The two favorite kinds are the partridge berry (*Mitchella repens*) and the thorn apple (various species of *Cratægus*), both of which were eaten by 40 of the 208 grouse examined. At least two species

of thorn apple are used for food—the cockspur thorn (*Cratægus crus-galli*) and the scarlet thorn (*C. coccinea*). These apple-like fruits afford a nutritious food. At Peterboro, N. Y., the writer observed grouse coming to thorn-apple trees during November and well into December. That they take large numbers at a meal is shown by an individual obtained at St. Vincent, Minn., which had eaten 38. W. H. Kobbé says that grouse eat with great relish the small wild crab apple of the Northwest (*Pyrus rivularis*).[a] They enjoy cultivated apples, seldom missing a chance at trees on the edge of woodlands. At Chocorua, N. H., in October, 1898, some of the birds killed in old orchards of abandoned farms had fed principally on apples. After thorn apples and partridge berries, a number of other fruits are also staples. The large brilliant clusters of the mountain ash (*Sorbus americana*) are acceptable, and the delicious wintergreen berries, with scarlet skin and snowy pulp, are also relished. The bayberry (*Myrica carolinensis*) is a favorite food wherever accessible. In grouse stomachs one often finds nothing but the little round granules contained in the waxy drupes of this berry. Blueberries also are eaten in large quantities. A bird killed at Chocorua, N. H., July 25, 1892, had eaten a hundred blueberries (*Vaccinium pennsylvanicum*), and one killed at Chateaugay, N. Y., in September, contained about three hundred. The high-bush blackberry and the huckleberry also are eaten, as well as the cranberry. Dr. A. K. Fisher found 21 whole cranberries in a bird shot at Lake George, N. Y., November 2, 1901. The extent to which blackberries are sometimes eaten is shown by the fact that the stomach of a grouse contained about 800 blackberry seeds. Another bird had eaten over a hundred sarsaparilla berries. An explanation of the delicious flavor of the ruffed grouse appears in its varied and highly flavored diet of fruit, herbs, and seeds. In addition to the fruits already noted the following kinds found in the birds examined may be named, though the total number mentioned in this bulletin is probably not a fourth of the complete list of fruits eaten by this bird:

Greenbrier (*Smilax* sp.).
Hairy Solomon's seal (*Polygonatum biflorum*).
Smooth Solomon's seal (*Polygonatum commutatum*).
Blackberry (*Rubus nigrobaccus*).
Black raspberry (*Rubus occidentalis*).
Raspberry (*Rubus strigosus*).
Domestic cherry (*Prunus avium*).
Cultivated plum (*Prunus domestica*).
Wild black cherry (*Prunus serotina*).
Wild red cherry (*Prunus pennsylvanica*).
Elder (*Sambucus canadensis*).
Red elder (*Sambucus pubens*).
Black haw (*Viburnum prunifolium*).
Nannyberry (*Viburnum lentago*).
Withe rod (*Viburnum cassinoides*).
Maple-leaved arrow wood (*Viburnum acerifolium*).

[a] Auk, XVII, p. 351, 1900.

High-bush cranberry (*Viburnum opulus*).
Mountain cranberry (*Vaccinium vitis-idæa*).
Snowberry (*Symphoricarpus* sp.).
Feverwort (*Triosteum perfoliatum*).
Black huckleberry (*Gaylussacia resinosa*).
Black alder (*Ilex verticillata*).
Flowering dogwood (*Cornus florida*).
Bunchberry (*Cornus canadensis*).
Cornel (*Cornus paniculata*).
Silky cornel (*Cornus amomum*).
Pepperidge (*Nyssa sylvatica*).
Mulberry (*Morus rubra*).
Bittersweet (*Celastrus scandens*).
Manzanita (*Arctostaphylos* sp.).
Barberry (*Berberis vulgaris*).
Virginia creeper (*Parthenocissus quinquefolia*).

The seeds of most of these berries pass through the digestive tract unharmed and are capable of germinating. Thus the grouse assists in planting many fruiting trees and shrubs, the heavy seeds of which must be disseminated mainly through the agency of animals that feed on them.

Food of the Young.

The young of most birds are far more insectivorous than adults, a statement that applies to gallinaceous birds, though to a less extent than to passerines. More than 95 percent of the diet of eight grouse chicks examined, none of which was more than a fourth grown, was insects. Seven adults collected in the breeding season had consumed only 30 percent of insects. Newly hatched chicks eat the largest proportion of insects. As they grow older they gradually become more frugivorous and granivorous. Three chicks, only a day or two old, collected by Prof. S. A. Forbes, at Waukegan, Ill., June 9, 1876, proved to have been exclusively insectivorous. They had eaten cutworms, grasshoppers, Lampyrid beetles, ants (*Tetramorium cæspitum*), parasitic wasps, buffalo tree hoppers, and spiders (*Attidæ* and *Phalangidæ*). A grouse about a week out of the shell, collected by F. H. King, had eaten a white grub, 7 spiders (*Phalangidæ*), and 13 caterpillars.[a] It should be noted, therefore, that the ruffed grouse, though only slightly insectivorous when adult, as a chick destroys great numbers of insects, and deserves much more credit from farmers than it usually receives.

