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## FOOD HABITS AND ECONOMIC STATUS OF THE BREWER AND RED-WINGED BLACKBIRDS

By PABLO S. SORIANO

### INTRODUCTION

FROM THE economic point of view, birds may be divided into three classes, which are: (1) birds that are destructive throughout their lives, for example, western goshawk and sharp-shinned hawk; (2) birds that feed on crops a part of the year and on insects

the rest of the year, for example, starling and meadowlark; (3) birds that are beneficial all of the time, for example, most hawks and owls.

The Brewer and red-winged blackbirds belong to the second class. Farmers whose crops are visited by flocks of these two kinds of birds complain greatly, and they are convinced that these birds are destructive. On the other hand, some orchardists and farmers whose orchards and crops have been saved from the attacks of insects by these birds feeding on them declare that they are beneficial. Both sides have good arguments to support their views. The question comes up—What is the real economic status of these birds, in the interests of everyone, beneficial or destructive? To answer this question it is desirable to investigate the yearly food of the birds, by means of examination of the stomach contents, and to find out the ratio of the destruction wrought to the benefit they do.

The materials that have been used in this work were collected by deputies of the California Fish and Game Commission and were prepared for long-time preservation by Dr. Harold C. Bryant when he was still connected with the Museum of Vertebrate Zoology, University of California, prior to 1916. The materials were thus already in the laboratory, ready to be worked upon, when this project was undertaken by the author in the summer of 1930. The work has been done in the Museum of Vertebrate Zoology under the guidance of Doctors Jean M. Linsdale and Joseph Grinnell.

#### GEOGRAPHICAL RANGES

##### Brewer Blackbird (*Euphagus cyanocephalus*)

Geographical range: Western North America; north to British Columbia, Alberta and Saskatchewan, in the Dominion of Canada; east to Manitoba, Minnesota, Nebraska, Kansas, Oklahoma, and Texas; south to Lower California, and in winter over the Mexican tablelands to Oaxaca. There are two subspecies.

##### Red-winged Blackbird (*Agelaius phoeniceus*)

Geographical range: Temperate North America; north in the eastern parts of the Dominion of Canada to Ontario, Nova Scotia and Quebec; in the interior to Mackenzie and Keewatin; and on the Pacific coast to southern British Columbia; south to Costa Rica, Central America. There are numerous subspecies.

#### DESCRIPTIONS

##### Brewer Blackbird

The Brewer blackbird is smaller than a robin. It is about  $7\frac{3}{4}$  to  $9\frac{3}{4}$  inches long. The male in summer is glossy greenish black with the neck purplish black. The female is one-fourth smaller. In summer it is brownish gray on the head, neck, and under parts of the body. Head and neck are faintly glossed. Wing and head are more glossed with bluish green. In winter it is paler. The first-winter male is more or less like the adult in color except that the tips of the feathers are grayish brown. Young birds of both sexes are like the female in color, but they are not glossy. The adult male is always distinguished from the female and young by its having a whitish eye; the female's

eye is brownish black. There is no stage in this species of blackbird when the plumage has streaks.

The Brewer blackbirds are common residents in foothills, lowlands, and plains, and they occur in smaller numbers in the mountains. They forage chiefly on open ground. They are tame and fearless in demeanor. A person can ordinarily approach them within a few yards.

When on the ground the birds walk with alternate tread and with a consequent side to side movement of the body, and fore and aft movement of the head. They walk easily and gracefully. They are restless creatures. As they continue moving they are looking for food. The birds in the rear, when in a flock, fly up and settle down just ahead of the foremost ones, and this is continued until, when they are all disturbed, the flock flies to a tree or to telephone wires nearby.

#### Red-winged Blackbird

The male red-winged blackbird is about the same size as the male Brewer blackbird. It is solidly black except for a brilliant red patch at the bend of each wing. The male in winter has the edges of the feathers on the back rusty. The female is decidedly smaller. The plumage of the female, especially in the nesting season, is harsh in comparison with the silky plumage of the male. The top of the head is dark brown with a buff stripe over the crown. The under surface is whitish, heavily streaked with dark brown. The color of young birds is like that of the adult female, the plumage being of heavily streaked pattern. This makes them easily distinguished from young Brewer blackbirds.

These birds are gregarious, most of the time. It is only in breeding season that they are not in flocks, but in pairs, although the pairs are usually in groups even at that season. Their favorite haunts are moist meadows, near streams, ponds, lakes, and marshes; also they often nest in rankly growing hayfields. They are not usually as tame as Brewer blackbirds. Red-winged blackbirds perch on the perpendicular, upright stalks of plants such as rushes along streams, around ponds, and in marshes.

#### Brief Life Histories of Brewer and Red-winged Blackbirds

The life histories of the Brewer and red-winged blackbirds are in major respects the same. The breeding season takes place in April and May. It is at this time of the year that these birds are in pairs. The courtship of the male Brewer blackbird is not so demonstrative as that of the red-winged blackbird. The nest is usually started within a week after mating and it takes the birds about a week to finish a nest.

The Brewer blackbirds never nest in large colonies. They usually build their nests in bushes or small trees at different heights from the ground, but sometimes also on the ground itself. The nests when placed in trees and bushes are quite bulky, consisting of platforms of coarse sticks supporting a deep cup composed of weed and grass stalks, shreds of bark, rootless dry grasses, mosses, and mud, the latter when dry serving as a binding cement. The nests built on the ground are well built and the materials used are mostly moist when gathered. The nest is generally about six inches in outer diameter, four inches in inner diameter, three inches in outer depth, and two and one-half inches in inner depth.

The red-winged blackbirds usually build their nests among the dense vegetation in marshes; sometimes the nests are in rank weed-patches or even in standing grain. The size of the nest is practically the same as of the nest of the Brewer blackbird. Mud, however, is not used by the red-wing. Sometimes red-winged blackbirds' nests are found in the forks of willow, alder or elder bushes. They nest in colonies.

The number of eggs that the Brewer blackbird lays is more, on an average, than that of the red-winged blackbird. The number of eggs in the former is usually five, while that of the red-winged blackbird is usually but three or four. Eggs are deposited daily until the set is completed. Incubation takes about two weeks.

The male Brewer blackbird is very helpful to his mate during breeding season. He helps in the construction of the nest, in the protection of the eggs, and in the protection and care of the young. Both male and female greatly protest at the approach of any animal to their nest and sometimes the neighbors help them in driving away the intruder (Grinnell and Storer, *Animal Life in the Yosemite*, 1924, p. 414). Incubation is done only by the female. The birds of a pair are usually seen walking side by side with swinging gait searching for food for themselves as well as for the young.

The male of the red-winged blackbird, as a partner, is not as helpful as the male Brewer blackbird. He does not help much in the building of the nest or in feeding and caring for the young. This is due, perhaps, to his polygamous habits. However, he defends the nests and young in the colony of red-wings against any intruder. Yet in nest protection, the Brewer blackbird is the more aggressive.

In winter red-winged blackbirds occur in great flocks. These birds, in parts of their general range, migrate twice a year—in the spring and in the fall. Spring migration usually takes place in March and April. At this time they are in flocks going to their breeding places, where they nest in April and May. In 16 days after hatching, the young birds leave the nests and join in flocks by themselves. In October and November they in company with the old birds migrate again to warmer places or to places where food is more plentiful. During the two migrations, when they are often in flocks of enormous numbers, is the time they do most damage to the crops. In both migrations the flights are usually made in the evening and early morning.

These two species of birds each have distinctive calls and notes. The song of the male Brewer blackbird is a wheezy *tseur* or *tshee*. Both the male and female utter a harsh *tshick* and this is uttered by them in flying, foraging or perching. The male red-winged blackbird gives a throaty *long-leur-lee*. Both sexes, adult or young, when excited give a sharp *chack*. The male whistles and scolds when an intruder approaches the nest.

#### BASIS FOR INFORMATION

A good and reliable basis for information as to the real economic status of birds is field observation supplemented by stomach examination (Bryant, Univ. Calif. Publ. Zool., 11, 1914, p. 456). In field observation, it is easy to see the destruction or benefit the birds do in the

grain fields and orchards, especially when they are in great flocks, which is hard to tell in the examination of stomach contents. It is the vividness of the impression that sometimes counts. In field observation, it can be also observed whether they take newly sown seeds or uncovered grains, which can not be told in laboratory examination. In field observation it is sometimes more easy to identify the insects as well as the vegetable food eaten, for the items are still complete.

In this work field observation was not done, for the specimens that have been worked upon were already assembled. However, the result of stomach examination gives a fair indication of economic status, for whatever objects are found in the stomachs are definitely what the birds get in feeding.

