

unfortunate if cows come near the yard for then the flocks of starlings break up after they come down.

Catching skylarks (*Alauda arvensis*) is very similar. Here we employ only one runner and one bird on the seesaw. With a home-made flute we try to imitate the skylark's callnote. If our imitation is not too poor, the migrating larks will ordinarily stop and come down. Early in spring we may have trouble with a skylark that happens to establish his territory on our yards. Other birds, however, have the same bad habit. They drive away all of their own kind and we would not catch a single bird if we left him alone. It is best to catch him as soon as he begins to fight with one of the decoy-birds.

Department of Zoology, University of Chicago, Chicago, Ill.

THE INVASION AND WING MEASUREMENTS OF THE EASTERN PURPLE FINCH AT ARDMORE, PA., DURING THE SPRING OF 1939

BY HORACE GROSKIN

THE Ardmore banding station is located in southeastern Pennsylvania, about 11 miles from the center of the City of Philadelphia. The banding record of the Ardmore station for the year 1939 is as follows: species banded 29; number of birds banded 2,189; repeats 1,670; returns 56; foreign bands 14; making total captures, or birds handled, for the year 3,929.

The largest number of any species banded during the year was the Eastern Purple Finch (*Carpodacus p. purpureus*). Of this race, 1,372 were banded during the year, and of this number 1,146 were banded between February 10th and May 15th, while more than 1,000 of these birds were banded in a six-week period between March 15th and April 30th, which was the peak of the Purple Finch invasion in this region.

The Ardmore station is adjacent to about 35 acres of deciduous woodland with a brook at its westerly edge. The banding equipment at the station consists of 12 traps as follows: a large pull-string flat trap, two modified Government sparrow traps, two Chardonneret, three false bottom types, three Potter types and one automatic tree trap. All traps are located within 100 feet of the residence, and during the winter and early spring months, the traps are moved to within a few feet of the house.

In order to attract as large a volume of birds as possible, bait is not only used freely in the traps, but food is also placed in eleven feeding devices where birds may secure food without being trapped.

Of course the traps also become free feeders when they are not in operation. The bait used consists mainly of the usual seed mixture, hemp, millet, cracked corn and sunflower seeds, as well as bread crumbs, white bread, peanuts, apples, raisins, grapes, and various berries, depending on the season of the year. Purple Finches, during the season at Ardmore, preferred sunflower seeds.

The number of Purple Finches banded at the Ardmore station does not fully represent the extent of the invasion at Ardmore and vicinity for large numbers of Purple Finches were always present at the feeders and about the station that passed through without being captured. This was due to the limited capacity of the traps and the fact that the traps could not be emptied soon enough and often enough to make possible the capture of additional birds. It was physically impossible for one working alone to handle any considerable number greater than was captured, considering the additional time required for measuring wings and other investigations in addition to banding. At least 500 additional Purple Finches might have been banded during the invasion at Ardmore had there been adequate facilities to capture the birds that were present.

Other species were also banded during this period, including 160 Northern Pine Siskins (*Spinus p. pinus*), which appeared to be associated with the Purple Finch in the spring migration.

According to the 1931 Edition of the A. O. U. Check-List, the Eastern Purple Finch does not breed in Pennsylvania, but Pennsylvania is within its winter range. The season at Ardmore, begins about the last week in October and ends about the middle of the following May. Of the 1,146 Purple Finches banded during the invasion, 450, about 39%, were adult males, and 696, or about 60% were olivaceous females and young. The largest number banded in a single day was 75 on March 25th, and the same number again on March 29th. On the former day the largest number of captures of Purple Finches was made; 75 banded and 22 repeats, making a total of 97.

During the two-week period between March 16th and March 31st, 482 birds were banded, and during the following two-week period between April 1st and April 15th, 380 birds were banded, making a total for the four weeks of 862 birds banded, or 75.22% of the entire number. If we include the following two-week period, April 16th to April 30th, making six weeks in all, 1,025 birds were banded, representing 90% of the entire 1,146 banded from February 10th to May 15th, 1939.