THE SPRUCE GROUSE.

(*Canachites canadensis.*)[b]

The spruce, or Canada, grouse inhabits the transcontinental coniferous forests from the northern border of the United States, east of

[a] Trans. Wis. Ag. Soc., vol. 24, pp. 472–473, 1886.

[b] The spruce grouse (*Canachites canadensis*) is separated into three geographic forms, of which two occur within our territory; these are the common spruce grouse (*C. c. canace*) of the northern border from Maine to Minnesota, and the Alaska spruce grouse (*C. c. osgoodi*) of Alaska and western Canada.

the Rocky Mountains, to Labrador and Alaska. The male is one of the handsomest of the grouse; it is gray, with black bars above and clear black and white below, with a rusty band edging its fanlike tail. In spring brilliant red combs above the eyes add to the beauty of the strutting cock. These birds drum in an odd way: The male selects an inclined tree and flutters up the trunk for 15 to 20 feet, drumming as he goes. The spruce grouse nests in May or early June and lays from 9 to 16 buff-colored eggs, handsomely marked with rich chestnut and brown.

FOOD HABITS.

Study of the food habits of the spruce grouse has been but meager, since only 8 stomachs were available for examination. These were collected in January, May, August, September, October, and November, 6 of them in Canada, 1 in Michigan, and 1 in Minnesota. The material in the stomachs consisted of 100 percent vegetable matter—18.33 percent seeds, 19.73 percent fruit, 61.94 percent coniferous foliage. The seeds were of spruce, thistle, and several unidentifiable plants. In its frugivorous habits the spruce grouse closely resembles its relative, the blue grouse. The proportion of bearberries was 16.67 percent, and of other fruit 3.06 percent. Solomon's seal (*Polygonatum*), blueberries (*Vaccinium*), bunchberries (*Cornus canadensis*), crowberries (*Empetrum*), and juniper berries are among the berries principally eaten. Dr. C. Hart Merriam, Chief of the Biological Survey, has informed the writer that the spruce grouse feeds largely on the bearberry (*Arctostaphylos uva-ursi*) and the wax currant (*Ribes cereum*).

When cold weather comes the spruce grouse usually abandons a berry diet and eats nothing but its favorite food—the leaves, buds, and tender shoots of conifers. This kind of browse formed 61.94 percent of the food of the eight birds examined in the laboratory. It is safe to assume that more than half the year's food of this grouse is obtained by browsing, and that nearly half consists of the foliage of conifers. Wilson and Bonaparte state that in winter this species feeds on the shoots of spruce,[a] a habit so generally known that it has given to the bird its name. According to Major Bendire, this grouse feeds also on the needles of tamarack (*Larix laricina*), and in certain localities feeds upon them exclusively.[b] It has been known also to eat the needles of *Pinus divaricata* and the fir balsam (*Abies balsamea*). As with the blue grouse, resinous food imparts to the flesh a decidedly pitchy flavor.

W. H. Osgood, of the Biological Survey, informs the writer that he examined crops of the Alaska grouse which contained the leaves

[a] Am. Ornith., vol. 4, p. 208, 1831.

[b] Life Hist. N. A. Birds, [1], p. 52, 1892.

of blueberry (*Vaccinium*) and horsetail (*Equisetum*). The Alaska spruce grouse, according to Dr. W. H. Dall, was found at Nulato in winter feeding exclusively on the buds of willow.[a]

The flesh of the spruce grouse is dark and for the table is in no way comparable to that of the blue grouse. Nor is the bird equal to the latter as an object of sport. It is, however, a thing of beauty in the dark northern coniferous forests, where its æsthetic value must impress every lover of nature. This grouse is strictly a forest bird, and nowhere appears to come into contact with agriculture.

THE FRANKLIN GROUSE.

(*Canachites franklini.*)

The Franklin grouse is very similar to its near relative, the spruce grouse, and differs mainly in the conspicuous white marking on its upper tail coverts and in lacking the rufous tip to the tail. It is found in the mountains of western Montana and Idaho, westward to the coast ranges of Oregon and Washington and northward through British Columbia to southern Alaska. Major Bendire records that nidification occurs during the last of May and in June. The food habits of the bird are similar to those of the spruce grouse. In Alberta, between August 25 and September 1, 1894, J. A. Loring, a field agent of the Biological Survey, examined the crops of several Franklin grouse and found in them berries and leaves. A. H. Howell, also of the Survey, examined crops and gizzards in Idaho during the last of September, 1895, and found in them large quantities of the leaves of the lodge-pole pine (*Pinus murrayana*) broken into bits from one-fourth to three-fourths of an inch long. Major Bendire notes that in summer they furnish Indians and packers with their principal supply of fresh meat. Their flesh is palatable then because they eat grasshoppers and berries and feed less freely on the buds and leaves of spruce and tamarack.[b]

Hon. Theodore Roosevelt writes of this bird in Montana:[c]

> The mountain men call this bird the fool-hen; and most certainly it deserves the name. The members of this particular flock, consisting of a hen and her three-parts grown chicks, acted with a stupidity unwonted even for their kind. They were feeding on the ground among some young spruce, and on our approach flew up and perched in the branches, four or five feet above our heads. There they stayed, uttering a low complaining whistle, and showed not the slightest suspicion when we came underneath them with long sticks and knocked them off their perches.