#### METHOD USED IN ESTIMATING THE QUANTITY OF FOOD IN A BIRD'S STOMACH

There are three methods generally used in estimating the quantity of food in a bird's stomach. They are: (1) The articles found may be weighed; (2) they may be estimated by the volume; (3) they may be counted (*Bryant, op. cit.*, p. 440).

The weight method is more or less neglected because it is not practicable. Besides, the weight of vegetable food or animal food does not indicate the degree of injury or benefit that the bird gives.

The percentage by volume has been used in this work only in the estimation of the space the vegetable food or animal food or pebbles occupies in the stomach, for this shows the ratio which each bears to the others. The presence of one limits the presence of the others, depending upon the size. For example, the greater the volume of wheat the less the volume of animal matter or pebbles, taking for granted that the stomach is full.

The degree of injury or benefit that an animal does depends directly on the total number of injurious organisms that it destroys. Having this in mind the numerical method is advisable. This method has been followed in taking the percentage of the different kinds of foods taken in connection with this work.

The number is determined by counting. The number of the paired mandibles of grasshoppers showed the number of grasshoppers taken. The number of snouts of beetles showed the number of weevils taken. The number of paired elytra showed the number of beetles taken.

#### METHODS OF IDENTIFICATION

The stomach is opened lengthwise at the side and carefully cut so that the materials inside are not destroyed. The contents are put in a white basin with a little water in it, so that it is easy to separate the vegetable food from the animal food, as well as from the pebbles. After they are separated they are piled up—one pile for vegetable food, one pile for insect food, and one pile for pebbles; and the ratio of each volume to the others is taken. After the ratio is taken, which perhaps is not arithmetically exact, the different kinds of food are separated and each kind is counted and identified. The ratio and the number are recorded on a card as shown below. The number of items of each kind found and their condition are recorded under "contents."

No. -----	Date-----	Time-----
Locality -----		
Type of vegetation-----	Collector-----	
Name of species -----		
Condition of stomach-----		
Animal matter, no. of items-----	Percentage-----	
Number of items of vegetable matter-----	Percentage-----	
Number of pebbles-----	Percentage-----	
Contents -----		

To identify the kinds of food found in the stomach is a hard task. If the grains, seeds, or insects found in the stomach are not yet at all digested, to identify them is not so hard; but when they are partly digested, then it becomes difficult to identify them with certainty.

To facilitate the identification, recourse is had to a collection of insects, seeds, and grains with which to compare what has been found in the stomach. The insects, the seeds, and the grains are put in vials (one vial to each kind) and are dried out for identification. In some cases the insects are put in water, to float, so that external appendages can be made loose for examination.

The insect collection of the Entomology Department of the University of California, in the Agricultural Hall, and the seed collections made by Dr. H. C. Bryant were used for comparison in connection with this work. In the examinations a hand lens in addition to a binocular microscope was used.

#### THE GROUPING OF COUNTIES

All the counties where the 500 birds examined were taken are arranged in three groups. Each group includes those counties that are near to each other, and this means that the season of planting and harvesting is almost the same, as well as the vegetation and crops raised, within each group.

Group I includes the following counties:

1. Siskiyou
2. Humboldt
3. Mendocino
4. Tehama

Group II includes the following counties:

1. Sonoma
2. Sutter
3. Nevada
4. Calaveras
5. Alameda
6. San Joaquin
7. Stanislaus

Group III includes the following counties:

1. Fresno
2. Kern
3. Riverside
4. Ventura

## FOOD HABITS OF THE BREWER BLACKBIRDS

## Group I

The examination of the 125 stomachs of Brewer blackbirds showed that 38 per cent of the annual food was animal matter. It was more than 50 per cent of the food from February to July except in April when it was only 9 per cent. The maximum was taken in May, June, and July, the figures for which were 70, 100, and 81 per cent, respectively. In April, although the vegetable food was 91 per cent of the whole food, most of the items were weed seeds, which made up 75 per cent of the total content. Animal food was lowest in December, when it was only 3 per cent of the food.

## Animal Food

## Insects

Out of the animal food which numbered 1135 items only one was an arachnid. Practically all the animals taken were insects. The monthly food percentages are: January, 49; February, 61; March, 55; April, 9; May, 70; June, 100; July, 81; August, 16; September, 11; October, 44; November, 5; December, 3. (See table 1.)

In winter the percentage of insect food was low due to the fact that insects hibernate. The insects mostly taken were the ones found in their hibernating places, and the bodies of the dead ones that were preserved by the winter cold—but as early as February, insect food was already 61 per cent and most of the destructive insects were caterpillars, locusts and click beetles. These insects were the destructive ones, most liable to be the prey of these birds because they hibernate on the ground and these birds are, most of the time, ground feeders.

## Coleoptera—Beetles

Out of the 38 per cent insect food 15 per cent were beetles. These beetles belonged to many families but most of them belonged to these families: weevil family (Curculionidae), 3 per cent; click beetle family (Elateridae), 2 per cent; June beetle family (Scarabaeidae), leaf beetle family (Chrysomelidae), ground beetle family (Carabidae), carrion beetle family (Silphidae), 1 per cent each.

Weevils were the beetles taken in greatest number. By the destruction of these insects, these birds rendered a great help to the farmers in particular and to the people in general, for these beetles are destructive. In January, weevils were 15 per cent of the food contents of the 10 stomachs of these birds examined, and 4 out of the 10 stomachs contained them (see table 3). In March, they were 11 per cent of the food contents of the 22 stomachs examined, being found in 6 stomachs out of the 22. The highest percentage of this kind of beetle in the food contents of 1 stomach was 62. In April, it was 3 per cent of the food contents of 21 stomachs examined, and it was found in 6 stomachs out of the 21. The highest percentage of this beetle in the food contents of 1 stomach was 77. In May, it was 10 per cent of the food contents of the 11 stomachs examined, and it was found in 1 stomach. It was 59 per cent in the food contents of that stomach. In February and November weevils were also taken, but the percentages were small. Weevils were the highest in percentage among all the beetles taken by the 125 birds examined. These birds then are effective in the destruction of weevils.

The click beetle family was the second highest in percentage among all the beetles found in the 125 stomachs. They were taken mostly in February for they were 7 per cent of the food contents of the 20 stomachs examined. Click beetles were found in 7 stomachs. One stomach was nearly filled with this kind of beetle, for the percentage was 94. In March, this kind of beetle was 1 per cent of the food contents of the 22 stomachs examined, being found in 2 stomachs. In May it was 2 per cent of the food contents of the 11 stomachs examined and it was found in 1 stomach only. This kind of beetle being the second highest in percentage among the beetles in the food contents of the 125 stomachs examined, shows Brewer blackbirds to be effective in destroying these harmful beetles.

June beetles, leaf beetles, ground beetles and carrion beetles were all the same in percentage in the food contents of the 125 Brewer blackbirds' stomachs examined. But in the number of items the June beetle stood foremost. It was taken mostly in March, April and June. It was taken mostly in June when it was 45 per cent of the contents of the 9 stomachs examined. It was found in 3 stomachs and one of these 3 contained 100 per cent June beetles. These June beetles (adults), although they are not as destructive as the larvae, do great damage to the plants by feeding on the leaves. The larvae are more destructive than the adults because they are root feeders and their presence is recognized only when the plants attacked become sickly. The best control is then directed to the adults, for the adults are exposed and the destruction of an adult means the destruction of many larvae. These Brewer blackbirds are a great help to the farmers and growers because they destroy the adults of this insect which is one of the most important beetles in their diet. The leaf beetles are taken mostly in January and May. In January, they were 11 per cent of the food contents of the 10 stomachs examined. In May, they were 13 per cent of the food contents of the 11 stomachs examined and were found in 3 stomachs. These beetles constituted the only food contents of 1 stomach. Ground beetles are taken mostly in January, March, May and June. In January, they were 1 per cent of the food contents of 10 stomachs, being found in 4 stomachs. In March, they were 2 per cent of the food contents of the 22 stomachs examined. They were found in only 3 stomachs. In May, they made up 3 per cent of the food contents of the 11 stomachs examined, being found in 1 stomach. In June, this beetle was 16 per cent of the food contents of the 9 stomachs examined. It was found in only 4 stomachs. It was also taken in February but the percentage was low. The ground beetles are both predaceous and vegetable feeders. Economically they are not so important to deal with, because the vegetarians are quite balanced by the predaceous ones. The carrion beetles were mostly taken in February, May, and June. In May, this group made up 23 per cent of the food contents of the 21 stomachs examined. It was in this month that it was taken most often. In June, it was 6 per cent of the food contents of the 9 stomachs examined. It was found in 1 stomach, in which it was the only food contained. These beetles are not important economically, for some of them feed on dead vegetable matter. The vegetarians are not a great menace to the crops and they are not important.