It is interesting to note that 450, or 39.27% of the 1,146 banded, were rosy adult males. This large percentage of rosy males is contrary to the general opinion that the ratio is one rosy to two olivaceous. The fact that 450 rosy males, or close to 40% of the total, were actually banded, may easily be misleading as to the true

ratio, if one fails to consider that they were captured during an abnormal period in an invasion which was brought about by special causes at present unknown.

It has become a matter of interest to learn what is the length of stay of migratory species at their resting or feeding stations while on their journey. Repeat data at banding stations offer information along this line. It should be borne in mind that these data present the known length of stay and not the actual time the birds remained. It is possible that many birds remained much longer than the records show, but all repeating birds stayed at least as long as the record shows they were repeating. The reason the information cannot be more exact is that it is not possible to secure these data even through the banding method of investigation. It is not possible to learn the length of time the bird was present at the station before it was captured, nor is it possible to know how long it remained after its last repeat. If it does not repeat at all after being banded, there is no way of learning whether or not it remained at the station or vicinity, and if it did remain without repeating, we cannot know the length of time it remained. Nevertheless, the data presented give a general idea of the length of stay of a large and substantial percentage of the total number of Purple Finches that were banded at the Ardmore station during the invasion.

The basis used in this study is somewhat different from the basis used by Raymond J. Middleton in his study of repeats (*Bird Banding*, 10, 1939: 145-148). Mr. Middleton used as a basis for the length of stay, the number of days that elapsed after the bird was first captured until the bird re-entered the traps, while in the present study, the length of stay is based on the number of days the bird remained from the day of banding to the last time it repeated.

TABLE I
COMPARATIVE NUMBERS OF REPEATING BIRDS

| Period | Ad.♂ | Ad.♀ and Im. | No. and % banded each period | Ad.♂ | Ad.♀ and Im. | No. and % not remaining of birds banded each period | Ad.♂ | Ad.♀ and Im. | No. and % repeating of birds banded each period |
|------------|--------------------|--------------------|------------------------------|--------------------|--------------------|---|--------------------|--------------------|---|
| Feb. 10-28 | 4 | 31 | 35 or 3.1% | 2 | 16 | 18 or 51.4% | 2 | 15 | 17 or 48.6% |
| Mar. 1-15 | 19 | 42 | 61 or 5.3% | 15 | 28 | 43 or 70.5% | 4 | 14 | 18 or 29.5% |
| Mar. 16-31 | 223 | 259 | 482 or 42.1% | 170 | 161 | 331 or 68.7% | 53 | 98 | 151 or 31.3% |
| Apr. 1-15 | 147 | 233 | 380 or 33.2% | 102 | 133 | 235 or 61.8% | 45 | 100 | 145 or 38.2% |
| Apr. 16-30 | 56 | 107 | 163 or 14.2% | 42 | 89 | 131 or 80.4% | 14 | 18 | 32 or 19.6% |
| May 1-15 | 1 | 24 | 25 or 2.2% | 1 | 20 | 21 or 84% | .. | 4 | 4 or 16% |
| | 450 or 39.3% | 696 or 60.7% | 1146 | 332 or 73.8% | 447 or 64.2% | 779 or 68% | 118 or 26.2% | 249 or 33.8% | 367 or 32% |

The data presented in Table 1 demonstrate that the peak of the invasion was between March 16th and April 30th. Of the 450 adult males banded, nearly half of them were banded in a two-week period between March 16th and March 31st. This table also shows that over two-thirds of the birds banded, or about 68%, passed through the station without repeating, and that about one-third, or 32%, repeated and remained from 1 to 68 days. Only 26% of the banded adult males repeated, while almost 36% of the banded olivaceous birds repeated.

