

FOOD OF THE STARLING IN CENTRAL  
NEW YORK STATE

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THE Starlings (*Sturnus vulgaris*) used in this study were collected by the writer during the years 1931-1933 and 1935-1936 about Ithaca, Hamilton, Cortland, Elmira, Binghamton, and Owego, N.Y. The total number of 1,268 stomachs includes 149 nestling stomachs taken in May and June of several years. Most of the adult birds were shot. However, in early spring many were secured at steeple roosts, and, although taken as soon as possible after their arrival, a large number of these contained insufficient food for use in estimating percentages. The percentage figures presented are calculated by volume of food and are based on 661 adults and independent juveniles and 139 nestlings. The results of the examination of these 800 stomachs are summarized in Table 1, which includes those food categories constituting at least 1 per cent of the annual food or else at least 2 per cent of the food during one month.

In order to gain an idea of the quantity of food brought to nestling Starlings, observations were made at two nest boxes fastened inside knot-holes in the side of a barn. Three periods of continuous observation totaled 10 hours, during which time feeding visits occurred at intervals averaging 13.6 minutes. All observations were made between 7:30 A.M. and 5:30 P.M. One of the nests contained but one nestling, which during eight hours was fed, by the female only, at an average interval of 14 minutes. This four-day old bird received during the eight-hour period on July 12 the following recognizable food items: 23 lepidopterous larvae, apparently chiefly of the smooth-skinned cutworm group; 11 larvae of the May beetle (*Phyllophaga*); 1 large grasshopper; 2 crickets; 2 ants; 1 wasp; 2 ground spiders and several spider egg-cases; 2 harvestmen; 1 milliped; and 2 earthworms. Many smaller insects were unidentified, and doubtless others were unseen within the mouth of the adult. Beginning two days later a record of the weight increase of this nestling was kept. It might be expected that with exclusive attention a single nestling would gain more rapidly than one member of a large brood. That such is not necessarily the case is indicated by the following data:

Age in days.....	1 - 5	6 - 10	11 - 15	16 - 20
Daily gain by solitary nestling (grams) .....	...	3.5	1.9	-1.1
Mean daily gain by five nestlings of one nest.....	4.8	5.3	1.3	1.2

Not only do the nestlings fail to gain weight during the last few days in the nest, but an actual loss occurred in both nests studied. When

16 days of age the solitary nestling weighed 74.0 grams, while it weighed but 68.3 grams when 19 days old, or one day before leaving the nest. The mean weight of the five nestlings dropped from 77.3 grams at 20 days of age to 75.0 grams at 22 days, the day before they flew. Probably the adult Starlings in these instances brought considerably less food than previously. Kalmbach and Gabrielson (1921) report that the average interval between feedings on the day before young Starlings left the nest was about twice that for the entire nesting period. The latter figure they found to be 6.1 minutes, with both adult birds bringing food.

As shown by Table 1, the proportion of vegetable food in the diet of nestlings is only about one-eighth of that of the adults. The identifiable vegetable items (other than garbage) from the 800 stomachs include 58 species representing 41 genera. Vegetable matter constitutes 41.4 per cent of the food of non-nestlings throughout the year. During December, January, and February more than half of the volume of food is vegetable matter, chiefly from garbage. The latter category, of course, includes also refuse of animal origin. Three-fourths of the December diet is vegetable, for the maximum amount of wild fruit, especially staghorn sumac (*Rhus typhina*) fruits, is consumed during that month. In February garbage forms more than three-fourths of the Starling's food.

It has been suggested that by feeding on wild fruit during the winter the Starling decimates the supply available for the early spring migrants. In March fruits of various dogwoods make up 1.3 per cent and *Viburnum* fruits 2.5 per cent of its food. This indicates that in the region of this study wild fruits are still available to Bluebirds and Robins during the previous month, February, in considerable quantities. If further increase in the numbers of Starlings occurs, competition of this sort with native species may become critically important.

When the cherries ripen, the Starling returns to vegetable food after three months of an overwhelmingly animal diet. The genus *Prunus* supplies 3.3 per cent of the annual food; about 1 per cent is the cultivated cherry in the region under discussion. Kalmbach (1928) reported the consumption of cultivated cherries in July as 15 per cent, while our findings give 10.5 per cent for this month, indicating less destructiveness to this crop in the local region than in the six eastern States covered generally in the earlier study.

