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THE RETURN OF ROBINS TO THEIR BIRTHPLACES[1]

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It appears to be well established that the breeding birds of many migratory passerine species show a marked tendency to return to the same locality in successive breeding seasons. The literature concerning this subject is extensive and has been adequately reviewed by Schenk (1927, 1929b), Schüz and Weigold (1931), Nice (1937, p. 177), and Groebbels (1937, p. 118). Ample evidence is also to be found among the banding data of the U. S. Fish and Wildlife Service as well as among those of the various European banding organizations. However, the relation of the breeding locality to the birthplace of the bird has been a matter of considerable controversy. The problem resolves itself into whether or not the young in their first northward migration display a tendency to return to breed at or near their individual birthplaces in a manner similar to the tendency of their parents to return to the breeding locality of the previous year. Knowledge of the degree of development of such a tendency is of obvious interest in the consideration of such problems as the extension of geographic range, isolation of breeding populations, and the differentiation of races and species. This paper is presented not only for its pertinent empirical data and conclusions concerning the Eastern Robin, *Turdus migratorius migratorius* L., but further to demonstrate how

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banding data may be employed in the study of these interesting problems.

Few problems in ornithology have provoked as diverse theories and opinions as has the problem of the return of birds to their birthplaces. As early as 1910 Schenk (1910), after an examination of his banding data, expressed the opinion that among species in which there is a mixing of individuals from a relatively large area during the winter, the young do not tend to return to their birthplaces. It was suggested that among such species the first-year birds follow the older birds northward in spring and are therefore led most frequently to localities other than their birthplaces. However, as more data were accumulated Schenk (1927, 1929b) apparently discarded this idea. Lincoln (1934) suggested that attachment to the breeding area is confined to adults and that the first nesting site is selected at random anywhere within the natural range of the species. L. B. Chapman (1935) in considering his data on Tree Swallows, *Iridoprocne bicolor* (Vieillot), concluded that among the possible explanations, Lincoln's theory of random dispersal throughout the range of the species was most nearly correct. F. M. Chapman (1937, p. xxxv) writes of the "apparent failure" of migrants to return to their birthplaces. Groebbels (1937, p. 118) concluded that both young and adult birds exhibit *Ortstreu* although it is better developed among adults. His conclusions were based to a considerable extent on Schenk's compilation (1927, 1929b) in which it was concluded that a strong tendency to return to the birthplace or to the previous breeding place exists among several species. Schenk's data were not classified according to age (young or adult) at banding and therefore do not show the relative development of the tendency in adults and first-year birds. Nevertheless, since some data on first-year birds were obviously included they are of some significance.[2] Dupond (1934,

[2] Schenk's (1927) compilation has been the source of some confusion. The table as presented to the X[e] Congrès International de Zoologie was entitled "Statistik der Fundorte von Ringvögeln während der Brutzeit nach deren Entfernungen vom Geburtsorte" (p. 1395) which would seem to indicate that the birds must have been banded as young. This apparently was the interpretation of Kluijver (1935a, p. 162). "Schenk (1927), die de literatuur tot 1927 hierop nasloeg, vond, dat 95% der Spreeuwenterugvangsten in den voortplantingstijd vielen binnen een afstand van 10 KM. van de geboorteplaats, 2% tusschen 10 KM. en 50 KM. en 3% verder dan 50 KM. . . . Schenk is op grond van bovengenoemde cijfers van meening, dat verreweg het grootste deel der jongen terugkeert naar geboorteplaats." That Schenk's compilation actually contains data on birds banded *both* as young and breeding adults is obvious from his description of his preparation of the table (p. 1387). "Dieses Datenmateriale wurde in 4 Gruppen geordnet. Die erste enthält sämtliche Daten, laut welchen der betreffende Vogel —ob gewesener Brutvogel, oder Jungvogel— in die nächste Umgebung des früheren Brutplatzes, oder des Erzeugungsortes zurückkehrte, oder dort verblieb." This is further verified by the column heading of the table in the Hungarian edition of the paper (Schenk, 1929b, p. 94), "A lelöhelyek száma az otthontól számitva," i.e., the distance of recoveries from home (not birthplace).

