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AN ORNITHOLOGICAL CROSS-SECTION OF ILLINOIS IN AUTUMN.

BY

S. A. FORBES, Ph.D.

ERRATA AND ADDENDA.

Page 55, line 15, for *1854* read *1855*.

Page 55, line 16, for *Horticultural* read *State Agricultural*.

Page 60, in second table, Illinois, for *240* read *241*.

Page 65, first line above foot-note, for *ventricosa* read *ligamentina*.

Page 72, line 9, for *imbecilis* read *imbecillis*.

Page 79, line 19, for *asperimus* read *asperrimus*.

Page 80, above *Quadrula rubiginosa* insert Section *Fusconaia* Simpson.

Page 76. The record of Calkins for *Margaritana margaritifera* is without doubt erroneous and should be eliminated. This species is not found in Illinois.

Page 95. *Pomatiopsis sheldonii* Pilsbry should read *Amnicola sheldonii* and should be transferred to the genus *Amnicola* on page 93.

Page 100. *Physa gyrina oleacea* Tryon is the immature stage of *Physa gyrina*.

Page 103. *Lymnæa tazewelliana* is a synonym of *Lymnæa parva*.

Page 105. *Lymnæa palustris michiganensis* is the immature form of *Lymnæa reflexa*.

Page 106. *Lymnæa reflexa iowensis* and *Lymnæa reflexa crystalensis* are synonyms of *Lymnæa reflexa*.

Page 112, line 6 from bottom, for *gouldi* read *gouldii*.

Page 114, line 5 from bottom, for *juxtigens* read *juxtidens*.

Page 115, line 21, for *Witter* read *Walker*; line 23, *Polygyra sayii* Binney should be changed to *Polygyra sayana* Pilsbry.

Page 116, line 1. *Polygyra exoleta* Binney (1885) should be changed to *Polygyra zaleta* Binney (1837).

Page 117, line 11 from bottom, for *leai* read *leaii*; line 3 from bottom, *Polygyra monodon fraterna* is a good species and should read *Polygyra fraterna*.

Page 119, foot-note. A specimen of *alliarius* in the collection of Mr. Aldrich, received from Calkins, proves to be *draparnaldi*.

Page 121, line 3 from bottom, for *Champaign* read *Piatt*.

Page 122, line 12 from bottom, for *Pyramidula striatella* Anthony read *Pyramidula cronkkitei anthonyi* Pilsbry; line 4, for *Held* read *Hald*.

Page 123, for *Helicodiscus lineatus* Say read *Helicodiscus parallelus* Say.

Page 162, line 7, for *glandulosa* read *linearis*.

Page 171, line 17, for *riparia* read *vulpina*.

Page 176, line 8 from bottom, for *canadense* read *majus*.

Page 180, line 9, for *virginica* read *virginiana*.

Page 221, line 6 from bottom, for *rectangulus* read *rectangularis*.

Page 226, line 3, for *fasciatus* read *fasciata*.

Page 239, line 11, strike out Lake Co. entry.

Page 246, lines 6 and 7, and page 248, lines 1, 14, 20, and 23, for *Œnothera* read *Onagra*.

Page 248, line 4, for *candida* Horn substitute n. sp.

Page 249, line 8 from bottom, for *Olethreutes dimidiana* Sodoff? read *Olethreutes separatana* Kearfott, and strike out parenthetical matter.

Page 251, line 7, for *grossa* read *thoracica*; line 21, for words preceding H. 6, read *Asilus rufipennis* Hine; line 18 from bottom, for words preceding H. 2, substitute *Asilus cacopilogus* Hine.

Page 253, line 8, for *Linn.* read *Emory.*

Page 257, line 15, for *pennsylvanicus* DeG. read *auricomus* Rob.

Page 261, Note 6. *Melanoplus macneilli* is very probably *M. fluviatilis* Brun.

Page 262, Note 9. Dr. Bergroth writes that *Nabis elongatus* is preoccupied. The original is *elogantus* in the check list. Comparison with long-winged *vicarius* is desirable before re-naming it.

Page 309, in table, for *59* read *57*, and for *743* read *741*.

Page 310, in table, for *59* read *57*.

Page 314, line 5, for *1587* read *481*; line 16, after *stubble* insert *meadows*; line 17, after *pastures* strike out *and meadows*, and after *1500* strike out *each*.

Page 315, last line, for *553* read *481*.

Page 362, line 7 from bottom, for *longa* read *parvilamellata*.

Page 373. As a second entry in synonymy insert as follows:

1854. *Nothrus bistriatus*, Nicolet, Acariens des Environs de Paris, p. 397, Pl. VII., Fig. 7.

Page 376, line 13 from bottom, for *Oribata* read *Oribates*.

Page 378, line 1, for *XXV.* read *XXXV.*

Page 384, after line 5 insert as follows:

N. bipilis Hermann. Mem. Apt., p. 95.
In moss, Arcola and Parker, Ill.

Page 384, line 5 from bottom, for *pyrostigma* read *pyrostigmata*.

Page 386, after line 11 from bottom insert as follows:

H. bistriata Nicolet. Acariens des Environs de Paris, p. 397, Pl. VII., Fig. 7.
Under logs and in moss, Urbana and Arcola, Ill.

Page 388, line 12, for *sphærulum* read *sphærula*.

ARTICLE IX.—*An Ornithological Cross-section of Illinois in Autumn.* By S. A. FORBES.

The subject of the relations of interaction between organisms and their environment, animate and inanimate, which goes by the name of ecology, may be studied with reference to the welfare of species or to that of the general assemblage of organisms to which the species belong. The ecology of a species is special ecology; that of the assemblage is a phase or division of general ecology—more or less general according to the size and contents of the assemblage considered. In special ecology every ecological factor, every feature of the environment, is valued according to its importance to the species; in general ecology the various ecological factors are valued according to their significance in the general system of life. In special ecology the species is the all-important, dominating center; in general ecology each species takes its appropriate place—dominant, important, subordinate, or insignificant—according to its dynamic value as a part of the whole.

Precise studies in animal ecology have heretofore been made mainly in the special field, necessarily so in the beginning since a knowledge of the ecology of species must precede that of groups or assemblages of species. These special studies are, however, merely preliminary to a general study of the dynamic system of organic life as exhibited in its larger and more complex units. Without the corrective and organizing influence of such a study of the system as a whole, our ideas of that system must be badly proportioned and correspondingly inadequate or misleading—a fact readily illustrated by the state of our knowledge and opinion respecting the ecological significance of birds.

To learn what we now know of the effects of the activities of birds has required much difficult, expert, time-consuming study, especially of the details of their food, since it is mainly

through the food relation that birds affect the welfare of other animals and of plants. These studies, although both qualitative and quantitative as related to the welfare of the various species of birds themselves, have been qualitative only as concerning the relation of birds to the general welfare; and we have little but vague estimate and doubtful surmise in place of a definite knowledge of the relative ecological values of the various species, and equally little knowledge, in consequence, of the total significance of birds as a class. We do know fairly well (owing, in part, to the early work of this Laboratory*, but mainly to that of the United States Biological Survey) the principal features of the food of many species of our common birds, but we can not lay these data together for an intelligent estimate of the total effect of the life of birds on their environment except on the supposition that the various species are about equally abundant wherever they occur. That this is not the fact is obvious to every one, and it must be equally obvious, consequently, that until we know how abundant, on an average, the various species are in the various parts of the country and throughout the country at large, we can make little definite application, either scientific or strictly practical, of the knowledge we now have. Our present information in this field is like a chain one of the links of which is missing and has been replaced by a piece of twine. To substitute iron for cotton at this point is the object of the studies now in progress in Illinois on the local distribution, average numbers, and ecological preferences of the various species of Illinois birds.