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[a] Nelson, Nat. Hist. Coll. Alaska, p. 130, 1887 (1888).

[b] Life Hist. N. A. Birds, [1], p. 58, 1892.

[c] The Wilderness Hunter, p. 116, 1893.

THE DUSKY GROUSE.

(*Dendragapus obscurus.*)[a]

The dusky, or blue, grouse lives mainly in coniferous forests of the western mountain ranges, occurring in the Rocky Mountains from New Mexico, Arizona, and Colorado, north to Canada and Alaska, and west to the Pacific coast. These grouse are large, plainly colored birds, mainly of a slaty or dusky shade. In unfrequented forests they are so unsophisticated that they often perch on a low branch and gaze curiously at an intruder until struck by a stone or stick. From their unsuspicious nature they are known in parts of the West, like the previous species, as fool-hens. While commonly habitants of the higher forests, they often descend to lower levels on the mountain sides where deciduous trees and bushes mingle with the conifers.

The dusky grouse is a valuable food bird and weighs from 2½ to 3½ pounds. Wilbur C. Knight says:[b]

> Of all the edible birds of the west this and the following variety [Richardson's grouse] are the most desirable. The flesh is highly flavored, tender, juicy, and as white as that of a tame fowl.

The flavor of a game bird's flesh is often affected by the character of its diet, as is the case with the blue grouse after it has been feeding on the pitchy foliage of conifers. "The use of such food imparts to the flesh of these birds," says Major Bendire, "a strong resinous flavor, not particularly relished by me at first."[c] Baird, Brewer, and Ridgway, however, state that the pine taste only improves the bird's gamy flavor.[d] Vernon Bailey states that half-grown young of the blue grouse which had been feeding largely on gooseberries were excellent eating, being entirely free from pitchiness. George B. Grinnell, editor of Forest and Stream, notes that a diet of a small species of red whortleberry also makes the flesh delicious.[e]

As an object of sport the blue grouse is in the front rank of game birds, even though it spends much time in the deep coniferous forests. It lies well to the dog, flies swiftly, and affords shots in heavy timber that test the sportsman's highest skill.

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[a] In addition to the common dusky grouse (*Dendragapus obscurus*) of the Rocky Mountains from New Mexico to Montana, three other geographic forms are known. These are the sooty grouse (*D. o. fuliginosus*) of the northwest coast, from California to southern Alaska; Richardson grouse (*D. o. richardsoni*), from Montana to northwestern British America; and the Sierra dusky grouse (*D. o. sierræ*) of the Sierra Nevada in California and east slope of Cascade Mountains in Oregon.

[b] Birds of Wyoming, p. 54, 1902.

[c] Auk, vol. 6, p. 33, 1889.

[d] Hist. N. A. Birds, vol. 3, pp. 424–425, 1874.

[e] Forest and Stream, vol. 12, p. 365, 1879.

The dusky grouse cock is quite uniformly dark in color, as the name implies. In the mating season the bird presents a striking appearance. The brilliant comblike wattles above its eyes are conspicuous, the large, yellow wind sacs on the sides of its neck are fully inflated, and it struts about like a turkey cock, with drooping wings and spreading tail, emitting a sound that closely resembles the hooting of the great horned owl. The nesting takes place during the last half of May, when the hen bird scratches a slight hollow in the earth and lays from 6 to 12 cream-colored, brown-spotted eggs. Usually but one brood is reared in a season. Prof. W. W. Cooke, in writing of the habits of the species in Colorado, says that it breeds from 7,000 feet altitude to timber line, 4,000 feet higher. At the former altitude it lays about the middle of May. In August the birds gather in flocks and visit grainfields, or frequent the more open gulches and foothills for berries. In September they wander above timber line to feed on grasshoppers, reaching an altitude of 12,500 feet. In severe winter weather some of the birds come down into the thick woods, but many remain the whole year close to timber line.[a]

FOOD HABITS.

The food habits of the dusky grouse have been studied by examination of the contents of 45 crops and stomachs, representing every month of the year except May, June, and November. Most of the birds were shot in British Columbia, Colorado, and Idaho, but a few came from Montana, Utah, Wyoming, and California. The food consisted of 6.73 percent animal matter—insects, with an occasional spider—and 93.27 percent of vegetable matter—seeds, fruit, and leaves. Grasshoppers constitute the bulk of the animal food, amounting to 5.73 percent. Beetles, ants, and caterpillars form the rest of the insect food. One stomach contained the common land snail (*Polygyra* sp.). Major Bendire, Vernon Bailey, and Walter K. Fisher have shown that the young birds feed largely on grasshoppers. Mr. Fisher shot a young bird at Forest Grove, Oreg., July 6, 1897, which had eaten 20 grasshoppers and several smooth, green larvæ.

