

FOOD HABITS OF THE CALIFORNIA QUAIL IN EASTERN WASHINGTON

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The Columbia Basin, which lies east of the Cascade Mountains in the state of Washington, is a semiarid region rimmed on all sides by plateaus, hills, and mountains. A tilted plateau, which is the center of this study of food habits, extends eastward from the Columbia Basin, crosses southeast Washington, and reaches to the forested foothills of the Moscow Mountains in western Idaho. This plateau is topographically characterized by undulating loessel soils over basalt; its vegetation consists of three principal associations. An *Agropyron-Poa* association occurs on a large central part of the plateau, a *Festuca-Symphoricarpos* association on its higher eastern edge, and an *Artemisia-Poa* association on its lower western edge.

The California Quail (*Lophortyx californica*) was established by introduction in eastern Washington over forty years ago, and today it is one of the important game birds in this region. According to the records of the Washington Department of Game, 108 birds were released in Walla Walla County in 1914. The following year, 12 quail were released in Garfield County and 48 in Yakima County. In 1920, 19 birds were released near Spokane. Subsequent releases of imported stock are believed to have given rise to the main concentrations before the Department of Game established its program of trapping and transplanting these birds from areas of high populations to other suitable ranges in the state.

By 1920, when 80 per cent of Adams, Spokane, and Whitman counties was in farmland, the Sharp-tailed Grouse (*Pedioecetes phasianellus*) was nearing extirpation in southeast Washington as a result of agricultural practices associated with wheat farming (Buss and Dziedzic, 1955). The consolidation of farms and the introduction of diesel-powered tractors in the 1930's encouraged removal of fencerows and resulted in destruction of much cover for wildlife (Dziedzic and Ball, 1950). Since 1940 brush removal, weed control, and stream grading have continued and limited drastically the cover available for upland game birds. In canyons and other restricted areas where shrubby cover still persists, the California Quail attains relatively dense but widely fluctuating populations from which birds were obtained for this study. The edges of wheat fields near such covers provide an abundance of weed seeds and waste grain. The utilization of these foods by many of the quail involved in this study indicates the importance of weed communities, induced and maintained by a highly mechanized agriculture, to the California Quail.

MATERIALS AND METHODS

This study was begun in October, 1940, and continued until June, 1956. In that period, 89 gizzards and 291 crops were obtained from 310 California Quail collected in 12 of the 20 counties in eastern Washington. Although some of these quail were less than a year old, they were indistinguishable in size from adults. Consequently, this is a study of food habits of full-grown California Quail.

The procedure used in the analyses of crop and gizzard contents was similar to that described by Korschgen (1948). Identification of the plant seeds was facilitated by a reference seed collection.

All data were grouped into three-month periods as follows: Spring—March, April, May; at this time young plants become available, and birds are establishing territories and nesting. Summer—June, July, August; plants start to mature and seeds become

Table 1
Analysis of Crop Contents from 291 California Quail

Food items	Spring	Summer	Fall	Winter
	Percentage total volume	Percentage total volume	Percentage total volume	Percentage total volume
<i>Secale</i> sp.	....	....	....	2.52
<i>Verbena bracteata</i>	Trace	....	2.21	Trace
<i>Bromus tectorum</i>	Trace	....	0.54	1.54
<i>Avena fatua</i>	0.26	....	0.49	0.88
<i>Setaria</i> sp.	....	....	Trace	1.29
<i>Trifolium</i> sp.	Trace	0.83	Trace	0.39
<i>Vicia</i> sp.	....	....	1.06	Trace
<i>Rhus glabra</i>	....	....	Trace	1.01
<i>Crataegus douglasii</i>	....	....	0.79	0.19
<i>Solanum nigrum</i>	....	....	....	0.87
<i>Polygonum aviculare</i>	....	....	0.11	0.70
<i>Pyrus malus</i>	....	....	0.78	Trace
<i>Bromus</i> sp.	....	0.55	0.16	Trace
<i>Avena</i> sp.	....	....	Trace	0.70
<i>Calamovilfa longifolia</i>	....	0.55	Trace	....
<i>Erigeron</i> sp.	0.53	....	....	....
Animal foods				
Orthoptera	....	0.55	1.78	Trace
Hymenoptera	0.30	1.66	Trace	....
Coleoptera	0.34	0.55	0.26	Trace
Unknown	Trace	0.55	0.15	Trace
Chaff	1.67	0.27	6.95	4.92
Grit	0.30	0.55	0.54	0.27
Miscellaneous				
Fruit pulp and skin	....	....	0.66	Trace
Total crops	31	9	164	87

available, birds generally have broods. Fall—September, October, November; waste grain and weed seeds are available in large quantities, broods are maturing and birds flocking. Winter—December, January, February; in this season waste grain and weed seeds are partly utilized, and some foods are covered with snow part of the time; the birds are in flocks.