Apples comprise less than 1 per cent of the food during the four months from August through November, and doubtless some of these are obtained from garbage or waste fruit.

The months when corn bulks largest as a food item are February and March. From May through September corn is unimportant, being less than 1 per cent in each of these months. It is clear that the corn gleaned during the fall and early spring is practically all waste grain.

The buckthorn (*Rhamnus cathartica*) was found in November stomachs only, forming 8.3 per cent of the month's food.

In the animal food of the Starling, the millipede is prominent. It makes up 14.2 per cent of the yearly diet and about half of the April food. According to Crosby and Leonard (1918), "Numerous species of millipedes belonging to several genera have been found injurious in America. . . . It is true that they prefer decaying vegetable matter but it is also well known that they will attack healthy roots." MacLeod and Rawlins (1933) report that these diplopods occasionally inflict severe injury on potato tubers in central New York. The Starling's fondness for millipedes is therefore of some economic interest.

No animals except millipedes and insects are important in this bird's dietary. Earthworms, a snail (*Cochlicopa lubrica*), and a crustacean (the sow-bug *Porcellio scaber*), each constitute about 0.1 per cent of the annual food, while arachnids form 0.2 per cent.

One hundred ninety-one species of insects, representing 55 families, were determined from the 800 stomachs. Orthoptera are of importance in the food of the nestlings, the single species *Gryllus assimilis* forming 2.6 per cent of their diet. Thirty-four nestling stomachs contained representatives of the Gryllidae. Adults also consume a large number of crickets in May and June, and of grasshoppers in August and September.

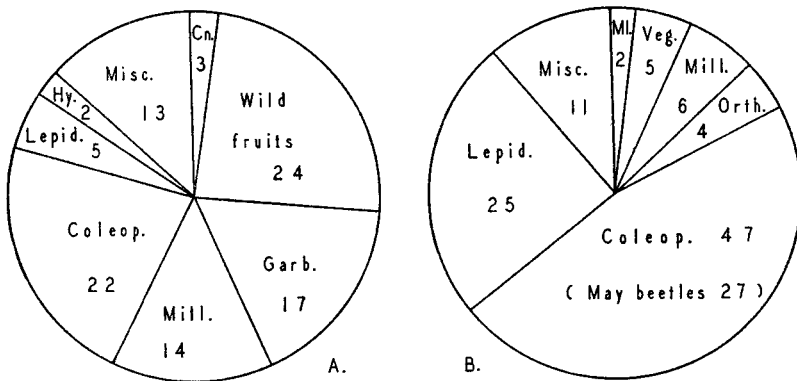


Figure 1—Percentages of the principal items in the food of: (A) 661 nestlings taken in all months, (B) 149 nestling Starlings taken in May and June. Cn., corn; garb, garbage; mill., millipedes; Coleop., Coleoptera; Lepid., Lepidoptera; Hy., Hymenoptera; misc., miscellaneous; ml., mineral matter; veg., vegetable matter; Orth., Orthoptera.

The predominant hemipterous insects eaten by both adult and nestling Starlings are the stink-bugs *Euschistus* and *Coenus* of the Pentatomidae. These bugs in stomachs collected in every month of the year, and their easily recognized fragments were very commonly found in winter stomachs. Crosby and Leonard (1918) wrote that