The other beetles taken were the darkling beetles, rove beetles and others but their numbers are so small that they do not have a great effect economically.

#### Orthoptera—Locusts, Grasshoppers, Crickets

Locusts were 1 per cent of the food contents of the 125 stomachs examined. Locusts were taken mostly in March, July, August, September, October and November. In March they were about one-half per cent of the food contents of the 22 stomachs examined. In July they were 73 per cent of the food contents of the 2 stomachs examined. They were found in 2 stomachs (see table 3) and comprised 73 per cent of the food contents. They were taken most often in this month. In August, this group was 15 per cent of the food contents of 2 stomachs. It was the sole food content of 1 stomach. In September, it was about 1 per cent of the food contents of 12 stomachs. In October, it was 13 per cent of the food contents of the 2 stomachs. In November, it was 1 per cent of the food contents of 9 stomachs.

Locusts are taken almost every month. Locusts are destructive to plants on account of their feeding habits. They are great eaters and they eat every leaf that they come to. These birds then may be a great help to the farmers whose crops are sometimes the victims of these voracious plant feeders.

#### Lepidoptera—Moths and Butterflies

Caterpillars were the ones mostly taken. They were 1 per cent of the food contents of the 125 stomachs. They were taken mostly in January, February, March, April and May. In January they were 1 per cent of the food contents of the 10 stomachs. In February this group was 6 per cent of the food contents of the 20 stomachs; in March, it was 1 per cent of the food contents of the 22 stomachs; in April, it was about 1 per cent of the food contents of the 27 stomachs. It was in May that it was taken the most, for it is the time of the year that caterpillars are abundant. Caterpillars are foliage feeders. They are such great feeders that they can easily defoliate a big tree, of course depending upon the number present. Brewer blackbirds are a great help to the farmers and growers by destroying these destructive larvae.

#### Hymenoptera

In the order Hymenoptera, the ants, family Formicidae, were the ones mostly taken. They comprised 18 per cent of the whole food contents of the 125 stomachs. These insects live in colonies in such great numbers that no matter how much is taken their number seems not to be reduced. Economically these insects are not so important except from the public health point of view. But these ants taken were not house invaders, so we are not affected by them. They were taken mostly in February, March, April and September. In February, they were taken the most, for they were 44 per cent of the food contents of the 20 stomachs examined. In March, the group was 35 per cent of the food contents of 22 stomachs, and in April, it was 27 per cent of the food contents of the 21 stomachs.

**Miscellaneous Insects**

Diptera, mostly larvae, were taken. They were 1 per cent of the food contents of the 125 stomachs examined. The larvae taken were the ones found in manure.

Hemiptera were not important as food for these birds. Only 1 hemipterous insect, family Scutelleridae, was taken and it was taken in March.

**Chilopoda and Arachnida**

Only one centipede and 1 spider were taken. The former was taken in February and the latter was taken in June.

**Vegetable Food**

Vegetable food was 62 per cent of the food contents of the 125 stomachs examined. The monthly percentages of the vegetable food were: January, 51; February, 39; March, 45; April, 91; May, 30; June, 0; July, 19; August, 84; September, 89; October, 56; November, 95; December, 97. (See table 1.)

**Cereals****Wheat Grains**

Among the vegetable food, grains of wheat ranked the highest. It was 30 per cent of the food found in the 125 stomachs examined. In January, it was 26 per cent of the food contents of the 10 stomachs examined. Only 1 of these 10 stomachs did not contain grains of wheat (see table 4). The highest percentage of grains of wheat in a stomach was 84. In February, it was 27 per cent of the food contents of the 20 stomachs. It was found in 14 stomachs. In March, it was 29 per cent of the food contents of the 22 stomachs. It was found in 12 stomachs and the highest percentage in a stomach was 100. In April, it was 16 per cent of the food contents of the 21 stomachs. It was found in 14 stomachs and the highest percentage in a stomach was 20. In May, it was 7 per cent of the food contents of the 11 stomachs. It was found in five stomachs and the highest percentage in one stomach was 85. In June no vegetable food was found in 9 stomachs. In July, practically no vegetable food was found. In August it was 84 per cent of the food found in 2 stomachs. Only 1 of the stomachs contained it and it was the only vegetable food. In September, it was 56 per cent of the food contents of the 12 stomachs. It was found in 9 stomachs, and the highest percentage in a stomach was 94. In October it was 39 per cent of the food found in the 2 stomachs. It was found in both of them. In November, it was 82 per cent of the food found in 9 stomachs. It was found in 6 stomachs and 1 stomach contained only wheat grains as the food contents. In December, it was 72 per cent of the food contents of the 5 stomachs. Only 1 stomach did not contain it, and another stomach did not contain any vegetable food except grains of wheat.

In winter months the percentages of wheat grains taken were high, due to the fact that the insects were then hibernating. Although the percentages were high these grains were considered waste grains and economically they were of no importance. In February and March the percentages of wheat grains taken in northern California were 27 and 29 respectively. Planting of cereals takes place in these

months. Taking for granted that these grains were the sown seeds uncovered, the damage the birds did was not great because the percentages were not high. During harvest season, which takes place in June and July, the percentages were very low due to the fact that insects were abundant at this time, especially the June beetles. This shows that these birds are more insectivorous in habit than vegetarian. In August the percentage was high but these grains were considered waste grains, for harvest was already finished.

#### Barley and Oat Grains

Barley grain was taken only in the months of March and April. In March it was 2 per cent of the food contents of 22 stomachs. In April it was only 1 per cent of the food contents of 21 stomachs.

Oat grain was taken only in April and May. In April it was about 1 per cent of the food contents of 21 stomachs. In May it was 2 per cent of the food contents of 11 stomachs.

Both of these cereals were taken in such a very small percentage that economically they are not important.

#### Miscellaneous Vegetable Food

In the 125 stomachs 19 per cent of the food contents was red-stem filaree (*Erodium cicutarium*). It was taken in January, February, March, April, September and October. It was mostly taken in April and September, when it was 73 and 31 per cent, respectively, of the food contents of the 21 and 12 stomachs. Rough pigweed (*Amaranthus retroflexus*) was 3 per cent and was taken in January, February, and March. Common knotweed (*Polygonum lapathifolium*) was about 3 per cent and taken in January, February, March, November and December. Common chickweed (*Stellaria media*) was 2 per cent and taken in February and November. Water grass (*Echinochloa crus-galli*) was taken in January and September. The percentage was so small as not to be significant.

#### Group II

##### Animal Food

In the yearly food contents of the 90 stomachs of the Brewer blackbirds examined, 12 per cent was animal food, consisting almost wholly of insects. The monthly percentages of insect food were: January, 14; February, 11; March, 22; April, 14; May, 35; June, 100; July, 100; September, 1; November, 0; December, 19. (See table 1).

No stomachs taken in August and October were examined.

##### Coleoptera—Beetles

Out of the 12 per cent insect food, 6 per cent was Coleoptera beetles). These beetles belonged to many different families and the most important families were: leaf beetle family (Chrysomelidae), weevil family (Curculionidae), June beetle family (Scarabaeidae), rove beetle family (Staphylinidae), carrion beetle family (Silphidae), darkling ground beetle family (Tenebrionidae), ground beetle family (Carabidae).

The leaf beetle family was taken more often than other kinds of beetles. It was taken in January, February, March, April, July and December. It was taken mostly in January and March. In January

it was 19 per cent of the food contents in the 19 stomachs examined. It was found in 3 stomachs (see table 3) and the highest percentage in a stomach was 69. In February it was 1 per cent of the food contents in 9 stomachs. In March it was 1 per cent of the food contents of 18 stomachs. In April it was 8 per cent of the food contents of 12 stomachs. In July it was 2 per cent of the food contents of 7 stomachs. In December it was 8 per cent of the food contents of 6 stomachs.

A leaf beetle is a destructive insect to plants. Birds destroying this insect may be a help to the farmers and growers.

The weevil group was taken mostly in January, February, and March. In January it was 3 per cent of the food contents of the 19 stomachs examined. It was found in 3 stomachs and the highest percentage in a stomach was 35. In February it was 1 per cent of the food contents of 9 stomachs. In March it was 1 per cent of the food contents of 18 stomachs. It was found in 3 stomachs and the food content of 1 stomach was solely weevil.

A weevil is a destructive insect, and birds destroying it may be doing a great help to the farmers and growers.

The June beetle family was taken mostly in April and July. In April it was 10 per cent of the food contents of 12 stomachs. In July it was 2 per cent of the contents of 7 stomachs. Both the adults and larvae of this family are destructive to plants and it is always desirable that they be killed.

