ALABAMA BIRDLIFE

VOL. 28 1980 NO. 3, 4

ALABAMA BIRDLIFE

Journal of the Alabama Ornithological Society

Vol. 28 1980 Nos. 3,4

CONTENTS

SONG SPARROWS CONTINUE RANGE EXPANSION

C. W. Summerour

In the last issue of Alabama Birdlife (Vol. 27, No. 1,2), I discussed the range extension of the Song Sparrow (Melospiza melodia) and cited positive breeding records. Since the publication of that article, the species has been found nesting in Jacksonville, Alabama, establishing the breeding range 15 (24 km) miles farther south into the State.

A singing male was first heard by the author in southwest Jacksonville on August 1, 1979. On August 5, I was successful in locating the nest containing 2 eggs in a dense viny tangle 5 m from the railroad tracks near the depot. On August 8, the nest still held only 2 eggs and the female was incubating. Only 1 singing male and its mate was heard or seen over a three week period and possibly represented the first Song Sparrows to become established in Jacksonville.

By summer's end the breeding range of the Song Sparrow in Alabama extended from Decatur south to Gadsden and Jacksonville and north to Piedmont and Cedar Bluff (for details see Summerour, 1979).

Literature Cited

Summerour, C. W. 1979. Breeding Status of the Song Sparrow in Alabama. Alabama Birdlife. Vol. 27, No. 1,2.

FOOD HABITS OF SOME OVER-WINTERING FRINGILLIDAE IN TUSCALOOSA COUNTY, ALABAMA, 1969

Dennis K. Shoemaker and D. T. Rogers, Jr.

INTRODUCTION

Probably the most quoted work on the foods of sparrows is a paper by Judd (1901). His data were derived from examinations of gizzards collected during 1885-1900 and he lists the principal plant and animal foods eaten. Judd stated that sparrows were collected over their entire geographical ranges yet his work excluded the southeastern states and possibly left a large part of the diet of the sparrows unknown. Other investigators (Forbush, 1929; Todd, 1940; Martin, Zim and Nelson, 1951; Evans, 1964) examined the foods of sparrows in the northern states, but again the Southeast was excluded.

Because of the inadequacies in the knowledge of the foods of over-wintering sparrows in the Southeast, the work being reported on here was undertaken. The period of study was from 24 February to 24 April 1969. This period was chosen to include differences in foods eaten from winter to spring.

The purpose of this study was to answer the following questions in relation to some Fringillidae wintering near Tuscaloosa, Alabama.

(1) Which of the three habitats selected for study do the respective birds choose while over-wintering?
(2) What foods do the birds eat in the habitats?
(3) What part of the food ingested is vegetation and what part is insect matter?

STUDY AREAS

All study areas were located on Rice Mine Road approximately five miles from Tuscaloosa, Alabama. The study sites were common habitats in the Tuscaloosa area and the general topography was flat. The areas were as follows:

I. Plowed Field

This was the largest study site (65 to 75 acres) and was planted in cotton (25 to 35 acres) and corn (40 acres) the summer previous to this study. Actually this field could have been treated as two distinct fields, but because of their adjacent positions, they were not. After the crops were harvested, the stalks, which remained until the fall, were cut and then plowed under. Many pieces of broken stalks from the crops and weeds, however, were left on the field. At the beginning of this study there was very little green vegetation on the field except near the edges. Later, green vegetation began appearing, but this along with the broken stalks was plowed under between 10-15 March. After this plowing, the field remained relatively barren until the end of the study.

This field was surrounded by early forest growth on three sides and Rice Mine Road on the fourth side, and was approximately ¼ mile from the other study areas. Across the road were more plowed fields and a pasture.

II. Broomsedge Field

This field covered approximately 30 to 35 acres and supported a dense cover of broomsedge (Andropogon virginica) with assorted weeds and mosses. This field had not been cultivated for at least six years, but earlier had been cultivated in corn. There were rows of briars (Rubus sp.) throughout this field and these served as excellent cover for birds.

This field was surrounded by early forest growth, the pasture study area, and Rice Mine Road. At the southeastern corner of this field was a swampy area which was not included in this study.

III. Pasture

This field was approximately 40 to 50 acres in area and supported a thick stand of crimson clover (Trifolium incarnatum) and barley (Sorgum pusillum) with many weed species present. The clover and barley did not produce seed during this study and did not serve as a food source. This field had been cultivated with these same species for four consecutive years. A fence and road divided this field in half. One side was used as a pasture for horses while the other side served only for horseback riding. This field was surrounded by early forest growth, the broomsedge study area, and Rice Mine Road. Across the road there was a plowed cotton field.

MATERIALS AND METHODS

I. Observations and Collections

The study areas were visited and birds collected throughout the day from early morning to late afternoon. On certain days only observing was done while on other days as many samples as possible were collected. The birds did not become shy or leave the study areas while this method of intermingling observation with collecting was employed. Over 100 hours were spent in the three study areas and 195 birds were shot and collected. Each bird was tagged with the date, time, and location.