TABLE 1  
MONTHLY PERCENTAGES OF ITEMS IN STARLING STOMACH CONTENTS

	Adults and Independent Young												Nestlings			
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	May	June	Both
Number stomachs.....	54	48	72	117	22	17	39	57	84	38	31	82	661	107	32	139
Mineral matter.....	1.8	2.0	1.9	0.9	0.4	.05	.07	...	...	0.8	0.2	1.4	0.8	2.6	1.2	2.2
Vegetable matter.....	56.4	56.5	46.7	7.1	0.5	2.4	40.6	43.4	53.4	34.1	42.5	75.6	41.4	5.5	2.8	4.9
Corn.....	...	8.8	11.5	1.3	...	...	...	...	...	4.9	3.1	...	2.5	...	...	...
Wild fruits.....	12.0	2.2	24.0	2.7	...	...	30.1	42.4	49.0	13.3	30.6	49.7	24.2	...	...	...
Wild cherries.....	...	...	...	...	...	...	26.5	9.3	1.3	...	2.0	...	0.8	...	...	...
Cultivated cherries..	...	...	...	...	...	...	10.5	2.2	...	...	...	...	8.8	...	...	...
Sumac fruits.....	8.5	1.7	19.8	1.6	...	...	1.9	...	0.9	4.9	5.6	38.7	8.8	...	...	...
Wild grape.....	...	...	...	...	...	...	...	...	1.3	...	9.2	3.6	1.1	...	...	...
Dogwoods.....	1.5	...	1.3	...	...	...	...	...	3.7	6.7	...	...	1.2	...	...	...
<i>Viburnum</i> .....	...	...	2.5	...	...	...	...	26.3	39.6	...	...	...	7.3	...	...	...
<i>Sambucus</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Garbage.....	57.4	77.7	19.5	3.8	...	...	...	0.3	0.7	1.8	2.6	26.0	16.7	5.1	9.9	6.2
Millipeds.....	...	...	6.5	48.5	29.0	30.1	2.0	0.1	2.2	40.4	8.8	0.1	14.2	3.6	7.0	4.4
Orthoptera.....	1.0	0.2	...	...	2.7	8.4	2.2	3.5	3.8	2.8	...	...	1.7	2.7	6.9	3.7
Gryllidae.....	...	...	...	...	1.7	7.6	...	...	...	...	...	...	0.6	...	...	0.7
Acrididae.....	1.0	0.2	...	...	...	...	1.2	3.5	3.0	0.2	...	...	0.8	...	...	...
Hemiptera.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pentatomidae.....	2.7	...	1.2	1.8	...	...	1.1	...	1.6	2.1	1.2	...	1.2	1.9	1.1	1.7
Coleoptera.....	2.4	2.6	22.5	30.3	38.3	35.4	36.6	42.0	31.2	15.1	39.0	6.4	22.0	53.9	23.5	46.9
Elatridae.....	...	...	...	...	7.0	...	1.2	...	...	...	6.9	...	0.8	...	...	0.6
<i>Phyllotaga</i> .....	...	...	...	...	9.7	20.7	...	...	...	...	...	...	0.9	33.5	5.8	27.0
Curculionidae.....	...	2.1	15.6	6.0	13.7	...	15.1	15.5	1.1	9.9	24.8	5.5	10.1	4.5	0.8	3.7
<i>Hypera</i> .....	...	...	13.3	5.0	12.9	...	3.7	20.9	0.5	4.6	8.1	4.5	6.0	4.4	...	3.6
Lepidoptera.....	2.3	0.2	3.9	.9	13.0	6.0	9.0	1.3	0.6	0.3	3.0	1.1	5.0	20.2	38.6	24.5
Diptera.....	...	...	...	...	...	...	2.4	1.5	...	...	...	4.6	1.1	...	...	...
Hymenoptera.....	...	...	2.3	2.6	2.1	0.9	2.4	1.1	10.1	...	...	...	2.4	...	...	...
Ants.....	...	...	...	1.2	...	1.0	1.0	1.0	10.1	...	...	...	1.7	...	...	...

*Euschistus* is said to hibernate in the adult state. This is apparently correct, since the January percentage for these two genera is greater than for any other entire order. If these insects were dead when picked up it is unlikely that they would be favored above all others. Indeed, the suggestion that the Starling may in winter eat dead insects in appreciable numbers is open to question. All the other insect species which are of any consequence as adults in the winter diet are those which hibernate.

Coleoptera form 22 per cent of the annual food of adults in central New York State, whereas Kalmbach and Gabrielson (1921) found this order to constitute 19.6 per cent. The only families we found exceeding 0.5 per cent are the noxious Elateridae, Scarabeidae, and Curculionidae. Indeed, the species of these families which predominate in the Starling's food are among the most harmful of insect pests. Beetles and their larvae make up 46.9 per cent of the nestling food.

The species of Elateridae most commonly eaten are the wheat wireworm (*Agriotes mancus*), the corn wireworm (*Melanotis communis*), and *Aeolus dorsalis*. Herrick (1925) considers wireworms among the first five pests of corn and the first twelve pests of wheat and oats.