TABLE II
PURPLE FINCHES BANDED—1146

| | |
|----------------------------------|-----------------------|
| Adult Males..... | <i>Repeats</i> 118 |
| Adult Females and Immatures..... | 249 |
| Total..... | 367 |

KNOWN LENGTH OF STAY OF REPEATS

| Period | 1 to 10 days | | 11 to 20 days | | 21 to 30 days | | 31 to 40 days | | 41 to 50 days | | 51 to 68 days | |
|------------------------|-------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-----------------|-------------------|-----------------|-----------------|----------------|-----------------|
| Feb. 10 to May 15 1939 | Total 170 | | Total 93 | | Total 54 | | Total 33 | | Total 9 | | Total 8 | |
| | Ad.♂ | Ad.♀ and Im. | Ad.♂ | Ad.♀ and Im. | Ad.♂ | Ad.♀ and Im. | Ad.♂ | Ad.♀ and Im. | Ad.♂ | Ad.♀ and Im. | Ad.♂ | Ad.♀ and Im. |
| Feb. 10-28 | 1 | .. | 1 | 3 | .. | 1 | .. | .. | .. | 3 | .. | 8 |
| Mar. 1-15 | 1 | 1 | 2 | 3 | .. | 2 | 1 | 6 | .. | 2 | .. | .. |
| Mar. 16-31 | 18 | 22 | 16 | 28 | 14 | 26 | 4 | 19 | 1 | 3 | .. | .. |
| Apr. 1-15 | 36 | 58 | 5 | 32 | 4 | 7 | .. | 3 | .. | .. | .. | .. |
| Apr. 16-30 | 14 | 15 | .. | 3 | .. | .. | .. | .. | .. | .. | .. | .. |
| May 1-15 | .. | 4 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | 70 or 59.3% | 100 or 40.2% | 24 or 20.3% | 69 or 27.7% | 18 or 15.3% | 36 or 14.5% | 5 or 4.2% | 28 or 11.2% | 1 or 0.9% | 8 or 3.2% | .. or .. | 8 or 3.2% |

Table 2 shows in detail the known length of stay of repeating birds. It will be noted that repeating adult males did not remain longer than 30 days, while olivaceous birds stayed up to 68 days. Comparatively few birds repeated after the 15th of April, only 36, or about 10% of the 367 repeating birds.

It is apparent from the length of stay of these repeats that Purple Finches during the 1939 spring migration, in the region of the Ardmore station, were moving north rapidly to their breeding territory. Sixty-eight percent of the entire 1,146 banded passed through the station without repeating. Adding the 170 birds that repeated and

stayed only from one to ten days, it appears that 82.80% of all the birds banded were gone by the end of ten days. Rosy males moved more rapidly than olivaceous birds—89.33% of the 450 rosy males were gone by the end of ten days, while only 78.59% of the 696 olivaceous birds were gone within ten days after banding.

The Ardmore station is no doubt along one of the routes in the eastern flyway of the Eastern Purple Finch, but judging from the experiences at Ardmore and other stations in southeastern Pennsylvania, there must be several routes in this region. For example, during the southward migration of 1939-40, 498 Purple Finches were banded at the Ardmore station, but only four birds were re-taken out of the 1,146 banded the previous spring. Of the 498 Purple Finches banded during the 1939-40 season, only about 10% were rosy adult males, against 450 or nearly 40% the previous spring. This would suggest that the birds follow one route in the spring and another one in the fall.

The routes travelled by the Purple Finches in southeastern Pennsylvania appear to be very narrow ones. After the spring invasion in 1939, I made an inquiry as to the number of Purple Finches banded at seven stations within a radius of twelve miles from the Ardmore station. During the invasion, the seven stations had banded a total of only 457 Purple Finches. Two of these stations, located ten and twelve miles northeast of the Ardmore station, in the direction of the spring migration, banded 390 Purple Finches, while the other five stations located two to ten miles south, east and west of the Ardmore station banded the remaining 67 birds. The fact that the two stations to the northeast of the Ardmore station banded 85% of the total of the seven stations is very significant in considering the width of the Purple Finch spring migration route in this region.

