

## THE FOOD OF NESTLING BIRDS.

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The surprisingly rapid growth of fledgling birds is a matter of common observation but the activities of the parents in the collection of food and the care of the young is scarcely realized by persons who have not carried on observations throughout the whole of a bird's working-day.

It has been the practice of the authors, each summer, for a period of years,\* to assign students in groups of four to the work of observing the activities of birds and their fledgling young from dawn until nightfall. The work was carried on in relays such that two persons were at the nest at all times, one to make the observations at close range with the aid of field-glasses, and the other to make the notes. By this method it was possible to observe, time and note in considerable detail, the activities of the birds, also the character and number of pieces of food brought at each trip to the nest.

Observations, many in duplicate, have thus been made upon seventeen different species of the birds common to Winona Lake, Indiana. In the several instances, the birds were under observation for a period of several consecutive days, and we have reason to believe, without markedly modifying their activities after the first hour or two.

The object of the present paper is to indicate the nature, quality and *quantity* of food brought to the young throughout a bird's full working-day. A transcript of a single example is given in full while others are given in summaries to indicate the number of feeds, number of pieces. Both "soft" and "hard" food are fed to the young birds in proportions which change somewhat with the age of the nestlings.

It is contended that the stomach contents afford the only accurate and reliable method of study of the food of birds. We believe that this method is not applicable to the food of nestling birds for two reasons: first, the food is soft and not readily identifiable; and the second and more important reason is that the food is digested very rapidly. The stomach contents do not serve as a criterion of the *quantity* of food that is eaten in the course of a day.

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## OBSERVATIONS ON THE BROWN THRASHER.

*Toxostoma rufum.*

There were four young in the nest. They remained in the same position throughout the day and were, therefore, indicated ( $\frac{1-2}{3-4}$ ). The nest was on the ground in a clump of weeds. The day was bright, warm and calm.

- 4:00 A. M. Parents off the nest.  
 25 Female fed (unidentified)—cleaned the nest.  
 26 Male fed (unidentified).  
 39 Male fed apparently a caterpillar.  
 55 Male and female fed apparently caterpillars.  
 57 Male fed caterpillar.  
 59 Male fed (unidentified)—brooded until 5:11.  
     (7 feeds during the hour.)
- 5:27 Female and male fed—earthworm.  
 27 to :40 female brooded.  
 40 Male fed—earthworm.  
 45 Female fed—earthworm.  
 47 Male fed (unidentified.)  
     (5 feeds during the hour.)
- 6:05 Male fed.  
 6:05 Male fed.\*  
 06 Female fed.  
 09 Female fed.  
 17 Male fed—earthworm.  
 17 to :40 the male brooded.  
 40 Female fed and carried away excrement.  
 50 Female fed.  
 50 to :53 the female brooded.  
 55 Male fed and carried away excrement.  
     (7 feeds during the hour.)
- 7:03 Male fed—brooded till :26.  
 26 Female fed.

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\*Food not identified where name is not given.

- 30 Female and male fed insects.  
 37 Female fed.  
 38 Female fed—caterpillar.  
 44 Male fed—brooded till :56.  
 56 Female fed and carried away excrement.  
     (8 feeds during the hour.)
- 8:01 Female fed.  
 12 Male fed—worms.  
 14 Female fed—worms.  
 15 Male fed—worms.  
 24 Male fed—large green larva.  
 26 Female fed.  
 28 Male fed.  
 32 Female fed and brooded till :53.  
 53 Male fed—insects and brooded till :58.  
 58 Female fed—caterpillar.  
 59 Male fed—caterpillar.  
     (11 feeds during the hour.)
- 9:08 Female fed—caterpillar.  
 09 Male fed—caterpillar.  
 18 Female fed—worm.  
 20 Male fed—worm.  
 25 Female fed—grasshopper, and brooded till :47.  
 52 Male fed and brooded till 10:19.  
     (6 feeds during the hour.)
- 10:19 to 10:29 the nest was vacant.  
 29 Male fed—caterpillar.  
 30 Female fed—insect.  
 33 Female fed—dragonfly.  
 33 Male fed—worm.  
 36 Female fed—worm.  
 42 Female fed—cutworm.  
 53 Male fed—cutworm and ate the excrement.  
 59 Male fed—cutworm and ate the excrement.  
     (8 feeds during the hour.)