VEGETABLE FOOD.

The dusky grouse and its near relative, the spruce grouse, are among our chief foliage-eating birds. Browse is eaten by the blue grouse to the extent of 68.19 percent of its annual food, and is distributed as follows: Buds and twigs, 5.28 percent; coniferous foliage, 54.02 percent; other leaves, 8.89 percent. The species spends most of

[a] Birds of Colorado, p. 70, 1897.

its time in pine forests feeding on needles, buds, and flowers. The yellow pine (*Pinus ponderosa*)—male flowers, the white fir (*Abies concolor*), *Abies magnifica*, the Douglas fir (*Pseudotsuga mucronata*), the western hemlock (*Tsuga heterophylla*), and the black hemlock (*Tsuga mertensiana*) are among the trees that afford it subsistence. That the blue grouse thus utilizes the foliage of conifers is well known to everybody familiar with the bird. Major Bendire writes that during the winter its food consists almost wholly of the buds and tender tops of pine and fir branches, refuse bits of which sometimes accumulate under a single tree to the amount of a bushel.[a] A blue grouse shot by W. W. Price at Slippery Ford, Cal., when 15 feet of snow lay on a level, had filled its crop with the young leaves of the white fir.[b] Plants other than conifers furnish 14.17 percent of the annual food of the species. This material includes red clover leaves, willow leaves, blueberry leaves, miterwort (*Mitella breweri*), birch shoots, and poplar flower buds. During July, in Montana and Utah, field agents of the Biological Survey have seen the bird feeding on the leaves, buds, and flowers of the Mariposa lily (*Calochortus*). It eats also the blossoms of lupine, columbine, and the Indian paint brush (*Castilleja*).

The blue grouse is only slightly granivorous. Its seed food amounts to but 4.99 percent of the whole—a proportion small indeed when compared with that of the bobwhite and the crested quails. The species is said by Alexander Wilson to resort to seeds only when other food is scarce.[c] At times it visits fields for oats and other grain. It feeds also on pine seeds (*Pinus flexilis* and other species). It picks up polygonum seeds (*P. polymorphum* and others), is fond of wild sunflower seeds, and has been known to sample false sunflower (*Wyethia mollis*), caraway (*Glycosma occidentalis*), and the capsules of *Pentstemon gracilis*. It picks up also the seeds of various species of lupine, and is fond of acorns, including those of the canyon live oak (*Quercus chrysolepis*).

The blue grouse is one of the most highly frugivorous of our gallinaceous birds. Fruit formed 20.09 percent of the food of the 45 birds whose stomachs were examined in the laboratory. Manzanita berries constituted a large part, amounting to 13.48 percent of the total. During the summer and early fall they were eaten in great quantities. The manzanita often forms tangled areas of chaparral and includes a number of species which furnish birds and mammals an abundant supply of berries. The berries eaten by the blue grouse

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[a] Auk, vol. 6, p. 33, 1889.

[b] Condor, vol. 3, p. 160, 1901.

[c] Am. Ornith., vol. 4, p. 191, 1831.

include *Arctostaphylos pungens*, *A. nevadensis*, and *A. uva-ursi*. Its list of fruits also includes the following:

Mountain twin berry.
Red elder (*Sambucus pubens*).
Honeysuckle (*Lonicera involucrata; Lonicera conjugialis*).
Cherry (*Prunus* sp.).
Mountain ash (*Sorbus sambucifolia*).
Salmon berry (*Rubus parviflorus*).
Service berry (*Amelanchier alnifolia*).
Salal (*Gaultheria shallon*).
Huckleberry (*Vaccinium occidentale*).
Currant (*Ribes cereum, Ribes sanguineum*).
Gooseberry (*Ribes menziesii*).

The food habits of all young birds differ more or less from those of their parents. Young blue grouse at first live chiefly on grasshoppers and other insects and on tender plant tops. Later in the season they subsist on berries, such as gooseberries and salal-berries, and some seeds, such as those of the wild sunflower. Florence Merriam Bailey, in writing recently of the habits of the dusky grouse in New Mexico, says:[a]

Near our camp at the foot of Pecos Baldy, Mr. Bailey discovered a winter roosting tree of the grouse. The tree was on a sheltered part of the wooded slope and was so densely branched that after a prolonged rain the ground beneath was perfectly dry. The earth was strewn with winter droppings, composed entirely of the leaves of conifers. Conifer needles had also been eaten by three of the grouse that were taken * * * in July and August, but at this season the birds were living principally on such fresh food as strawberries, bearberries (*Arctostaphylos uva-ursi*), sheperdia berries, flowers of the lupine and paint brush, seeds, green leaves, grasshoppers, caterpillars, ants, and other insects. One crop contained twenty-seven strawberries, twenty-eight bearberries, and twelve sheperdia berries, besides flowers, leaves, and insects, while the accompanying gizzard was filled with seeds, green leaves, and insects.

THE WILLOW PTARMIGAN.