p. 9) in a review of the results of banding studies in Belgium stated that the return of birds to their birthplaces is a principle that holds true for all species of birds.[3] However, the number of recoveries of birds banded as young on which this statement is based is not apparent. Verheyen (1939) made a special study of the data on birds banded as young and subsequently recovered over a period of ten years in Belgium. He concluded that in several species of migratory passerine birds there is a strong tendency for the young to return as breeding birds to their birthplaces. Hickey (1943, p. 40) has given a brief, but excellent, discussion of the factors and problems involved in the study of the tendency of birds to return to their birthplaces. He also presents the first quantitative study of this phenomenon in the American Robin. The investigations cited and reviewed in the following paragraphs are not intended as a thorough summary of the entire field but rather a description of some of the important studies on certain passerine species.

Vilks and von Transehe (1933) studied the return of Starlings, *Sturnus vulgaris* L., to their birthplaces in Lithuania. They found that the return of first-year birds to the colony where they were hatched was only three to five percent whereas the return of banded adults to these colonies was found to be 25-30 percent. In view of the greater mortality among the young, the difference in the actual percentage of live first-year birds and adults is not as pronounced as these data indicate superficially. Kluijver's painstaking studies (1933, 1935a) have contributed much to the knowledge of this species. He estimated (1935b) that 44 percent of the live first-year birds return to the vicinity of their birthplaces (within 1200 meters) and that the others breed further afield. His data indicate a strong tendency among Starlings to return to the general vicinity of the birthplace. The situation is complicated by problems of partial migration and by the fact that not all first-year birds breed. E. S. Thomas (1934) has suggested that the tendency to return to the birthplace is not well developed in young Starlings and that the expansion of this species in the Middle West was due largely to first-year birds. Schüz and Weigold (1931) have noted that the return of adult Starlings to previous breeding sites, as well as the return of first-year birds to their birthplaces as breeding birds, has been observed many times.

Nice (1937) states that in some years the return among young Song Sparrows, *Melospiza melodia euphonia* Wetmore, to the vicinity of their

[3] "Cette règle du retour aux lieux de naissance est un principe vrai pour tous les oiseaux. Des examples prouvés par le baguage ont été fournis par un grand nombre d'espèces."

birthplace exceeded the 44 percent return of first-year Starlings recorded by Kluijver (1935b). It was estimated that one-half to three-fifths of the surviving young returned to their place of birth. She concluded (p. 185) that the young are "certainly far less *ortstreu* or faithful to their homes than are adults" and that the young of many species do scatter widely although not over the entire range of the species or subspecies. Price (1936) observed only a two percent return to the birthplace in the Plain Titmouse, *Baeolophus inornatus inornatus* (Gambel).

Kendeigh and Baldwin (1937, p. 115) in their extensive and careful studies of a restricted population of the House Wren, *Troglodytes aëdon aëdon* Vieillot, found only a 2.5 percent return among birds banded as nestlings as compared to 29 percent among those banded as adults. These authors calculate that about 26 percent of the nestlings survive to the following breeding season and that 20.5 percent of the banded nestlings (allowing an error of 2.5 percent) "drift away into other regions." However, their data do not allow a calculation of the actual distances of displacement ("drift") of the members of this group. These data together with others presented by the same authors indicate that the tendency of first-year birds to return to their birthplaces is not as well developed as the tendency of adult birds to return to the breeding locality of the previous season.

A great deal of material has been accumulated on the return of swallows to their birthplaces. In his observations on nesting colonies of *Hirundo rustica* L., d'Abadie (1925, 1926) noted the failure of young to return as breeding birds to the colonies in which they were hatched. Schüz and Weigold (1931, p. 104) reviewed the available data on this species and concluded that both the young and adults return "not infrequently" to their birthplace or previous nesting site although the tendency was noted to be much stronger in adults.[4] Uchida (1932) in Japan found that about one-half of the adult swallows banded during the breeding season returned to the same nesting place in subsequent breeding seasons. A very small percentage of banded nestlings returned to the birthplace as breeding birds. Boley (1932) reported that 85 percent of the swallows *(Hirundo rustica)*, banded by him as nestlings and subsequently recovered as breeding birds, were recovered at the birthplace; an additional ten percent were taken within two kilometers of the birthplace. Thomas (1933) referring to the same species concluded that nestlings return to the same district but "probably