II. Gizzard Contents

Gizzard contents were removed and preserved in 70 per cent ethanol. Subsequently the contents from

each gizzard were examined for seed types. Each seed type was identified and counted. If half or more of a seed was present it was counted as one seed. If less than half was present, the small pieces were grouped together into approximate seed size and counted as one seed. Twenty seeds of each type were oven dried for three days at 105° F, and then weighed to obtain the average dry weight for each seed type.

Insects were not identified. Insect biomass was determined indirectly by taking the difference between the total sample weight and the combined weight of seeds and grit.

After identifying and counting the seeds, the contents of each gizzard were filtered through a No. 1 Whatman filter, oven dried three days at 105° F, and then weighed. This process gave the total dry weight for each sample.

The samples were then ashed for 30 minutes at 1000° F in previously weighed procelain crucibles. The difference between the crucible weights and the combined crucible, ash, and grit weights was designated as grit weight. The ash weights of the seeds and insects were included in the grit weights. It was assumed that these ash weights contributed little to the true grit weight; therefore, no separation of ash and grit was deemed necessary. Colley (1968) reported the ash weight for spittlebugs (Philaenus spurmarius) to be 0.1 to 2.1 per cent of their dry weight. Using this figure to estimate the ash weights of insects and seeds, it appears that ash residues add only 2 to 4 mgs. to the grit weight per sample.

To determine the average weight of each of the filter papers employed in the 195 samples, 20 pieces of No. 1 Whatman filter paper were wetted with 70 per cent ethanol, oven dried for three days at 105° F, and then weighed.

RESULTS AND DISCUSSION

I. Distribution of Birds

The monthly distribution of the birds that were examined is shown in Table 1. Of the 195 birds collected, 10.7 per cent were taken in February, 70.9 per cent in March, and 18.4 per cent in April. The low percentage in February was due to the short collection period. The low percentage taken in April, however, was apparently due to the diminishing number of birds in the habitats as the same collection effort was put forth in April as in March. Apparently the birds began leaving for their respective breeding grounds in early April.

II. Diet Composition

Seeds comprised the major portion of the diets of the birds from 24 February to 21 March, representing 68.7 per cent by weight of the food found in the gizzards. From 21 March, a point at which insect biomasses increased markedly, until the last bird was collected (18 April), seeds comprised only 33.5 per cent by weight of the gizzard contents. Nineteen seed types were eaten by the sparrows during this study; of these, 16 had developed the previous season, 4 to 9 months before the sparrows arrived. These seeds were characteristically small, with hard seed coats, which enabled them to resist decay. These seeds were important during the entire study, but were most important the first month, and included the following: Leptoloma sp., Eleusine indica, Andropogon virginica, Dactyloctenium aegyptium, Paspalum sp., Rumex sp., Chenopodium sp., Carex sp., Cyperus sp., three species of Panicum, Sporobolus sp., Lespedeza sp., Cynodon dactylon, and an unidentified seed designated U.

During the second month mature seeds with relatively soft seed coats, having just matured, were more important than older seeds. The following seeds

TABLE 1

MONTHLY DISTRIBUTION OF THE BIRDS COLLECTED

SPECIES	FEBRUARY	MARCH	APRIL	TOTALS
Vesper Sparrow *Pooecetes gramineus*	4	16	8	28
Savannah Sparrow *Passerculus sandwichensis*	7	18	15	40
Field Sparrow *Spizella pusilla*	3	36	4	43
Northern Junco *Junco hyemalis*	1	9	5	15
Chipping Sparrow *Spizella passerina*	0	10	1	11
Song Sparrow *Melospiza melodia*	2	5	0	7
White-throated Sparrow *Zonotrichia albicollis*	0	27	1	28
Swamp Sparrow *Melospiza georgiana*	4	17	2	23
				195

were of this type: Stellaria sp., Poa annua, and Veronica sp. In addition during March and April various immature seeds were also available but only those of Stellaria sp. were taken.

Insects represented 31.3 per cent by weight of the gizzard contents of the birds from 24 February to 21 March and 66.5 per cent by weight from 22 March until the last bird was collected. The primary insect types eaten by the birds were snout beetles (Curculionidae), leaf beetles (Chrysomelidae), and Hymenopterans, especially ants. Other insects were found in the gizzards, but the above types were found most often. The snout beetles were especially important, present in the gizzard contents of at least one sparrow of each species.

III. Habitat and Diet According to Species

Vesper Sparrows. Of the three study habitats only the plowed field was occupied by Vesper Sparrows. These birds preferred the center of the field and were usually found in small flocks by themselves, or intermingled with Savannah Sparrows or Field Sparrows.

