



BUTCHERBIRD OR NORTHERN SHRIKE (Lamins borealis)

### U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF BIOLOGICAL SURVEY

# CUCKOOS AND SHRIKES

### IN THEIR RELATION TO AGRICULTURE

THE FOOD OF CUCKOOS - - By F. E. L. Beal, B. S.

THE FOOD OF SHRIKES - - By Sylvester D. Judd, Ph. D.

Prepared under the direction of

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## LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF BIOLOGICAL SURVEY,
Washington, D. C., June 15, 1898.

SIR: I have the honor to transmit herewith, and recommend for publication as Bulletin 9 of this Division, two papers on the food habits of birds, based on investigations conducted in the laboratory of the Biological Survey by Prof. F. E. L. Beal and Mr. Sylvester D. Judd. Respectfully,

C. HART MERRIAM, Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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# CUCKOOS AND SHRIKES IN THEIR RELATION TO AGRICULTURE.

# THE FOOD OF CUCKOOS.

By F. E. L. BEAL, B. S.

GENERAL NOTES.

Cuckoos are quiet and rather shy birds. While they do not avoid the haunts of man, they nevertheless have a way of concealing them-

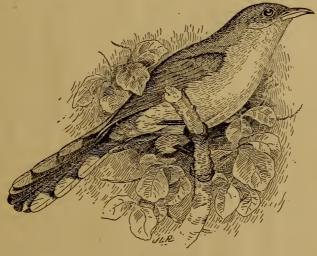


Fig. 1.—Yellow-billed cuckoo.

selves in foliage, seldom alighting on naked branches or in exposed places, and hence are not often seen. Their favorite resorts are open groves or woods, the edges of forests, orchards, and clumps of trees or shrubs. They often visit shade trees about houses, and are frequently heard in the trees along village streets or even in city parks. In many parts of the country they are known as 'Rain Crows' or 'Kow-kows,' the syllables kow-kow being an imitation of their notes.

The cuckoo's nest is usually built in bushes or small trees at no great height from the ground, and is a flimsy affair, composed of a few sticks, forming a mere platform for the eggs, which vary in number from two to four. The European cuckoo, like our cowbird, lays its eggs in the nests of other birds; a reprehensible habit not shared by its American cousin, although occasional instances of such parasitism have been observed. Our euckoos do not ostensibly rear more than one brood in a season, but they frequently lay their eggs at intervals, so that the young hatch successively, the later eggs being incubated in part by the young.

Three species and two subspecies occur in the United States. Of these, one species and one subspecies are restricted almost entirely to the southern coast of Florida, and are properly West Indian birds. The others occupy practically the whole country, except the plains and deserts, though in winter they are found in the extreme southern part only. The yellow-billed cuckoo (Coccyzus americanus) breeds from the Gulf of Mexico to southern Canada; the black-billed (Coccyzus erythrophthalmus) ranges still farther north. The northward migration does not begin until spring is well advanced, and is usually completed by the end of May. Most of the birds leave the Northern States in August, but some linger through September and even into October.

From an economic standpoint cuckoos rank among our most useful birds. Their habit of remaining concealed in foliage suggests, and close observation proves, that their diet consists for the most part of insects—very largely caterpillars—found on trees and shrubs.

#### EXAMINATION OF STOMACHS.

In the laboratory of the Biological Survey 109 stomachs of the yellowbilled and 46 of the black-billed cuckoo were examined. All were taken between May and October, inclusive, except one of the yellow-billed collected in Texas in January. These stomachs were obtained in twenty States, the District of Columbia, and Canada, and were fairly distributed over the country from Louisiana and Texas to Canada, and from Massachusetts to Kansas and Nebraska. A greater number would have been desirable, but the contents of those examined were so uniform that it seems fair to infer that they give a reasonably accurate idea of the general food of the species. It has been deemed best to treat the two species together, since they prove to be very much alike in diet. The greatest difference is that the yellow-billed cuckoo eats more beetles (Colcoptera) and fewer bugs (Hemiptera). The seasonal variation in diet is much less than in most birds. Of the 155 stomachs of both species examined, only one contained any vegetable food, and this only two berries of the wild rough-leaved cornel (Cornus asperifolia). One other stomach contained a bit of rubbish, probably taken accidentally with some insect. Drs. C. Hart Merriam and A. K. Fisher have seen the yellow-billed species feeding on mulberries in Westchester County, N. Y., and Dr. B. H. Warren found berries in

<sup>&</sup>lt;sup>1</sup> Annual Report, U. S. Dept. Agriculture for 1890, p. 285, 1891.

one of the nine stomachs examined by him.<sup>1</sup> These observations show that cuckoos do at times eat fruit, but the results of our investigation indicate that it is not their usual habit.

The insect food of cuckoos consists of beetles, grasshoppers, cicadas, bugs, ants, wasps, flies, caterpillars, and spiders, of which grasshoppers and caterpillars constitute more than three-fourths. The great majority of the insects found in the stomachs were harmful kinds. Caterpillars, katydids, and tree crickets are exactly the prey that cuckoos might be expected to secure from their peculiar method of hunting in foliage, while the large numbers of grasshoppers eaten furnish additional proof of the fact so often illustrated that birds are particularly fond of grasshoppers, and that species not naturally ground feeders become so during the grasshopper season.

It is a matter of common observation that cuckoos feed largely on caterpillars, and stomach investigations not only confirm this but show that unlike most other birds they eat freely of hairy and bristly species. Nearly half of the cuckoo's food was found to be caterpillars. An attempt was made to obtain an approximate idea of the actual number in the stomachs by counting the heads and jaws, but in many cases this was nearly impossible, as many of the insects were very young and the jaws consequently minute. The result of this estimate, however, showed that no less than 2,771 caterpillars were contained in 129 stomachs, or an average of more than 21 in each. If the whole number of stomachs (155) is considered, the average is reduced to 18, and it is absolutely certain that this is much below the actual number.