(*Lagopus lagopus.*)

Ptarmigans are characteristic of the arctic and arctic-alpine regions. During summer they are mainly gray and brown, resembling the mottled colors of the bare earth, but at the approach of winter they change this plumage for one of pure white. Thus they harmonize with their surroundings at all seasons and are better able to escape their numerous enemies. There are four species of these birds in the United States and Alaska. Of these the willow ptarmigan, white ptarmigan, or willow grouse, as it is variously known, is the largest, most abundant, and consequently the most important. It is found in the arctic regions of both hemispheres, and is widely spread and abundant throughout the tundra country of Alaska, except on the Aleutian Islands. Throughout its range, especially in winter, it is an important food bird. In the north

[a] Auk, vol. 21, p. 351, 1904.

periods of famine are ever recurring among the natives, and these birds frequently stand between them and starvation. It rears but one brood in a season, nesting on the ground early in June and laying from 7 to 12 eggs. By the middle of August the young are nearly grown. In the northern part of its range the willow ptarmigan is a summer resident only, and at the approach of winter most of the birds migrate in large flocks, sometimes numbering a thousand or more, southward or inland to a region of scattered trees or bushes. Ernest Thompson Seton, quoting from Hutchins' manuscript concerning observations at Hudson Bay in 1782, says that over 10,000 ptarmigans were caught with nets at Severn from November to April.[a] The birds are so tame, especially in winter, that their capture is easy. Like all other gallinaceous birds, ptarmigans require gravel for milling their food, and in winter deep snow makes this hard to procure. The natives, taking advantage of the birds' necessities, bait their nets with gravel, and sometimes catch as many as 300 at one spring of a net.[b] E. W. Nelson writes of encountering flocks of several thousand white ptarmigans in Alaska in midwinter, and says that the whirring of their wings as they rose sounded like the roll of thunder and seemed to shake the ground. He reports that the birds are snared and shot in great numbers by both the Alaskan Eskimos and the Indians.[c] The flesh is not so palatable as that of many other game birds, and is decidedly dry and often bitter when the bird feeds on willow buds. The flesh of old birds is dark colored, but that of the young is white and delicately flavored.

FOOD HABITS.

Study of the food of the willow ptarmigan unfortunately has been slight, for only five birds were available. Their food was entirely vegetable. Three shot in January in Labrador had eaten 10 percent of berries and 90 percent of buds, more than half the buds being willow. One stomach contained about 300 willow-flower buds. The two other birds were collected in December in Labrador and had eaten willow buds exclusively. Though the data are so scanty, the results agree with those of other students. Ludwig Kumlien, for instance, says:[d]

> They [willow ptarmigans] are quite common in the larger valleys, where there is a ranker growth of willows. The stomachs of those I examined of this species contained willow buds and small twigs.

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[a] Proc. U. S. Nat. Mus., vol. 13, p. 514, 1890.

[b] Hearne, Journey to the Northern Ocean, pp. 413–415, 1795.

[c] Nat. Hist. Coll. in Alaska, p. 132, 1887 (1888).

[d] Bull. 15, U. S. Nat. Mus., pp. 82–83, 1879.

Baird, Brewer, and Ridgway have stated that the crops of ptarmigans were often found to contain a double handful of willow buds.[a] L. M. Turner writes thus of the bird in Alaska:[b]

During the winter these birds subsist on the past year's twigs of willow and alder or other bushes. I have cut open the crops of many of these winter-killed birds and found them to contain only pieces of twigs about one-third of an inch long, or just about the width of the gape of the posterior horny part of the bill, as though this had been the means of measurement in cutting them off. The flesh at this time is dry and of a peculiar taste. In spring the ptarmigans congregate in great numbers on the willow bushes and eat the tender, swelling buds. The flesh then acquires a bitter but not unpleasant taste. As open weather advances they find berries that have remained frozen the entire winter, and tender grass shoots, and later, insects. The young are insectivorous to a great degree in their youngest days. They consume great numbers of spiders that are to be found on the warm hillsides.

In writing of the food of the willow grouse, Major Bendire says that the buds and tender leaves of birch are eaten, and the berries of cranberry, whortleberry, and arbutus.[c] Wilson and Bonaparte state that it feeds on berries, including the crowberry (*Empetrum nigrum*) and the mountain cranberry (*Vaccinium vitis-idæa*).[d]

THE ROCK PTARMIGAN.

(*Lagopus rupestris.*)[e]

The rock ptarmigan inhabits arctic America from Labrador to Alaska (including the entire Aleutian chain, where the willow ptarmigan is unknown). It is similar to the latter bird, but smaller and has a black line from the bill to the eye by which it may readily be distinguished. This bird is less common than the willow ptarmigan and prefers more rocky and elevated situations. Owing to its smaller size and fewer numbers it is far less important to the people of the north as an article of food than the willow ptarmigan.

FOOD HABITS.

No stomachs of the rock ptarmigan have been available for examination. In Alaska, during May, E. W. Nelson found it feeding on berries of the preceding season.[f] Major Bendire says that the sub-

[a] Hist. N. A. Birds, Land Birds, III, p. 461, 1874.