- 11:02 Female fed—worm and beetle—carried away excrement.  
 03 Male fed—cutworm.  
 05 Male fed—dragonfly.  
 14 Male fed—caterpillar.  
 20 Female fed—caterpillar.  
 27 Male fed—caterpillar to bird No. 3.  
 33 Female fed—caterpillar to bird No. 1.  
 34 Male fed—caterpillar to bird No. 2, and brooded till :39.  
 43 Female fed—caterpillar to bird No. 2.  
 44 Male fed—caterpillar to bird No. 2.  
 47 Male fed—caterpillar to bird No. 2—ate excrement.  
 52 Female fed—caterpillar to bird No. 3.  
 53 Male fed—2 insects to bird No. 1.  
 58 Female fed—caterpillar to bird No. 4.  
 58 Male fed—caterpillar to bird No. 4.  
 (15 feeds during the hour.)

- 12:04 Male came but did not feed—brooded till :11.  
 12 Female fed—caterpillar to No. 1.  
 21 Male fed—caterpillar to No. 2 brooded till :30.  
 30 Female fed—cut-worm to No. 1.  
 40 Male fed green larvae to No. 2 and No. 3.  
 40 to :45, the nest was vacated.  
 45 Female fed larvae to No. 3 and No. 4, and ate excrement.  
 46 Chased blackbirds away from the tree; flicker and other birds.  
 48 Male fed—dragonfly to No. 2.  
 (6 feeds during the hour.)

- 1:00 Female fed—dragonfly to No. 2.  
 08 Male fed—larvae to No. 1 and No. 3—carried away excrement.  
 09 Female fed—larvae to No. 2.  
 11 Female fed—larvae to No. 2.  
 16 Female fed—larvae to No. 3.  
 21 Female fed—cut-worm to No. 2.  
 25 Female fed—cut-worm to No. 4.  
 29 Male fed—cut-worm to No. 3 and No. 4.  
 43 Female fed—cutworm to No. 2.  
 44 Male fed—larva to No. 2.

47 Male fed—larva to No. 3.

50 Male fed—larva.

51 Male fed—larva.

58 Male fed—larva.

(14 feeds during the hour.)

2:02 Female fed—larva to No. 1.

14 Male fed—larva to No. 2.

14 Female fed—larvae to No. 1 and No. 3.

23 Female fed—beetle to No. 4.

24 Male fed—beetle to No. 3 and No. 4.

24 Female fed—to No. 1 and No. 2.

37 Male fed—larva to No. 4—ate the excrement.

40 to :45 male brooded, and ate the excrement.

45 Male fed—larva to No. 4.

46 Female fed—larva to No. 3.

51 Male fed—larva to No. 1.

54 Female fed—larva to No. 1.

57 Female fed—beetle to No. 1.

58 Female fed—cut-worm to No. 2.

(13 feeds during the hour.)

3:00 Female fed—cut-worm to No. 2, No. 3, and No. 4.

05 Female fed—cut-worm to No. 3 and ate the excrement.

10 Male fed insect to No. 1.

15 to :25 Male fed—cut-worm, rested, ate excrement.

26 Male fed—insect to No. 2.

28 Male fed—2 insects to No. 4.

37 Female fed—to No. 3, and ate excrement.

38 Male fed—to No. 2, and ate excrement.

51 Male fed—cut-worm to No. 2.

52 Female fed—cut-worm to No. 1.

56 Female fed—cut-worm to No. 4.

57 Female fed—cut-worm to No. 3 and No. 4.

(12 feeds during the hour.)

4:01 Male fed—cut-worm to No. 4 and ate excrement.

09 Female fed—cut-worm to No. 1.

- 17 Male fed—cut-worm to No. 2.  
 20 Female fed—cut-worm to No. 4 and ate excrement.  
 21 Female fed—dragonfly to No. 1, and ate excrement.  
 28 Male fed—insect to No. 4.  
 32 Male fed—cut-worm to No. 3.  
 36 Female fed—dragonfly to No. 3.  
 37 Female fed—dragonfly to No. 1.  
 42 Female fed—cut-worm to No. 4.  
 44 Male fed—dragonfly to No. 3.  
 50 Female fed—beetle to No. 3.  
 51 Male fed—dragonfly to No. 3.  
 51 to 54, rested at the nest.

(13 feeds during the hour.)

- 5:02 Female fed—dragonfly to No. 3.  
 03 Female fed—dragonfly to No. 3.  
 05 Male fed—cut-worm to No. 3.  
 09 Female fed—winged ant to No. 1.  
 10 Female fed—beetle to No. 2.  
 11 Female fed—cut-worm to No. 1.  
 14 Female fed—cut-worm to No. 2 and No. 3.  
 16 Female fed—ants to No. 1 and No. 3; ate excrement.  
 20 Male fed—ants to No. 1.  
 25 Female fed—ants to No. 4.  
 26 Female fed—ants to No. 1.  
 27 Male fed—ants to No. 1 and No. 4.  
 32 Female fed—ants to No. 2, rested till :40 at nest.  
 43 Female fed—ants to No. 3.  
 49 Male fed—ant to No. 4.