[4] ". . . so dass man sagen darf: Alte und junge Rauchschwalben kehren nicht selten zu ihren Heimatort zurück, alte freilich viel regelmässiger als die Jungen, die auf andere Ställe und auch andere Ortschaften (und selbst andere Länder . . .) besiedeln."

spread out very much further than adults—half a mile to 13 miles." Low (1933, 1934) has recorded 11 percent returns of nestling Tree Swallows, *Iridoprocne bicolor* (Vieillot); among 48 such returns only one was found more than 25 miles from the birthplace. Dupond (1934) concluded that Swallows, *Hirundo rustica rustica* L. and *Delichon urbica urbica* (L.), return to the place of birth although it is by no means an absolute rule. L. B. Chapman (1935) found fledgling returns as breeding birds to be 4.6 to 6.25 percent. The returns and recoveries tabulated by Creutz (1938) for *Hirundo rustica* and *Delichon urbica* show that there is a marked tendency for young to return to the vicinity of their birthplace and often to the exact locality; however, these data show further that the return of adults to the previous nesting locality occurs with even greater precision. Verheyen (1939) found that 119 of 120 *Hirundo rustica rustica*, banded as nestlings and recovered as breeding birds, were recovered within 10 kilometers of the birthplace. Stoner (1941) in discussing 15 years' banding of Bank Swallow, *Riparia riparia riparia* (L.), points out that of 35 recoveries, during the breeding season, of birds banded as young, eight were recovered in the colony in which they were banded and that none were recovered away from the general vicinity of the birthplace.

In general the theories of random dispersal of young birds during their first breeding season are based on the observed relatively low percentages of returns of birds banded as young at the banding station and its immediate vicinity. The literature contains numerous examples of this type of observations. For example, Kluijver recorded a return of 8.3 percent of 980 Starlings, banded as nestlings, to the exact banding locality. Nice (1937, p. 183) tells of the recapture in her garden of only five of 317 Song Sparrows banded as young although 35 others were found at distances within 1400 meters—12.6 percent in all. Stoner (1926, 1928a, 1928b) recorded only about a two percent return among Bank Swallows banded as young. Thomas (1933), Low (1933, 1934), L. B. Chapman (1935), and Uchida (1932), as described above, have all observed apparently small percentages of returns among swallows. As mentioned previously Kendeigh and Baldwin (1937) recovered only 2.5 percent of House Wrens banded as nestlings. Low percentages of returns of birds banded as young have been observed generally by banders. However, Whittle (1926) has pointed out that the assumptions, based on the low returns to individual stations, that the first-year birds do not have a tendency to return to their birthplaces are fundamentally unsound. He pointed out that the failure to detect returned young may be due to failure on the part of the bander to operate traps in a sufficient number of adjacent territories or that the young are unable, because of competition, to return to the exact locality. In a later

paper Whittle (1936) points out that higher loss among juvenile birds, as compared to adults, must be considered in comparing the percentages of returns of birds banded as young and those banded as adults. He also suggested that if, as is the case in several species, the adults precede the first-year birds in northward migration, there will be a certain amount of displacement of first-year birds because of prior occupancy of territories by adults. His data on Song Sparrows indicated that first-year birds will take over parent territories when they are unoccupied; otherwise they are forced to nest elsewhere. Nice's (1937, p. 183) experience did not confirm these observations, but her situation was characterized by a surplus of suitable territories for Song Sparrows. Concerning the higher loss among young birds suggested by Whittle (1936), Kluijver (1935a) calculated that 17 percent of the fledged Starlings survive to breed, Nice (1937) estimated 20 percent for the Song Sparrow, and Farner (1945) 20 percent for the American Robin. Farner (1945) has estimated that the survival of adult Robins for the same period is about 50 percent.