The unusual number of Purple Finches captured during the invasion presented the opportunity to secure wing measurements of a large number of a single species in a short time. The closed wing measurement, or the chord, was taken of each one of the 1,146 Purple Finches banded. The wing was measured with dividers in millimeters, the length was determined from the farthest anterior part of the bend of the wing to the tip of the longest primary, without flattening out the curve of the feather, so when comparison was made with the measurement of skins, it would help to eliminate any possible difference because of shrinkage that may occur in the drying of the skins. The purpose in taking these wing measurements was to find out, if possible, whether or not there was any correlation between the wing length and the sex of olivaceous birds.

The wing measurements were taken of the 450 live adult rosy males banded, a study was made of the wing measurements of a series of 115 Purple Finch skins now in the collection of the Academy

of Natural Sciences of Philadelphia, and these findings are compared with the Purple Finch measurements, taken with dividers, by Robert Ridgway (1901, *Birds of North and Middle America*, U. S. Nat. Museum Bulletin No. 50, part 1), and the Purple Finch wing measurements of live birds, taken with a ruler by Mrs. Kenneth B. Weatherby (1934, *Bird Banding*, 5 (2), 1934.)

TABLE III
WING MEASUREMENTS OF EASTERN PURPLE FINCH
Males Females

| Series | Sex | Males | | Millimeters | Average | Females | | Millimeters | Average | |
|--|------|--------------|-------------------|-------------|---------|------------------|-------------------|-------------|-------------|-------|
| | | No. of Skins | No. of Live Birds | | | No. of Skins | No. of Live Birds | | | |
| Academy of Nat. Sciences | Ad.♂ | 49 | .. | 81.00-95.00 | 84.84 | ♀ | 39 | .. | 73.50-84.50 | 80.69 |
| Academy of Nat. Sciences | Im.♂ | 27 | .. | 79.50-86.00 | 82.37 | .. | .. | .. | .. | .. |
| Robert Ridgway Mrs. Kenneth B. Weatherby | Ad.♂ | 15 | .. | 80.77-86.36 | 83.31 | Ad.♀ | 15 | .. | 76.71-82.55 | 80.26 |
| Horace Groskin | Ad.♂ | .. | 72 | 79.25-88.00 | 83.43 | Ad.♀ | .. | 142 | 76.75-87.00 | 80.52 |
| | Ad.♂ | .. | 450 | 79.00-90.00 | 83.06 | ♀ and Im.♂ and ♀ | .. | 696 | 73.00-86.00 | 80.28 |

THE 4 SERIES OF BIRDS MEASURED BY HORACE GROSKIN
Of total birds in each series the greatest number measured as follows:

| Series | Total No. in Series | Greatest No. and in Series | Measured in Millimeters | Average |
|------------------------------------|---------------------|----------------------------|-------------------------|---------|
| Academy of Nat. Sciences | 49 Ad.♂ skins | 37 or 75.51% | 82.50-86.00 | 84.19 |
| Academy of Nat. Sciences | 27 Im.♂ skins | 20 or 74.07% | 82.00-86.00 | 83.03 |
| Horace Groskin | 450 Ad.♂ live birds | 338 or 75.11% | 82.00-86.00 | 83.60 |
| Academy of Nat. Sciences | 39 ♀ skins | 29 or 74.36% | 79.00-83.00 | 80.83 |

From the data presented in Table 3, it is evident that in the four series of 586 adult male birds, comprising both live birds and skins, no wing measurement of an adult male is less than 79 millimeters. In the series of 27 olivaceous birds, sexed as males, in the collection of the Academy of Natural Sciences, no wing measurement of these immature males is less than 79 millimeters.

