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GRAY PARTRIDGE FORAGING ECOLOGY IN EASTERN SOUTH DAKOTA¹

Jerry W. Hupp², John T. Ratti³, and Loren M. Smith⁴

ABSTRACT.—We examined crop contents of 217 Gray Partridge (*Perdix perdix*) collected during a two-year period in eastern South Dakota. Row crop grains (corn, sunflowers) dominated late fall, winter, and spring diets. Small grains (oats, barley, wheat, rye) were rarely consumed although fields of small grains were widely available. During a severe winter when waste row crop grains were buried by snow, partridge consumed more leafy vegetation. Insects dominated the early summer diet, while foxtail (*Setaria* spp.) seeds were a major late summer and early fall food.

Previous North American studies of Gray Partridge foraging ecology have demonstrated the importance of agricultural crops. Most studies have been conducted in areas where small grains were the predominant agricultural crop (Yocom 1943, Westerskov 1966, Hunt 1974, Kobriger 1977, 1981). Not surprisingly, small grains comprised the majority of foods consumed. There has been little evaluation of Gray Partridge foraging ecology in areas with both row crop and small grain production. Therefore, opportunities to evaluate relative forage preference between these two types of domestic grains have been limited. Only Yeatter (1934) and Bishop et al. (1977) presented food habits data from areas where row crops were produced. Their studies were based on small samples (53 and 33 respectively) and data for all seasons were limited.

We studied Gray Partridge foraging ecology during a two-year period in an agriculturally diverse region of South Dakota. Our objective was to assess variation in partridge diets in response to seasonal changes in agricultural treatments and weather. Because both small grains and row crops were available on our study area, we were able to evaluate dietary proportions of these domestic grains relative to the available acres of crops.

METHODS

We conducted the study in Brookings County in eastern South Dakota. Row crops

comprised 33–42% and small grains 22–29% of agricultural acreage in the county in 1978–80. Both types of domestic grains were highly interspersed with each other and widely available throughout the region (Smith et al. 1982, Ratti et al. 1983). Pastures, alfalfa/grass hayfields, and idle grass cover were also available and comprised approximately 30% of the region.

Partridge were collected from July 1978 to June 1980. We collected most individuals along section roads within the study area. Hunter cooperators provided additional samples from birds shot during the fall hunting season. Crop contents of collected Gray Partridge were removed and oven-dried at 80 C. Food items were identified, segregated, and volumetrically measured (± 0.1 ml). Volumes < 0.1 ml were considered trace levels. Only crops with > 0.1 ml of food were used in the analysis. Data were summarized into two-month periods to evaluate seasonal variation. Data are presented using aggregate percent and percent occurrence methods (Martin et al. 1946, Swanson et al. 1974). Individual items were classified as either row crop grains, small grains, wild seeds, leafy vegetation, or invertebrate food. We used Krsukal-Wallis tests to evaluate differences in consumption of each food category among two-month periods (Conover 1980:229). Complete lists of food items consumed by Gray Partridge are in Hupp (1980) and Smith (1980).

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TABLE 1. Composition of Gray Partridge diets in Brookings County, South Dakota, 1978-80.

	22 Jun- 21 Aug (n = 13)		22 Aug- 21 Oct (n = 53)		22 Oct- 21 Dec (n = 54)		22 Dec- 21 Feb (n = 34)		22 Feb- 21 Apr (n = 18)		22 Apr- 21 Jun (n = 22)	
	Agg % ^a	% Occ ^b	Agg %	% Occ								
Row crop grains ^{c,d}	18.7	30.8	28.2	35.8	34.7	66.7	52.1	82.3	48.8	88.9	47.3	81.8
Small grains	3.1	53.8	10.8	35.8	9.1	25.9	5.3	20.6	4.3	16.7	4.8	31.8
Wild seeds ^c	15.4	46.2	40.4	92.4	34.9	87.0	15.3	85.3	7.2	55.6	12.3	72.7
Leafy vegetation ^{c,d}	7.7	15.4	14.2	86.8	17.1	85.5	26.5	73.5	39.6	88.9	29.6	86.4
Animal ^c	49.7	69.2	6.0	35.8	0.3	12.7	0	0	0	0	5.4	50.0

^aAggregate percent^bPercent occurrence^cConsumption differed ($P < .05$) among two-month periods.^dConsumption differed ($P < .05$) between years during some two-month periods (see Table 2).

TABLE 2. Yearly differences in late fall through winter consumption of row crop grains and leafy vegetation by Gray Partridge in Brookings County, South Dakota, 1978-80.

	22 Aug-21 Oct			22 Oct-21 Dec			22 Dec-21 Feb		
	n	Agg % ^a	% Occ ^b	n	Agg %	% Occ	n	Agg %	% Occ
Row crop grain									
1978-79	34	14.1	20.1	26	19.5	61.5	25	42.4	76.0
1979-80	19	53.5	63.2	28	48.9	71.4	9	78.8	100.0
Leafy vegetation									
1978-79	34	21.8	94.1	26	26.6	92.3	25	34.9	76.0
1979-80	19	0.7	73.7	28	8.3	82.1	9	3.6	66.7

^aAggregate percent^bPercent occurrence

RESULTS

We examined crops of 217 Gray Partridge; 194 contained > 0.1 ml of food and were included in the analysis. Seasonal differences in consumption of row crop grains were apparent (Table 1). The proportion of row crop grains in the diet increased from late summer (22 Aug-21 Oct) through winter (22 Dec-21 Feb), and remained high during early (22 Feb-21 Apr) and late (22 Apr-21 Jun) spring. From winter through late spring, row crop grains comprised approximately 50% of the foods consumed by Gray Partridge. During that period, corn was a much larger proportion (33-49%) of the diet than sunflowers (0-14%). Late summer through winter consumption of row crop grains was lower in 1978-79 than in 1979-80 (Table 2).