The darkling ground beetle family was taken mostly in January, February, March, April, May, July and September. It was the most widely taken among the beetles. The highest percentages were taken in May and July. In May it was 5 per cent of the food contents of the 3 stomachs examined, and it was 4 per cent of the food contents of the 7 stomachs in July. The members of the darkling ground beetle family are both predacious and vegetarian.

The click beetle family was taken in February, March, April and May. It was mostly taken in March and in May. In March it was 1 per cent of the food contents of the 18 stomachs examined. In May it was 2 per cent of the food contents of 3 stomachs. This family of beetle is destructive and it is always advisable that they be destroyed.

The other families of beetle—rove beetle (*Staphylinidae*), carrion beetle (*Silphidae*), ground beetle (*Carabidae*)—taken were both predacious and vegetarian. In some cases predacious ones are beneficial, but in some cases they are destructive because they feed on other predacious insects that feed on destructive insects. Others, which are vegetarian, are destructive to our crops. As a food of these Brewer blackbirds, their percentages are so small that economically, in either direction, they are not important.

#### Lepidoptera—Caterpillars

Caterpillars made up 6 per cent of the yearly food contents of the 90 stomachs of Brewer blackbirds examined. They were taken mostly in January, February, March, and June. Highest percentages were taken in February, March and June. In February, the group was 2 per cent of the food contents of 9 stomachs. In March, it was 2 per cent of the food contents of 18 stomachs. In June, it was 66 per cent of the food contents of the only stomach examined.

### **Orthoptera—Locusts, Crickets, Grasshoppers**

The locust group was 1 per cent of the yearly food contents of the 90 stomachs examined. It was taken mostly in March, May, and July. In March, it was 2 per cent of the food contents of the 18 stomachs examined. In May, it was 5 per cent of the food contents of the 3 stomachs examined. In July, it was 41 per cent of the food contents of the 7 stomachs.

Crickets were taken in January and March. In January, they were 4 per cent of the food contents of the 19 stomachs examined. In March, they made up less than 1 per cent of the contents of 9 stomachs.

### **Homoptera—Aphids and Leafhoppers**

In March, aphids were 3 per cent of the food contents of the 18 stomachs examined. In April, leafhoppers were 1 per cent of the food contents of the 12 stomachs examined. These two insects are destructive to plants, especially to crops. Their destruction helps the farmers and growers.

### **Miscellaneous Insect Food**

Diptera were taken in January and March. They were taken mostly in March, for the percentage of the food contents of the 18 stomachs examined was 7. Hemiptera were taken in February, March and July—most of them belonging to the family Miridae. It was mostly taken in July, for it was 14 per cent of the food contents of the 7 stomachs examined. Among the Hymenoptera, the family Formicidae was taken the most. It was taken in February, March and December. It was taken most often in December, when it was 15 per cent of the food contents of the 6 stomachs examined.

### **Chilopoda and Arachnida**

Chilopods were taken in March, although only 3 in number.

Arachnids were taken in February, March and April. Only 1 arachnid was taken in each month.

### **Vegetable Food**

In the yearly food (average of ten months) of the 90 stomachs examined, 68 per cent was vegetable food. The monthly percentages of vegetable food were: January, 86; February, 89; March, 78; April, 86; May, 65; June, 0; July, 0; September, 99; November, 100; December, 81. No stomachs were examined for August and October. (See table 1.)

#### **CEREALS**

##### **Wheat**

Of the 68 per cent vegetable food, 20 per cent was wheat grain. Wheat grains were taken in the months of January, February, March, April, November, and December. They were taken thus mostly in the winter months. In January, wheat grain was 63 per cent of the food contents of the 19 stomachs examined. It was found in 18 stomachs (see table 4) and the highest percentage in a stomach was 100. In February, it was 52 per cent of the food contents of the 9 stomachs. The highest percentage in a stomach was 96. In March, it was 8 per cent of the food contents of the 18 stomachs. It was found in 4 stomachs, and the highest percentage in a stomach was 100. In April,

it was 9 per cent of the food contents of the 12 stomachs. It was found in 2 stomachs and the highest percentage in a stomach was 93. In November, it was 16 per cent of the food contents of the 8 stomachs examined. It was found in 4 stomachs, and the highest percentage in a stomach was 95. In December, it was 51 per cent of the food content of the 6 stomachs examined. It was found in all 6 stomachs and the highest percentage in a stomach was 100.

#### Oat Grain

Oat grain was taken in February, April and September. In February, it was 2 per cent of the food contents of the 9 stomachs examined. In April, it was 14 per cent of the food contents of the 12 stomachs examined. In September, it was taken most often. It was 30 per cent of the food contents of the 7 stomachs examined. It was found in 4 stomachs and the highest percentage in a stomach was 95.

#### Sorghum Grain

*Sorghum halepensis* was taken in January and March. The percentages were so small that they are of no importance at all.

Cereals were taken mostly when there were no insects. In June and July, the harvest time for wheat and oats, none of these cereals was taken, because at these times insects were abundant, showing that these birds are more insectivorous than vegetarian. Most of the cereals taken in November, December, January, and February were taken near barns and stables and some from the newly sown seeds uncovered. Such being the case, these birds during planting seasons are not destructive, and the destruction they do is small in comparison with the benefit they give during the rest of the year.

The percentage of oat grain taken was so small that it has no economic bearing.

#### Miscellaneous Vegetable Food

In the 90 stomachs examined, 29 per cent of the food contents was red-stem filaree (*Erodium cicutarium*). It was taken mostly in January, February, March, April, May, September, and November. *Amaranthus blitoides* was 4 per cent; common knotweed, 3 per cent; *Panicum*, 23 per cent; rough pigweed, 1 per cent; *Amsinckia*, 1 per cent. Most of these were taken in the months when insects were few.

Seeds of berries of the genus *Ribes* were taken in May and September. They were so few that economically they are of no importance.

### Group III

#### Animal Food

In the yearly food contents of the 70 stomachs of Brewer blackbirds examined, 9 per cent was animal food, all insects. The monthly percentages of the insect food were: January, 2.4; February, 0.9; April, 75; May, 74; June, 83; October, 20; November, 8; December, 0. No stomachs were examined in March, July, August and September. (See table 1.)

#### Coleoptera—Beetles

Out of the 9 per cent insect food, 3 per cent was Coleoptera (beetles). These beetles belonged to several different families and the most important families were: leaf beetle family (Chrysomelidae),

ground beetle family (Carabidae), darkling ground beetle family (Tenebrionidae), rove beetle family (Staphylinidae), weevil family (Curculionidae), June beetle family (Scarabaeidae).

In the yearly food contents of the 70 stomachs examined, every family of beetle was less than 1 per cent. Most of the beetles taken belonged to the leaf beetle family and they were taken in January, May, October and November and the number of items taken were three, ten, two and two, respectively. The second in number was the ground beetle family. They were taken in January, April, May and June. The number of items in each month was: January, 1; April, 2; May, 7; June, 1. The third was the darkling ground beetle family. They were taken in February, April, May, June and October and the numbers of items taken in each month were one, six, one, two and three. The fourth was the rove beetle family. They were taken in April and May. The fifth was the weevil family. They were taken in February, April, May and November and the numbers of items taken in each month were one, three, one and two, respectively. The sixth was the June beetle family. They were taken in January, April and December, and the number of items taken in each month was two, two and three respectively. The number of stomachs examined in each month was: January, 13; February, 12; April, 4; May, 3; June, 4; October, 12; November, 11; December, 11. In spite of the fact that the numbers of stomachs examined in April, May, and June were few, more insects than seeds were taken. This is due to the abundance of insects in these months.

#### Miscellaneous Insect Food

Diptera were taken in January, April, June and November. They were taken mostly in June and November and the numbers of items taken were 31 and 29 respectively.

Hymenoptera were taken in January, October, and November. Most of them belong to the ant family (Formicidae). In January 2 Hymenoptera were taken; in October, 37; in November, 3.

Orthoptera were taken in June and October. In June, 6 locusts (Locustidae) and 2 crickets (Gryllidae) were taken. In October, only 1 locust (Locustidae) was taken.

#### Vegetable Food

Vegetable food was 91 per cent of the food contents of the 70 stomachs of Brewer blackbird examined. The monthly percentages were: January, 97.6; February, 99.1; April, 25; May, 26; June, 17; October, 80; November, 92; December, 100. (See table 1.)