In the series of Ardmore specimens of 450 live adult males, the wings of 338, or 75.1% measured 82-86 millimeters, and in the series of the Academy of Natural Sciences of 49 adult male skins, the wings of 37, or 75.5% measured 82.50-86.00 millimeters, and in the Academy of Natural Sciences' series of 27 immature males, the wings of 20, or 74.1% measured 82-86 millimeters. The greatest number and percentage of male birds in each series had wing measurements that not only exceeded 79 millimeters, but was more than 82 millimeters. Four olivaceous birds banded at Ardmore measuring 84.50, 83.50, 79.00 and 79.00 millimeters respectively, returned as rosy adult male birds.

It is demonstrated that in the three series of 196 female wing measurements of both live birds and skins, all wing measurements are less than 85 millimeters except in Mrs. Weatherby's series which reaches 87 millimeters. However, the averages of the three series show less than one-half millimeter difference and Mrs. Weatherby's average is so close to the others, that it is quite apparent very few of her birds could have measured over 85 millimeters. Therefore, it appears from a comparison of the four series that female wings usually do not measure over 85 millimeters. The study made of the 39 female skins in the collection of the Academy of Natural Sciences as shown in the second portion of Table 3, is particularly conclusive. Of these 39 skins of females, the wings of 29, or 74.4% measured 79-83 millimeters and only five birds in the Academy's female series measured over 83 millimeters, while the longest wing in the series did not measure over 84.50 millimeters. Ridgway's series of adult females did not exceed 82.55 millimeters.

Therefore, it is suggested that olivaceous birds with wings measuring less than 79 millimeters are usually females and olivaceous birds with wings measuring more than 85 millimeters are usually males, while olivaceous birds with wings measuring between 79 and 84 millimeters may be males or females.

Bird banders handling thousands of live birds each year have an unusual opportunity to increase the value of their efforts by taking accurate measurements by some agreed upon uniform method. Banders are in a position to secure large series of measurements of many species, in fact much larger series than the series of skins now found in the museums throughout the world. These measurements taken of live birds would be of great value in helping to determine the differences between species and sub-species, as well as the variations existing within the species, and in some species assist in determining sex where the plumage is similar in the male and female.

As a result of the 1939 spring invasion, there have been some interesting recoveries of foreign bands made at Ardmore, as well as Ardmore birds being recovered at other stations. Twenty-four Purple Finches banded at Ardmore during the invasion were recovered within 60 days from the date of banding. Twenty-one of these birds were retrapped at one or another of the seven stations within a 12 mile radius from Ardmore. The three remaining birds were recovered as follows: One bird, banded at Ardmore, March 25, 1939, was caught by a cat 58 days later, (May 22, 1939) at Clarksville, northern New Hampshire, about 500 miles northeast of the Ardmore station; another, banded at Ardmore March 18, 1939, was recovered 39 days later (April 26, 1939) at Athol, Mass., about 300 miles northeast of Ardmore; and the third, banded at Ardmore March 29, 1939, was recovered 33 days later (May 1, 1939) at Sault Ste. Marie, northern Michigan, about 1,000 miles northwest

of Ardmore. During the same period and almost at the same time that the birds banded at the Ardmore station were being captured at Athol, Mass., and at Sault Ste. Marie, Michigan, I was capturing birds at Ardmore coming from those stations.

At the Ardmore station during the invasion ten Purple Finches were captured with foreign bands, *i.e.* birds banded at other stations. Four of these birds had been banded at stations within a ten mile radius from the Ardmore station and the six remaining birds captured came from four other states—New Jersey, Massachusetts, Maine and Michigan. One of the birds, captured at Ardmore on April 15, 1939, had been banded by H. P. Baily a year and eight months before (August 9, 1937) at Northeast Harbor, Maine, about 600 miles northeast of Ardmore. Another, also banded by H. P. Baily at Northeast Harbor, Maine, August 11, 1935, was captured nearly four years later (March 23, 1939) at Ardmore. (Mr. Baily states this bird was an adult male when banded, so it was at least 5 years old when captured at Ardmore). A bird captured at Ardmore March 26, 1939, had been banded four days before (March 22, 1939) at Boonton, New Jersey, 90 miles north of Ardmore.