The diets of Vesper Sparrows show a declining importance of seeds in per cent by weight of the diet from February to April. Seeds represented 62.0 per cent by weight of the gizzard contents in February, 52.3 per cent by weight in March, and 49.5 per cent by weight in April. During these months seed biomasses in individual birds fluctuated between a high of 63.24 mgs in March and a low of 4.32 mgs in April. With 15 seed types eaten (Table 2), the Vesper Sparrows had a more diverse seed diet than the other sparrow species; however, only 4 of the 15 seed types, Eleusine indica, Leptoloma sp., Dactyloctonium aegyptium, and Rumex sp., were dominants (a dominant being defined as any seed found in 50 per cent or greater frequency and representing greater than 12 per cent by weight of the seed diet). These four seed types represented 78.4 per cent

TABLE 2
FREQUENCY AND PERCENTAGE BIOMASS OF SEEDS EATEN BY SPARROWS IN THE PLOWED FIELD

Seed Type	Vesper Sparrow (N=28) Freq.	Vesper Sparrow (N=28) % of Total Seed Diet	Savannah Sparrow (N=20) Freq.	Savannah Sparrow (N=20) % of Total Seed Diet	Field Sparrow (N=24) Freq.	Field Sparrow (N=24) % of Total Seed Diet
Dactyloctenium	50.0	16.10	50.0	20.00	62.5	14.40
Eleusine	50.0	22.80	30.0	1.70	79.2	52.30
Leptoloma	71.4	25.70	90.0	66.00	54.2	16.20
Rumex	60.7	13.80	55.0	4.70	0.0	0.00
Panicum	42.9	15.30	70.0	4.90	66.6	0.60
Paspalum	32.1	6.30	35.0	2.20	4.2	0.10
Stellaria	17.9	0.60	0.0	0.00	16.7	0.20
Poa	7.1	0.10	0.0	0.00	50.0	15.60
Cyperus	10.7	0.10	5.0	0.04	0.0	0.00
Chenopodium	7.1	0.10	15.0	0.40	25.0	0.60
Andropogon	3.6	0.02	0.0	0.00	12.5	0.30
Lespedeza	3.6	0.06	0.0	0.00	4.2	0.20
Sporobolus	3.6	0.02	0.0	0.00	0.0	0.00
Cynodon	0.0	0.00	5.0	0.06	8.3	0.04

by weight of the seed diet. Panicum spp. and Paspalum sp. were of secondary importance and represented 21.60 per cent by weight of the seed diet. Three of the dominant seeds were found in high frequencies during February, March, and April. These 3 seeds had developed the previous season. Newly developed seeds, however, were not found in February and rarely in March but were found in relatively high frequencies in April. Newly developed seeds seemed to supplement the insect diets which also showed an increase in April.

Insects in the diets of the Vesper Sparrows show an increasing importance from February to April, representing 38.0 per cent by weight of the gizzard contents in February, 47.7 per cent by weight in March, and 50.5 per cent by weight in April. Insect biomasses in individual birds fluctuated between a low of 2.79 mgs in February to a high of 106.52 mgs in April. Beetles, ants, plus other hymenopterans were the primary insect types eaten.

Grit weights in individual birds varied between 31.00 mgs and 155.00 mgs over the entire study period. Correlation coefficients were calculated each month for seeds and grit, and insects and grit. No r value was found over 0.254. With an r value of 1.00 representing a perfect correlation, it appears that there is no correlation between either seeds and grit, or insects and grit.

Savannah Sparrows. The Savannah Sparrows occupied all the study habitats. They occupied the plowed field until early April and at that time they relocated in the pasture, not being present in the pasture prior to this time. Rarely, and then only in small numbers were they found in the broomsedge field.

While in the plowed field the Savannah Sparrows flocked with Vesper Sparrows and, like the Vesper Sparrows, preferred the middle of the plowed field

away from the wooded edges. In both the broomsedge field and pasture, the Savannah Sparrows were observed alone or in pairs and never in association with other species.

Percentage-wise the seed diet of the Savannah Sparrows was similar to the seed diet of the Vesper Sparrows during February and March. During February and March seeds represented 58.0 per cent and 55.8 per cent by weight of the gizzard contents of the Savannah Sparrows. This compares to 62.0 per cent and 52.3 per cent by weight of the gizzard contents of the Vesper Sparrows. During these two months seed biomasses in individual birds varied between 4.13 mgs and 64.73 mgs in the gizzards of Savannah Sparrows. The dominant seeds were Leptoloma sp. and Dactyloctonium aegyptium (Table 2). Of secondary importance were Rumex sp., Panicum spp., and Paspalum sp., which represented 11.8 per cent by weight of the total seed diet. One difference between the seed diets of the Savannah Sparrows as compared to that of the Vesper Sparrows was the lack of Eleusine indica as a dominant food in the diet of Savannah Sparrows during these 2 months. This difference is apparently due to selective differences in seed preferences. The Savannah Sparrows also had a slightly less diverse seed diet.

Insect biomasses in individual birds fluctuated between 0.28 mgs and 34.88 mgs during these two months. The primary insect types eaten were beetles and ants.