During May and June, when tent caterpillars are defoliating the fruit trees, these insects constitute half of the cuckoo's food. When cuckoos visit the nests of the tent caterpillars they apparently eat as many of the occupants as possible. Most of the stomachs that contained the larvae at all were filled with them, some having more than 100 individuals. Mr. Otto Lugger, formerly of the Department of Agriculture, examined one stomach which was so full that he concluded that the bird had devoured the whole colony, as there were several hundreds of these hairy caterpillars.

Perhaps the most curious insects found in the cuckoo stomachs were the larvæ of the Io moth. These caterpillars are thickly covered along the back and sides with spines growing from tubercles, which are not only very sharp but poisonous, and sting the hand quite severely when carelessly touched. Nevertheless, they were found in five stomachs, one of which contained seven, another three, and the others one each.

It is noticeable that the larvæ of moths, particularly hawk-moths (*Sphingidæ*), are eaten much oftener than those of butterflies. Whether this comes from preference and selection on the part of the bird or from the greater abundance and more conspicuous habits of the insects

<sup>&</sup>lt;sup>1</sup> Birds of Pennsylvania, 2d ed., p. 161, 1890.

still remains to be determined. As to the kinds of caterpillars eaten, it may be said that the hairy and spiny species far outnumber the smooth, but this may be due either to the greater abundance of the hairy ones or to the bird's preference.

This diet of hairy caterpillars has a curious effect upon the birds' stomachs. A cuckoo's stomach, unlike that of seed-eating species, has only a thin muscular coat on the outside, and the usual smooth lining is almost entirely devoid of rugae or folds so characteristic of the stomachs of many birds. This inner layer is almost always found pierced by at least a few caterpillar hairs; often by so many as to be completely furred and the membrane itself almost entirely concealed. Incidentally this hairy lining affords an excellent means of determining the motion of the food during digestion. If a stomach is divided in the plane of its two greater diameters the hairs on each half will be found brushed around a center like the nap on the top of a silk hat, indicating that the whole mass of food revolves in this plane. It may also be noticed that the skins of caterpillars taken from the stomachs of birds are always twisted like a cord or rope, and often require considerable untwisting before their characters can be determined.

In a review of the food of cuckoos the most striking point is the great number of caterpillars or lepidopterous larvæ which enter into the year's diet. These insects are crude feeders, eating immense quantities of vegetable tissue, and are usually so distended with it that the amount of real nutrition in any one of them must be small. In fact, stomachs of birds that have eaten largely of caterpillars always show a quantity of this finely cut vegetable matter derived from the insects' stomachs. As digestion in birds is rapid it would seem necessary to fill the stomach several times a day with such quickly digested and slightly nutritious food as this, while the number of caterpillars found in a stomach at any one time probably represents but a small portion of the actual daily consumption. From these considerations it appears that cuckoos must eat an enormous number of larvæ in the course of a season. If the contents of all the stomachs examined are regarded as so many daily meals of the same bird, then the result indicates that the bird has eaten 2,771 caterpillars in 155 consecutive days, at the rate of only one meal each day, and some days not eating any. Now, 155 days is about the length of time that cuckoos remain in their summer range; moreover, as indicated above, one cuckoo must eat several meals a day, so this number (2,771) probably falls far short of the actual number of caterpillars devoured by each cuckoo during the season.

In view of such considerations it seems hardly possible to overestimate the value of the cuckoo's work. All caterpillars are harmful, many of them are pests, and any of them are likely to become so. The common tent caterpillar formerly fed upon the wild cherry, but has now turned its attention principally to apple trees, sometimes com-

pletely defoliating them. What this caterpillar has done, many others may do. In the cuckoos we probably have one of nature's most efficient checks on the increase of these harmful species. It is said that hairy caterpillars are protected by their coats from the attacks of the ichneumon flies; if this be true, the work of the cuckoos in destroying the hairy species is complementary to that of the ichneumons, which help to destroy the smooth-coated caterpillars. Considering the number of grasshoppers, locusts, and other insects that cuckoos eat in addition to caterpillars, it is evident that from an economic point of view these birds are two of our most valuable species, and as they have not been convicted of doing any harm, they should be protected and encouraged in every possible way.

Besides insects proper, a number of spiders were found in the stomachs examined, most of them the long-legged kinds commonly known as 'daddy longlegs' or harvestmen (Phalangidw). One stomach contained seven, the mass of tangled legs looking like a bunch of coarse hair. When we consider the disgusting odor of these spiders, their long legs, and the fact that their bodies have the texture of sandpaper, we are again forcibly reminded that tastes differ. But the most remarkable thing which the cuckoos had eaten was a small tree frog (Hyla) which had been swallowed whole!

In view of Audubon's accusation that the yellow-billed cuckoo sucks the eggs of other birds, it may be said that eggshells were found in several stomachs taken in July and August, but only in very small quantities—no more than found in the stomachs of nearly every species that has been examined. It is probable that these were merely empty shells eaten for the sake of the lime they contained. It may be added that one stomach disclosed a snail shell, which was probably taken for the same purpose. A number of stomachs contained each from one to three bits of gravel, but why the stones were swallowed was not apparent. Cuckoos do not eat hard seeds, and even if they did their stomachs are not muscular enough to act as a mill for grinding, as are those of gallinaceous and fringilline birds.

#### GENERAL INSECT FOOD OF CUCKOOS.

#### BEETLES.

The beetles found in the stomachs belong to several families, no one of which forms any important percentage of the total food. The stomach taken in Texas in January contained 17 percent of beetles belonging to five different families, all harmful. Beetles constitute 14 percent of the food in May, but later in the season decrease, and after July practically disappear. The useful *Carabidæ* are rarely eaten, which is easily explained by the fact that they live on the ground, while the cuckoos feed mainly in trees. One bird, however, had eaten a specimen of *Calosoma scrutator*, one of the largest and most predatory of these beetles,

which, it may be added, is one of the most disgusting in odor. This was probably the most useful insect that the birds had eaten. Scarabacidae were somewhat more numerous than other beetles. The most noticeable of these was the goldsmith beetle (Cotalpa lanigera), which was found in 3 instances—6 specimens in one stomach and 3 in each of the others. Two stomachs contained each 2 specimens of the Colorado potato beetle (Doryphora 10-lineata). Elateridae, Buprestidae, Tenebrionidae, Cerambycidae, Lampyridae, and a few Rhynchophora, or snort beetles, were also found. Among the latter was 1 specimen of the rice weevil (Calandra oryzae). Altogether beetles constitute a little more than 6 percent of the year's food.