A bird captured at Ardmore, April 3, 1939 had been banded 21 days before (March 13, 1939) at Belmont, Mass., about 300 miles northeast of Ardmore.

A bird captured at Ardmore on April 5, 1939, had been banded 30 days before (March 6, 1939) at Athol, Mass., about 300 miles northeast of Ardmore. It is interesting to note that both of the Massachusetts birds were banded in March during the spring migration and in breeding territory, and yet they had migrated at least 300 miles southwest to a non-breeding territory when captured at Ardmore, Pa. It appears that the Athol bird came to Ardmore to invite an Ardmore bird to come to Athol, Mass., which it did three weeks later on April 26.

The last bird on the list of foreign bands was captured at Ardmore, March 10, 1939. It had been banded by M. J. Magee about nine months before (May 22, 1938) at Sault Ste. Marie. Mr. Magee writes me that out of the thousands of Purple Finches he had banded in the last 18 years, this was the first one of his finches ever to be recovered in Pennsylvania, and makes the fourth bird captured in the eastern section of the country—one in Nova Scotia, one in Massachusetts, one in Virginia and now, one in Pennsylvania. I have since learned another one of Mr. Magee's birds has been captured in Massachusetts. The recoveries of these birds in the east and Mr. Magee's capture of my Ardmore bird at Sault Ste. Marie, is an indication of a possible east-west migration of the Eastern Purple Finch.

The number of Purple Finches banded during the autumn and winter of 1939-40, at Ardmore, is by far the largest number ever

banded in any previous corresponding period. During the fall and winter of 1939-40, 498 were banded. During a similar period of 1937-38, fifty-four birds were banded to March 1, and during 1938-39, forty-three birds were banded. Therefore, the unusual number of Purple Finches coming through in the fall and winter migration of 1939-40, suggests the possibility of another invasion in the spring of 1940, or, perhaps, some type of "lag" factor never before recognized in our studies on migratory birds.

Ardmore, Pennsylvania.

SOME PARASITES OF THE EASTERN CROW

(*Corvus brachyrhynchos brachyrhynchos* Brehm)¹

By B. B. MORGAN and E. F. WALLER

DURING the past two academic years, 1938-39 and 1939-40, we have had the opportunity to examine a total of 112 crows (*Corvus brachyrhynchos brachyrhynchos* Brehm); 64 females and 48 males. Seventeen of these were collected in southern Wisconsin and the remainder from five different counties in Iowa. With the exception of six live birds in the Wisconsin group, all others had been shot and had been dead from 24 to 72 hours by the time the examination was made. The dead crows were usually submitted in groups of twelve to fifteen at a time, all in a single container. This naturally provided an opportunity for an exchange of the ectoparasites. The parasitic fauna of these 112 crows was so heavy and the parasites so widely distributed taxonomically that the survey seems worthy of record.

MATERIALS AND METHODS

Part of these birds were submitted by State Conservation Officers through the U. S. Biological Survey, Iowa Cooperative Unit, Iowa State College, Ames, Iowa. Other crows were submitted by hunters and sportsmen. Many of the birds were shot for bounty.

Methods of procedure were very similar to that outlined by Morgan and Waller (1940). That is, the carcasses were chilled at 40° C. for at least one hour. This benumbed the ectoparasites so they could be readily collected. The lice and mites were preserved in 95 per cent alcohol. Examination of the carcasses was made under a 500 watt daylight lamp. After the ectoparasites had been collected, the skin was incised from the head to the anus along the ventral median line and then laid back on each side. This facilitated

¹A joint contribution from the University of Wisconsin, Department of Zoology and Veterinary Science and Iowa State College, Department of Veterinary Pathology; Project 570 in cooperation with the United States Biological Survey, American Wildlife Institute, and the Iowa Conservation Commission.