The Field Method.

To this end, after a preliminary quantitative study made in 1905-06 of the bird life of a single limited tract—a 400-acre stock and grain farm in central Illinois—a systematic program of field observation and statistical record was entered upon last August, with complete arrangements for its continuance through one entire year. Two acute and thoroughly reliable ornithological observers—one of whom, Mr. A. O. Gross, al-

* See Bull. Ill. State Lab. Nat. Hist., Nos. 3 and 6, Vol. I.

though still an undergraduate student in the University of Illinois, has had several years' experience as a collector and observer of birds—were sent into the field under instructions to traverse the state in various directions, traveling always in straight lines and always thirty yards apart, and noting and recording the species, numbers, and exact situation of all birds flushed by them on a strip fifty yards in width, including also those crossing this strip within one hundred yards to their front. No attention is paid by them, for this purpose, to any other birds.

As they are able to recognize with accuracy all species of Illinois birds at sight, and most of them by song, their movement is like that of a gigantic sweep-net 150 feet wide and 300 feet deep, so drawn across the country day by day as to capture every bird which comes in its way; with this difference, that the birds are not actually caught or even inconvenienced, and that nothing can escape the meshes of their well-trained observation.

One of these observers, Mr. H. A. Ray, also a University student, is primarily responsible for the record of distances and kinds of surface over which they travel, carrying for this purpose a pedometer whose action has been carefully tested and repeatedly checked, and a mechanical tally or "lumber-counter"—both used to make a record of the number of paces traveled over each crop or other kind of surface vegetation.

The reports of their travel made to me by Mr. Gross contain every needful detail as to date and time of day; to precise location of their line of march; to temperature, wind, and other features of the weather; to distances traveled in succession over each field or other distinguishable area; to vegetation, wild or cultivated, on each tract; and to the species and numbers of birds identified on each area and in each kind of crop.

General Results of Observations.

The present paper is a discussion of the product of one of their earlier trips, made from August 28 to October 17, 1906, across the state from east to west, from the Indiana line be-

yond Danville, Ill., to Quincy, on the Mississippi River. It has to do with autumnal conditions in the central part of the state, and is merely preliminary to a comprehensive report on the whole investigation.

The entire distance covered by these observations is 191.86 miles, and the strip from which all birds were accurately determined and numbered was 150 feet in width for this whole distance. The area thus covered was 3519 acres, or 5½ square miles. It included every kind of surface, soil, and vegetation traversed by the observers, with the exception of forests of too lofty or too dense a growth for a complete and certain recognition of their bird population.

The whole number of birds identified was 4804, of which 1620 were English sparrows and 3184 were of native species. The average number of birds seen was 25 for each mile of the trip, which is 1.36 for each acre covered, or 874 for each square mile. The English sparrows averaged .46, and the native species .9, per acre, or 295 per square mile for the sparrows and 579 per square mile for the native birds. The total number of species recognized was 93; but 90 per cent. of the individual birds seen, belonged to 20 of these species, leaving but 10 per cent. for the other 73 species. Indeed, 15 species included 85 per cent. of the individual birds observed, leaving for the other 81 species but 728 birds—an average of 130 birds per square mile, or one bird to each five acres.

It is evident, consequently, that the real dynamic significance of the birds of this district at this time was to be found wholly in the fifteen most abundant species, the remainder being virtually negligible as a general ecological factor.* These fifteen species are arranged in the order of their frequency in the following table, which shows for each the number of indi-

* A species represented by a relatively small number of birds may have a special ecological significance if it is concentrated in a special class of situations; and may, indeed, be especially important ecologically if the class of situations in which it is concentrated is especially important. This aspect of the general problem must be reserved for discussion when a larger mass and a more comprehensive variety of data are available.

ERRATA.

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viduals seen, the ratio of its numbers to the number of all the birds observed, and the average number of the species per square mile of the area under observation.

TABLE I. THE FIFTEEN MOST IMPORTANT BIRDS, INDIANA LINE TO QUINCY, AUGUST 28 TO OCTOBER 17, 1906.

SPECIES	NUMBER	PER CENT.	PER SQ. MI.
English sparrow	1620	34.	295
Crow-blackbird	517	11.	94
Meadow-lark	312	6.5	59
Crow	226	4.7	41
Cowbird	221	4.6	40
Horned lark	220	4.6	40
Mourning-dove	180	3.7	33
Swamp-sparrow	155	3.2	28
Goldfinch	134	2.7	24
Myrtle warbler	112	2.3	20
White-throated sparrow	93	1.9	17
Field-sparrow	83	1.7	15
Vesper-sparrow	72	1.5	13
Quail	69	1.4	13
Flicker	62	1.3	11
Totals	4076	85.1	743

If we exclude the English sparrow from consideration, as an obnoxious alien whose habits should not be permitted to influence opinion concerning the ninety-two species of our native birds, we must compute the ratios of abundance for the native species with reference to the 3184 such birds identified on this trip. This is an average of 579 per square mile, instead of 874, the former number. To obtain 85 per cent. of all the native birds seen we must add to the above list the next most abundant species, which are the robin, the bluebird, the killdeer, and the blue jay. The following table shows the ratios of abundance and the birds per square mile of the eighteen species of this amended list. The seventy-four native species remaining are now represented by 499 birds—an average of 1 to about seven acres; a proportion far too small to have any general significance.

TABLE II. THE EIGHTEEN MOST IMPORTANT NATIVE BIRDS, INDIANA LINE TO QUINCY.

SPECIES	NUMBER	PER CENT.	PER SQ. MI.
Crow-blackbird	517	16.	94
Meadow-lark	312	9.8	59
Crow	226	7.1	41
Cowbird	221	7.	40
Horned lark	220	7.	40
Mourning-dove	180	5.7	33
Swamp-sparrow	155	4.9	28
Goldfinch	134	4.2	24
Myrtle warbler	112	3.5	20
White-throated sparrow	93	3.	17
Field-sparrow	83	2.6	15
Vesper-sparrow	72	2.2	13
Quail	69	2.2	13
Flicker	62	2.	11
Robin	61	2.	11
Bluebird	61	2.	11
Killdeer	60	1.9	11
Blue jay	57	1.8	10

The Vegetable Covering of the Soil.

As the area traversed on this trip was almost wholly under cultivation, the relation of these birds to the vegetable covering of the soil was virtually their relation to the agricultural and horticultural crops of central Illinois in autumn—almost entirely to the former, since the horticultural area is comparatively insignificant in this part of the state. Nearly all this surface was in fields of ripe corn, the stalks standing in some fields and in others cut and shocked; in blue-grass pastures; in meadows of timothy, clover, and millet, or timothy and clover mixed; in fields of stubble, mostly after a crop of oats; in fields of young wheat; in ground freshly plowed, mainly as a preparation for wheat; and in orchards, almost all of apple. Plowing for wheat was in progress when the trip began, and fields of young wheat were reported in increasing numbers after October 1. Some of the later plowing was doubtless done for corn.

The track of my observers led them also through barnyards, and gardens of vegetables and shrubs, and occasionally across a shrubby ravine or a neglected field which had grown up to weeds With the exception of a large marshy tract in the bottoms of the Illinois River near Meredosia, there was very little waste land worth mentioning on this line.