#### BUGS (HEMIPTERA).

Hemiptera, or bugs, are represented by cicadas, pentatomids, and a few others. The great bulk is made up of cicadas, or dog-day harvest flies, which seem to be a favorite article of food, as no less than 5 were found in one stomach and 4 in another. Stink-bugs (Pentatomidæ) were found in quite a number of stomachs, but not in large quantities. A few assassin bugs (Reduriidæ) were also detected. No Hemiptera were contained in the stomachs collected in January, but in the May stomachs they amount to 12 percent, and do not vary much until after August, when they begin to disappear. They amount to about  $6\frac{1}{2}$  percent of the food of the year.

#### GRASSHOPPERS (ORTHOPTERA).

The Orthoptera eaten by the cuckoos consist of common grass-hoppers, katydids, and tree crickets. The common grasshoppers are evidently favorites, as is the case with so many other birds. Several stomachs contained from 10 to 20 of these insects—a good meal for so small a bird. Katydids and their eggs were found in many stomachs, and often several individuals in a single stomach. The snowy tree cricket (*Ecanthus niveus*) is another insect that would seem naturally to fall in their way, and which their stomachs prove that they often eat. Orthoptera collectively were found in 86 of the 155 stomachs examined, and constitute about 30 percent of the year's food. Beginning with about 3 percent in May, they increase to over 43 percent in July, and do not fall much below this point during the remainder of the year.

#### CATERPILLARS.

Nearly half of the yearly food (48.5 percent) consists of caterpillars, which were found in 129, or 83 percent, of the 155 stomachs examined. The stomach taken in January contained 15 percent; in May the percentage rose to 60; in July and August it fell off a little to make room for grasshoppers, and in September reached the maximum of 75.

One of the most conspicuous and interesting of these larvæ is the

common tent caterpillar (Clisiocampa americana), which was recognized in 17 stomachs, and was almost certainly contained in many more, though the remains were too fragmentary for positive identification. When it is considered that this species can be obtained only during May and June and that only 50 stomachs were collected in these months, it will be seen that more than one-third of all the birds that could get these insects had eaten them. Though the remains in many stomachs could not be identified with certainty, there is no reasonable doubt that these caterpillars constitute at least half of all the food during this period.

Another caterpillar which appears very frequently in the cuckoo's diet is the destructive fall web-worm (Huphantria cunea). In one stomach 217 heads of this insect were counted, and the fragments of others indicated that 250 would be nearer the correct number. The larvæ of the white-marked tussock moth (Orgyia leucostigma) are also frequently eaten. One stomach contained remains of a number of army worms (Leucania unipuncta), but as these caterpillars feed upon grass, grain, and other plants that grow in the open, they do not naturally fall in the way of cuckoos. It is probable that army worms would be more extensively eaten if the fields infested with them were in the immediate vicinity of woods. Besides eating caterpillars of ordinary size, cuckoos often indulge in a meal of the larvæ of the larger moths and hawk moths. Of the latter, Protoparce carolina and Deilephila lineata were found in several stomachs. In fact, sphingid larvae appear to be favorites, and make up a large proportion of the hairless caterpillars eaten. Giant silkworms were represented by one larva of Telea polyphemus, the Io moth (Hyperchiria io) by 13 larvæ, and royal moths by 1 of Eacles imperialis, each as large as a man's finger. Only 3 butterfly larvæ were identified, one the black spiny larva of Vanessa antiopa, another the well-known Limenitis disippus, the third the larva of a skipper, Eudamus tityrus. While cuckoos eat many larvæ of Lepidoptera, remains of the adult insects were found only once. In this case the stomach contained the heads of several small moths of the Arctiidæ, a family whose larvæ are bairy.

#### MISCELLANEOUS INSECTS.

A little more than 5 percent of the food is made up of miscellaneous insects, consisting of Diptera, Hymenoptera, and a few others. Tipulids, or crane flies, constitute the greater part of the Diptera; they are found in quite a number of stomachs, but do not amount to much in bulk. Among the Hymenoptera, the most interesting, as well as those most frequently found, are larvæ of sawflies (*Tenthredinidæ*). These so closely resemble caterpillars that entomologists call them 'false caterpillars'; and it seems probable that this resemblance explains why the cuckoo eats them. They do not, however, appear distasteful, for one bird had eaten over 60. Larvæ of our largest species of sawfly (*Cimbex* 

americana) were found in several stomachs. Ants, too, are frequently eaten; probably captured when crawling over leaves or branches possibly when tending their dairies of plant lice. One stomach from western Pennsylvania, taken on June 2, contained, among other insects, 2 curious heads of ants, which were identified by Mr. Pergande, of the Division of Entomology, as belonging to the genus Cryptocarus. This genus is not known from the United States, but is abundant in Mexico and the West Indies. The bird was probably a late migrant. A few other Hymenoptera were found, among them a specimen of that curious long-bodied creature, Pelecinus polyturator. In the stomachs examined a few dragon flies were detected, but not enough to constitute a perceptible percentage. There were also some spiders, mainly Phalangidae.

As a matter of interest to the entomologist, as well as the ornithologist, a list of insects identified in the cuckoos' stomachs is appended:

#### INSECTS IDENTIFIED IN THE STOMACHS OF CUCKOOS.

#### Coleoptera:

Calosoma scrutator.

Lachnosterna sp.

Osmoderma sp.

Cotalpa lanigera.

Gnorimus maculosus.

