

FALL DIET OF BLUE GROUSE IN OREGON¹

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ABSTRACT.—The early fall diet of Oregon blue grouse (*Dendragapus obscurus pallidus*) from Wallowa County, Oregon, was determined from 145 crops obtained during 1981 and 1982. Of more than 50 plant and animal foods in the diet, short-horned grasshoppers (*Acrididae*), prickly lettuce (*Lactuca serriola*), yellow salsify (*Tragopogon dubius*), wild buckwheat (*Eriogonum* spp.), and snowberry (*Symporicarpus albus*) occurred in 30% or more of the crops and collectively amounted to 68% of the diet by weight. Seven of the 12 most common foods were consumed differentially by the four sex and age classes of birds. Results indicated that blue grouse foraged in forest and grassland habitats.

In 1981, a study was established to determine the early fall diet of the Oregon blue grouse in Wallowa County, Oregon. Our objectives were to compare the diet of grouse in this area with diets from other locations, especially within the range of this subspecies, and to determine if dietary differences existed among the sex and age classes.

Previous work indicated that western larch (*Larix occidentalis*) needles were one of the most important foods from August through October for blue grouse in northcentral Washington and Idaho (Beer 1943, Boag 1963). Fir (*Abies* spp.) and Douglas-fir (*Pseudotsuga menziesii*) needles, staple winter foods, also composed a major portion of the fall diet (Beer 1943, Stewart 1944, Marshall 1946, Boag 1963). Bearberries (*Arctostaphylos uva-ursi*) likewise were noted as common foods by Beer (1943) and Boag (1963). Grasshoppers and ants composed most of the animal foods in the fall diet of blue grouse (Beer 1943, Stewart 1944, Marshall 1946, Martin et al. 1951, Boag 1963, King and Bendell 1982).

Few differences in the diets of adult and immature blue grouse during late summer and fall have been noted. King and Bendell (1982) commented that from late July through September adults and juvenile blue grouse (*D. o. fuliginosus*) on Vancouver Island consumed approximately the same types and amounts of foods. Beer (1943), in Idaho, reported that adults consumed more larch

needles than did immatures during August, but by September the diets were similar.

A contrasting work by Boag (1963) revealed that greater amounts of larch needles were eaten by adults than by immatures during September and October, but no other differences in the consumption of the major foods by the sex and age classes of blue grouse were found.

STUDY AREA AND METHODS

In Wallowa County blue grouse typically inhabit bunchgrass ridges, which are dissected by draws that are timbered on the north-facing aspect. Elevation ranges from 600 to 1500 m. Bunchgrass communities are dominated by bluebunch wheatgrass (*Agropyron spicatum*) and Idaho fescue (*Festuca idahoensis*). Dominant forbs are wild buckwheat (*Eriogonum* spp.) and arrow-leaf balsamroot (*Balsamorhiza sagittata*). Timbered draws are dominated by ponderosa pine (*Pinus ponderosa*), Douglas-fir, true firs, and western larch. Shrub understories are composed of mallow ninebark (*Physocarpus malvaceus*), snowberry (*Symporicarpus albus*), big huckleberry (*Vaccinium membranaceum*), creambush ocean-spray (*Holodiscus discolor*), currants (*Ribes* spp.), and shiny-leaf spiraea (*Spiraea betulifolia*). Idaho fescue and pinegrass (*Calamagrostis rubescens*) are the most common grasses in the understories. Grazing by domestic livestock occurs on most

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TABLE 1. Fall diet of blue grouse, Wallowa County, Oregon, 1981-1982.