RESULTS

Seeds represented the major portion of the diet of the California Quail, the most important being wheat (*Triticum aestivum*) which ranked first in percentage of total volume throughout the year. Other seeds which comprised more than 5.0 per cent of the total volume of material, but were seasonal in their consumption, included: Spring—*Chenopodium* sp., *Eleocharis macrostachya*; Summer—*Amaranthus graecizans*, *Amsinckia* sp., *Pisum sativum*; Fall—*Helianthus annuus*, *Salsola kali*; and Winter—*Dipsacus sylvestris*, *Melilotus alba*, *Polygonum aviculare*, *Robinia pseudo-acacia*, *Sisymbrium altissimum*.

Green plant material represented a significant percentage of food consumed by the quail. Although found in all seasons, this food item was utilized principally during the spring months.

Animal foods, primarily insects, appeared to be a minor component of the quail's

Table 2
Analysis of Gizzard Contents from 89 California Quail

Food items	Spring Percentage total volume	Summer Percentage total volume	Fall Percentage total volume	Winter Percentage total volume
<i>Amsinckia intermedia</i>	1.22	....	....
<i>Symphoricarpos</i> sp.	0.21	0.99
<i>Chenopodium</i> sp.	0.61	0.55	....
<i>Bromus</i> sp.	0.62	....	Trace	0.49
<i>Mellilotus</i> sp.	0.55	0.49
<i>Amaranthus retroflexus</i>	Trace	0.99
<i>Setaria</i> sp.	Trace	0.99
<i>Chenopodium botrys</i>	0.99
<i>Cirsium arvense</i>	0.88	....
<i>Lactuca scariola</i>	0.61	0.21	....
<i>Echinochloa crusgalli</i>	0.77	....
<i>Robinia</i> sp.	0.61	0.11	....
<i>Polygonum</i> sp.	0.71	....
<i>Sambucus</i> sp.	0.66	....
<i>Capsella bursa-pastoris</i>	0.61	....	....
<i>Cerastium</i> sp.	0.61	....	....
<i>Claytonia parviflora</i>	0.61	....	....
<i>Viola</i> sp.	0.61	....	....
<i>Amaranthus</i> sp.	0.60	....
<i>Lotus americanus</i>	0.60	....
<i>Vicia villosa</i>	0.60	....
Unknown	2.44	1.74	....
Animal foods				
Hymenoptera	..	0.61	Trace	....
Grit	27.78	56.70	24.77	53.21
Chaff	62.35	18.90	30.60	1.48
Total gizzards	3	9	64	13

diets. These were utilized throughout the year, but they were eaten most frequently during the summer and fall.

Grit and chaff made up more than 50 per cent of the total volume of material found in gizzards but never exceeded 8.0 per cent in crops.

In all, 169 different food items were recorded of which 159 were plant species. Those items found in crops and gizzards in quantities greater than 0.1 per cent of the total volume are listed in table 1 and table 2, respectively. Those found in quantities of less than 0.1 per cent are as follows:

Animal foods: Arachnida, Diplopoda, Gastropoda, Hemiptera, Homoptera, Lepidoptera, Orthoptera and unknown animal material.

Plant foods: *Agropyron spicatum*, *Agropyron triticeum*, *Agrostis* sp., *Alisma plantago-aquatica*, *Amaranthus* sp., *Amaranthus hybridus*, *Ambrosia artemisiifolia*, *Amsinckia intermedia*, *Amsinckia iycopsoides*, *Anthemis cotula*, *Anthriscus sylvestris*, *Arctium minus*, *Asperugo procumbens*, *Astragalus* sp., *Atriplex* sp., *Avena sativa*, *Bassia hyssopifolia*, *Beckmannia syzigachne*, *Berberis nervosa*, *Berberis repens*, *Betula fontinalis*, *Bromus brizaeformis*, *Caucalis microcarpa*, *Ceanothus sanguineus*, *Celtis douglasii*, *Centaurea melitensis*, *Cephalanthus occidentalis*, *Chenopodium album*, *Chenopodium botrys*, *Chenopodium leptophyllum*, *Cirsium arvense*, *Cirsium vulgare*, *Claytonia* sp., *Claytonia linearis*, *Claytonia parviflora*, *Cleome serrulata*, *Convolvulus arvensis*, *Corispermum hyssopifolium*, *Crataegus douglasii*, *Cuscuta epithimum*, *Datura stramonium*, *Echinochloa crusgalli*, *Elymus* sp., *Epilobium* sp.,