Euphoria melancholica.

Dichelonycha sp.

Lucanus sp.

Sandalus petrophya.

Lina scripta.

Disonycha abbreviata.

Chrysomela scalaris.

Doryphora 10-lineata.

Romaleum atomarium.

Prionus sp.

Leptura sp.

Buprestis sp.

Chauliognathus sp.

Phytonomus nigrirostris.

Tyloderma æreum.

Pissodes sp.

Calandra oryzæ.

Cratoparis lunatus.

#### Hemiptera:

Brochymena sp.

Euschistus sp.

Nezara hilaris.

Cicada pruinosa.

Cicada tibicen.

#### Orthoptera:

Œdipoda sp.

Pezotettix sp.

Ceuthophilus sp.

(Ecanthus niveus.

#### Lepidoptera:

Anisota senatoria.

Anisota virginiensis.

Alypia octomaculata.

Acronycta americana.

Hyperchiria io.

Eacles imperialis.

Clisiocampa americana.

Cerura sp.

Datana ministra.

Datana contracta.

Dryocampa rubicunda.

Deilephila lineata.

Eudryas unio.

Edema albifrons.

Heterocampa manteo.

Hyphantria cunea.

Leucania unipuncta.

Nadata gibbosa.

Notodonta sp.

Orgyia leucostigma.

Psychomorpha epimenis.

Smerinthus sp.

Protoparce carolina.

Spilosoma virginica.

Telea polyphemus.

Eudamus tityrus.

Vanessa autiopa.

Limenitis disippus.

#### Hymenoptera:

Pelecinus polyturator.

Lophyrus sp.

Cimbex americana.

Camponotus sp.

Cryptocarus sp.

## THE FOOD OF SHRIKES.

By SYLVESTER D. JUDD, Ph. D.

#### HABITS OF SHRIKES.

Two species of shrikes inhabit North America. One, the loggerhead shrike (*Lanius ludovicianus et subspec.*), is a permanent resident in the United States; the other, the butcherbird (*Lanius borealis*), visits us from the north in winter. Either might be mistaken for a mocking bird, but upon close inspection is seen to have the hooked beak of a hawk; instead of possessing talons, however, it has weak and slender feet, thus combining characters of a bird of prey with those of a song bird.

During cold weather the shrike in wait for prey takes his stand on some high perch that commands a wide view. In this position he watches, ready to pounce on the first bird that twitters in the briers, or mouse that rustles in the grass. When the quarry has been secured, it is carried to a sharp twig or thorn and spitted, and then the hunter, ever eager to satisfy his desire for the chase, goes off to the hedgerows to search for more game. In Germany it is said that a closely allied species daily kills and impales nine victims, from which belief came the common name 'Neuntödter' or Ninekiller. It is well known that the shrike kills and hangs up in his shambles more than he can utilize. But this apparently wanton slaughter may often be the salvation of many a shrike whose hunt over snow-covered fields has yielded no return.

This habit of impaling its prey is well described by Mr. Benjamin Mortimer who, in writing from Orange, Fla., says:

In March, 1889, two instances of the loggerhead shrike's killing smaller birds came under my notice. In both cases the victim was a grasshopper sparrow, although birds of this species were few and scattered at that time, while the savanna sparrow was very abundant. The sparrows were impaled by the neck upon orange thorns, and there were no wounds on any other part of the body. \* \* \* This bird (the shrike) impales its prey not only when it wishes to preserve it, but also when it intends to devour it immediately, and the long slivers on fresh pine stumps are commonly selected for the purpose wherever they can be found. The bird flies to a stump with its victim, usually a beetle, and forces it upon a sliver, just behind the thorax, thus having a convenient place to stand and a convenient fork to hold the morsel while he breaks open the hard shell and eats the softer parts. The same stump is resorted to many times by the same bird, so that it is common to find quantities of the legs and wing cases of beetles about these curious dining tables.

The habit of killing small animals and hanging up their bodies has given the shrike the appropriate generic name *Lanius*, which means 'butcher.' The name 'Butcherbird' is more properly applied to the larger northern bird, while to the smaller and more southerly species the title 'Loggerhead' shrike is given.

Different diets affect in time the structure of an animal. Special parts are developed for procuring and digesting food. But the rôle that food habits play in the production of such variations has not yet been fully worked out. All structures are necessarily developed and maintained in direct relation to function. Shrikes have special structures suited to their peculiar feeding habits. So long as the northern shrike or butcherbird is restricted to an animal diet, because of the relative searcity of insects at the North during most of the year, it must be more of a meat eater than its southern consin, the loggerhead. The struggle for existence in the North is so keen that the butcherbird, during cold weather, must hold itself in readiness to fly at the first bird or mouse that is sighted.

The food habits of the shrikes, so far as determined from the examination of 155 stomachs, collected during every month of the year, from Saskatchewan to Florida and from the Atlantic to the Pacific, are very similar to those of the sparrow hawk; that is to say, the food consists of mice, small birds, and insects, the latter mainly grasshoppers. Both birds are much less insectivorous in cold than in warm weather—the oncoming of winter and consequent increasing scarcity of insects necessitating a change in food.

In discussing the insectivorous habits of the shrike, it is hardly necessary to state that the destruction of grasshoppers is a great service to the farmer. The shrike also devours a large number of beetles, and often eats caterpillars, wasps, and spiders. Since it takes practically no vegetable food, it can not injure crops, unless indirectly, by killing birds and insects that prey upon insect pests. The birds selected, however, are for the most part seed eaters and consequently less valuable than the insectivorous kinds; and if it be granted that the harm done by the destruction of one of these birds is counterbalanced by the killing of one mouse, then it follows that the harm done by the shrike in killing birds is completely offset. Furthermore, the attacks of the shrike are often directed against the English sparrow, now so obnoxious in many parts of the United States. Concerning the insect food, it may be safely stated that the percentage of noxious grasshoppers is four times as great as that of the useful ground beetles.