(15 feeds during the hour.)

- 6:02 Male fed—beetle to No. 2.  
 07 Female fed—three ants to No. 1.  
 17 Female fed—beetle to No. 2, and ate excrement.  
 24 Male fed—cut-worm to No. 4.  
 24 Female fed—ants to No. 3.  
 29 Male fed—moth to No. 3; brooded till :33.  
 35 Male fed—ants to No. 3.

- 42 Female fed—cut-worm to No. 3.  
 42 Male fed—cut-worm to No. 3; brooded till 7:00.  
 (9 feeds during the hour.)
- 7:04 Male fed—cut-worm to No. 1 and No. 3.  
 13 Male fed—beetle to No. 2.  
 25 Female fed—cut-worm to No. 3.  
 27 Female fed—beetle to No. 4.  
 30 Female fed—worm to No. 1; carried away excrement.  
 35 Male fed—cut-worm to No. 1; ate excrement.  
 42 Male fed.  
 47 Male returns without feed: broods.  
 (7 feeds during the hour.)
- 8:00 Still brooding on the nest for the night.

The young were weighed on the following day, as indicated below. The weight of the young was 40 grams.

The weight of  $\left. \begin{array}{l} 1 \text{ beetle} \\ 7 \text{ ants} \\ 1 \text{ dragonfly} \end{array} \right\}$  is 1 gram.

Weight of 308 pieces (estimated number of pieces), 35 grams. Approximately this weight of food was consumed by four birds in a single day. Thus each bird consumed approximately one-fourth its weight of insects and worms.

Total number of feeds, 156.

Average number of feeds per hour, 9 5-8.

Individual feeds during the day:

To No. 1, 43 feeds (about).

To No. 2, 42 feeds (about).

To No. 3, 48 feeds (about).

To No. 4, 40 feeds (about).

Feeds by the male.....78 times.

Feeds by the female.....78 times.

Age of young not determined.

Classified list of food:

150 cutworms.

9 "worms."  
5 earthworms.  
11 dragonflies.  
10 beetles.  
50 ants.  
1 grasshopper.  
72 or more other insects.

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308 or more.

## SUMMARIES OF ACTIVITIES OF AMERICAN ROBINS

*Merula migratoria* (Ten Nests.)

	Number of Visits to the Nest by Parent Birds.	Number Young in the Nest.	Total Number Feeds.	Total Number Pieces.	Number of Feeds.		List of Food: Classified.	Enemies Driven Away.
					Male.	Female.		
July 3, 1912	136	4	130	130	51	79	35 earthworms..... 1 caterpillar..... 2 grasshoppers..... 42 other insects..... 27 berries (blackberries, raspberries, gooseberry) 1 bread..... 22 unidentified.....	None.
July 10, 1913	140	2 (4-days) old	140	140	60	72	86 earthworms..... 6 caterpillars..... 10 grasshoppers and crickets..... 21 other insects..... 5 berries..... 12 unidentified.....	Other robin. Cowbird.
July 10, 1913	105	2 (8-days)	101	126	.....	101	21 earthworms..... 12 caterpillars..... 7 grasshoppers and crickets..... 43 other insects..... 40 berries..... 1 cherry..... 1 seed..... 1 unidentified..... Water three times.....	Chased sparrows twice.

## SUMMARIES OF ACTIVITIES OF AMERICAN ROBINS—Continued.

	Number of Visits to the Nest by Parent Birds.	Number Young in the Nest.	Total Number Feeds.	Total Number Pieces.	Number of Feeds.		List of Food: Classified.	Enemies Driven Away.
					Male.	Female.		
July 10, 1914	202	4	211	211	200	1	101 earthworms..... 7 caterpillars..... 9 grasshoppers and crickets..... 42 other insects..... 6 berries..... 46 unidentified.....	Domestic difficulties; male drove female from the nest; did not permit her to return. He drove blackbirds and also other unidentified bird away.
July 10, 1914	77	2 (left nest before end of the day)	77	77	48	29	25 earthworms..... 1 caterpillar..... 5 grasshoppers and crickets..... 11 other insects..... 20 berries..... 15 unidentified..... Water one time.....	Purple grackle three times.
July 10, 1914	60	2	52	53	31	21	38 earthworms..... 4 grasshoppers..... 11 other insects.....	None.
July 10, 1914	110	2 (5-days) about	107	107	57	50	58 earthworms..... 6 grasshoppers..... 18 other insects..... 25 berries (chiefly mulberries)..... Water two times.....	None.