For an analysis of the preferences of the principal species of birds with respect to the various classes of situation and kinds of food available to them at the time, it is necessary to take into account the areas in each of the crops along the line of travel. For this purpose the following table has been prepared, showing the total distance traveled through each kind of crop, and the acreage in each from which a complete count and analysis of the bird life was obtained.

TABLE III. CROP AREAS, INDIANA LINE TO QUINCY.

CROP	MILES TRAVELED IN CROP	PER CENT. IN EACH CROP	ACRES IN 50-YARD STRIP	NUMBER OF FIELDS	ACRES IN AVERAGE FIELD*
Corn	71.87	38.	1306.64	362	32.
Stubble	37.4	19.5	680.56	205	18.2
Wheat.....	8.48	4.4	155.36	59	17.
Plowed Ground	5.76	3.	105.66	34	18.4
Pasture..... ..	50.97	26.6	926.65	345	14.
Meadow	8.4	4.5	153.18	51	21.7
Orchard....	2.5	1.3	46.7	23	9.5
Miscellaneous	6.48	2.7	134.25	36	.....
Totals	191.86		3509.00	1115	

Corn, it will be seen, was the principal crop. A distance of nearly seventy-two miles was traveled through 362 corn fields of an average size of 32 acres per field, and all the birds were determined for 1306.64 acres of this crop. That is, 38 per

*Virtually all central Illinois farm-fields are rectangular, and the average form of a sufficient number is consequently that of a square. The length of one side of such an average field was found by dividing the entire distance traveled in any crop by the number of fields of that crop crossed. The square of this side is, of course, the area of this average field.

cent. of the entire journey was in fields of corn. The next largest area was in blue-grass pastures, over which my observers traveled 51 miles, determining the birds of 926.65 acres, which was 26.6 per cent. of the whole area of their observations. Thirty-seven and four tenths miles in fields of stubble, mainly oats, averaging 18.2 acres each, gave a total of 680.56 acres for the 50-yard strip, or 19.5 per cent. of its entire length. Thus the oats fields were more than one half, and the pastures more than two thirds, the area in corn, and these three crops together covered 83 per cent. of the surface. If to this we add the 4.5 per cent. of meadow-lands, we have nearly 88 per cent. of the total area in corn, oats, and grass (including in the last a small amount of clover, usually growing with timothy).

The surface in wheat is not accurately obtainable from these data, since wheat sowing had not begun and plowing for wheat was not finished when the start was made, but both were finished before the trip was ended. If virtually all the fall plowing was being done for wheat, the area in that crop was about 7 per cent., or 260 acres for the 14 miles traveled through 93 fields. About 2½ miles were traveled through 23 orchards, aggregating 1.3 per cent. of the strip, or 46.7 acres in all. The marshes, waste lands, forests, gardens, farmyards, brushy hollows, and other miscellaneous tracts examined, amount to 2.7 per cent. of the whole. An immense plain of corn, oats, and grass, the first greatly predominating, with a little wheat, less clover, and an occasional farm orchard—this is the region, quite typical for nearly all the central two thirds of Illinois, from which these data were drawn.

General Distribution according to Crops.

We have next to see how our 4800 birds, belonging to 93 species,—and especially how our 15 most abundant species, represented by 4076 birds,—had distributed themselves over the 3500 acres in these crops actually scrutinized by these observers.

This latter query admits of various answers: (1) we may simply give the number of individuals of each species observed in each kind of crop; (2) we may give the number of species on

equal areas of each crop—an acre or a square mile; (3) we may give the percentage of each of the species found in each of the crops; (4) we may compare the actual numbers of each species in each crop with the number which would occur there if the species were uniformly distributed over its area, thus showing where and in what degree the species is densely or sparsely distributed above or below the average; or (5) we may compare several species one with another, and each with all the rest, in a way to show just how and how far they differ in their numerical relations to the various crop areas they inhabit. All these several forms of answer are contained in full in the following tables for our most abundant birds, and from these I will extract here and there only such data for discussion as seem adapted to a general treatment of the subject.

From Table IV., showing the distribution of all birds without distinction of species for the principal areas actually covered by this inspection, we see that 2249 of these birds were found in pastures, 955 of them in corn fields, 454 in stubble

TABLE IV. GENERAL DISTRIBUTION OF ALL BIRDS, BY CROPS, INDIANA LINE TO QUINCY.

CROP	ACRES	ACREAGE PER CENT.	BIRDS	BIRDS PER CENT.	BIRDS PER ACRE	BIRDS PER SQ. MILE
Corn	1306.64	38.	955	20.	.73	468
Stubble	680.56	19.5	454	9.	.67	429
Wheat	155.36	4.4	46	1.	.30	192
Plowed ground	105.66	3.	71	1.5	.67	430
Pasture	926.65	26.6	2249	47.	2.43	1551
Clover	79.08	2.3	51	1.	.65	416
Timothy	57.10	1.7	47	1.	.83	531
Millet	17.	.5	17	.....	1.	640
Orchard	46.70	1.3	199	4.	4.23	2726
Yards	11.77	.003	121	2.5	10.28	6580
Swamp	47.16	.013	98	2.	2.08	1331
Timber*	7.34	.....	9	.....	1.23	785
Miscellaneous	78.	1.1	487	.....	.....	.....

*All forests "skipped" if high or dense.

ground, 199 in orchards, 115 in meadows, 71 on recently plowed ground, and 46 of them on young wheat. Taking into account the different acreages of these areas and computing the number of birds per square mile in each, we have 2726 per square mile in orchards, 1551 in pastures, 1587 in meadows, 468 in corn fields, 430 on plowed ground, 429 on stubble, and 192 on young wheat. A square mile of swamp land, if we may judge by the forty-seven acres examined, would have contained a population of 1331 birds; and a square mile of farmyards, 6580. Compared by percentages of all the birds in each crop, 47 per cent. were in pastures, 20 per cent. in corn, and 9 per cent. in stubble, the ratios in other crops and situations ranging from 4 per cent. down.

The above crops may be divided, from this point of view, into four classes: young wheat, with less than 200 birds to the square mile; corn, stubble, and plowed ground, with about 450 each; pastures and meadows with over 1500 each; and orchards, with 2700 birds to the like area. The fact that birds are nearly as common in old stubble fields as in corn, suggests that it is not the grain in either case which attracts them there, but rather the seeds of the weeds by which both kinds of fields are generally covered in fall. Their preference for pasture-lands is probably due to the amount of food found by them in the droppings of stock, and to the greater abundance of insect life in such a situation. Other comparative conclusions may best be postponed until the special assemblages of birds characterizing each of these principal classes of situation are more fully discussed.

The Principal Birds in each Crop.

The next four tables give us the data of the distribution and abundance of the principal species of birds as related to the principal crops. In Table V. we have the numbers identified of the twelve most abundant birds in each kind of crop, without reference to differences in acreage. In Tables VI.–VIII. the list of species is reduced to nine by dropping the three passing migrants. In Table VI. the number of birds per section, or square mile, of each crop is given for each of the species; in Table

TABLE V. NUMBER OF PRINCIPAL BIRDS IN PRINCIPAL CROPS, INDIANA LINE TO QUINCY.