Adult May-beetles (*Phyllophaga*) and their larvae, white grubs, form one-tenth of the food in May and two-tenths in June. This genus is notoriously injurious, especially to corn, timothy, potatoes, and strawberries (Herrick, 1925). It constitutes 27 per cent of the total food of nestlings, and well over half of their coleopterous food.

The single family of insects eaten most commonly is the Curculionidae, or snout beetles, forming one-tenth of the yearly diet and one-fourth of the monthly food in November. Although this yearly figure compares closely with the 8.5 per cent average of Kalmbach and Gabrielson, the November data from our area is strikingly different, since their study showed only 5.3 per cent for curculionids in November. However, we had only 31 November stomachs sufficiently full for estimating percentages. The favorite species is the destructive clover-leaf weevil (*Hypera punctata*) which far outnumbers any other insect species in the Starling's food, both adults and larvae being eaten. Next in importance are the clover-root curculio (*Sitona hispidulus*) and the clover sitona (*Sitona flavescens*), together constituting 1.3 per cent of the annual food and 9.3 per cent for August. Both adults and larvae of *Hypera* and *Sitona* seriously injure clovers and alfalfa. The strawberry crown-girdler (*Brachyrhinus ovatus*) is frequent in stomachs throughout the year, forming 0.1 per cent of the food. This insect winters in the adult state, as do *Hypera* and *Sitona*, which explains the remarkable number of curculionids in winter and early spring stomachs.

Lepidoptera, which Kalmbach and Gabrielson recorded as 6 per cent of the yearly food of adults, make up 5 per cent in central New York, and about one-fourth of the food of nestlings. Cutworms of the

family Noctuidae greatly predominate. Table 2 shows the forms found in adult and nestling stomachs, and the numbers of stomachs in which they occurred.

TABLE 2  
LEPIDOPTERA LARVAE FROM STARLING STOMACHS

	Adult stomachs	Nestling stomachs
Pyralididae		
<i>Crambus</i> sp. (2 species).....	5	4
Geometridae (1 species).....	..	1
Noctuidae (13 species).....	..	4
Unidentified smooth-skinned cutworms.....	5	10
<i>Sidemia devastatrix</i> (glassy cutworm).....	..	9
<i>Cirphis</i> sp. (2 species).....	1	3
<i>Nephelodes emmedonia</i> (bronze cutworm)...	..	17
<i>Agrotis ypsilon</i> (greasy cutworm).....	1	3
<i>Feltia</i> sp. ....	2	25
<i>Euxoa</i> sp. ....	6	6
Arctiidae.....	2	2
<i>Apantesis</i> sp. ?		
<i>Estigmene acraea</i> ?		
Hesperiidae.....	..	3
Pieridae.....	..	1

The order Diptera is represented chiefly by the larvae of the green-bottle fly (*Lucilia* sp.) which account for the entire 4.6 per cent for the order in December, but were found in no other month. *Sarcophaga* larvae comprise 0.2 per cent of the animal food, being eaten principally in July and August.

No Hymenoptera are eaten consistently except ants, represented by *Myrmica scabrinoides*, *Myrmica rubra*, *Formica fusca*, and *Lasius* sp. As a group, ants form 1.7 per cent of the annual food of adults. The remainder of the 2.4 per cent for the order is largely cocoons, which are taken for the most part in winter and early spring. However, in some cases these were doubtfully determined as hymenopterous.

#### SUMMARY

It may be stated in summarizing the data on Starling food for central New York State that insects (identifiable at least to order) constitute about 35 per cent of the material in adult stomachs, and 77 per cent in nestling stomachs. Vegetable matter makes up 41.4 per cent in adults and 4.9 per cent in nestlings, while mineral items are 0.8 per cent and 2.2 per cent respectively. The remainder of the food in each case is animal matter other than insects, especially millipedes, unidentified animal matter, and animal garbage.

Intensive work in central New York indicates that the economic status of the Starling, as evidenced by analyses of stomach contents, does not differ fundamentally from that determined by Kalmbach and

Gabrielson for six eastern States before this bird had attained its present numbers and distribution. The food habits are on the whole decidedly beneficial, especially in the case of the nestlings.

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