#### Cereals

##### Wheat and Oats

Among the vegetable food items, wheat grain ranked the highest. It was 26 per cent of the food contents of the 70 stomachs examined. In January it was 32 per cent of the food contents of the 13 stomachs examined. It was found in 10 stomachs (see table 4), and the highest percentage in a stomach was 100. In February, it was 59 per cent of the food contents of the 12 stomachs. It was found in all the 12 stomachs and the highest percentage in a stomach was 100. In April,

it was 25 per cent of the food contents of the 4 stomachs. In June, it was 12 per cent of the food contents of the 4 stomachs. In October, it was 59 per cent of the food contents of the 12 stomachs. In November, it was 12 per cent of the food contents of the 11 stomachs. In December, it was 2 per cent of the food contents of the 11 stomachs.

The highest percentages of wheat grain were taken in February just after planting and in September just before planting. These grains then were probably waste grains. The grains of wheat taken during planting were few and the chances are that these grains were taken, near stables and barns. Only 6 grains of wheat were taken in June—the harvest month.

Oat grain was taken in May, just before harvest. It was 36 per cent of food contents of the 3 stomachs examined.

#### Sorghum

Sorghum was taken in January, June, October, November and December. It was 2 per cent of the food contents of the 70 stomachs examined. Most of these grains were the wild corn (*Sorghum halepensis*). The highest percentage was taken in October. It was 15 per cent of the food contents of the 12 stomachs examined. Although it was taken during harvest time the percentage was small so that the destruction probably would not be felt.

#### *Hordeum*—Wild Barley

*Hordeum* was taken in January, October, November and December. It was taken mostly in December and January. In December, it was 21 per cent of the food contents of the 11 stomachs examined. In January, it was 10 per cent of the food contents of the 13 stomachs examined. For the rest, the percentages were very low.

#### Miscellaneous Vegetable Food

*Amaranthus blitoides* made up 5 per cent of the food found in the 70 stomachs examined. It was taken only in November. Knotweed (*Polygonum*) was 11 per cent, and was taken in January, February, October, November and December. Red-stem filaree (*Erodium cicutarium*) was 1 per cent and was taken in January, February, June, October and November. *Phalaris* was 1 per cent and taken in January, February and November. Rough pigweed was 1 per cent and taken in January, February and December. Foxtail grass, *Amsinckia* and *Ribes* were so few that economically they are of no importance.

### FOOD HABITS OF THE RED-WINGED BLACKBIRDS

#### Group I

##### Animal Food

In the yearly food contents of the 109 stomachs of red-winged blackbirds examined, 13 per cent consisted of animal food and all of these animals were insects. The monthly percentages of insect food were: January, 15; February, 2; March, 13; April, 25; May, 11; June, 16; July, 100; August, 25; September, 8; October, 11; November, 6; December, 1.

**Coleoptera—Beetles**

Out of the 13 per cent insect food, 8 per cent was Coleoptera—beetles. These beetles belong to different families and the most important families were: weevil family (*Curculionidae*), rove beetle family (*Staphylinidae*), darkling ground beetle family (*Tenebrionidae*), ground beetle family (*Carabidae*), click beetle family (*Elateridae*), and leaf beetle family (*Chrysomelidae*).

The weevil group was taken the most and it was 2 per cent of the food contents of the 109 stomachs. It was taken mostly in March, May and June. In March, it was 4 per cent of the food contents of ten stomachs examined. It was found in eight stomachs (see table 5), and the highest percentage in a stomach was 50. In May, it was 3 per cent of the food contents of 20 stomachs. It was found in four stomachs and the highest percentage in a stomach was 76. It was taken the most often in June, when it was 8 per cent of the food contents of 23 stomachs. It was found in 13 stomachs and the highest percentage in a stomach was 50. The percentages of those taken in August, September and November were so low as not to be worth considering.

The rove beetle family was 1 per cent of the food contents of the 109 stomachs. It was taken mostly in April, June and August. In April, it was 6 per cent of the food contents of the 15 stomachs. In June, it was 2 per cent of the food contents of 23 stomachs. In August, it was 2 per cent of the food contents of ten stomachs.

Darkling ground beetle family was taken mostly in April and June. In April, it was 3 per cent of the food contents of the 15 stomachs. In June, it was 2 per cent of the food contents of the 23 stomachs. Economically this family of beetles is not important.

Ground beetle family was mostly taken in April, May and August. In April, it was 4 per cent of the food contents of the 15 stomachs. In May, it was 1 per cent of the food contents of the 20 stomachs. In August, it was 2 per cent of the food contents of the ten stomachs. Having the same status as the darkling ground beetle family, this family is not important.

Click beetles were taken mostly in January. This group was 2 per cent of the food contents of the four stomachs. These beetles are destructive.

Leaf beetles were taken mostly in October. They were 1 per cent of the food contents of the 15 stomachs. This kind of beetle is destructive.

**Lepidoptera—Caterpillars**

Caterpillars were 1.6 per cent of the yearly food contents of the 109 stomachs. They were taken mostly in January, April, May, June and October. In January, they were 9 per cent of the food contents of the four stomachs examined. In April, they were 5 per cent of the food contents of the 15 stomachs. In May, they were 3 per cent of the food contents of the 20 stomachs. In June, they were 2 per cent of the food contents of the 23 stomachs. In November, they were 4 per cent of the food contents of the 11 stomachs. These insects are destructive insects due to their feeding habits (vegetarian) and their elimination locally is desirable.

**Orthoptera—Locusts, Crickets, and Cockroaches**

The locust group was taken in June, July, and August. It was taken mostly in July and August. In July, it was 100 per cent of the food contents of the only stomach examined. In August, it was 18 per cent of the food contents of the 10 stomachs. It was found in 7 stomachs and the highest percentage in a stomach was 60.

Only 1 cricket was taken, and it was taken in December.

Only 1 cockroach was taken, and it was taken in January.

**Miscellaneous Insect Food**

Diptera were taken in March, April, May and June. They were taken mostly in April, when they were 3 per cent of the food contents of the 15 stomachs examined.

Hemiptera were taken in April, May, June, and October. This order was taken mostly in April and June, when the percentages were about 1 per cent of the food contents of the 15 and 23 stomachs, respectively.

Only 2 Homoptera (family Jassidae) were taken in March.

In Hymenoptera, only insects belonging to the family Formicidae were taken. They were taken in March, May, August, September, and October, but most were taken in September, when they were 7 per cent of the food contents of the 9 stomachs examined.

**Arachnida**

Only 3 Arachnida were taken. Two were taken in April and one in May.

**Vegetable Food**

Vegetable food was 87 per cent of the yearly food contents of the 109 stomachs of the red winged blackbirds examined. The monthly percentages of the vegetable food were: January, 85; February, 98; March, 87; April, 75; May, 89; June, 84; July, 0; August, 75; September, 92; October, 89; November, 94; December, 99.

These birds are vegetarians. Not less than three-fourths of the monthly food contents of the stomachs was vegetable food. In July no vegetable food was taken. It is not wise to conclude that in July, then, birds do not take vegetable food, for only 1 stomach was examined and it happened that the only food it contained was locust.

**Cereals****Wheat and Oat Grains**

Among the vegetable foods taken wheat grain was the highest in percentage. It was 17 per cent of the yearly food contents of the 109 stomachs examined. It was taken in every month except July, in which its presence is doubtful. In January, it was 46 per cent of the contents of 4 stomachs. It was found in 2 stomachs (see table 6) and it was 77 per cent of the food contents of 1 stomach. In February it was found in 1 of the 2 stomachs examined. It was 98 per cent of the food contents of that stomach. In April, it was 4 per cent of the food contents of the 15 stomachs. It was found only in 1 stomach and it was 90 per cent of the food contents of that stomach. In May, it was 3 per cent of the food contents of the 20 stomachs. It was found in 3 stomachs and it was the only vegetable food in 1

stomach. In June, it was 13 per cent of the food contents of the 23 stomachs. It was found in 8 stomachs and its highest percentage in a stomach was 89. In August, it was 66 per cent of the food contents of the 10 stomachs. It was found in 7 stomachs and its highest percentage in a stomach was 88. In September, it was 27 per cent of the food contents of the 9 stomachs and in 1 stomach there was no vegetable food except grains of wheat. In October, it was 27 per cent of the food contents of the 11 stomachs. It was found in 7 stomachs and in 1 stomach it was the sole vegetable food. In November, 2 of the 3 stomachs examined contained only grains of wheat. In December, the only stomach examined contained 33 per cent grains of wheat.

Oat grain was taken only in March. It was found in 1 stomach. Its highest percentage in a stomach was 78, and it was 3 per cent of the food contents of the 10 stomachs.

In northern California, north of the Sacramento Valley, these birds are quite destructive to the cereals. In this part of the State wheat grains are planted in spring and fall and these birds are apt to get the uncovered grains.