	CORN	STUBBLE	WHEAT	PASTURE	MEADOW	PLOWED GROUND	ORCHARD	YARDS	WEEDS	SHRUBBERY	FALLOW AND WASTE
English sparrow	562	38	....	530	10	9	101	119	251	...	....
Crow-blackbird	21	22	....	445	...	...	....	9	....	...	....
Meadow-lark	49	97	21	122	20	3	....	....	....	...	....
Crow	12	7	1	190	3	13	....	....	....	...	....
Cowbird	2	2	1	133	20	1	....	....	(62*)	...	....
Horned lark	6	26	7	141	1	38	....	1	....	...	....
Mourning-dove	53	41	1	73	8	1	3	....	....	...	....
Swamp-sparrow	14	7	....	20	15	...	7	....	....	5	87
Goldfinch	20	7	4	56	...	...	16	....	28	3	....
Myrtle warbler	30	3	....	47	1	2	13	....	....	5	11
White-throated sparrow	19	8	1	15	...	...	16	....	21	13	....
Field-sparrow	11	2	1	33	1	...	8	....	11	16	....

*Sorghum.

TABLE VI. NUMBER OF BIRDS PER SQUARE MILE IN EACH CROP.

	CORN	STUBBLE	WHEAT	PASTURE	MEADOW	PLOWED GROUND	ORCHARD
English sparrow	275	36	.....	366	48	55	1383
Crow-blackbird	10	21	.....	307	.....	.....	.....
Meadow-lark	24	92	86	84	98	18	.....
Crow	6	7	4	131	15	79	.....
Cowbird	1	2	4	89	98	6	.....
Horned lark	3	25	29	97	5	230	.....
Mourning-dove	26	39	4	50	39	6	42
Goldfinch	10	7	17	39	.....	.....	220
Field-sparrow	5	2	4	23	5	.....	110
All birds	468	429	192	1551	553	430	2726

TABLE VII. PERCENTAGE OF EACH SPECIES IN EACH OF THE PRINCIPAL CROPS.*

	CORN	STUBBLE	WHEAT	PASTURE	MEADOW	PLOWED GROUND	ORCHARD	YARDS	SHRUBBERY	SORGHUM	WASTE
English sparrow	35	2	....	33	.6	.5	6	7	....	....	15
Crow-blackbird	4	4	....	90	....	....	....	2	....	....	....
Meadow-lark	16	31	7	38	7.	1.	....	....	....	....	....
Crow	5	3	....	84	1.	6.	....	....	....	....	....
Cowbird	1	1	....	60	9.	....	....	....	....	28	....
Horned lark	3	12	3	64	....	17.	....	....	....	....	....
Mourning-dove	29	23	1	40	4.	1.	2	....	....	....	....
Goldfinch	15	5	3	42	....	....	12	....	2	....	21
Field-sparrow	13	2	1	40	1.	....	10	....	19	....	14
All birds	20	9	1	47	2.	1.	4	3	1	1	11

*Read from left to right.

TABLE VIII. RATIO OF EACH SPECIES IN EACH CROP TO ALL BIRDS IN THAT CROP*.

	CORN	STUBBLE	WHEAT	PASTURE	MEADOW	PLOWED GROUND	ORCHARD
English sparrow	.59	.08	.....	.24	.09	.13	.51
Crow-blackbird	.02	.05	.....	.20	.....	.....	.....
Meadow-lark	.05	.21	.45	.05	.18	.04	.....
Crow	.01	.02	.02	.09	.03	.18	.....
Cowbird	.....	.....	.02	.06	.18	.01	.....
Horned lark	.....	.06	.15	.06	.01	.53	.....
Mourning-dove	.06	.09	.02	.03	.07	.01	.01
Goldfinch	.02	.02	.09	.03	.....	.....	.08
Field-sparrow	.01	.....	.02	.02	.01	.....	.04

*Read from above downwards.

VII. are the percentages of each species found in the various crops; and in Table VIII. we have in each crop column, percentages showing for each species the ratio of the number of

birds of that species found in that crop to the total number of all birds found in the same crop.

From Table VIII. it will be seen that the principal *corn-field* species at the times and places of this trip was the English sparrow, to which more than half the birds seen in corn fields belong, and that the mourning-dove and the meadow-lark were the species next in abundance there—6 per cent. and 5 per cent. respectively. In *stubble fields* the meadow-lark was the most abundant species, making about a fifth of all the birds seen in such fields. The next in order of abundance were the mourning-dove, the English sparrow, the horned lark, and the crow-blackbird, present in ratios ranging from 9 per cent. to 5 per cent. The meadow-lark was also much the most abundant bird on fields of *young wheat*, where it made 45 per cent. of all the birds seen; and the horned lark and the goldfinch were next to this in number, one third and one fifth as great respectively. The principal *pasture* species were the English sparrow (24 per cent.) and the crow-blackbird (20 per cent.), with the crow, the cowbird, the horned lark, and the meadow-lark following in numbers ranging from a third to about a fifth the number of the sparrows. In *meadows*, on the other hand, the meadow-lark and the cowbird were in the lead, each 18 per cent. of all the meadow birds identified, and the English sparrow and the mourning-dove were about half as numerous. On *fall plowing* more than half the birds were horned larks, and the only other abundant species were the crow (18 per cent.) and the English sparrow (13 per cent.). In the small number of *orchards* traversed the English sparrow was at this time much the most abundant bird (51 per cent.). The other common species were the goldfinch (8 per cent.), the field-sparrow (4 per cent.), and a few passing migrants—the myrtle warbler and the white-throated sparrow, for example. (See Table V.)

The Principal Species Separately.

English Sparrows.—From these tables we learn that about two thirds of the English sparrows were in corn fields and pastures, and in about equal numbers in each; that approximately

half as many were found in waste weedy fields as in pastures; and that the remainder were about equally divided between barn-yards and orchards. Some 52 per cent. of this species—those in corn fields, stubble, and waste lands—were among weeds, and 40 per cent. of them were following farm stock in pastures and yards. Those in orchards (6 per cent.) were doubtless there mainly for shelter and rest. The table of numbers per square mile (Table VI.) shows that orchards were the favorite resort of the sparrows. Barn-yards, pastures, and corn fields were their principal feeding grounds, and only scattering numbers occurred in stubble, meadows, and plowed fields. Not a single one of the 1620 sparrows noted on this trip was seen in the 59 fields of young wheat. These sparrows were, in a word, barn-yard, corn-field, and pasture birds, and were doubtless feeding mainly on weed seeds and undigested fragments of grain.

Crow-blackbirds and Crows.—Blackbirds, on the other hand, were seen to be at this time essentially birds of the pasture, 90 per cent. of them occurring there, and only 4 per cent. in corn fields, 4 per cent. in stubble, and 2 per cent. in farmyards. Practically the same may be said of the crows, whose ratios of abundance are close copies of the preceding excepting for the 6 per cent. on plowed ground, the 1 per cent. in meadows, and the absence of crows from barn-yards. During this whole trip of 192 miles, only 12 crows and 21 blackbirds were seen in the 1300 acres of corn covered by these observations—an average of 6 crows and 10 blackbirds per square mile of corn. It was suggestive of a useful feature of the habits of crows that an average of 79 of these birds per square mile were seen on plowed ground, where they could have found little if any food except insect larvæ—mainly white-grubs. The record for blackbirds is disturbed by the fact that they were moving southward when the trip began, as is shown by their occurrence at the rate of 7.2 per mile of travel during the first half of the period of this trip and at only 1.1 per mile during the last half.