[b] Nat. Hist. Alaska, p. 153, 1886.

[c] Life Hist. N. A. Birds, [I], p. 74, 1892.

[d] Am. Ornith., IV, p. 328, 1831.

[e] Besides the typical *Lagopus rupestris* of arctic America, the rock ptarmigans of North America include the Reinhardt ptarmigan (*L. r. reinhardi*), of Greenland and northern Labrador; the Welch ptarmigan (*L. welchi*), of Newfoundland; and four forms found in the Aleutian Islands—*L. r. nelsoni*, *L. r. atkhensis*, *L. r. townsendi*, and *L. evermanni*.

[f] Nat. Hist. Coll. Alaska, p. 136, 1887 (1888).

species *Lagopus rupestris reinhardi* feeds on insects, leaves, berries, including the crowberry (*Empetrum nigrum*), tender leaves of the dwarf birch and white birch, willow buds, and sorrel.[a] Samuel Hearne notes that the rock ptarmigan eats the buds and tops of the dwarf birch (*Betula glandulosa*).[b] Kumlien examined a crop that was crammed with sphagnum moss.[c]

THE WHITE-TAILED PTARMIGAN.

(*Lagopus leucurus.*)

The white-tailed ptarmigan is found above timber line in Alaska, in the mountains of British Columbia, and in the higher Cascades south to Mounts Hood and Jefferson. It ranges south along the Rocky Mountains through Colorado to northern New Mexico. Unlike the other species, this ptarmigan has no black feathers in the tail. Writing of this bird in Colorado, W. W. Cooke says that it breeds above timber line, virtually under arctic conditions, and that only in most severe winters does it descend into timber. He records that it breeds at from 11,500 to 13,500 feet altitude, and wanders up to the summits of peaks 1,000 feet higher. Nesting takes place early in June and is similar to that of other ptarmigans. In winter, when the birds descend to lower altitudes, the sexes are in different flocks.

The white-tailed ptarmigan is a trusting creature, lacking the fear necessary for self-preservation. Clark P. Streator, while employed by the Biological Survey in the Cascade Mountains of Washington, reported that one could approach within 10 feet of it, that miners killed it with stones, and that it was very good for food.

In Colorado public sentiment is strongly in its favor, and it is protected by an absolutely prohibitory law. The ptarmigan is one of the sights pointed out to tourists in the Colorado mountains. Its status here may be contrasted with that of the willow grouse in the north, where thousands are killed by Eskimos and Indians. Killing birds for food, however, even by wholesale, has its excuse, but wholesale slaughter for millinery purposes, such as has overtaken the ptarmigans in the Old World, is unpardonable. A single shipment of ptarmigan wings in Russia consisted of 10 tons.[d]

FOOD HABITS.

During winter in Colorado, according to Professor Cooke, they subsist, like other ptarmigan, largely on willow buds. The stomachs

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[a] Life Hist. N. Am. Birds, [1], p. 80, 1892.

[b] Journey to Northern Ocean, p. 416, 1795.

[c] Bull. 15, U. S. Nat. Mus., p. 83, 1879.

[d] Engelhardt, A Russian Province of the North, 1899.

of two birds collected at Summitville, Colo., in January, 1891, at an altitude of 13,000 feet, were found to contain bud twigs from one-third to one-half inch long, but the kind of bush from which they came could not be determined. Doctor Coues, quoting T. M. Trippe, states that the food of this bird is insects, leguminous flowers, and the buds and leaves of pines and firs.[a] According to Major Bendire, the flowers and leaves of marsh marigold (*Caltha leptosepala*) and the leaf buds and catkins of the dwarf birch (*Betula glandulosa*) are eaten.[b] Dr. A. K. Fisher examined the stomachs of two downy chicks collected on Mount Rainier, Washington, and found beetles and flowers of heather (*Cassiope mertensiana*) and those of a small blueberry.

THE WILD TURKEY.

(*Meleagris gallopavo.*) [c]

The wild turkey, our biggest game bird, was formerly abundant over a wide area. It has been exterminated throughout much of its former range, and unless radical measures are taken it will become extinct in a few years. In early colonial days it was numerous in Massachusetts, coming about the houses of the settlers in large flocks. It is now totally extinct in New England. It is hard to realize that at the beginning of the nineteenth century turkeys were so abundant that they sold for 6 cents apiece, though the largest ones, weighing from 25 to 30 pounds, sometimes brought a quarter of a dollar. A big wild turkey nowadays would not long go begging at $5. It is their value as food that has made it worth while to hunt turkeys to the very point of extermination. So-called sportsmen go out in the late summer ostensibly to shoot squirrels, but really to pot turkeys on the roost. Another practice is to lie in ambush and lure the game by imitating the call note of the hen in spring. The writer has personal knowledge of such methods of hunting in Virginia and Maryland, and they are largely responsible for the extermination now imminent. Trapping turkeys in pens—a very simple matter—has also accelerated the destruction of the species.