#### Sorghum Grain

Most of the grain of sorghum taken was of the wild one—Johnson grass (*Sorghum halepensis*). It was taken mostly in January, November and December. It was 9 per cent of the yearly food contents of the 109 stomachs. It was taken mostly in December, when it was 65 per cent of the food contents of the 1 stomach examined.

#### Miscellaneous Vegetable Food

*Amaranthus blitoides* was 4 per cent of the yearly food contents of the 109 stomachs. It was taken in April and June. Rough pigweed (*Amaranthus retroflexus*) was 2 per cent of the yearly food of the 109 stomachs. It was taken in February and March. Common chickweed (*Stellaria media*) was 11 per cent of the yearly food contents of the 109 stomachs. It was taken in April, May, and June. Red-stem filaree (*Erodium cicutarium*) was 8 per cent of the yearly food contents of the 109 stomachs. It was taken in March, April, May, June, August, September, and October. It was mostly taken in May. Water grass (*Echinochloa crusgalli*) was 8 per cent of the yearly food contents of the 109 stomachs. It was taken in January, September and October. It was taken mostly in September. *Lupinus* was taken in March and September. It was 8 per cent of the yearly food contents of the 109 stomachs. *Montia* was 2 per cent. It was taken in May and June. *Datisca glomerata* was taken in May. *Polygonum* was taken in January, April, May, August, September, October and December. It was widely taken but the percentages were very low. *Amsinckia* was taken only in June.

#### Group II

##### Animal Food

Animal food was 30 per cent of the yearly food contents of the 80 stomachs of red-winged blackbirds examined. Out of 30 per cent animal matter, 29 per cent was insect food. The monthly percentages of insect food were: January, 9; February, 25; March, 37; April,

19; May, 59; June, 86; July, 96; August, 39; October, 2; November, 12; December, 0. No stomach taken in September was examined.

#### Coleoptera—Beetles

Coleoptera made up 20 per cent of the yearly food contents of the 80 stomachs examined, showing that beetles dominated in the insect food. The chief families of beetles taken were: hister beetle (*Histeridae*), rove beetle (*Staphylinidae*), leaf beetle (*Chrysomelidae*), weevil (*Curculionidae*), ground beetle (*Carabidae*), June beetle (*Scarabaeidae*), darkling ground beetle (*Tenebrionidae*).

The rove beetle family was the highest in percentage among all the families of beetles taken. It was 2 per cent of the yearly food of the 80 stomachs. It was taken in February and mostly in August, where it was 4.6 per cent of the food contents of the 12 stomachs examined. Economically this family is not important.

The family *Histeridae* was the second in rank. It was taken only in August, when it was 3 per cent of the food contents of the 12 stomachs examined. This family of beetles is not important economically.

The leaf beetle family was the most widely taken. It was 1 per cent of the yearly food of the 80 stomachs. It was taken in February, April, May, June, August, and November. In February, it was 16 per cent of the food contents of the 7 stomachs examined. In April, it was 1 per cent of the food contents of the 6 stomachs. In June, it was 14 per cent of the food contents of the 2 stomachs. In August, it was less than 1 per cent of the food contents of the 12 stomachs. In November, it was 6 per cent of the food contents of the 4 stomachs. They are destructive beetles and their elimination is desirable.

Weevils were taken in April, May, and August. In August, they were less than 1 per cent of the food contents of the 12 stomachs. In April, they were 4 per cent of the food contents of 6 stomachs. In May, they were 8 per cent of the food contents of the 16 stomachs. They were found in 4 stomachs and its highest percentage in a stomach was 50. Weevils are destructive beetles and their elimination is highly desirable.

Ground beetle family was taken in January, April and May. It was taken mostly in April and May when they were 4 and 6 per cent of the food contents of the 6 and 16 stomachs, respectively. Economically these beetles are not important.

The darkling beetle group was taken in January, February, June, and November. Only a few were taken. Carrion beetles were taken in March, April, May, and July. Only small numbers were taken. Only 2 click beetles were taken—1 in April and 1 in October. Only 2 metallic wood borers were taken and they were taken in February.

#### Lepidoptera—Caterpillars

Caterpillars were 2.4 per cent of the food contents of the 80 stomachs. This group was taken in March, May, October, and November. It was taken mostly in March and May when it was 11 and 26 per cent of the food contents of the 2 and 16 stomachs, respectively. Caterpillars are not desirable, being destructive insects.

### Orthoptera—Locusts and Crickets

Locusts were 4 per cent of the yearly food contents of 80 stomachs. They were taken mostly in January, March, May and July. In January, they were 3 per cent of the food contents of the 11 stomachs. In March, they were 5 per cent of the food contents of the 2 stomachs. In May, they were 6 per cent of the food contents of 16 stomachs. They were taken most often in July. They were 93 per cent of the food contents of 4 stomachs. They were found in 3 of the 4 stomachs and the highest percentage in a stomach was 100.

Crickets were taken in January, April, May, and June. They were .6 per cent of the yearly food contents of the 80 stomachs.

Both of these families of insects are destructive. Their elimination is also desirable.

### Homoptera

Aphids were taken in May, comprising 25 per cent of the food contents of the 16 stomachs. They were 2 per cent of the yearly food contents of the 80 stomachs. Aphids are destructive insects and their elimination is highly desirable.

### Miscellaneous Insect Food

Diptera were taken in May and mostly in August, being 2 per cent of the yearly food contents of the 80 stomachs.

Only 5 Hemiptera were taken, 4 in May and 1 in August.

### Chilopoda and Arachnida

Only 4 Chilopoda were taken in April. They belonged to the family Geophilidae. Only 1 arachnid was taken in January.

### Vegetable Food

Vegetable food was 70 per cent of the yearly food contents of the 80 stomachs. The monthly percentages of vegetable food were: January, 91; February, 75; March, 63; April, 81; May, 42; June, 14; July, 4; August, 61; October, 98; November, 88; December, 100. (See table 2.)

#### Cereals

##### Wheat Grain

Out of the 70 per cent of yearly vegetable food of the 80 stomachs, 13 per cent was wheat grain and 4 per cent was oat grain.

Wheat grain was taken in January, February, April, May, June, August, October and November. In January, it was 16 per cent of the food contents of the 11 stomachs. It was found in 4 (see table 6), and the highest percentage in a stomach was 97. In February, it was 28 per cent of the food content of the 7 stomachs. It was found in 3 stomachs and the highest percentage in a stomach was 87. In April, it was 10 per cent of the food contents of the 6 stomachs. It was found only in 1 stomach and the percentage in that stomach was 77. In May, it was 26 per cent of the food contents of the 16 stomachs. It was found in 3 stomachs and the highest percentage in a stomach was 90. In June, it was 14 per cent of the food contents of the 2 stomachs. In October, it was 22 per cent of the food contents of 8 stomachs. It was found in 2 stomachs and 1 stomach contained

only wheat grain as vegetable food. In December, it was 63 per cent of the food contents of the 8 stomachs. It was found in 2 stomachs and 1 stomach contained only wheat grain as food.

#### Oat Grain

Oat grain taken was 4 per cent of the yearly food contents of the 80 stomachs. It was taken in January, March, April, and May. In January, it was 30 per cent of the food contents of the 11 stomachs examined. It was found in 1 stomach, and the percentage in that stomach was 70. In March, it was 70 per cent of the food contents of 2 stomachs and it was 100 per cent in 1 of the stomachs. In April and May, it was 1 and 5 per cent of the food contents of 6 and 16 stomachs, respectively.

#### Rice Grain

Rice grain was 6 per cent of the yearly food contents of the 80 stomachs. It was taken in August and November. In August, it was 11 per cent of the food contents of the 12 stomachs examined. It was found in 5 stomachs and the highest percentage in a stomach was 84. In November, it was 59 per cent of the food contents of the 4 stomachs. It was found in 2 stomachs and in one of these it was 100 per cent.

Planting of wheat is done in the months of November to February and harvest takes place in June to July. In the planting season the grains of wheat taken by these birds are high in percentages and if these grains are taken from the sown fields, for these birds are apt to get the uncovered grains, then these birds at this time of the year are destructive. At harvest season more insects are taken than grains of wheat, showing that they prefer insects when available to grain. At this time of the year the birds are beneficial.

Planting and harvesting season for oats is much the same as for wheat. To oats the birds are also destructive.

Planting of rice grain is done in April to May, and harvesting is done from October to December. The grains of rice taken in August are considered waste grains, but those taken in December, which are high in percentage (for the sole food found in 1 stomach was grains of rice) are considered valuable. If these grains were taken in the field, then red-winged blackbirds are destructive to rice crops at this time of the year.