METHODS AND MATERIALS

The American Robin, *Turdus migratorius* L., was selected for this study because of the relatively large number of available banding returns and furthermore because of the reasonable certainty with which the young can be distinguished from the adults by the bander. Since only records of Robins banded north of the Ohio and Missouri Rivers and north of the southern boundaries of Pennsylvania and New Jersey are used, it is assumed that the data apply to the northern race, *Turdus migratorius migratorius* L., although there is the possibility that a few records of the southern race, *achrusterus* (Batchelder) may be included. All records of birds banded within the ranges of the western races, *caurinus* (Grinnell) and *propinquus* Ridgway, were discarded. No records of birds banded within the range of *nigrideus* Aldrich have been included. For the purposes of this study only those records with adequate data of birds banded as young and subsequently recovered, either as "returns" or "recoveries," during the breeding season were used. The breeding season was fixed, according to data and discussions of Howell (1942), from April 1 to September 1. It is of further importance that records of birds banded after the latter date not be used, because after this time increasing numbers of young are completing the partial post-juvenal molt making them difficult if not impossible to distinguish from adults. Table 1 classifies the records according to the states in which the birds were recovered during the breeding season.

TABLE 1

DISTRIBUTION OF RECORDS OF BREEDING SEASON BIRDS BANDED AS YOUNG

State or Province[1]	Type of Record: Retrapped	Other	Total
Arkansas	0	1[2]	1
Connecticut	4	0	4
Illinois	14	55	69
Indiana	2	17	19
Iowa	3	11	14
Maine	0	1	1
Maryland	0	1[3]	1
Massachusetts	11	19	30
Michigan	8	45	53
Minnesota	5	20	25
Missouri	0	1[4]	1
Nebraska	0	1[2]	1
New Jersey	6	19	25
New York	8	12	20
North Dakota	17	12	29
Ohio	11	32	43
Pennsylvania	19	23	42
South Dakota	3	5	8
Wisconsin	8	18	26
Alberta	0	1	1
Manitoba	0	4	4
Ontario	1	5	6
Quebec	0	1	1
Saskatchewan	1	3	4
Total	121	307	428

[1] According to locality where recorded during breeding season.
[2] Hatched in Iowa.
[3] Hatched in Massachusetts.
[4] Hatched in Illinois.

It is assumed that the recovered birds, selected as described above and tabulated in Table 1, constitute a normal sample of the population of the breeding season and consequently that the spacial relationships of their breeding localities to their birthplaces is typical for the entire subspecies. Nevertheless, such an assumption must be examined from several aspects. The sample obviously differs from the population as a whole in that each bird carried a band; however, it is highly doubtful that this has any bearing on the validity of the samples. It is not known what percentage of the birds recovered in the breeding range during the breeding season are actually breeding birds. It is assumed in Robins that the percentage of non-breeding birds is low. Furthermore, it is probable that some early April recoveries and some late August birds may not have been breeding birds at the recovery

locality. If the percentage of non-breeding recoveries is appreciable it may reduce to a certain extent the percentage of returns to the breeding locality. A further deviation may occur in that some of the young birds may have wandered some distance from their birthplace by the time of banding although there are few, if any, data which suggest that this is of importance. The data are classifiable into two groups: those recovered by trapping and those recovered by other means such as "found dead," "killed by cat," "shot," etc. The first group is from one point of view a better sample in that it includes normal live birds and is probably a more accurate sample of the breeding population. Kluijver (1935a) in discussing Schenk's (1927) compilation criticizes this method of sampling in studying the return of birds to their birthplaces, pointing out that the operation of traps at the locality where the birds were banded will recapture only those returning to the locality, thereby giving an exaggerated picture of the tendency to return to the birthplace. This criticism is only partly tenable. *If, for instance, the theories of random dispersal were true, then the chances of trapping a first-year breeding bird would be essentially equal for all stations operating which trap Robins during the breeding season.* If, as is the case with Robins, birds are invariably retrapped during the breeding seasons only at the stations where they were banded as young, there is certainly indication of a strong tendency to return to the place of birth. Nevertheless, trapping returns may give an exaggerated picture since they will not usually detect those birds which have returned to the *general vicinity* rather than to the *exact locality.* In this respect Kluijver's (1935a) criticism is certainly valid. Birds recovered by other means represent a more random sample with certainly, at most, only a slightly greater chance of recovery at the banding station. On the other hand, it is possible that many of the birds found dead may have died before the breeding season and should not have been included since they would have been en route to rather than at the breeding locality. Others may have been sick birds and hence non-breeders. Data on these birds which cannot be separated from the data on valid breeders will tend to decrease the percentage returning as breeders to their birthplaces. An attempt to eliminate some of the non-breeder records has been made by a consideration of each recovery during the breeding season more than 150 miles from the banding locality. This analysis is tabulated in Table 2. Actually it seems probable that the trapping data represent the maximum possible percentage of return to the birthplaces, whereas the percentages of return calculated from the other data probably represent the minimum limit of return as breeding birds to the birthplaces.