In considering the relation of the shrikes to agriculture, it must be remembered that one inhabits a fertile country where cultivation yields heavy crops, while the other lives in a northern region where agriculture amounts to very little. Therefore, the good or harm done by the northern butcherbird must be mainly accomplished when it migrates south into the United States. From the present limited investigation, it

appears that the beneficial qualities of both shrikes outweigh the injurious. Furthermore, it is probable that when it is possible to study the summer food habits of the butcherbird, this species, like its southern relative, the loggerhead, will be found to be a destroyer of quantities of grasshoppers and other noxious insects.

#### NORTHERN SHRIKE OR BUTCHERBIRD.

The northern shrike is a bird of the Hudsonian zone, breeding from Labrador to Alaska, and visiting the United States in winter only, when its food supply fails at the North. During its winter sojourn it renders a threefold service by killing grasshoppers, English sparrows, and mice. The birds and mice together amount to 60 percent, and insects to 40 percent, of the food from October to April. Grasshoppers constitute one-fourth of the food, and are equal to twice the combined amounts of beetles and caterpillars.

Apparently no mineral or vegetable matter is intentionally swallowed. Indeed, its exclusively animal diet makes it, practically, a bird of prey, and therefore we must consider what animals it destroys.

#### BIRDS EATEN BY THE BUTCHERBIRD.

The Chippewa Indians call this shrike 'big cannibal bird,' and several instances of cannibalism are recorded. In one case a hungry butcherbird pounced upon and carried off his companion, which had been shot and laid on the top of a log cabin. The butcherbird, when impelled by extreme hunger, becomes very bold, and has been known to enter a room and decapitate a caged canary.

In the stomachs of the 67 butcherbirds examined 28 species of seedeating birds were found. Of these 3 were tree sparrows, 5 juncos, and 7 English sparrows; the others could not be named with certainty. The tree sparrows and juncos were found in shrikes that had been taken in rural districts. On the other hand, English sparrows were found only in stomachs of birds that had been collected in cities.

In speaking of the enemies of the English sparrow, Prof. W. B. Barrows says:

Probably the most useful bird in this respect is the northern shrike (Lanius borealis), which visits most of our northern cities in winter and feeds freely on the sparrow. At one time this shrike became so abundant on the Common and public parks in Boston that it threatened to destroy all the sparrows, but the shortsighted authorities kept a man busy shooting the shrikes, until several dozen had been killed, and the useless sparrows were considered safe.

It is to be hoped that in other cities this enemy of the sparrow will be protected instead of persecuted. If there were 6 butcherbirds in each of 20 New England cities, and each butcherbird killed 1 sparrow a day for the three winter months, the result would be a removal of 10,800 sparrows. Since 2 sparrows could raise under favorable conditions four broods of 5 each, the increase would be tenfold, so that those

destroyed by the butcherbirds, if allowed to live, would have amounted at the end of the first year to 118,800, and at the end of the second year to 1,306,800 individuals. The shrike is at work every winter in the cities of the northern tier of States, killing the sparrows which tend to increase until they become so abundant that more are obliged to resort to the country for food. In a number of instances where English sparrows had been devoured, their stomachs, containing seeds and gravel. were found within the butcherbirds' stomachs. A golden-crowned kinglet's stomach also was detected, filled with fragments of a beetle and scores of tiny gnats. Mr. Frank M. Drew, in an article entitled 'Field Notes on the Birds of San Juan County, Colorado' (Bull. Nutt. Ornith. Club, vol. 6, p. 89), says that this shrike lives by foraging on little troops of titmice. Dr. G. S. Agersborg, of South Dakota, states (The Auk, vol. 7, p. 279) that it seems to follow the wake of the tree sparrows (Spizella monticola), and leaves in the spring at the same time they do. Prof. F. E. L. Beal while at Ames, Iowa, noted the butcherbird attacking birds only once, although he had time and again recorded their killing mice. In this exceptional case the victim was a downy woodpecker (Dryobates pubescens) which the shrike had hung in a crotch while devouring the brains. The most remarkable account of the butcherbird's not molesting birds also comes from Professor Beal at the same station. A shrike was perched on a telegraph wire above a rank weed patch which was all a-twitter with hundreds of native sparrows. Every now and then the shrike would leave the wire to scour the prairie, apparently hunting for mice, and then return to his perch. He paid no attention to the sparrows, and they showed no signs of apprehension.

Following is a list of birds that the butcherbird has been known to kill:

Chickadee (Parus atricapillus).1 Bush tit (Psaltriparus). English sparrow (Passer domesticus).2 Tree sparrow (Spizella monticola).2 Snowflake (Plectrophenax nivalis). Downy woodpecker (Dryobates pubescens). Vireo (Virco sp.). Juneo (Junco hyemalis).2 Kinglet (Regulus satrapa).2 Field sparrow (Spizella pusilla).2 Goldfinch (Spinus tristis).2 Siskin (Spinus pinus).2 Yellow-rumped warbler (Dendroica coronata).2 Mourning dove (Zenaidura macroura). Cardinal (Cardinalis cardinalis). Longspur (Calcarius).3 Shore lark (Otocoris).3

<sup>&</sup>lt;sup>1</sup> Dr. J. Dwight, jr.

<sup>&</sup>lt;sup>3</sup> Ornithologist and Oologist.

<sup>&</sup>lt;sup>2</sup> Identified in the laboratory.

#### MAMMALS EATEN BY THE BUTCHERBIRD.

The stomach of a shrike that has recently eaten a mouse is found to be filled with a large ball of fur, with bones in the center. It is impossible for these large masses to pass through the small intestine, therefore they are expelled through the mouth. A number of birds, including the European shrike (*Lanius excubitor*), are known to disgorge pellets after the manner of birds of prey.