#### Miscellaneous Vegetable Food

Water grass (*Echinochloa crusgalli*) was taken the most often. It was 16 per cent of the food contents of the 80 stomachs examined. It was taken in August and October, but mostly in August, when it was 12 per cent of the food contents of the 12 stomachs.

Knotweed (*Polygonum*) was 9 per cent of the yearly food contents of the 80 stomachs. It was taken in January, May, July, August, October, November and December. In November and December it was 28 and 36 per cent of the food contents of the 4 and 8 stomachs, respectively.

Panic grass (*Panicum*) was 6 per cent of the yearly food of 80 stomachs. It was taken only in October.

Red-stem filaree (*Erodium cicutarium*) was 5 per cent of the yearly food contents of the 80 stomachs. It was taken in January, April, May,

August and December. It was taken mostly in May, when it was 17 per cent of the food contents of the 16 stomachs.

Rough pigweed (*Amaranthus retroflexus*) was 4 per cent of the food contents of the 80 stomachs. It was taken in February, April, May, and August. It was taken mostly in April, when it was 72 per cent of the food contents of the 6 stomachs.

Wild barley (*Hordeum*) was taken only in August. It was 7 per cent of the food contents of the 12 stomachs.

Other plants were also taken, but their percentages are too small to be important.

### Group III

#### Animal Food

There were only 26 stomachs of red-winged blackbirds in this group. These stomachs were taken in April, May and June, and the numbers of stomachs in each month were: April, 7; May, 16; June, 3. In these 3 months, the percentage of animal food found in these 26 stomachs was 71, all insects.

#### Coleoptera—Beetles

Beetles were 30 per cent of the food contents of these 26 stomachs. The most important families of beetles taken and their percentages in the food contents of the 26 stomachs were: June beetle (Scarabaeidae), 3; weevil (Curculionidae), 13; leaf beetle (Chrysomelidae), 6; carrion beetle (Silphidae), 3; darkling ground beetle (Tenebrionidae), 3; ground beetle (Carabidae), 2.

June beetles were taken mostly in April. They were 3 per cent of the food contents of 7 stomachs. Weevils were taken mostly in April, when they were 24 per cent of the food contents of the 7 stomachs. Leaf beetles were taken mostly in May, when they were 8 per cent of the food contents of the 16 stomachs. Carrion beetles were taken mostly in April, when they were 33 per cent of the food contents of the 7 stomachs. Darkling ground beetles were taken mostly in April, when they were 5 per cent of the food contents of the 7 stomachs. Ground beetles were taken mostly in June.

#### Miscellaneous Insect Foods

Diptera made up 13 per cent of the food contents of the 26 stomachs, being taken mostly in April.

Homoptera made up 4 per cent of the food contents of the 26 stomachs. They belonged to the leafhopper family (Jassidae). They were taken only in May.

Lepidoptera were taken in June, and constituted 4 per cent of the food contents of the 26 stomachs.

The order Hymenoptera made up 21 per cent of the food contents of the 26 stomachs. It was taken in May, and was represented by the family of ants (Formicidae).

#### Vegetable Food

Vegetable food made up 29 per cent of the food contents of the 26 stomachs. Most of the vegetable matter taken was wheat and oat grain. Wheat grain was taken every month and the percentages in

each month were: April, 26 in 7 stomachs; May, 11 in 16 stomachs; June, 7 in 3 stomachs.

Oat grain was taken in April and May, and the percentages were 7 and 3, respectively.

Knotweed was also taken in May and June.

Johnson grass was taken in June and red-stem filaree was taken in May and June.

In these months these birds are beneficial, for insects are taken in greatest proportion as a part of their diet. Cereals taken in these months are considered waste grain, and economically they amount to nothing at all.

#### SUMMARY

The Brewer blackbirds in geographic group I are found to be more vegetarian than insectivorous. Insects are taken in greatest proportion from May to July (see table 1). Insect food in January is 49 per cent of the total, and it rises up to June and July when it reaches the highest percentages, then it goes down until December, when it reaches the lowest percentage, roughly speaking; for the rise and fall are not continuous.

Vegetable food is in highest percentage when insects are taken least, due to their scarcity. Insects hibernate during winter and they are not easily found by these birds. In the absence of insects, vegetable food is resorted to. In the months when insects and vegetable food, especially cereal in the harvest season, are both abundant, vegetable food is taken less, showing that these birds are primarily more insectivorous in food habits than vegetarian.

Most of the insects taken belong to the destructive families of insects from the point of view of the farmer and fruit grower. Very few of the beneficial insects are taken. The destruction of these harmful insects means a great help to farmers and growers in particular, and to consumers in general.

Cereals are the vegetable foods taken most. They are taken almost every month, whether it be harvesting or planting season. In June and July, which are the harvest months, the percentage of cereals taken, if taken at all (it happened that in group I no cereal was taken), is very low, because at this time insects abound. From November to February and August to October, the planting seasons, in this group (I), most of the vegetable matter taken is cereal. But most of this cereal is not taken from the newly planted seeds, for the birds take sown seeds uncovered, as also grain from pastures, barnyards, orchards and grain fields. Economically, this cereal is not important and it can be considered waste grain.

The rest of the vegetable food is almost all weed seeds. Bryant (1914) defines weeds as "plants out of place." These plants are not economically important, but their destruction is desirable because, if they are allowed to grow, they compete with the cultivated plants which results in the diminution of the crop's yield, in quantity as well as in quality. If weeds are not to be allowed to compete with the crops, a certain amount of energy and time is expended by the farmer toward their destruction. By the destruction of the seeds of weeds, blackbirds give appreciable help to the farmers.

Brewer blackbirds in geographic groups II and III were found to be practically the same in food habits and economic status as those of Group I. (See table 1.)

The red-winged blackbirds are found to have, as a rule, the same food habits and economic status as the Brewer blackbirds except that the red-wings in Group I get less cereal in their yearly food. The difference is not great. This difference is due, perhaps, to the fact that more stomachs of the red-winged blackbird were obtained in April and May, the breeding months, when they feed mostly on insects and when insects are more abundant. On the other hand, fewer stomachs of the other species were examined in these two months. In Group I more vegetable food was taken in all the months in spite of the fact that more stomachs were examined, showing that red-winged blackbirds are more vegetarian than the Brewer blackbirds.

The Brewer and red-winged blackbirds, in food habits, are both primarily insectivorous. But in the absence of insects they are vegetarian, and cereal is taken whenever it is available. Being gregarious birds before and after the breeding season their depredations in grain fields cannot be denied. The degree of destruction that they do depends upon the size of a flock and the size and location of the grain field. Their destruction could be easily felt, if the flock is big and the grain field is small; the reverse also is true.

#### CONCLUSION

Economically, in the widest human interests, the Brewer and red-winged blackbirds are beneficial, being more insectivorous than vegetarian in food habits. However, being gregarious birds, they can now and then inflict such great damage on crops that to give them full protection is not fair to the farmer whose crops are immediately threatened. It is wisest, then, that these birds be protected during the breeding season when they destroy many insect pests, and that farmers and growers allow them to nest on their farms. But when and where they become vegetarian and inflict real damage to crops, then their numbers should be reduced, though only to such degree that the damage done by those remaining can hardly be felt.

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We need the record of more observations of this sort in order that we may better verify the facts and more accurately fix the dates.—  
N. B. Seofield, 510 Russ Building, San Francisco, August 17, 1931.