Small grains comprised a minor proportion ($< 10\%$) of the diet during all collection periods (Table 1). Seasonal variation in small grains consumption was not apparent

($P = .31$). Barley and oats were the small grains usually consumed by Gray Partridge.

Consumption of leafy vegetation was highest during early and late spring (Table 1). Leafy vegetation included leaves of alfalfa and cool season grasses available in pastures and hayfields. During late summer through winter, Gray Partridge consumed more leafy vegetation in 1978-79 than in 1979-80 (Table 2).

Wild seeds were a major proportion (35-40%) of the late summer and fall (22 Oct-21 Dec) diet but comprised a smaller proportion (7-15%) of foods consumed during other periods (Table 1). Foxtail (*Setaria* spp.) dominated the wild seed portion of the diet (Hupp 1980). Other wild seeds that frequently appeared in crops included wild buckwheat (*Polygonum* spp.) and ragweed (*Ambrosia* spp.).

Invertebrate foods were primarily consumed during early summer (22 Jun-21 Aug) (Table 1). Early summer data were primarily based on juvenile Gray Partridge; only three

adults were collected during that period. Insects of the orders Lepidoptera and Orthoptera were the major early summer invertebrate foods. Invertebrate foods were rarely consumed between fall and early spring. Consumption of insects increased slightly in late spring.

DISCUSSION

In agricultural regions domestic grains are primarily available to ground-foraging birds following harvest of crops but before field tillage in preparation for planting (Balldassarre et al. 1983, Warner et al. 1985). Small grain fields in Brookings County were usually harvested in early August. Therefore, during late summer waste small grains were available in unplowed stubble. In spite of the wide distribution of small grain fields and availability of waste seeds following harvest, small grains were a minor proportion of the late summer diet. Gray Partridge primarily fed on wild seeds during that period. Concurrent evaluation of Gray Partridge habitat use in Brookings County indicated that coveys primarily remained in unharvested row crops during late summer (Smith et al. 1982). Partridge apparently preferred to forage in the more protective cover of standing row crops rather than the shorter, more exposed small grain stubble. Wild seed-producing plants were available between rows and along borders of corn and sunflower fields. Foxtail was the source of wild seeds usually consumed by Gray Partridge and was the most common wild plant in agricultural fields in eastern South Dakota (South Dakota Cooperative Extension Service 1975:57).

Small grains remained a minor component of the diet throughout the fall and winter periods. Consumption of row crop grains increased in October and November. Increased consumption of row crop grains likely reflected greater availability of waste corn and sunflowers following harvest. Gray Partridge coveys were more frequently observed in row crop rather than small grain stubble in late fall and winter (Smith et al. 1982). Row crop grains may have been preferred fall and winter forage because they were energetically superior to small grains (McDonald et al. 1971:376).

Gray Partridge consumed more leafy vege-

tation and less row crop grain in 1978–79 than in 1979–80. Annual differences in late summer consumption of row crop grains were likely due to variation in timing of collections relative to harvest of corn and sunflowers. During late summer in 1978–79 most birds were collected before harvest of row crops was initiated. In 1979–80 a higher proportion of Gray Partridge was collected after harvest of row crops started, and when waste grain was more available. Differences in winter severity likely caused late fall and winter consumption of row crop grain and leafy vegetation to differ between years. Conditions during late fall and winter 1978–79 were severe, with maximum snow depths of 54 cm. Waste grain was buried by drifted snow during the 1978–79 winter, and Smith et al. (1982) observed that Gray Partridge coveys used pasture habitats more frequently during that period. Pastures were often blown free of snow, and birds were able to forage on available leafy vegetation. Also, forage resources in pastures are likely uniformly distributed, and the energetic investment in digging through snow may be less "risky" than in row crop stubble where resource distribution is likely more patchy (Krebs 1978). The 1979–80 winter was mild, with maximum snow depths of 4 cm. During that period waste grains were not covered by snow, and Gray Partridge primarily foraged on corn and sunflower seeds available in row crop stubble.

Juvenile Gray Partridge were primarily collected in early summer when the proportion of invertebrate foods in the diet was high. Juvenile birds often require a high percentage of invertebrates in the diet to meet nutritional demands of growth (Scott 1972). Survival of Gray Partridge chicks may be affected by the availability of insect foods (Potts 1970, 1980). Invertebrate consumption declined in late summer and fall as wild seeds and domestic grains became more available, insect abundance decreased, and chicks matured.

Forage exploitation by Gray Partridge in eastern South Dakota varied seasonally. Our results demonstrate the importance of year-round analysis of avian foraging ecology (Gullion 1966). Agricultural treatments and winter snow depth affected food resource availability and influenced foraging behavior of Gray Partridge. Gray Partridge apparently prefer to forage on row crops rather than small grains in

an area where both types of domestic crops are produced.

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