Mice were found in one-third of the stomachs examined, constituting one-fourth of the food, and were eaten most frequently in March. these mice 15 were identified as follows: 1 white-footed mouse (Peromyscus), 1 harvest mouse (Reithrodontomys), and 8 meadow mice (Microtus). This last mouse is the one that oftenest falls a victim to hawks and owls. Mr. William Brewster, of Cambridge, Mass., states in The Auk (Vol. XI, p. 329) that he saw a shrike seize a large meadow mouse by the back, drag it across the snow, and then drop it. The mouse, instead of trying to escape, sprang at the shrike and drove it back several feet. Finally the bird, by several well-aimed passes, succeeded in intimidating the mouse, and then, as the latter turned to run away, caught it by the neck and worried it to death, as a terrier would a rat. The mouse was afterwards borne off in the shrike's claws and fixed in the fork of a tree. Meadow mice, besides consuming grass and grain, also girdle fruit trees, and the house mouse, in addition to wasting corn in the granary, wantonly destroys grain standing in the shock.

Dr. E. A. Mearns, United States Army, states in a letter that shrikes in Minnesota during March live exclusively upon meadow mice (*Microtus*), and Mr. W. L. Scott (The Auk, Vol. I, p. 158) cites an instance in which a butcherbird was caught in the act of giving chase to a chipmunk (*Tamias striatus*).

Carrion is sometimes eaten. Prof. F. E. L. Beal, while at Ames, Iowa, in January, 1880, saw a butcherbird fly over the brown frozen prairie to a carcass of a cow, where it lit on one of the ribs and greedily tore off shreds of the flesh.

#### INSECTS EATEN BY THE BUTCHERBIRD.

Active insects are much more liable than sluggish ones to fall victims to the butcherbird, because objects which at rest can not be discriminated are instantly seen when moving. Thus it happens that flying grasshoppers and running beetles form a large proportion of the food of this bird. Grasshoppers and crickets (*Orthoptera*), which are eaten during every month from October to April, form 24 percent of the total volume of food, and for October and November together these insect pests form more than half of the food. Compared with *Orthoptera*, the beetles (*Coleoptera*) eaten are of minor importance, amounting to only 6 percent of the food. More than half these beetles belong to the family *Carabida*, the members of which prey upon insect pests. Cater-

pillars were contained in one-fifth of the stomachs examined, and during the months of January and February amount to 8 percent of the volume of the stomach contents. Dr. A. K. Fisher collected in March two stomachs that were full of caterpillars. Even the bristly Isabella caterpillar is eaten, an object apparently as edible as a chestnut bur. Cutworms were found in several instances, but moths were seldom met with. Ants, wasps, flies, and thousand legs are sometimes eaten, and spiders constitute 3 percent of the food; but bugs (Hemiptera) were not detected during our laboratory investigations, though a cicada supposed to have been impaled by a shrike was found by Mrs. Musick, at Mount Carmel, Mo.

Important as is the study of the food of nestlings, it must, for lack of material, rest on the work of other writers. Audubon states that caterpillars, other insects and spiders, together with small fruits, form the first food of young butcherbirds. It seems odd that a bird which eats no fruit itself should feed its young on berries. The loggerhead shrike, as far as my investigation shows, neither takes vegetable food nor gives it to its young; and furthermore, our fruit-eating birds, so far as known, never begin by feeding their young on fruit.

The present investigation shows that beneficial birds form less than one-fourth of the food of the butcherbird. It also shows that the butcherbird, in addition to being an enemy of mice, is a potent check on the English sparrow, and on several insect pests. One-fourth of its food is mice; another fourth grasshoppers; a third fourth consists of native sparrows and predaceous beetles and spiders, while the remainder is made up of English sparrows and species of insects, most of which are noxious.

#### THE LOGGERHEAD SHRIKE.

The geographic races of the loggerhead shrike have almost identical habits, and consequently will be considered together. During the breeding season the loggerhead, the southern representative of the butcherbird, inhabits the United States, northern Mexico, and the southern part of the interior of Canada. It is smaller and differs in minor details of color: the lower mandible is black, while that of the butcherbird is yellowish; and the black bars on the side of the head meet across the forehead, but fail to do so in the butcherbird. In fall the loggerheads wander southward, but in spring they return to their breeding grounds and next in thorny shrubs.

#### BIRDS EATEN BY THE LOGGERHEAD.

Only 7 birds were found in the 88 loggerhead stomachs examined. One of these was an English sparrow, another a tree sparrow, and most of the others, which were not specifically identified, were also seed-eating birds.

Following is a list of birds reported to have been killed by the loggerhead:

English sparrow (Passer domesticus).

Tree sparrow (Spizella monticola).

Yellow-winged sparrow (Ammodramus savannarum passerinus).

Song sparrow (Melospiza fasciata).

Western chipping sparrow (Spizella socialis arizona).\(^1\)

White-throated sparrow (Zonotrichia albicollis).\(^2\)

Young chicken.\(^3\)

Canary (Serinus canarius).\(^4\)

Chimney Swift (Chatura pelagica).\(^4\)

Ground dove (Columbigallina passerina terrestris).

Bell's vireo (Vireo belli).\(^1\)

Snow bunting (Plectrophenas nivalis).\(^5\)

Blue-gray gnatcatcher (Polioptila carulea).\(^1\)

#### MAMMALS EATEN BY THE LOGGERHEAD.

From the laboratory investigation there is no evidence to show that shrews are eaten, but Mr. Robert Ridgway has seen shrews that had been impaled by the loggerhead. Mice are often found in stomachs of birds killed in winter, at which season they form 50 percent, and for the whole year 16 percent, of the food. The pretty white-footed mice are favorites. Bones, skin, and two tails of this mouse were taken from one stomach. The loggerhead is a good mouser during cold weather, but owing to its weaker bill is not so successful as the butcherbird in its battles with the large meadow mice.

Cases have been recorded where loggerheads ate carrion. Mr. William Lloyd, in an article entitled 'Birds of Tom Green and Concho counties, Texas' (The Auk, Vol. IV, 1887, p. 295), states that in the severe January of 1884 he found a loggerhead shrike so gorged from feeding on a dead sheep that it could not fly.