Meadow-larks.—That good genius of the farm, the meadow-lark, was evidently at home almost everywhere on the farm

premises, as is shown especially by the numbers per square mile, which are approximately equal for stubble fields, meadows, pastures, and fields of young wheat (Table VI.). These birds were about a fourth as numerous in corn fields, and a fifth as numerous on plowed ground, as in meadows and fields of stubble, and somewhat more numerous in these latter situations than in pastures and young wheat; but taking into account the actual crop areas in the country covered (Table VII.) we find meadow-larks so distributed through these crops as to be about equally common in pastures and stubble fields, and about half as common in corn, with only 7 per cent. of their number in wheat and meadow-lands respectively. Their recorded numbers on plowed ground amounted to only 1 per cent. of the whole number seen. The occurrence of 86 of these birds per square mile in fields of young wheat suggests a possible economic depredation, of which, in fact, they have been sometimes accused.

Cowbirds.—The cowbird's record of occurrence for this trip would be almost exclusively that of a pasture and meadow species if it had not been for a flock of 62 seen in a field of sorghum, feeding on the seeds. Even including these in the ratios, 60 per cent. were in pastures and 9 per cent. in meadows, the remaining distribution being merely a scattering one. Tested by the number of species per square mile in each crop, as shown by Table VI., the cowbird shows no very decided choice between pastures and meadow-lands, averaging 89 per square mile for the former and 98 for the latter. The species was evidently migrating at the time, as only one example was seen during the last seventy miles of the trip.

It should be noted at this point that these generalizations concerning gregarious birds, which roost in company or feed in flocks, require a much larger body of data than those for birds of solitary habit. The averages of this paper are hence more likely to require amendment for blackbirds, cowbirds, and crows, as information accumulates, than for the other species of our list.

Horned Larks.—The birds of this species found in central

Illinois were all of the prairie variety, *praticola*. With habits much like those of the meadow-lark, they differed from that species widely in their local distribution, especially in their preference for plowed ground, on which they occurred at the rate of 230 per square mile as against 18 meadow-larks for the same area. Their next preference was for pastures, where 97 per square mile were found, the remainder occurring mostly on stubble and young wheat, 25 and 29 per square mile respectively. Nearly two thirds of their actual numbers were found in pasture-lands, 17 per cent. were on plowed ground, and 12 per cent. on stubble. The remainder were in fields of wheat and corn, 3 per cent. in each.

Mourning-doves.—Mourning-doves were mainly in pastures (40 per cent.), corn fields (29 per cent.), and stubble lands (23 per cent.), these three situations thus containing 92 per cent. of all these birds recorded. As tested by the average numbers per square mile, their preferences seem much less definite. While commonest on pasture-lands (50 to the square mile), they were almost as abundant in stubble, meadows, and orchards,—about 40 per mile in each situation,—and more than half as common in corn fields (26 to the mile). Their occurrence on plowed ground and wheat was only occasional, and their numbers there were trivial.

Goldfinches and Field-sparrows.—These little birds were at this time similarly distributed, occurring in the same situations and in nearly equal ratios in each. Both were most numerous in pastures, 42 per cent. for the goldfinches and 40 per cent. for the field-sparrows, and were otherwise rather equally scattered through corn fields and orchards and on waste patches of weeds. In birds per square mile they were about three times as common in orchards as in all the other places taken together, their next apparent preference being for pasture-lands, where, however, the sparrows averaged only 23 to the square mile and the goldfinches 39.

Summary for Principal Species.

Summarizing now the data for all these nine species taken

together as one group, we find an average of 1755 birds to the square mile of orchard, more than three fourths of this number English sparrows; 1186 per square mile in pasture, nearly one third of them English sparrows; 394 to the square mile of plowed ground, 230 of these being horned larks; 373 to the square mile of corn, three fourths of these English sparrows; 308 to the square mile of meadow-lands, where meadow-larks and cowbirds made each about a third of the number; 231 to the square mile of stubble, about two fifths of them meadow-larks; and 148 to the square mile of young wheat, of which meadow-larks made nearly three fifths. This statement may be still further generalized and simplified by saying that the number of these birds per square mile varies in round numbers from 150 in young wheat to eight times that number in pastures, and to nearly 12 times the same number in orchards; and that the intervening ratios were 230 per square mile in stubble, 300 in meadows, 375 in corn, and 400 on plowed ground.

The wide differences of their numbers in these several situations can not be taken to demonstrate corresponding differences in the local or ecological preferences of these birds, although they do indicate something of the effects which birds may be producing on equal areas in these crops. If sparrows resort to orchards largely for resting places and for protection against the wind, they would tend to accumulate there in much greater numbers to the unit of area in a country containing only scattering small orchards than in one where many large orchards were within their reach; and if horned larks decidedly prefer bare ground to a grassy turf, there will be a larger number of them in plowed fields to the square mile when but few fields have been lately plowed than when the larger part of the agricultural area has just been broken up.

Ratios of Frequency and Preference.

Bearing in mind the necessity thus shown for an intelligent analysis and interpretation of certain of the facts, the following tables of *frequency ratios*, and *coefficients of preference* may

be found convenient as a compact systematic summary of my data. The frequency ratios express the comparative densities of population on each kind of surface, for each species tabulated and for all the birds of our list. Taking the ratio of the number of birds found in a crop to the whole number of birds as a dividend, and the ratio of the area in that crop to the entire area as a divisor, the quotient is the frequency ratio for those birds and that crop. If a species were equally distributed over the entire area studied, this ratio would be 1 for all situations and all crops. If 40 per cent. of the area were in corn, then 40 per cent. of the birds of that species would be in corn fields. If, on the other hand, only 20 per cent. of the birds were in corn, the density of population in corn fields would be expressed by the frequency ratio of 50 per cent. All ratios below 1 indicate a density of population less than that resulting from a uniform distribution; and all greater than 1, a density above that limit.

The coefficients of preference are found by dividing in succession the frequency ratios of a species for each crop by its frequency ratios for each of the other crops. They are thus a measure of the degree of preference of the species for one crop or situation over another; and as arranged in my tables of coefficients following, they enable us to see just where the preferences lie, and how they compare one with another. Turning, for example, to the coefficient table for the mourning-dove (Table XI., p. 327), we find at the left of the table a list of the crops in which this bird is found, and a like list, in the same order, at the top. At the place of intersection of the line of figures for one crop with the column of figures for another, will be found the coefficient of the preference of the mourning-dove for one of these crops as compared with the other,—the standard crop being the one whose name is at the head of the column. Selecting, as an illustration, the column headed "corn," and following it to its intersection with the line for "meadows," we find there the coefficient 1.16,—the meaning of which is that for every hundred mourning-doves found in a given area of corn fields, 116 would be found, according to our data, in a

like extent of meadows. If any number of these birds found in corn fields is multiplied by the coefficient 1.16, the product is the number which we may expect to find in meadows of the same aggregate area.

Reading upward from 1 in any column, one gets a descending series of expressions for the densities of the dove population in crops less attractive than the one named at the head of the column; and reading downward from the same point, a reverse series for crops more attractive to doves than this standard crop. The figures on one side of the diagonal line of 1's are the reciprocals of those on the other side.

Tables of this description will be useful for a comparison of the distribution and ecology of the several species at different seasons and in different situations, and for a comparative study of the statistics of bird distribution in different parts of the state and in different states.

TABLE IX. RATIOS OF FREQUENCY, MOST ABUNDANT BIRDS, INDIANA LINE TO QUINCY.