TABLE I  
Proportions of Important Kinds of Food of the Brewer Blackbird. Showing the Percentages of All the Food for Each Month

	January	February	March	April	May	June	July	August	September	October	November	December
No. of Brewer Blackbirds	10	20	22	21	11	9	2	12	2	9	9	5
Insect food	49	61	55	9	70	100	81	11	44	5	5	3
Vegetable food	51	39	45	91	30	0	19	84	56	95	97	97
Coleoptera	29	15	17	5	62	96	8	0	2	0	1	0
Cereal	26	27	29	16	9	0	0	84	55	39	82	72

Group II

	January	February	March	April	May	June	July	August	September	October	November	December
No. of Brewer Blackbirds	19	9	18	12	3	1	7	-----	7	-----	8	6
Insect food	14	11	22	14	35	100	100	100	100	100	0	19
Vegetable food	86	89	78	86	65	0	0	0	99	100	100	81
Coleoptera	9	7	4	12	29	33	44	0	0	0	0	4
Cereal	63	54	8	23	0	0	0	0	30	30	16	51

Group III

	January	February	March	April	May	June	July	August	September	October	November	December
No. of Brewer Blackbirds	13	12	-----	-----	3	4	-----	-----	-----	12	11	11
Insect food	2.4	0.9	-----	4	74	83	-----	-----	-----	20	8	8
Vegetable food	97.6	99.1	-----	75	25	26	17	17	80	92	92	100
Coleoptera	1	0.8	-----	25	71	63	6	6	3	3	0.9	0
Cereal	32	59	-----	25	15	12	12	12	59	59	12	2

TABLE 2  
Proportion of Important Kinds of Food of the Red-Winged Blackbird. Showing the Percentages of All the Food for Each Month

## Group I

	January	February	March	April	May	June	July	August	September	October	November	December
No. Red-winged Blackbirds	4	2	10	15	20	23	1	10	9	11	3	1
Insect food	15	2	13	25	11	16	100	25	8	11	6	1
Vegetable food	85	98	87	75	89	84	0	75	92	89	94	99
Coleoptera	8	1	11	16	17	15	0	5	1	5	6	6
Cereal	46	23	3	4	3	13	0	66	27	27	27	33

## Group II

	January	February	March	April	May	June	July	August	September	October	November	December
No. Red-winged Blackbirds	11	7	2	6	16	2	4	12	8	4	4	8
Insect food	9	25	37	19	58	80	96	39	2	12	12	8
Vegetable food	91	75	63	81	42	42	4	61	98	88	0	0
Coleoptera	2	20	21	12	18	71	2	9	0.4	7	59	100
Cereal	16	7	63	11	31	14	0	11	22	22	59	63

## Group III

	January	February	March	April	May	June	July	August	September	October	November	December
No. Red-winged Blackbirds	.....	.....	.....	.....	7	16	3	.....	.....	.....	.....	.....
Insect food	.....	.....	.....	.....	65	84	55	.....	.....	.....	.....	.....
Vegetable food	.....	.....	.....	.....	35	16	65	.....	.....	.....	.....	.....
Coleoptera	.....	.....	.....	.....	42	38	12	.....	.....	.....	.....	.....
Cereal	.....	.....	.....	.....	33	14	7	.....	.....	.....	.....	.....

TABLE 3  
Shows the Number of Stomachs of Brewer Blackbirds Containing Each Kind of Animal Food, Arranged by Months and by Groups of Counties (I, II and III).

	I.	II.	III.
Coleoptera—			
Buprestidae	4	1	3
Carabidae	2	1	3
Cicindelidae <sup>2</sup>	4	1	6
Chrysomelidae	2	1	6
Coccinellidae	3	1	6
Curenchomidae	6	1	1
Cerambycidae	1	1	1
Dytiscidae	7	2	2
Elateridae	1	1	2
Histeridae	1	1	2
Hydrophilidae	1	1	3
Scarabaeidae	6	1	5
Silphidae	1	1	1
Stephoniidae	1	1	2
Tenebrionidae	1	1	1
Unidentified	1	2	3
Diptera—	4	1	1
Asilidae			
Tachinidae			
Unidentified			
Hemiptera—			
Miridae			
Scutelleridae			
Unidentified			
Homoptera—			
Aphidae			
Jassidae			
Membracidae			
Unidentified			
Hymenoptera—			
Formicidae	5	4	2
Unidentified	3	1	3
Lepidoptera (caterpillars)	1	1	3

Orthoptera—	
Blattidae .....	1
Gryllidae .....	1
Locustidae .....	1
Unidentified .....	1
Chilopoda—	
Geophilidae .....	1
Unidentified .....	1
Arachnidae .....	1
Insecta (unidentified) .....	1
Totals .....	16 28 29 13 21 16 3 1 12 4 3 2 14 13 30 12 7 2 13 2 13 9 4

TABLE 4  
Shows the Number of Stomachs of Brewer Blackbirds Containing Each Kind of Vegetable Food, Arranged by Months and by Groups of Counties (I, II and III).



TABLE 5  
Shows the Number of Stomachs of Red-winged Blackbirds Containing Each Kind of Animal Food, Arranged by Months and by Groups of Counties (I, II and III).

	I.	II.	III.
Coleoptera—			
Buprestidae			
Carabidae	3	2	1
Cicindelidae	1	1	2
Chrysomelidae			
Coeloididae			
Cyclonedidae			
Cerambycidae	8	4	13
Dytiscidae	2	1	1
Elateridae			
Histeridae			
Hydrophilidae			
Serphidae	3	1	1
Slipidae			
Staphylinidae			
Tenebrionidae	5	1	3
Unidentified	3	3	2
Diptera—			
Asilidae			
Tachinidae			
Unidentified	1	1	1
Hemiptera—			
Miridae			
Scutelleridae			
Unidentified	1	1	1
Homoptera—			
Aphidae			
Jassidae	1		
Membracidae			
Unidentified			
Hymenoptera—			
Formicidae	1	1	2
Unidentified			1
Lepidoptera (caterpillar)	1	3	1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	8010	8011	8012	8013	8014	8015	8016	8017	8018	8019	8020	8021	8022	8023	8024	8025	8026	8027	8028	8029	8030	8031	8032	8033	8034	8035	8036	8037	8038	8039	8040	8041	8042	8043	8044	8045	8046	8047	8048	8049	8050	8051	8052	8053	8054	8055	8056	8057	8058	8059	8060	8061	8062	8063	8064	8065	8066	8067	8068	8069	8070	8071	8072	8073	8074	8075	8076	8077	8078	8079	8080	8081	8082	8083	8084	8085	8086	8087	8088	8089	8090	8091	8092	8093	8094	8095	8096	8097	8098	8099	80100	80101	80102	80103	80104	80105	80106	80107	80108	80109	80110	80111	80112	80113	80114	80115	80116	80117	80118	80119	80120	80121	80122	80123	80124	80125	80126	80127	80128	80129	80130	80131	80132	80133	80134	80135	80136	80137	80138	80139	80140	80141	80142	80143	80144	80145	80146	80147	80148	80149	80150	80151	80152	80153	80154	80155	80156	80157	80158	80159	80160	80161	80162	80163	80164	80165	80166	80167	80168	80169	80170	80171	80172	80173	80174	80175	80176	80177	80178	80179	80180	80181	80182	80183	80184	80185	80186	80187	80188	80189	80190	80191	80192	80193	80194	80195	80196	80197	80198	80199	80200	80201	80202	80203	80204	80205	80206	80207	80208	80209	80210	80211	80212	80213	80214	80215	80216	80217	80218	80219	80220	80221	80222	80223	80224	80225	80226	80227	80228	80229	80230	80231	80232	80233	80234	80235	80236	80237	80238	80239	80240	80241	80242	80243	80244	80245	80246	80247	80248	80249	80250	80251	80252	80253	80254	80255	80256	80257	80258	80259	80260	80261	80262	80263	80264	80265	80266	80267	80268	80269	80270	80271	80272	80273	80274	80275	80276	80277	80278	80279	80280	80281	80282	80283	80284	80285	80286	80287	80288	80289	80290	80291	80292	80293	80294	80295	80296	80297	80298	80299	80300	80301	80302	80303	80304	80305	80306	80307	80308	80309	80310	80311	80312	80313	80314	80315	80316	80317	80318	80319	80320	80321	80322	80323	80324	80325	80326	80327	80328	80329	80330	80331	80332	80333	80334	80335	80336	80337	80338	80339	80340	80341	80342	80343	80344	80345	80346	80347	80348	80349	80350	80351	80352	80353	80354	80355	80356	80357	80358	80359	80360	80361	80362	80363	80364	80365	80366	80367	80368	80369	80370	80371	80372	80373	80374	80375	80376	80377	80378	80379	80380	80381	80382	80383	80384	80385	80386	80387	80388	80389	80390	80391	80392	80393	80394	80395	80396	80397	80398	80399	80400	80401	80402	80403	80404	80405	80406	80407	80408	80409	80410	80411	80412	80413	80414	80415	80416	80417	80418	80419	80420	80421	80422	80423	80424	80425	80426	80427	80428	80429	80430	80431	80432	80433	80434	80435	80436	80437	80438	80439	80440	80441	80442	80443	80444	80445	80446	80447	80448	80449	80450	80451	80452	80453	80454	80455	80456	80457	80458	80459	80460	80461	80462	80463	80464	80465	80466	80467	80468	80469	80470	80471	80472	80473	80474	80475	80476	80477	80478	80479	80480	80481	80482	80483	80484	80485	80486	80487	80488	80489	80490	80491	80492	80493	80494	80495	80496	80497	80498	80499	80500	80501	80502	80503	80504	80505	80506	80507	80508	80509	80510

TABLE 6  
Shows the Number of Stomachs of Red-winged Blackbirds Containing Each Kind of Vegetable Food, Arranged by Months and by Groups of Counties (I., II. and III.).