In April, seeds represented only 14.5 per cent by weight of the gizzard contents of the Savannah Sparrows as compared to 49.5 per cent by weight of the gizzard contents of the Vesper Sparrows. This decrease in seed importance is apparently correlated with the Savannah Sparrows sudden change in habitat. This change probably took place because of the availability of insects in the pasture. Seed biomasses in

individual birds fluctuated between 0.00 mgs and 12.79 mgs during April. No seeds eaten were dominants as previously defined. The primary seeds eaten were Dactyloctonium aegyptium and Stellaria sp. (Table 3). The presence of Dactyloctonium aegyptium in fairly high amounts indicates that the Savannah Sparrows apparently left the pasture and fed from the plowed field across the road. The presence of Stellaria sp. indicates that newly developed seeds are a supplement to the insect diets during April. The frequencies of newly developed seeds increased in April.

The insect diet of the Savannah Sparrows represented 85.5 per cent by weight of the gizzard contents during April. Insect biomasses in individual birds varied between 20.05 mgs and 51.06 mgs during this month. Insect diversity increased markedly during April. Hymenopterans were prominent in the gizzard contents yet many other unidentified insect types were also important.

Only three Savannah Sparrows were collected from the broomsedge field. The dominant seed eaten was Andropogon virginica which comprised 93.2 per cent by weight of the seed diet (Table 4). These three birds contained no identifiable insects.

Grit weight in individual birds fluctuated between 15.00 mgs and 147.00 mgs during the study months. Correlation coefficients were calculated each month for seeds and grit and insects and grit. No r value was found greater than 0.331.

Field Sparrows. The Field Sparrows occupied two habitats; the plowed field and the broomsedge field. While in the plowed field they were in small flocks integrated with Chipping Sparrows. They stayed near the wooded edges and were often seen feeding in grassy areas around the plowed field. In the broomsedge field the Field Sparrows formed a

TABLE 3

FREQUENCY AND PERCENTAGE BIOMASS OF THE SEEDS EATEN BY SAVANNAH SPARROWS WHICH OCCUPIED THE PASTURE

	SAVANNAH SPARROW (N=17)	
SEED TYPE	FREQ.	% OF TOTAL SEED DIET
Leptoloma	23.5	9.60
Paspalum	5.9	1.20
Sporobolus	5.9	0.10
Dactyloctenium	17.6	46.60
Rumex	5.9	0.40
Chenopodium	11.8	0.30
Cyperus	5.9	0.20
Eleusine	17.6	0.80
Poa	17.6	3.20
Stellaria	35.3	38.30
Veronica	5.9	1.20

TABLE 4
FREQUENCY AND PERCENTAGE BIOMASS OF SEEDS EATEN BY SPARROWS IN THE BROOMSEDGE FIELD

Seed Type	Field Sparrow (N=19) Freq.	Field Sparrow (N=19) % of Total Seed Diet	Swamp Sparrow (N=23) Freq.	Swamp Sparrow (N=23) % of Total Seed Diet	Savannah Sparrow (N=3) Freq.	Savannah Sparrow (N=3) % of Total Seed Diet
Dactyloctenium	10.5	0.20	0.0	0.00	0.0	0.00
Eleusine	5.3	0.90	0.0	0.00	0.0	0.00
Leptoloma	5.3	0.06	4.3	0.02	0.0	0.00
Rumex	5.3	0.04	0.0	0.00	0.0	0.00
Panicum	36.8	6.00	43.5	3.90	66.6	5.10
Stellaria	26.3	13.00	0.0	0.00	33.3	1.70
Cyperus	5.3	0.20	13.0	0.40	0.0	0.00
Chenopodium	0.0	0.00	4.3	0.10	0.0	0.00
Andropogon	94.7	81.00	95.7	92.70	100.0	93.20
Lespedeza	0.0	0.00	4.3	0.04	0.0	0.00
Veronica	0.0	0.00	4.3	0.04	0.0	0.00
Carex	0.0	0.00	13.0	2.10	0.0	0.00
Poa	5.3	0.10	0.0	0.00	0.0	0.00
Seed U	0.0	0.00	4.3	0.70	0.0	0.00

single large monotypic flock. They ranged over the entire broomsedge field, apparently not preferring any particular area of the field.

The gizzard contents of the Field Sparrows which occupied the plowed field consisted of 86.4 per cent by weight seeds during February. In March, however, when more birds were collected, the gizzard contents consisted of 54.8 per cent by weight seeds which is similar to the diets of the Vesper Sparrows and Savannah Sparrows which occupied this habitat. No Field Sparrows were collected from this habitat in April. They left this habitat but did not relocate in the other study areas. During February and March, seed biomasses in individual birds fluctuated between 2.40 mgs and 43.57 mgs. The dominant seeds were Eleusine indica, Dactyloctenium aegyptium, Leptoloma sp., and Poa annua (Table 2). These seeds represented 98.5 per cent by weight of the seed diet. The Field Sparrows from this field had a slightly less diverse seed diet than the Vesper Sparrows but a more diverse seed diet than the Savannah Sparrows. The Poa annua seeds represent another difference between the diet of the Field Sparrows as compared to that of the Vesper Sparrows and Savannah Sparrows. There was an increase in frequency of newly developed seeds in the diet of the Field Sparrows from February to March.