Food item	Parts consumed	Frequency (%) (n = 145)	Weight (%) (n = 83) ^a
PLANTS			
Prickly lettuce (<i>Lactuca serriola</i>)	seed heads	43	17
Yellow salsify (<i>Tragopogon dubius</i>)	seed heads	41	9
Wild buckwheat (<i>Eriogonum</i> spp.)	leaves	33	5
Snowberry (<i>Symporicarpos albus</i>)	berries	30	5
Douglas-fir (<i>Pseudotsuga menziesii</i>)	needles, buds	16	2
Elkhorns clarkia (<i>Clarkia pulchella</i>)	seed heads	16	tr ^b
Unidentified Gramineae	leaves, seeds	12	tr
Western larch (<i>Larix occidentalis</i>)	needles	10	4
Clover (<i>Trifolium</i> spp.)	leaves	10	1
Everlasting (<i>Antennaria</i> spp.)	leaves	7	1
Serviceberry (<i>Amelanchier alnifolia</i>)	berries	6	1
Ponderosa pine (<i>Pinus ponderosa</i>)	seeds	6	tr
Dwarf mistletoe (<i>Arceuthobium</i> spp.)	entire plant	5	4
Smartweed (<i>Polygonum</i> spp.)	seeds	5	tr
Unidentified Compositae	seed heads	5	tr
Lodgepole pine (<i>Pinus contorta</i>)	seeds, needles	4	tr
Filaree (<i>Erodium cicutarium</i>)	seeds, leaves	4	tr
Selaginella (<i>Selaginella</i> spp.)	entire plant	3	tr
Hawthorne (<i>Crataegus douglasii</i>)	berries, stems	3	7
Elderberry (<i>Sambucus cerulea</i>)	berries	3	3
Currant (<i>Ribes</i> spp.)	berries	3	2
Huckleberry (<i>Vaccinium membranaceum</i>)	berries	3	1
Unidentified Ericaceae	berries	1	1
Juniper (<i>Juniperus occidentalis</i>)	berries	1	tr
Yew (<i>Taxus brevifolia</i>)	needles	1	tr
Engelmann spruce (<i>Picea engelmannii</i>)	needles	1	tr
Fir (<i>Abies</i> spp.)	needles	1	tr
Microseris (<i>Microseris</i> spp.)	seed heads	1	tr
Dandelion (<i>Taraxacum</i> spp.)	seed heads	1	tr
Sorrel (<i>Rumex</i> spp.)	leaves	1	tr
Bedstraw (<i>Galium</i> spp.)	leaves, seeds	1	tr
Strawberry (<i>Fragaria virginiana</i>)	berries	1	tr
Unidentified Leguminosae	seeds	1	tr
Brome (<i>Bromus</i> spp.)	leaves	1	tr
Bentgrass (<i>Agrostis</i> spp.)	stems	1	tr
Unidentified plant material	leaves	4	tr
ANIMALS			
Short-horned grasshoppers, Acrididae		46	32
Ants, Formicidae		24	1
Long-horned grasshoppers, Tettigoniidae		20	3
Spittle bugs, Cercopidae		7	tr
Ground beetles, Carabidae		5	tr
Ladybird beetles, Coccinellidae		4	tr
Stink bugs, Pentatomidae		3	tr
Darkling beetles, Tenebrionidae		3	tr
Unidentified Insecta larvae		3	tr
Unidentified Insecta		2	tr
Chinch bugs, Lygaeidae		1	tr
Stink bugs, Scutelleridae		1	tr
Flies, Diptera		1	tr
Spiders, Araneida		1	tr
Sawflies, Tenthredinidae		1	tr
Yellow jackets, Vespidae		1	tr
Treehoppers, Membracidae		1	tr
Plant bugs, Miridae		1	tr
Stilt bugs, Berytidae		1	tr
Unidentified Hemiptera		1	tr

^a Weight was obtained only for crops obtained during 1981.^b All items marked "tr" combined amounted to 1% of the diet by weight.

sites. Many of the forest stands are managed for commercial timber production and some have extensive road systems.

From 28 August through 29 September of 1981 and 1982, 145 crops containing food (39 adult males, 34 adult females, 39 immature males, and 33 immature females) were obtained from hunter-killed blue grouse. The majority of crops (61%) were from birds taken between 28 August and 3 September, 33% came from the second week, and the remainder from birds killed from 11 to 29 September. The four sex age classes were represented similarly through time; for example 59% of the crops from immature males and females and 63% from adult males and females were collected during the first week. Ages of immatures in weeks was determined by stage of molt sequence of primary feathers (Zwickel and Lance 1966) and ranged from 9 to 17 weeks ($\bar{x} = 13$ weeks) (Redfield and Zwickel 1976). Contents of the crops were dried in an oven at 50°C for three days, identified and weighed. Contents of the 62 crops collected in 1982 were inadvertently destroyed before weighing. A subjective evaluation of the relative amounts of foods in the 1982 sample revealed that they were essentially identical to the 1981 sample. Frequencies of occurrence of the most common foods were tested among the four sex and age classes with Chi-square analysis (Snedecor and Cochran 1967:20). Analysis of variance (Snedecor and Cochran 1967:258) was used to test for differences in weights of foods eaten by the sex and age classes.

RESULTS AND DISCUSSION

More than 50 plant and animal foods were consumed by blue grouse (Table 1). Of these, short-horned grasshoppers, prickly lettuce, yellow salsify, wild buckwheat, and snowberry were consumed at a frequency of 30% or more; collectively, these foods accounted for 68% of the diet by weight. Five additional plant foods and two groups of insects were found in 10% to 29% of crops and contributed 11% of the diet by weight. Of the 12 most common foods, 7 were consumed differentially by the sex or age classes of blue grouse (Table 2).

Short-horned grasshoppers (*Acrididae*), an important summer food of blue grouse (Stewart 1944, Marshall 1946, Martin et al. 1951), were found in 46% of the crops and contributed 32%

by weight. The frequency of short-horned grasshoppers in the diet was higher ($P < 0.001$) for immatures (64%) than for adults (27%). Prickly lettuce was the second most frequent item in the fall diet and was consumed with similar frequency by all sex and age groups. Females, of both ages, consumed yellow salsify ($P \sim 0.02$) and wild buckwheat ($P \sim 0.06$) more commonly than did males. Previous work (Boag 1963) indicated that prickly lettuce, yellow salsify, and wild buckwheat were only minor components of the fall diet.