	CORN	STUBBLE	WHEAT	PLOWED GROUND	PASTURES	MEADOWS	ORCHARDS	YARDS	SHRUBS	SWAMPS	WEEDS
English sparrow	.92	..1	.....	.17	1.24	.13	4.61	2333.	.....	.....	60
Crow-blackbird...	.11	.21	.....	.....	3.42	.....	.....	6.66	.....	.....	.....
Meadow-lark	.42	1.59	1.59	.33	1.43	1.56	.....	.....	.....	.....	.....
Crow.....	.13	.15	.....	2.	3.16	.22	.....	.....	.....	.....	.....
Cowbird...	.026	.05	.....	.....	2.26	2.	.....	.....	.....	.....	.....
Horned lark	.079	.61	.68	5.66	2.41	.....	.....	.....	.....	.....	.....
Mourning-dove...	.76	1.18	.23	.33	1.50	.88	1.54	.....	.....	... ..	.....
Goldfinch	.39	.26	.69	.....	1.58	.....	9.23	.....	750	.....	14000
Field-sparrow	.34	.10	.23	.....	1.50	.22	7.69	.....	3500	.....	5500
All birds.....	.53	.47	.23	.33	1.76	.44	3.08	8.33	.....	1.54	.....

TABLE X. COEFFICIENTS OF PREFERENCE, ALL BIRDS, INDIANA LINE TO QUINCY.

	WHEAT	PLOWED GROUND	MEADOWS	STUBBLE	CORN	SWAMP	PASTURES	ORCHARDS	YARDS
Wheat	1.	.70	.52	.49	.43	.14	.13	.075	.028
Plowed ground	1.43	1.	.75	.70	.62	.21	.19	.11	.04
Meadows	1.91	1.33	1.	.94	.83	.29	.25	.14	.053
Stubble	2.05	1.42	1.1	1.	.89	.31	.27	.15	.057
Corn	2.30	1.61	1.2	1.1	1.	.34	.30	.17	.064
Swamp	6.70	4.67	3.5	3.3	2.9	1.	.88	.5	.185
Pastures	7.65	5.33	4.	3.7	3.3	1.1	1.	.57	.21
Orchards	13.39	9.33	7.	6.6	5.8	2.	1.75	1.	.37
Yards	36.22	25.24	18.8	18.	16.	5.4	4.7	3.	1.

TABLE XI. COEFFICIENTS OF PREFERENCE, NINE MOST ABUNDANT BIRDS, INDIANA LINE TO QUINCY.

ENGLISH SPARROW	STUBBLE	MEADOWS	PLOWED GROUND	CORN	PASTURES	ORCHARDS	WEEDS	YARDS
Stubble	1.	.77	.6	.11	.08	.022	.002	.00004
Meadows	1.3	1.	.76	.14	.10	.03	.002	.00006
Pl'd ground	1.7	1.31	1.	.19	.14	.04	.003	.00007
Corn	9.2	7.08	5.41	1.	.74	.2	.015	.0004
Pastures	12.4	9.54	7.29	1.35	1.	.27	.02	.0005
Orchards	46.1	35.5	27.	5.01	3.72	1.	.08	.002
Weeds	600.	462.	353.	65.	48.4	13.	1.	.03
Yards	23330.	17946.	13724.	2536.	1881.	506.	38.9	1.

TABLE XI.—*Continued.*

CROW-BLACKBIRD	CORN	STUBBLE	PASTURES	FARMYARDS
Corn	1.	.52	.03	.02
Stubble	1.91	1.	.07	.03
Pastures	31.1	16.28	1.	.48
Farmyards	60.55	31.71	2.06	1.

MEADOW-LARK	PLOWED GROUND	CORN	PASTURES	MEADOWS	STUBBLE	WHEAT
Plowed ground	1.	.79	.23	.21	.21	.21
Corn	1.27	1.	.29	.27	.26	.26
Pastures	4.33	3.40	1.	.92	.90	.90
Meadows.	4.73	3.71	1.09	1.	.98	.98
Stubble.....	4.82	3.78	1.11	1.02	1.	1.
Wheat.....	4.82	3.78	1.11	1.02	1.	1.

CROW	CORN	STUBBLE	MEADOWS	PLOWED GROUND	PASTURES
Corn	1.	.87	.55	.065	.04
Stubble	1.15	1.	.68	.075	.05
Meadows	1.69	1.47	1.	.11	.07
Plowed ground	15.4	13.3	9.09	1.	.63
Pastures	24.3	21.	14.4	1.58	1.

TABLE XI.—*Continued.*

COWBIRD	CORN	STUBBLE	MEADOWS	PASTURES
Corn	1.	.52	.013	.01
Stubble	1.92	1.	.025	.02
Meadows	76.9	40.	1.	.88
Pastures	80.	45.2	1.13	1.

HORNED LARK	CORN	STUBBLE	WHEAT	PASTURES	PLOWED GROUND
Corn	1.	.13	.12	.03	.01
Stubble	7.72	1.	.90	.25	.11
Wheat	8.61	1.11	1.	.28	.12
Pastures	30.51	3.95	3.54	1.	.43
Plowed ground	71.65	9.28	8.32	2.35	1.

MOURNING-DOVE	WHEAT	PLOWED GROUND	CORN	MEADOWS	STUBBLE	PASTURES	ORCHARDS
Wheat	1.	.70	.30	.26	.19	.15	.15
Plowed ground	1.43	1.	.43	.38	.28	.22	.21
Corn	3.30	2.33	1.	.86	.64	.51	.49
Meadows	3.96	2.67	1.16	1.	.75	.59	.57
Stubble	5.13	3.58	1.55	1.34	1.	.79	.77
Pastures	6.52	4.55	1.97	1.70	1.27	1.	.97
Orchards	6.70	4.67	2.03	1.74	1.31	1.03	1.

TABLE XI.—*Continued.*

FIELD-SPARROW	STUBBLE	MEADOWS	WHEAT	CORN	PASTURES	ORCHARDS	SHRUBS	WEEDS
Stubble...	1.	.45	.43	.29	.07	.013	.00003	.00002
Meadows	2.2	1.	.95	.65	.15	.028	.00006	.00004
Wheat....	2.3	1.05	1.	.68	.15	.03	.00007	.00004
Corn	3.4	1.55	1.48	1.	.23	.04	.0001	.00006
Pastures	15.	6.82	6.52	4.41	1.	.19	.0004	.0003
Orchards	76.9	35.	33.4	22.6	5.13	1.	.002	.001
Shrubs....	35000.	15909.	15217.	10294.	2333.	455.	1.	.64
Weeds....	55000.	25000.	23913.	16177.	3666.	715.	1.57	1.

GOLDFINCH	STUBBLE	CORN	WHEAT	PASTURES	ORCHARDS	SHRUBS	WEEDS
Stubble	1.	.66	.38	.17	.028	.00035	.00002
Corn	1.50	1.	.56	.25	.042	.00052	.00003
Wheat	2.65	1.77	1.	.44	.075	.00092	.00005
Pastures.....	6.04	4.05	2.29	1.	.171	.0021	.0001
Orchards.....	35.5	23.7	13.4	5.84	1.	.0123	.0006
Shrubs	2885.	1923.	1087.	475.	81.3	1.	.0534
Weeds	53846.	35897.	20290.	8861.	1517.	18.7	1.

The data of Table XI., arranged under the different species of birds, may also be classified, as in Table XII., according to the different situations, or the different kinds of crops, frequented by the birds. The one table shows us how each kind of bird is related to the various crops; and the other, how each crop is related to the various kinds of birds. Table XI. is thus essentially ornithological, showing the preferences of each kind of bird with respect to the food resources and places of resort offered it by each kind of crop or other situation. Table XII. is essentially agricultural, and shows the principal bird visitants of each kind of crop, brought into comparison with respect to their preferences for that crop alone. Referring, for example, to the section for corn, we see at the left the names of the principal birds of the corn field, arranged from above downwards in the order of their frequency in corn, the least frequent visitants uppermost. We may use this table to compare any species with another as a corn-field bird—the horned lark with the meadow-lark, for instance—by finding the place of the one species in the diagonal series of 1's and going up or down the column until the line for the other species is reached. The coefficient at the intersection of the column with the line shows the frequency relation of the one bird to the other. In this way we learn that for every hundred horned larks, 532 meadow-larks were found in corn, or, what is virtually the same thing, that for every hundred meadow-larks there were 19 horned larks on an average in corn.