Insects represented 13.6 per cent by weight of the gizzard contents in February and 45.2 per cent by weight in March. Insect biomasses in individual birds fluctuated between 0.03 mgs and 60.61 mgs. The primary insects eaten were hymenopterans.

Grit weights in individual birds from this field fluctuated between 48.75 mgs and 181.00 mgs. Correlation coefficients were calculated each month for seeds and grit and insects and grit. No r value greater than 0.213 was found between seeds and grit or insects and grit.

The Field Sparrows which occupied the broomsedge field had diets different from the Field Sparrows of the plowed field. Seeds were of less importance in the diets of the birds from the broomsedge field, representing 45.3 per cent by weight of the gizzard contents in March and 32.8 per cent by weight of the gizzard contents in April. Seed biomasses in individual birds fluctuated between 0.32 mgs and 34.14 mgs during these two months. The dominant seed was Andropogon virginica which represented 81.0 per cent by weight of the seed diet (Table 4). Of secondary importance were Panicum spp. and Stellaria sp. which comprised 19.0 per cent of the seed diet. The presence of Stellaria sp. in a high percentage indicates that Field Sparrows from this field relied on newly developed seeds to some extent. This is similar to the diets of the birds from the plowed field.

Insects represented 54.7 per cent by weight of the gizzard contents in March and 67.2 per cent by weight in April. Insect biomasses in individual birds fluctuated between 0.36 mgs and 45.53 mgs. The primary insect types eaten were hymenopterans and beetles.

Grit weights in individual birds varied between 24.50 mgs and 122.00 mgs. Correlation coefficients were calculated each month for seeds and grit and insects and grit. No r value greater than 0.244 was found between seeds and grit, or insects and grit during the study months.

Northern Juncos. The Juncos occupied only the plowed field. They, as did the Field Sparrows, ate from the grassy edges of the field. Only one Junco was collected in the middle of the plowed field

The Northern Juncos were always seen in flocks and apparently moved from the study habitat to outside habitats. They would be present in the plowed field one day and absent the next. They showed no close association with other species.

Because of their movements into and out of the study area, Juncos were collected on 7 days only. The percentage of seeds and insects is shown for the month of March alone. It was during this month only that an adequate number of samples was obtained to compare to the other "edge species." Seeds represented 57.6 per cent by weight of the gizzard contents during this month. Seed biomasses in individual birds fluctuated between 5.24 mgs and 64.73 mgs. The dominant seeds were Eleusine indica, and Chenopodium sp. (Table 5). These seeds represented 48.5 per cent by weight of the seed diet. Of secondary importance were Dactyloctonium aegyptium, Stellaria sp., Rumex sp., Panicum spp., and Leptoloma sp. These seeds represented 49.1 per cent by weight of the seed diet. The seed diet of the Juncos resembled in some respects that of the Vesper Sparrow although the presence of Chenopodium sp. as a dominant and Stellaria sp. as an important seed differed from that of the Vesper Sparrows. Newly developed seeds, especially Stellaria sp., were important to this species. The seed diet of the Juncos, in this respect, resembles the diet of all the previously mentioned sparrows.

Insects represented 42.4 per cent by weight of the gizzard contents. This percentage resembles the percentages of both the Vesper Sparrows and Savannah Sparrows for the month of March. Insect biomasses in individual birds varied between 5.58 mgs to 72.07 mgs. Ants and beetles were the most important insects eaten.

Grit weights in individual birds fluctuated between 61.00 mgs and 154.00 mgs. Correlation

TABLE 5
FREQUENCY AND PERCENTAGE BIOMASS OF SEEDS EATEN BY BIRDS IN THE EDGE HABITAT

	Junco (N=15)		Song Sparrow (N=7)		White-throated Sparrow (N=28)		Chipping Sparrow (N=11)	
Seed Type	Freq.	% of Total Seed Diet	Freq.	% of Total Seed Diet	Freq.	% of Total Seed Diet	Freq.	% of Total Seed Diet
Dactyloctenium	40.0	14.60	0.00	0.00	0.0	0.00	27.3	0.60
Eleusine	73.3	36.30	14.30	0.40	14.3	1.60	63.6	13.70
Leptoloma	53.3	8.60	71.40	30.00	28.6	33.80	63.6	61.80
Rumex	46.7	6.20	14.30	0.10	7.1	1.00	0.0	0.00
Panicum	80.0	8.50	71.40	44.80	14.2	1.00	36.4	13.00
Paspalum	20.0	0.70	57.10	17.90	25.0	6.90	0.0	0.00
Stellaria	26.7	11.20	0.00	0.00	10.7	4.20	0.0	0.00
Poa	20.0	0.70	14.30	0.50	0.0	0.00	36.4	10.30
Cyperus	33.3	0.90	0.00	0.00	46.4	28.20	9.1	0.10
Chenopodium	53.3	12.20	42.90	4.20	3.6	0.20	0.0	0.00
Andropogon	6.7	0.04	28.60	0.50	0.0	0.00	9.1	0.10
Lespedeza	0.0	0.00	0.00	0.00	17.9	23.10	0.0	0.00
Sporobolus	6.7	0.06	14.30	1.40	0.0	0.00	9.1	0.20