#### OTHER VERTEBRATES EATEN BY THE LOGGERHEAD.

Lizards were found in 6 of the 9 stomachs collected south of the latitude of Nashville, Tenn. One of the lizards was the so-called chameleon (Anolis principalis). Snakes, fish, and frogs are occasionally eaten. On this subject Mr. H. G. Gedney writes: \* \* \* "I have often seen them (loggerheads) return to lizards and tree toads which they had impaled \* \* \*. I saw a loggerhead attack a snake of the genus Leptophis, nearly two feet long, and after a sharp contest succeed in dispatching it." It is not at all uncommon for loggerhead shrikes to kill snakes. In The Osprey for April, 1897, is a picture of an impaled garter snake (Eutania sirtalis) beside a loggerhead's nest, and several observers have told me that they attack snakes and impale their bodies. Prof. W. G. Johnson, of the Maryland Agricultural College,

<sup>1</sup> William Lloyd.

<sup>&</sup>lt;sup>3</sup> Florida Dispatch.

<sup>&</sup>lt;sup>5</sup> W. H. Collins.

<sup>&</sup>lt;sup>2</sup> William Palmer.

<sup>4</sup> Robert Ridgway.

has observed the loggerhead impale snakes on a barbed-wire fence. At times loggerheads feed upon fish. The stomach of a bird killed in Utah on a cold winter's day contained nothing but minnow's bones; and Bachman speaks of the shrike's impaling fish that have been left by fishermen.

#### INSECTS EATEN BY THE LOGGERHEAD.

The larger part of the insect food of this shrike consists of Orthoptera (grasshoppers and crickets), and the remainder is principally beetles. In summer, when grasshoppers are abundant, the loggerhead does not seem to attack birds. The fact that in time of plenty more insects are killed and impaled than can be utilized indicates that the percentage of these pests destroyed is much greater than the laboratory examinations show. The same statement would not hold good in the case of the destruction of birds, because during cold weather when birds are killed there is a scarcity of food, and all the spoils of the chase are probably utilized. Grasshoppers and crickets were found in threefourths of the stomachs examined, and 14 of the 88 shrikes had fed exclusively upon these pests. Most of the Orthoptera eaten are grasshoppers, though some crickets are taken. Most of the grasshoppers found in stomach contents are flying species, among which have been noted the dust-colored Dissosteira carolina which, when rising from the road, shows beautiful yellow underwings, and the red-legged grasshopper (Melanoplus femur-rubrum) which is so conspicuous in hay fields. The pellucid grasshopper (Camnula atrox), which is somewhat migratory, is frequently captured, and also an ugly grasshopper (Hippiscus). In Arizona Dr. Horn has seen loggerheads eatch grasshoppers and impale them on cactus spines. One of the largest insects devoured by this bird is a sand cricket, the so-called Idaho devil. The mole cricket, likewise a large insect, is attacked and eaten by the shrikes of the southeastern United States. The fact that they take these enormous insects shows that whatever food becomes available in any locality is generally utilized.

Beetles and their larvæ are found in about one-fourth of the stomachs, and constitute 20 per cent of the bulk of the food. Most of the beetles are eaten in spring before grasshoppers become abundant. Half the beetles and their larvæ destroyed are useful carnivorous species that prey upon insect pests. Some of the largest of these beneficial beetles have been found stuck upon the splinters of the stump of a felled tree. There were taken from one loggerhead's stomach 112 jaws of the larvæ of a large predaceous beetle, and from another stomach the remains of the useful tiger beetle. It is probable that the killing of useful beetles is more detrimental to agricultural interests than the destruction of birds. Although half the beetles eaten are beneficial, most of the others are injurious. Among this latter class may be mentioned large, bright-colored, wood-boring bee-

tles (Buprestidæ), with the adult beetles of wire worms, weevils, and some allies of the May beetle. There are also eaten some of the harmless species closely related to this last group of beetles, as for instance the little dung beetles (Aphodius) and the large green-and-gold tumble-bug (Phanœus carnifex). Darkling (Tenebrionidæ) and carrion beetles (Silphidæ) are frequently caught, and the latter insects have been found stuck upon a barbed-wire fence.

The insect food of the loggerhead, like that of the butcherbird includes about 11 percent of caterpillars, wasps, and spiders. In the stomach of one bird was the abdomen of a large wasp with its sting stik attached. That the loggerhead is given to catching large insects is shown by the fact that one stomach was distended with a large grasshopper (Schistocerca americana), another contained a mole cricket, and a third was filled with an enormous saw fly (Urocerus). This last wasplike insect does much damage by puncturing trees, thus making an opening for wood-boring insects.

Loggerheads relish caterpillars; they destroy canker worms (Geometridæ), cut worms (Noctuidæ), and even bristly caterpillars (Arctiidæ); but as far as this investigation goes they have not been known to take adult Lepidoptera, although Bachman says he has seen them seize butterflies and moths on the wing. To complete the items of the invertebrate food there should be added crane flies, ants, dragon flies, May flies, thousand-legs, snails, and cray fish. These, though occasionally eaten, never form any significant percentage of the food.

To this account of the loggerhead shrike are added the following field notes kindly written for this paper by Mr. E. A. Schwarz, of the U. S. Department of Agriculture:

Insects impaled by Lanius ludovicianus excubitorides in southwestern Texas.

From April 24, 1896, the date of my arrival at San Diego, Duval County, Tex., up to May 21, I do not remember having seen any impaled insects. During this time the weather was extremely dry, but quite a number of large-sized insects abounded. On May 21 a copious rainfall occurred and brought out myriads of specimens of the Scarabæid genus Canthon (tumble bugs). These seem to be greatly relished by the shrikes, and large numbers of specimens could now be seen impaled every day. Other species of impaled insects observed at the time were Pasimachus, Dicælus, and a single Hymenopter (Glis). No impaled grasshoppers were seen at this season.

The shrubs more especially selected by the birds are Celtis pallida and Prosopis juliflora, dead shrubs being preferred to living ones.