It is also easy to ascertain from these tables whether there is any group of species which seem especially and strongly attracted to any special situation. We notice such a group in the horned larks, mourning-doves, and meadow-larks, considered as visitants of fields of stubble, and found there respectively about 3 times, 5 times, and $7\frac{1}{2}$ times as frequently as are blackbirds; in the crows and the horned larks, considered as visitants of plowed fields, found there approximately 6 times and 17 times as frequently as are meadow-larks; and in the field-sparrows, goldfinches, meadow-larks, mourning-doves, and English sparrows in the corn fields, in which they occur from 3

to 8 times as frequently as blackbirds. The principal meadow birds, by these tables, are mourning-doves, meadow-larks, and cowbirds, since they occur in meadows 7 times, 12 times, and 15 times as commonly as English sparrows; while pastures apparently afford a common meeting ground for all the birds of this list of most important species, the coefficient of the blackbird—the most frequent pasture bird—being less than three times that of the English sparrow, the least frequent of these birds in pastures.

Numerous questions of cause, effect, and controlling condition are suggested by these data, some of them readily answerable and others doubtfully so, but the discussion of ecological problems may best be postponed until the data here presented may be brought into comparison with those obtained from other trips, made at other seasons and in other parts of the state.

TABLE XII. COEFFICIENTS OF PREFERENCE, TABULATED BY CROPS.

CORN	COWBIRD	HORNED LARK	CROW-BLACKBIRD	CROW	FIELD-SPARROW	GOLDFINCH	MEADOW-LARK	MOURNING-DOVE	ENGLISH SPARROW
Cowbird.....	1.	.33	.24	.20	.08	.07	.06	.03	.03
Horned lark	3.04	1.	.72	.61	.23	.20	.19	.10	.09
Crow-blackbird...	4.23	1.39	1.	.85	.32	.28	.26	.14	.12
Crow.....	5.	1.65	1.18	1.	.38	.33	.31	.17	.14
Field-sparrow	13.08	4.30	3.09	2.61	1.	.87	.81	.45	.37
Goldfinch	15.	4.94	3.55	3.	1.15	1.	.92	.51	.42
Meadow-lark	16.15	5.32	3.82	3.23	1.24	1.08	1.	.55	.46
Mourning-dove...	29.23	9.62	6.91	5.85	2.24	1.95	1.81	1.	.83
English sparrow	35.38	11.64	8.36	7.08	2.71	2.36	2.19	1.21	1.

TABLE XII.—*Continued.*

STUBBLE	COWBIRD	FIELD-SPARROW	ENGLISH SPARROW	CROW	CROW-BLACKBIRD	GOLDFINCH	HORNED LARK	MOURNING-DOVE	MEADOW-LARK
Cowbird	1.	.5	.5	.33	.24	.19	.08	.04	.03
Field-sparrow	2.	1.	1.	.66	.48	.38	.16	.08	.06
English sparrow	2.	1.	1.	.66	.48	.38	.16	.08	.06
Crow	3.	1.5	1.5	1.	.71	.58	.24	.13	.09
Crow-blackbird	4.2	2.1	2.1	1.40	1.	.81	.34	.18	.13
Goldfinch	5.2	2.6	2.6	1.73	1.24	1.	.43	.22	.16
Horned lark	12.2	6.1	6.1	4.07	2.90	2.35	1.	.51	.38
Mourning-dove	23.6	11.8	11.8	7.87	5.62	4.54	1.93	1.	.74
Meadow-lark	31.8	15.9	15.9	10.6	7.57	6.11	2.61	1.35	1.

WHEAT	MOURNING-DOVE	FIELD-SPARROW	HORNED LARK	GOLDFINCH	MEADOW-LARK
Mourning-dove	1.	1.	.34	.33	.14
Field-sparrow	1.	1.	.34	.33	.14
Horned lark	2.96	2.96	1.	.99	.43
Goldfinch	3.	3.	1.01	1.	.43
Meadow-lark	6.91	6.91	2.34	2.30	1.

PLOWED GROUND	ENGLISH SPARROW	MEADOW-LARK	MOURNING-DOVE	CROW	HORNED LARK
English sparrow	1.	.52	.52	.08	.03
Meadow-lark	1.94	1.	1.	.16	.06
Mourning-dove	1.94	1.	1.	.16	.06
Crow	11.76	6.06	6.06	1.	.35
Horned lark	33.29	17.15	17.15	2.83	1.

PASTURES	ENGLISH SPARROW	MEADOW-LARK	MOURNING-DOVE	FIELD-SPARROW	GOLDFINCH	COWBIRD	HORNED LARK	CROW	CROW-BLACKBIRD
English sparrow..	1.	.87	.83	.83	.78	.55	.51	.39	.36
Meadow-lark	1.15	1.	.95	.95	.90	.63	.59	.45	.42
Mourning-dove...	1.21	1.05	1.	1.	.95	.66	.62	47	.44
Field-sparrow	1.21	1.05	1.	1.	.95	.66	.62	.47	.44
Goldfinch	1.27	1.10	1.05	1.05	1.	.70	.66	.50	.46
Cowbird.....	1.82	1.58	1.51	1.51	1.43	1.	.93	.71	.66
Horned lark.....	1.94	1.69	1.61	1.61	1.52	1.07	1.	.76	.70
Crow.....	2.55	2.21	2.11	2.11	2.	1.40	1.31	1.	.92
Crow-blackbird ..	2.76	2.39	2.28	2.28	2.16	1.51	1.42	1.08	1.

MEADOWS	ENGLISH SPARROW	CROW	FIELD-SPARROW	MOURNING-DOVE	MEADOW LARK	COWBIRD
English sparrow.....	1.	.59	.59	.15	.08	.07
Crow.....	1.69	1.	.1	.25	.14	.11
Field-sparrow	1.69	1.	1.	.25	.14	.11
Mourning-dove.....	6.77	4.	4.	1.	.57	.44
Meadow-lark	12.	7.09	7.09	1.77	1.	.78
Cowbird.....	15.38	9.09	9.09	2.27	1.28	1.

Conclusion.

The circumstance that the data of this paper are summarized in numerical tables must not be permitted to obscure the fact that they merely present a fixed picture of a fleeting condition; that they are to be taken only as numerical generalizations of the observations here recorded, and do not, in themselves, warrant much by way of inference beyond their immediate contents. The view of the autumnal bird life of central Illinois which we get by their means is like a short-time photograph of a changing scene—changing so rapidly, indeed,

that the effects of its transformations are noticeable even in the picture itself; for it is evident, especially from the list of species at the end of this paper, that there was some bird migration southward during the fifty days of this trip. Summer residents of central Illinois diminish in numbers, or even wholly disappear, during its course, winter residents come in, and migrants to the south, not seen in the earlier days of the journey, become abundant as they move across the line of march in the western part of the state.