coefficients were calculated each month for seeds and grit and insects and grit. No r value greater than 0.334 was found between seeds and grit, or insects and grit.

Chipping Sparrows. In the three habitats studied, these sparrows occupied the plowed field and the wooded edges surrounding this field, remaining close to the edges at all times. The Chipping Sparrows were in constant association with Field Sparrows, but never associated with other sparrow species.

Seeds represented 62.5 per cent by weight of the gizzard contents of the Chipping Sparrows during March. Seed biomasses in individual birds fluctuated between 1.00 mgs and 39.16 mgs for this month. The dominant seeds were Leptoloma sp. and Eleusine indica (Table 5). These seeds represented 75.5 per cent of the seed diet. Panicum spp. and Poa annua were also important and represented 23.3 per cent of the seed diet. The seed diets of these sparrows closely paralleled that of the Field Sparrows which occupied the plowed field. The importance of Poa annua in the diet of the Chipping Sparrows and in the diets of the Field Sparrows emphasizes this close relationship. They were the only two sparrow species which ate large amounts of this seed.

Insects represented 37.5 per cent by weight of the gizzard contents during March. Insect biomasses in individual birds fluctuated between 0.25 mgs and 39.95 mgs during this month. Hymenopterans were the dominant insects eaten.

Grit weights in individual birds fluctuated between 29.00 mgs and 123.00 mgs. Correlation coefficients were calculated each month for seeds and grit and insects and grit. No r value was found greater than 0.248 between seeds and grit, or insects and grit.

Song Sparrows. There was not a large number of over-wintering Song Sparrows in the study areas. Those present occupied the wooded edges surrounding all study sites.

The Song Sparrows showed no close associations with other sparrows. They were usually seen alone or in pairs. No Song Sparrows were seen after 21 March. Apparently these birds began leaving for their breeding grounds earlier than the other sparrows.

Seeds represented 45.7 per cent by weight of the gizzard contents of the Song Sparrows during March. Seed biomasses in gizzards fluctuated between 2.88 mgs and 42.88 mgs during this month. The dominant seeds were Leptoloma sp., Panicum spp., and Paspalum sp. (Table 5). These seeds represented 91.0 per cent of the seed diet. Chenopodium sp. was also an important seed. Its importance links the diet of the Song Sparrows to that of the Juncos, another "edge species." The diet of this sparrow also closely resembled the diets of all the other sparrows which were found in the study areas. Apparently the Song Sparrows left the wooded edges and fed from the study sites.

Insects represented 54.3 per cent by weight of the gizzard contents from Song Sparrows. Insect biomasses in gizzards varied between 12.13 mgs and 37.09 mgs. Hymenopterans and snout beetles were the primary insects eaten.

Grit weights in individual birds fluctuated between 53.00 mgs and 155.00 mgs. An r value of 0.679 was found between seeds and grit and 0.376 between insects and grit.

White-throated Sparrows. The White-throated Sparrows occupied a cedar grove adjacent to the plowed field. They were often seen in the edges of the plowed field but never in the middle and were absent from the broomsedge field and pasture. These

sparrows were often seen intermingled with other edge species and were always present in large numbers varying from 150 to 200 birds.

Since many seeds were unidentifiable in the White-throated Sparrow samples, seed and insect biomasses were not separated.

The identifiable seeds consisted primarily of Cyperus sp., Leptoloma sp., and Lespedeza sp. (Table 5), although no seed was as dominant as previously defined. These 3 seeds represented 85.1 per cent by weight of the identifiable seed diet. The importance of Cyperus sp. and Lespedeza sp., seeds not reported in the diets of the other sparrows, indicated the White-throated Sparrows dependence on foods from the edge habitats. However, the presence of Leptoloma sp. as an important seed, a seed previously found prominent in all of the diets of the "plowed field" sparrows, indicated that the White-throated Sparrows had also apparently eaten from the plowed field.

Swamp Sparrows. The Swamp Sparrows occupied the broomsedge field only. They often stayed close to the numerous rows of briars which transected the field. Swamp Sparrows were predominantly seen alone or in pairs. They showed no close associations with other species.