Epilobium paniculatum, *Erodium* sp., *Erodium botrys*, *Erodium cicutarium*, *Erysimum* sp., *Festuca* sp., *Glyceria borealis*, *Heracleum maximum*, *Hordeum* sp., *Iva xanthifolia*, *Lepidium perfoliatum*, *Lithophragma* sp., *Lithophragma bulbifera*, *Lomatium* sp., *Lotus* sp., *Lotus americanus*, *Lupinus* sp., *Lupinus sericeus*, *Madia glomerata*, *Medicago* sp., *Medicago lupulina*, *Melilotus* sp., *Nepeta cataria*, *Oenothera* sp., *Oryzopsis hymenoides*, *Panicum* sp., *Panicum capillare*, *Phacelia* sp., *Phacelia leucophylla*, *Philadelphus lewisii*, *Phleum pratense*, *Physalis* sp., *Physocarpus* sp., *Pinus ponderosa*, *Plagiobothrys hispidulus*, *Plantago lanceolata*, *Polygonum bistortoides*, *Polygonum convolvulus*, *Polygonum lapathifolium*, *Prunus* sp., *Pseudotsuga* sp., *Pseudotsuga menziesii*, *Ranunculus* sp., *Ribes* sp., *Rosa* sp., *Rubus laciniatus*, *Rumex acetosa*, *Rumex crispus*, *Rumex fenestratus*, *Rumex mexicanus*, *Sambucus glauca*, *Sanguisorba* sp., *Setaria glauca*, *Setaria italica*, *Silene noctiflora*, *Silybum marianum*, *Sisymbrium* sp., *Solanum* sp., *Solanum dulcamara*, *Solanum nigrum*, *Sorghum vulgare*, *Stellaria* sp., *Suaeda* sp., *Taraxacum officinale*, *Thlaspi arvense*, *Trifolium agrarium*, *Urtica gracilis*, *Verbena bracteata*, *Verbena stricta*, *Vicia americana*, *Zea mays* and unknown plants.

Miscellaneous: feathers, lead shot, nut shell, wire.

DISCUSSION

Although the food habits of the California Quail have been studied in various parts of its native breeding range, this paper represents the first investigation of a similar nature on this species in eastern Washington where it was introduced.

Sumner (1935) found 103 species of plants and 16 species of animals in 102 crops taken from quail collected in California. Later, Glading, Biswell, and Smith (1940) examined 114 crops obtained over a period of one year in that state. The latter reported that seeds made up the major portion of the food items and were particularly abundant in crops from April to December. Insects occurred in low numbers and were found most frequently in April, May, and November. Green plant material comprised approximately 25 per cent of the total food items and was principally taken from February to May. The average grit content in 80 gizzards was 17.5 per cent.

Our findings agree essentially with those just discussed. It can be seen that the adult California Quail is primarily a vegetarian, with insects comprising less than 3.0 per cent of its annual diet. The observation that wheat accounts for 20 to 35 per cent of its total diet in eastern Washington is not surprising since wheat farming is the dominant agriculture in much of this area.

It has been suggested by Sumner (*op. cit.*) and Glading, *et al.*, (*op. cit.*) that the California Quail is selective in its feeding. Since the percentage of wheat which occurred in crops in the fall, when the most waste grain was available, was only 19.09 as compared to at least 24.36 during other seasons (table 1), it is evident that selective feeding also occurred in the quail of eastern Washington. Similarly, it appears that pigweed (*Chenopodium* sp.), teasel (*Dipsacus sylvestris*), and locust (*Robinia pseudo-acacia*) were utilized selectively. Evidently sunflower (*Helianthus annuus*), and Russian thistle (*Salsola kali*) were highly preferred since they were eaten almost exclusively during fall when most foods were available in greatest abundance. However, it appears that the utilization of prickly lettuce (*Lactuca scariola*) was governed primarily by availability. Finally, it was noted that as many as 20 different species of plants were frequently found in one crop, indicating the importance of availability.

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