Some of the effects of this migration were seen a fortnight later in the very different picture of bird life presented on a trip made by these same observers, October 31 and November 1, from Cairo, the southernmost point in Illinois, to Ullin, some twelve and a half miles north. Here, instead of the scanty average of 874 birds per square mile, as found in central Illinois, there were over 9 to the acre, or 5882 to the square mile. Two thirds of these were crow-blackbirds and robins—45 per cent. of the first and 23 per cent. of the second—and the next most abundant species was the white-throated sparrow (7 per cent.), and next to that, the quail (4 per cent.). The meadowlark was reduced to 2 per cent. of the birds observed; and, more remarkable still, the English sparrow, to a little more than 1 per cent. Into the angle formed by the meeting of the Ohio River with the Mississippi, birds from the north were dropping down by thousands as into a huge pocket, to be held there, no doubt, until cold weather or a diminution of their food supply should drive them farther south.

Definite conclusions of permanent value concerning the numbers and significance of the bird life of the state evidently can not be drawn until many such pictures as these have been assembled, compared, and adjusted in their right relations; and it has been the principal object of this paper to describe and illustrate one process, at least, by which the materials necessary to a correct general view of the ornithological ecology of the state may be brought together and made available.

LIST OF BIRDS IDENTIFIED, INDIANA LINE TO QUINCY, ILL.

CHECK-LIST NO.	SPECIES	I*	II	III	IV	V	VI
190	Botaurus lentiginosus	....	....	....	....	....	1
194	Ardea herodias	1	....	....	....	....	....
201	Butorides virescens	1	....	....	....	....	....
214	Porzana carolina	1	1	....	....	....	....
261	Bartramia longicauda	1	1	1	....	....	....
273	Oxyechus vociferus	55	....	2	3	....	....
289	Colinus virginianus	....	....	....	....	14	55
305	Tympanuchus americanus	2	7	....	....	....	....
316	Zenaidura macroura	56	22	14	42	32	14
325	Cathartes aura	4	....	2	....	....	....
331	Circus hudsonius	....	1	1	....	....	1
337	Buteo borealis	2	....	....	....	1	1
347a	Archibuteo lagopus sancti-johannis	1	....	....	1	....	....
357	Falco columbarius	....	....	....	....	....	1
360	Falco sparverius	3	1	....	....	....	....
387	Coccyzus americanus	2	1	....	....	....	....
390	Ceryle alcyon	1	....	....	....	....	....
393	Dryobates villosus	....	....	....	....	....	1
394c	Dryobates pubescens medianus	....	....	1	1	....	8
402	Sphyrapicus varius	....	....	2	....	....	....
406	Melanerpes erythrocephalus	21	....	1	....	....	....
409	Centurus carolinus	....	....	....	1	....	2
412	Colaptes auratus	23	8	14	14	2	1
420	Chordeiles virginianus	21	....	....	....	....	....
423	Chætura pelagica	2	1	....	5	1	8
444	Tyrannus tyrannus	2	....	....	....	....	1
456	Sayornis phœbe	....	....	2	....	1	3
461	Contopus virens	1	....	1	....	....	....
466	Empidonax traillii	2	....	....	....	....	....
474b	Otocoris alpestris praticola	41	61	49	17	2	50
477	Cyanocitta cristata	11	3	15	12	2	14
488	Corvus brachyrhynchos	14	5	19	20	158	10
494	Dolichonyx oryzivorus	....	....	1	....	....	....
495	Molothrus ater	60	24	63	73	....	1
498	Agelaius phœniceus	3	....	....	....	....	5
501	Sturnella magna	82	19	50	31	20	110
511b	Quiscalus quiscula æneus	309	65	11	95	....	37
517	Carpodacus purpureus	....	....	....	....	....	4
——	Passer domesticus	188	447	112	683	5	185
529	Astragalinus tristis	12	1	10	12	....	99
540	Poocætes gramineus	....	8	11	....	....	52
542a	Passerculus sandwichensis savanna	....	....	....	1	....	6
546	Coturniculus savannarum passerinus	16	11	4	1	5	7
548	Ammodramus leconteii	....	....	....	....	12	11
554	Zonotrichia leucophrys	....	....	....	2	....	6
558	Zonotrichia albicollis	....	....	....	2	....	91

* I=Indiana line to Champaign, Aug. 28–Sept. 1. II=Urbana to Decatur, Sept. 17–21. III=Decatur to Springfield, Sept. 24–29. IV=Springfield to Jacksonville, Oct. 1–4. V=Jacksonville to Meredosia, Oct. 5–8. VI=Meredosia to Quincy, Oct. 12–17.

LIST OF BIRDS IDENTIFIED.—*Continued.*

CHECK-LIST NO.	SPECIES	I	II	III	IV	V	VI
560	Spizella socialis	...	1	...	...	...	....
563	Spizella pusilla	2	1	1	1	1	77
567	Junco hyemalis	...	...	...	3	1	32
581	Melospiza cinerea melodia	...	...	...	4	1	19
583	Melospiza lincolni	...	...	...	3	...	3
584	Melospiza georgiana	...	...	1	12	32	110
585	Passerella iliaca	...	...	...	...	...	2
587	Pipiló erythrophthalmus	...	...	...	...	...	14
593	Cardinalis cardinalis	...	...	1	...	1	1
598	Cyanospiza cyanea	1	...	...	...	...	....
604	Spiza americana	2	...	...	...	...	....
611	Progne subis	4	...	...	...	...	....
612	Petrochelidon lunifrons	6	...	...	...	...	....
613	Hirundo erythrogaster	3	...	...	...	...	....
614	Iridoprocne bicolor	...	...	...	...	9	2
619	Ampelis cedrorum	...	...	...	....	...	1
622	Lanius ludovicianus	3	1	...	...	...	1
624	Vireo olivaceus	...	...	1	...	...	....
626	Vireo philadelphicus	...	...	1	...	...	....
629	Vireo solitarius	...	1	...	...	...	....
645	Helminthophila rubricapilla	1	...	...	...	...	....
646	Helminthophila celata	...	...	...	...	...	1
647	Helminthophila peregrina	...	1	...	...	...	....
655	Dendroica coronata	...	2	34	33	7	36
657	Dendroica maculosa	...	1	..	...	...	....
667	Dendroica virens	...	2	..	1	...	....
672	Dendroica palmarum	2	...	...	1	...	....
681d	Geothlypis trichas brachidactyla	...	...	1	...	...	....
687	Setophaga ruticilla	...	2	...	...	...	....
697	Anthus pensilvanicus	...	...	...	...	...	25
703	Mimus polyglottos	...	...	...	1	...	....
704	Galeoscoptes carolinensis	2	1	...	...	...	....
705	Toxostoma rufum	...	2	2	1	...	....
719	Thryomanes bewickii	...	...	1	...	...	....
721	Troglodytes aëdon	3	...	..	1	...	2
724	Cistothorus stellaris	...	...	2	2	...	3
726	Certhia familiaris americana	...	...	...	2	...	1
727	Sitta carolinensis	...	...	...	...	...	2
728	Sitta canadensis	...	...	3	...	...	1
731	Bæolophus bicolor	...	...	...	...	...	10
735	Parus atricapillus	...	...	...	...	...	22
736	Parus carolinenis	...	...	3	4	...	....
748	Regulus satrapa	...	...	...	2	...	2
749	Regulus calendula	...	...	...	...	...	6
758a	Hylocichla ustulata swainsoni	...	1	...	...	...	....
761	Merula migratoria	4	15	18	5	...	19
766	Sialia sialis	...	...	10	11	...	40
?*		3	1	1	2	6	10

* Indentification uncertain.