Snowberries were consumed equally by all sex and age classes and apparently are a more important fall food in Oregon than elsewhere within the range of the Oregon blue grouse (Beer 1943, Stewart 1944, Boag 1963). No differential use by the sex and age classes of blue grouse were found for ants, Douglas-fir needles, or unidentified grasses. Both ants and Douglas-fir needles were reported as common in the fall diet of blue grouse (Stewart 1944, Boag 1963).

Clarkia (*Clarkia pulchella*) and clover (*Trifolium* spp.) were more frequently ($P \sim 0.06$) consumed by adults than by immatures. *Clarkia* was more common in the diet of blue grouse from Oregon (9% to 24% frequency) than from Washington (1% to 3% frequency) (Boag 1963), whereas the use of clover was similar. *Clarkia* was considered a food rejected by blue grouse on Vancouver Island (King and Bendell 1982). Long-horned grasshoppers (*Tettigoniidae*) were consumed more frequently ($P \sim 0.05$) by immatures than by adults.

Needles of western larch were the most important food in the diet of blue grouse during September and October in eastern Washington, where they were consumed with a frequency of 28% to 60% (Boag 1963). Beer (1943) found that larch needles composed 46.9% of the diet by volume during August, but they dropped to 2.3% in September. In our study, larch needles were consumed in a moderate amount (10% frequency, 4% weight), but were used most commonly by adult males ($P < 0.001$). Larch needles occurred in 28% of the crops from adult males and in only 3% to 6% of the other three groups. Boag (1963) found that adults utilized larch significantly more than did immatures, but he found no differences in use between adult males and adult females.

TABLE 2. Frequency of the 12 most common foods by sex and age classes of blue grouse, Wallowa County, Oregon, 1981-1982.

Food item	Frequency (%)			
	Adult male (n = 39)	Adult female (n = 34)	Immature male (n = 39)	Immature female (n = 33)
Prickly lettuce ^a	43	38	45	47
Yellow salsify ^b	35	50	28	53
Wild buckwheat ^c	25	35	28	47
Snowberry ^a	35	24	28	35
Clarkia ^d	20	18	5	12
Douglas fir ^a	18	9	20	15
Unidentified Gramineae ^a	15	9	13	9
Western larch ^e	28	6	3	3
Clover ^d	15	15	5	6
Short-horned grasshoppers ^f	18	38	63	65
Ants ^a	25	18	35	18
Long-horned grasshoppers ^g	10	15	28	24

^a No significant differences among sex and age classes.^b Females > males, $P \sim 0.02$.^c Females > males, $P \sim 0.06$.^d Adults > immatures, $P \sim 0.06$.^e Adults males > all other, $P < 0.001$.^f Immatures > adults, $P < 0.001$.^g Immatures > adults, $P \sim 0.05$.

The average number of food items in a crop was 4.2. Average numbers of items ranged from 3.7 (adult females) to 4.6 (immature females), but no difference ($P > 0.25$) existed in the number of items/crop among the sex and age groups.

Our work revealed, in contrast to results of studies by Beer (1943), Stewart (1944), and Boag (1963), that most of the common early fall foods were consumed differentially by the sex and age groups of blue grouse. Greater consumption of short-horned and long-horned grasshoppers likely reflected availability of these groups during late August and September in Oregon and probably represented a retention of the feeding patterns of immatures from summer. Stewart (1944) reported a fivefold greater consumption of animal matter by immatures during summer. Likewise, the greater use of Elkhorns clarkia and clover by adults possibly represented a continuation of summer feeding habits. Beer (1943) found that adults ate more fruits, seeds, and green leafy material during summer than did immatures. By contrast, King and Bendell (1982) noted that the consumption of fruits, leaves, and flowers during late summer and early fall was similar between adult and immatures.

Of the four foods with the greatest frequency of use, yellow salsify and wild buck-

wheat were taken more commonly by females than males. The preponderance of prickly lettuce and yellow salsify seed heads and wild buckwheat leaves in the fall diet of blue grouse in Oregon was likely related to availability.

Adult males during August and September are solitary and commonly at higher elevations than adult hens and immatures (Marshall 1946, Boag 1963). In addition, our observations of habitat use by adult males during September indicated that they commonly are found in larch thickets, which may account for the greater use of larch needles by adult males.

The results of previous work (Beer 1943, Boag 1963) indicated that Oregon blue grouse foraged primarily in forested habitats during early fall, e.g., areas containing larch, Douglas-fir, true firs, and bearberry. In contrast, birds in this study made use of a broad range of foods and, presumably, foraging habitats. The two most important plant foods, prickly lettuce and yellow salsify, are introduced "weed" species. Both are common in bunchgrass communities, especially where the soil has been disturbed by the burrowing activities of small mammals or by grazing and trampling by wild and domestic ungulates. Clarkia is common in disturbed areas (W. C. Krueger, personal communication). Wild buckwheat character-

istically is found in dry, open habitats (W. C. Krueger, personal communication). In addition, the importance of forested areas for foraging by blue grouse in Oregon is exemplified by the use of snowberry, western larch, and Douglas-fir.

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