Insects were more important than seeds to the Swamp Sparrows. Insects represented 64.4 per cent by weight of the gizzard contents in February, 69.8 per cent by weight in March, and 82 per cent by weight in April. Even though insects were the most important part of the diet of the Swamp Sparrows in every month, the increasing percentages of insects from February to April is still shown here as it was in the diets of other sparrows. Insect biomasses in individual birds fluctuated between a low biomass of 1.95 mgs in February to a high biomass of 61.46 mgs in April.

The most important group of insects to this species was snout beetles which were found in every Swamp Sparrow sample. Ants were also important but other hymenopterans were rarely found.

Seeds represented 35.6 per cent by weight of the gizzard contents in February, 30.2 per cent by weight in March and 18.0 per cent by weight in April. Seed biomasses in individual birds varied between 15.20 mgs in February and 0.80 mgs in April. The dominant seed was Andropogon virginica (Table 4). This seed represented 92.7 per cent of the seed diet. Newly developed seeds were unimportant in the diet of Swamp Sparrows.

Grit weights in individual birds fluctuated between 22.0 mgs and 150.00 mgs. An r value of 0.649 was found between insects and grit, and 0.196 between seeds and grit.

IV. Diets in Relation to Habitat

Plowed Field. Sparrows which occupied the plowed field had seed and insect diets showing many similarities. In terms of percentages of seeds and insects eaten during different months, the diets resemble each other fairly closely, especially during March. In the overall diet of the sparrow species, seeds decreased in importance from February to April while insects became more important. The Savannah Sparrows and Field Sparrows left this habitat during April. This change in habitat by the Savannah Sparrows seems to be correlated with the availability of insects in the new habitat as evidenced by the increase in insect consumption during this month. It is not known whether the Field Sparrows changed habitats to obtain more insects than were available in the plowed field or whether they sought a new habitat for other reasons.

Only the Vesper Sparrows remained in the plowed field during April. Their diet shows an increasing amount of insects eaten from February to March. There was very little diversity, however, in the insect diet of the Vesper Sparrows. The primary insect types eaten were hymenopterans.

Hartley (1948) stated that the frequencies of foods in the diet of birds tends to stress similarities in their diets. Using frequency as an index one can note close similarities in the dominant seed diets of the "plowed field" sparrows (Table 2). Dactyloctenium aegyptium, Eleusine indica, Leptoloma sp., Panicum spp., and Poa annua were the dominant seeds. The relatively close frequencies of these seeds in the diet of the "plowed field" sparrows indicated a close seed diet relationship.

While having a similar seed diet in terms of dominant seeds, the "plowed field" sparrows also had a more diverse seed diet than the sparrows from the other habitats. An average of 13 seed types were eaten from this habitat. It is not known whether these seeds were eaten randomly or selectively.

Broomsedge Field. The sparrows which occupied the broomsedge field had diets showing higher percentages of insects eaten as compared to the diets of the sparrows from the other study habitats. Insects represented greater than 60.6 per cent by weight of the gizzard content of the Swamp Sparrows during February, March and April while representing greater than 55.0 per cent by weight of the gizzard content of the Field Sparrows during March and April. As in the diets of the "plowed field" sparrows, however, insects increased in importance from February to April.

When the diet of the Swamp Sparrows is compared to that of the Field Sparrows distinct differences are noticed. The Swamp Sparrows ate considerably more insects than did the Field Sparrows. Snout

beetles were especially important to the Swamp Sparrows but not to the Field Sparrows which ate primarily hymenopterans, especially ants.

The seed diets of the "broomsedge field" sparrows consisted primarily of Andropogon virginica, the only dominant seed (Table 4). Even though the seed diets were similar in this respect they differed from each other in that the Field Sparrows ate five seed species not found in the diet of the Swamp Sparrows and the Swamp Sparrows ate five seed types not found in the diet of the Field Sparrows. A newly developed seed, Stellaria sp., was found in the diet of the Field Sparrows while not found in the diet of the Swamp Sparrows. This could possibly explain the differences in insect percentages eaten between these two species as newly developed seeds probably complemented the insect diet of the Field Sparrows but not the insect diet of the Swamp Sparrows.

The "broomsedge field" sparrows had the least diverse seed diet, with an average of only eight seed types eaten per bird. This was not surprising, however, due to the predominance of Andropogon virginica in each diet.

Edge Habitats. The diets of the "edge" species could only be compared in reference to the month of March. This was the only month in which an adequate number of birds was collected. The diets of the Chipping Sparrows and Juncos were similar in percentages of seeds and insects eaten. The diet of the Song Sparrows did not resemble the diets of the other "edge" species but closely resembled the diet of the Field Sparrows which occupied the plowed field and broomsedge field.

The dominant seed type consumed by the species in the edge habitats was different for each "edge" species (Table 5). Several similar seed types were

eaten by each "edge" species but the seed diets as a whole were not very similar. In fact, each of the diets of the "edge" species corresponds more closely to the diets of one or more of the "plowed field" species.