William Brewster found the turkey breeding in North Carolina among the conifers at 5,000 feet altitude, and also in the hardwoods at low altitudes. Edward A. Preble, of the Biological Survey, dis-

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[a] Birds of the Northwest, p. 427, 1874.

[b] Life Hist. N. A. Birds, [I], pp. 85–86, 1892.

[c] The typical *Meleagris gallopavo* is restricted to Mexico; but four geographic races have been recognized within the United States. These are the wild turkey of the Eastern States and the Mississippi Valley (*Meleagris gallopavo silvestris*); the Florida turkey (*M. g. osceola*); the Rio Grande turkey (*M. g. intermedia*); and the Merriam turkey of Colorado, New Mexico, Arizona, and the table-land of northern Mexico (*M. g. merriami*).

covered a turkey's nest, in June, 1893, in Somerset County, Pa., which contained 14 eggs. William Lloyd states that the Texas turkey breeds twice a year. He found a nest, May 29, containing 8 eggs. The chicks, like those of the tame turkey, are very delicate, and are especially sensitive to wet. Audubon says that during wet weather they are fed by their mothers with the buds of spice bush, much as human youngsters are dosed with quinine.[a] When the chicks are 2 weeks old they fly up and roost on low branches with their mother. At this age they have weathered most of their early perils.

During the last of December, 1902, along the Roanoke River, near the North Carolina line, the writer found turkeys in typical turkey country. Few of the plantations here are under a thousand acres, and many include three or four thousand. Along the river are lowlands, often flooded during high water. Several hundred yards farther back is a bluff, the old river terrace, which marks the beginning of the uplands. A part of this bluff, half a mile long by an eighth of a mile wide, consists of a slate outcrop, much elevated above the rest and varying from 50 to 150 feet above the river. It is locally known as 'the mountain,' and is heavily forested with pine and oak. The turkeys were found on the backbone of the 'mountain,' among white oak trees, where fresh droppings and places where the birds had scratched in the dry oak leaves to the depth of 2 or 3 inches were visible. So recently had the birds been there that the humus had not dried. The scratching places were from 15 to 18 inches in diameter and circular in shape. In the growth of white oaks there were fully fifty scratching holes, as many as five being found within one square rod, where the birds had made diligent search for acorns. A turkey dog was sent ahead and soon flushed a bird, which came flying by, looking like a giant ruffed grouse. All through the woods were turkey blinds, some made of young pine trees and others, more elaborate, of logs. Most of the turkeys killed here are shot by calling them up to these blinds. In a patch of rank broomsedge and briers a 20-pound gobbler sprang into the air and was shot while making off in clumsy fashion. It had not had time to eat much, and the stomach and crop contained seven dipterous larvæ, the remains of white-oak acorns, and about a hundred flowering dogwood berries. On the 15th of June, 1903, two broods of young about the size of game hens were seen.

FOOD HABITS.

The Biological Survey has examined, in all, 16 stomachs and crops of wild turkeys. These were collected during February, March, July, September, November, and December. They contained 15.57 percent

[a] Ornith. Biog., vol. 1, p. 7, 1831.

of animal matter and 84.43 percent of vegetable matter. The animal food consisted of insects—15.15 percent—and miscellaneous invertebrates, such as spiders, snails, and myriapods—0.42 percent. Grasshoppers furnished 13.92 percent, and beetles, flies, caterpillars, and other insects 1.23 percent.

The 84.43 percent of the bird's vegetable food was distributed as follows: 'Browse,' 24.80 percent; fruit, 32.98 percent; mast, 4.60 percent; other seeds, 20.12 percent; miscellaneous vegetable matter, 1.93 percent.

The wild turkey is very fond of grasshoppers and crickets. William Hugh Robarts has observed a flock of a hundred busily catching grasshoppers.[a] Vernon Bailey, of the Biological Survey, killed a turkey at Corpus Christi, Tex., in May, 1900, that had eaten a large number of grasshoppers and a sphinx moth. During the Nebraska invasion of Rocky Mountain locusts, Professor Aughey examined the contents of six wild turkey stomachs and crops collected during August and September. Every bird had eaten locusts, in all amounting to 259.[b] The wild turkey has been known also to feed on the cotton worm[c] (*Alabama argillacea*), the leaf hoppers, and the leaf-eating beetles (*Chrysomela suturalis*). The grasshopper (*Arnilia* sp.) and the thousand-legs (*Julus*) form part of the turkey's bill of fare. Tadpoles and small lizards also are included.