July 7, 1915	70	2	57	63	54	3	45 earthworms. 3 caterpillars. 3 grasshoppers and crickets. 1 other insect. 5 mulberries. 6 unidentified. Several flies and a few seeds.	Young robin; red squirrels period of fifteen minutes.
Showers during the morning. Very heavy rain during last half of the afternoon	Male covers young. His wings hang over nest; drains rain from the nest							
July 7, 1915	96	2 (5-days) old	84	87	56	28	54 earthworms. 1 centipede. 5 grasshoppers. 15 other insects. 1 berry 10 cherries. 1 bread.	None.
Showers during the morning. Very heavy rain during last half of the afternoon								
July 6, 1915	205	Not recorded	196	188	85	91	26 earthworms. 18 caterpillars. 3 grasshoppers. 53 other insects. 2 spiders. 84 berries (77 mulberries).	Drove yellow hammer 4 times. flickers twice, red squirrel once, 3 robins, sparrow once.

SUMMARY OF THE ACTIVITIES OF TWO WOOD PEWEES.

(*Contopus virens.*)

	Number of Visits to Nest by Parent Birds.	Number Young in the Nest.	Total Number of Feeds and Pieces.		List of Food Classified.	Enemies Driven Away.
<i>Clear Day</i> July 3, 1912. . . .	477	3 (age?)	369	369 +	2 caterpillars, . . . . . 3 butterflies, . . . . . 1 fly, . . . . . 7 dragonflies, . . . . . 1 winged ant., . . . . . 1 grasshopper, . . . . . 354 + unidentified insects, . . . . .	2 Cowbirds. Blackbird 4 times. Six Blackbirds at one time. Nuthatch, Woodpecker, Downy Woodpecker. Blue Jay. Yellow Hammer. Cowbird again. 2 Flickers. Squirrel twice.
<i>Rainy Day</i> July 7, 1915. . . .	670	3	65	65 +	7 caterpillars, . . . . . 1 butterfly, . . . . . 9 flies, . . . . . 5 dragonflies, . . . . . 1 beetle, . . . . . 1 black wasp, . . . . . 41 + other insects, . . . . .	None.

## SUMMARY OF THE ACTIVITIES OF A KINGBIRD.

*Tyrannus tyrannus.*

The same nest, with *two* young, was under observation for a period of six days beginning with the morning on which the eggs hatched. The data of the first day were imperfectly recorded and are, therefore, not included in the summary. The data cover the 3rd, 4th, 6th, 7th, and 8th day after the hatching of the eggs.

SUMMARY OF THE ACTIVITIES OF A KINGBIRD

	Number of Visits to the Nest by Parent Birds.	Total Feeds.	Number of Feeds		List of Food.	Enemies Driven Away.
			By Male.	By Female.		
July 12, 1913. 3rd day....	102	60	37	23	2 earthworms..... 2 caterpillars..... 1 white grub..... 2 damselflies..... 2 dragonflies..... 1 moth..... 6 grasshoppers..... 8 beetles..... 2 other insects..... 14 seeds..... 20 unidentified.....	Woodpecker.
July 13, 1913. 4th day....	102	92	69	23	7 earthworms..... 16 caterpillars..... 2 grubs..... 12 grasshoppers..... 2 crickets..... 2 katydids..... 2 damselflies..... 12 dragonflies..... 1 bee..... 2 beetles..... 12 other insects..... 19 unidentified.....	None.
July 14, 1913.....					Rain. No observations.....	

July 15, 1913. 6th day. . . .	78	74	40	34	10 earthworms. . . . . 1 caterpillar. . . . . 2 grubs. . . . . 3 grasshoppers. . . . . 1 cricket. . . . . 2 damselflies. . . . . 12 dragonflies. . . . . 1 beetle. . . . . 20 other insects. . . . . 1 seed. . . . . 21 unidentified. . . . .	Robin. Blue jay.
July 16, 1913. 7th day. . . .	74	61	39	22	2 earthworms. . . . . 9 grubs. . . . . 1 damselfly . . . . . 18 dragonflies. . . . . 1 moth. . . . . 13 other insects. . . . . 19 unidentified. . . . .	None.
July 17, 1913. 8th day. . . .	111	100	40	60	16 earthworms. . . . . 8 grubs. . . . . 3 damselflies. . . . . 15 dragonflies. . . . . 1 moth. . . . . 1 beetle. . . . . 1 grasshopper. . . . . 38 other insects. . . . . 1 centipede. . . . . 17 unidentified. . . . .	Blackbird. Sparrow. 3 Blackbirds.

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