The dominant seeds eaten by the "edge" species were Eluesine indica, Leptoloma sp., Rumex sp., Paspalum sp., and Chenopodium sp. All of these seeds were found as dominants in at least one diet of the species from the other habitats. This could indicate that these birds used the edges of the study habitats more for protection than as a food source. The "edge" species had a seed diet diversity of 10.5 seed species per bird. This is not as diverse as the seed diet of the "plowed field" species but more diverse than the "broomsedge field" species.

Insects were the predominant food of Song Sparrows during March. In the diet of the Chipping Sparrows and Juncos, however, insects were less important than seeds. Ants, other hymenopterans and beetles were the primary insects eaten and each shared importance from week to week.

SUMMARY

The food habits of some over-wintering Fringillidae in Tuscaloosa County, Alabama, were determined from gizzard contents during 24 February to 24 April 1969.

Nineteen seed types were eaten by the over-wintering birds. The majority of these seeds were monocots and had lain on the ground for months prior to being eaten. Newly developed seeds became important in most of the diets of the sparrows during April and seemed to complement the insect diets during this month. Many immature seeds were available to the birds but only one type, Stellaria sp. was eaten.

Individually, seeds comprised the major portion of the diets of the birds from 24 February to 24 March and represented 68.0 per cent by weight of the food in the gizzard samples. After 21 March, seeds represented only 33.5 per cent by weight of the food in the gizzards. The seed biomasses in the birds fluctuated randomly showing no definite food patterns.

The primary insect types eaten by the birds were snout beetles, leaf beetles and Hymenopterans, but other insect types were also present. Insects represented 31.3 per cent by weight of the diet from 24 February to 21 March, but increased to 66.5 per cent by weight after 21 March. Insect biomasses in individual birds fluctuated randomly as did seed biomasses.

The diet of the birds in relation to habitat preferences showed many similarities. The "plowed field" species had the most diverse seed diet but least diverse insect diet. The "broomsedge field" species had the least diverse seed diet but most diverse insect diet. The "edge" species showed patterns resembling each of the other habitats and apparently used the edges more for cover than for food.

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GROUND FORAGING BY THREE SPECIES OF SWALLOWS

Wayne C. Weber

Ground foraging by swallows is rare, but has been previously described by Bent (U.S. Natl. Mus. Bull. 179, p. 450, 1942) for Barn Swallows (Hirundo rustica) and by Jackson and Weber (Iowa Bird Life 45:99, 1975) for both Barn Swallows and Cliff Swallows (Petrochelidon pyrrhonota). This note describes a case of ground foraging by Barn Swallows, Cliff Swallows, and Bank Swallows (Riparia riparia), which I observed at Decatur, Alabama on July 23, 1978.

The incident to be described occurred at the Decatur boat harbor, on an island in Wheeler Lake on the Tennessee River, between 7:00 and 7:30 a.m. About 25 Bank Swallows, 25 Barn Swallows, and at least 3 or 4 Cliff Swallows were observed attempting to pick insects off the surface of a paved parking lot. The main object of interest was two species of large mayflies (mainly Isonychia aurea Traver, with smaller numbers of Hexagenia limbata (Guerin)) which had settled in large numbers on the pavement and were swarming over the adjacent lawns. Two Common Grackles (Quiscalus quiscula) were also feeding on the mayflies, but a number of House Sparrows (Passer domesticus) and Red-winged Blackbirds (Agelaius phoeniceus) which were feeding nearby on scraps of garbage showed no interest in the insects.

Although both Barn and Bank Swallows were seen to successfully capture and swallow some mayflies, the rate of success seemed quite low. Frequently a swallow would alight several inches away from a mayfly and walk toward it, only to have the mayfly take wing before the swallow could catch it. The swallows also seemed handicapped by their short bills in dealing with these rather large insects (both mayfly species have a body length of 16 to 20 mm. (about 0.7 in.), or about 50 mm. (2 in.) including the twin "tails"). Often a swallow would drop a mayfly three or four times in succession, and then either would seemingly lose interest in it or would lose it to another equally clumsy bird.

The behavior of the swallows while foraging differed from that noted by Jackson and Weber (1975). Rather than alighting, pecking, and quickly taking wing again, the swallows would often spend a minute or more on the ground, and would walk from one insect to another. Aggressive interactions occurred frequently, both intraspecifically among Barn Swallows and Bank Swallows, and interspecifically between the two species. The Bank Swallows in particular often pecked at inappropriate objects, such as cigarette butts and feathers; some of these birds appeared to be juveniles, which perhaps had not yet learned to consistently discriminate food from nonfood items. The swallows appeared nervous while feeding on the ground, and frequently all of them would take off for no obvious reason, only to land again in a few seconds.

Swallows are highly-specialized aerial predators of insects, with short legs and bills which are ill-adapted for catching insects on the ground. Nonetheless, observations like those above show that they will take insects on the ground under some conditions (unusual abundance and/or conspicuousness of insects on the ground, or possibly scarcity of flying insects) even if their efficiency at doing so is not high.