Besides the bird shot on the Roanoke, already mentioned, the stomachs and crops of four other Virginia turkeys have been examined by the Biological Survey. One of these contained only small quartz pebbles. Another bird had eaten only a few grapes and flowering dogwood berries. A third had made a respectable meal. Ten percent of its food was animal matter and 90 percent vegetable. The animal part consisted of 1 harvest spider (*Phalangidæ*), 1 centipede, 1 thousand-legs (*Julus*), 1 ichneumon fly (*Ichneumon unifasiculata*), 2 yellow-jackets (*Vespa germanica*), 1 grasshopper, and 3 katydids (*Cyrtophyllus perspiculatus*). The vegetable food was wild black cherries, grapes, berries of flowering dogwood and sour gum, 2 chestnuts, 25 whole acorns (*Quercus palustris* and *Q. velutina*), a few alder catkins, seeds of jewel weed, and 500 seeds of tick-trefoil (*Meibomia nudiflora*). Another turkey, also shot in December, had eaten a ground beetle, an ichneumon fly, 2 wheel bugs, 10 yellow-jackets, a meadow grasshopper, 75 red-legged grasshoppers, a few sour-gum berries, some pine seeds (with a few pine needles, probably taken accidentally), several acorns, a quarter of a cupful of wheat, and a little corn.

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[a] Am. Field, vol. 55, p. 42, 1901.

[b] First Rep. Ent. Com., App. II, p. 46, 1878.

[c] Fourth Rep. Ent. Com., p. 88, 1885.

One turkey, collected December 23, 1899, in North Carolina, had eaten half a pint of dogwood berries. Its crop contained also a few pine needles. Four Florida wild turkeys also were examined. Nearly 100 percent of their food was vegetable. The animal matter was found in two birds and consisted of the useful predaceous ground beetle (*Scarites subterraneus*) and the injurious 12-spotted cucumber beetle (*Diabrotica 12-punctata*); also caterpillars (*Hadena turbulenta*), grasshoppers (*Melanoplus arboreus* and *Arnilia* sp.), 2 dragon flies (*Libellula* sp.), and 1 centipede. This is the only record of the first-mentioned grasshopper's occurrence in Florida. A third turkey had eaten half a pint of long-leafed pine seeds. Many of these seeds were germinating, and some of them had cotyledons more than an inch long. The Florida bobwhite also is very fond of these pine seeds. The same bird had eaten three thimblefuls of grass seed (*Panicum minimum*), 12 spicebush berries (*Benzoin benzoin*), 20 berries of the wax myrtle (*Myrica cerifera*), 2 live-oak acorns (*Quercus virginiana*), and 15 acorns of the Spanish oak (*Quercus digitata*). Another turkey had taken 25 tubers of the ground nut (*Apios apios*)—some of them exceeding an inch in length—and the berries of false Solomon's seal (*Polygonatum* sp.), southern tupelo, and wax myrtle. Half a pint of the fruiting panicles of a grass (*Muhlenbergia* sp.) was taken from the crop of a New Mexican turkey shot in November in the Manzano Mountains. It had eaten also grass blades, seeds of cheat, piñon nuts, and seeds of other pines.

Although grain was found in only one stomach, the writer observed turkeys on the Roanoke bottoms in December, 1903, feeding on corn after the crop had been harvested. During November and December half of the food of the turkey is fruit. The kinds most frequently eaten include, besides those already mentioned, myrtle holly (*Oreophila myrtifolia*), mulberries, wild strawberries, blackberries, cedar berries, and holly berries. On San Francisco Mountain, Arizona, Dr. C. Hart Merriam found turkeys in August feeding on wild gooseberries. A month later, at the same locality, he found them living on piñon nuts.[a] In Arizona E. A. Goldman found a flock of 150 young and old turkeys that roosted in one place. The gobblers were at this time in a separate flock. These birds were feeding on nuts of the piñon (*Pinus edulis*), a staple Indian food of the West. They ate also juniper berries (*Juniperus utahensis*).[b] On the upper Gila River, New Mexico, in November, 1873, H. W. Henshaw found turkeys very numerous and feeding almost exclusively upon grass seeds and grasshoppers, the crops of many birds being fairly crammed with the former. Major Bendire says that the Florida turkey feeds on

[a] N. A. Fauna, No. 3, p. 89, 1890.

[b] Auk, vol. 19, p. 123, 127, 1902.

white-oak acorns, chinquapins, chestnuts, pecan nuts, black persimmons, fruit of prickly pear, leguminous seeds, all cultivated grains, and tender tops of plants.[a] Wild turkeys feed also on mountain rice (*Oryzopsis pringlei*), mesquite beans, sedge, poa grass, and composite flowers.

Florence Merriam Bailey, in writing of the wild turkey in New Mexico, says:[b]

> Mr. Vilas, a cattleman of the country, told us that in the fall they go down to the nut pine and juniper mesas in the Glorieta region and, gathering at the few springs that furnish drinking places, are shot by wagon loads by the Mexicans. The only specimen we obtained was taken July 27, at over 11,000 feet. Its crop and gizzard held mainly grasshoppers and crickets, but also grass seed, mariposa lily buds, and strawberries, while its gizzard contained in addition a few beetles.

The wild turkey consumes both insect pests and seeds of weeds, but now is nowhere abundant enough to have much effect on agriculture. The domestic turkey's habit of hunting grasshoppers and of 'worming' tobacco shows what might be expected from the wild species were it sufficiently numerous.

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[a] Life Hist. N. A. Birds, [I], p. 114, 1892.

[b] Auk, vol. 21, p. 352, 1904.

INDEX.

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Date Due

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MAY 2 8 1974	MAY 1 0 1974		
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