However, the number of impaled insects in early summer is small in comparison with that seen toward the end of October. Impaled grasshoppers abound now, but there is no lack of other terrestrial insects, especially Carabidæ. Some soft-bodied insects are also among them, notably various terrestrial spiders and larvæ of Carabidous Coleoptera. Finally, there are numerous lizards and horned toads. It was also then noticed for the first time that the barbs of wire fences are used for impaling insects.

Most of the impaled specimens are never eaten by the birds, and remain for many weeks on the thorns. It would seem that the bird has acquired the habit of impaling insects without having the intention of eating them.

#### FOOD OF NESTLING LOGGERHEAD SHRIKES.

A female parent and 6 half-grown young were collected for the purpose of ascertaining whether, as is commonly believed, young shrikes are fed upon song birds. Three-fourths of the contents of each of these stomachs were insects, mainly grasshoppers. Parts of a meadow mouse had been fed to 2 of the nestlings. Mr. F. H. King, who has made extended studies on the food of birds, cites an instance of a shrike of this species carrying a warbler to its young, but Mr. Ernest Seton Thompson, who has recently examined the stomachs of 4 fledglings, found no birds, but many beetles, grasshoppers, and bristly caterpillars. The caterpillars belonged to the family Arctiide, and were covered with spines. It is very important that the few birds which will eat such caterpillars should be rigorously protected.

#### SUMMARY.

The food of the butcherbird and loggerhead, as shown by 155 stomachs collected during every month in the year, and in an area extending from California to the Atlantic coast, and from Saskatchewan to Florida, consists of invertebrates (mainly grasshoppers), birds, and mice. During the colder half of the year the butcherbird eats birds and mice to the extent of 60 percent and ekes out the rest of its food with insects. In the loggerhead's food birds and mice amount to only 24 percent. It will readily be seen from the table on page 26 that the loggerhead's beneficial qualities outweigh 4 to 1 its injurious ones. Instead of being persecuted it should receive protection.

#### LIST OF INVERTEBRATES DESTROYED BY THE BUTCHERBIRD.

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Orthoptera:
    Grasshoppers (Aeridiidae) { Melanoplus. Tettix.
    Crickets (Gryllida).
Coleoptera:
    Ground beetles (Carabida).
    Tiger beetles (Cicindelida).
    Darkling beetles (Tenebrionida).
Diptera:
    Flies.
Hymenoptera:
    Ants (Formicida).
    Wasps.
Lepidoptera:
    Cut worms (Noctuida).
    Bristly eaterpillars (Arctiida).
Arachnida:
    Spiders.
Myriapoda:
    Thousand-legs (Julus).
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Crustacea:

Sand fleas (Amphipoda).

LIST OF INSECTS DESTROYED BY THE LOGGERHEAD.1

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Orthoptera:
     \text{Grasshoppers} \dots \begin{cases} A cridiida \dots \begin{cases} Melanoplus \ femurrubrum. \\ Camnula \ atrox. \\ Dissosteira \ carolina. \\ Schistocerca \ americana. \end{cases} 
     Crickets and mole crickets (Gryllida).
Coleoptera:
                                              (Anisodactylus.
                                              Amara interstitialis.
     Ground beetles (Carabida)....
                                              Pterostichus.
                                              Carabus?.
                                              May beetles.
                                             Tumblebugs.... {Canthou. {Geotrupes.} Dung beetles (Aphodius hyperboreus).
     Scarabæids .....
                                              Flower beetles (Euphoria).
     Histerids (Hister).
     Longicorn beetles (Cerambycida).
     Rove beetles (Staphylinida).
     Tiger beetles (Cicindelida).
     Click beetles (Elateridae) [Melanotus].
     Carrion beetles (Silphidw) ....{Silpha\ ramosa. \\ Necrophorus\ marginatus.}
     Weevils (Rhynchophora).
     Darkling beetles (\mathit{Tenebrionida}) \dots \begin{cases} \mathit{Upis ceramboides}. \\ \mathit{Eleodes tricostata}. \end{cases}
Hemiptera:
     Bugs (Heteroptera).
Odonata:
     Dragon flies....\begin{cases} Agrion. \\ Libellula. \end{cases}
Lepidoptera:
      Cutworms (Noctuida).
      Canker-worms (Geometrida).
      Arctiida.
      Hymenoptera:
           Ants....{Formicidæ....Camponotus pennsylvanicus.
Myrmicidæ.
           Wasps (Vespina, Sphecina, Urocerus).
      Diptera:
           Crane flies (Tipulida).
      Ephemerida:
           May flies.
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OTHER INVERTEBRATES DESTROYED BY THE LOGGERHEAD.

Spiders. Snails.

Thousand legs.

<sup>&</sup>lt;sup>1</sup> Some of these insects are from records sent in by Mr. Ernest Seton Thompson.

Table showing percentages of principal elements of food of the butcherbird and loggerhead, calculated by volume.

Name.	Vertebrates.	Invertebuates.	Mammals.	Birds.	Other verte- brates.	Grasshoppers and crickets.	Spiders.	Wasps.	Caterpillars and moths.	Ground beetles.	Other beetles.	No. of stomachs.
Butcherbird Loggerhead Butcherbird Loggerhead Do Do Butcherbird Loggerhead Butcherbird Loggerhead	77 76 77 20 11 2 27 10 60 28	23 24 23 80 89 98 73 90 40 72	22 55 46 9 3  11  26 46	55 14 31 9  16 10 34 8	7 8 8 2	8 13 9 24 71 67 57 50 24 39	3 1 1 9 3 2 4 5	1 3 4 4 7 2 3	6 2 5 11 4 1 6 3	4 4 3 14 7 5 4 13 4 9	$ \begin{array}{c} 1 \\ 6 \\ 2 \\ 18 \\ 4 \\ 19 \\ 2 \\ 12 \\ \hline 1 \\ 13 \end{array} $	Dec., Jan., and Feb.   33   14   14   14   15   16   16   16   16   16   16   16