TABLE 2

SUMMARY OF BIRDS RECOVERED DURING THE BREEDING SEASON AT UNUSUAL DISTANCES FROM BANDING LOCALITIES

Number	Banding Data		Recovery Data		Relation of Recovery Locality to Banding Locality		Type of Recovery	Conjectural[1] Breeding Status
	Locality	Date	Locality	Date	Distance	Direction		
40-355521	White Bear, Minn.	7/6/40	Rolla, N. D.	4/20/41	425	NW	"Found dead"	Highly probable
A375989	Hillsdale, Mich.	7/25/30	Gilberts, Ill.	4/21/31	192	W	"Killed by auto"	Probable
A224341	Fenton, Mich.	5/23/32	Milwaukee, Wis.	5/3/36	215	WNW	Found dead	Highly probable
A320638	Sault Sainte Marie, Mich.	7/7/30	Toledo, Ohio	5/18/31	335	ESE	Found dead	Doubtful
A310284	Westfield, Wis.	6/21/29	Gary, Ind.	6/4/30	186	SSE	"Killed"	Probable
A360388	Appleton, Wis.	8/17/30	Gladstone, Mich.	7/14/31	148	NNE	Found injured	Probable
B308523	Wilmette, Ill.	6/12/31	Toledo, Ohio	8/13/32	218	E	Found dead	Probable
38-321028	Blue Island, Ill.	8/11/39	St. Louis, Mo.	5/25/40	250	SW	Found dead	Very doubtful
34-245217	Sutherland, Ia.	8/8/34	Nevada Co. Ark.	4/15/35[2]	640	S	"Killed"	Very doubtful
A395740	Muncie, Ind.	5/18/31	Harvey, Ill.	7/7/33	180	NW	Found dead	Probable[3]
34-353228	Story Co., Ia.	7/19/36	Omaha, Neb.	4/23/37	220	SW	Caught in snare	Doubtful
23227	Danvers, Mass.	6/12/22	Baltimore, Md.	5/1/23	375	SSW	"Remains found"	Very doubtful
A278295	Groton, Mass.	7/28/31	Lavalette, N. J.	6/24/32	300	SSW	"Remains found . . . not much of it left"	Doubtful

[1] In analyzing these records consideration is given to the date of recovery, direction from banding locality, and the possibility, in the case of birds recovered dead, of a period of time between death and recovery. In cases of birds recovered in April approximately south of the banding locality, it was concluded that they were more probably non-breeding strays or migrants than actual breeding birds.

[2] Date of reporting letter; bird may have been recovered much earlier in year.

[3] This may be a southward migrant since the letter recording the recovery is dated 10/25/33 and gives no date of recovery. The source of the date, 7/7/33, which appears on the Fish and Wildlife Service card is not known and may be erroneous.

ANALYSIS OF BANDING RETURNS

The two groups of data, *i.e.*, those obtained by retrapping and those secured by other means ("found dead," "killed by cat," etc.), have been classified into five groups according to the distances of the recoveries from the banding locality (Table 3). The distances have been selected arbitrarily, based only on the fact that it is difficult to compute with accuracy displacement distances of less than 25 miles. Figure 1 shows the directional as well as spacial displacement of those birds recovered during the breeding season at points more than 25 miles from the banding locality.

TABLE 3
RECOVERIES AND RETURNS DURING THE BREEDING SEASON OF ROBINS BANDED AS YOUNG

	Distance from Banding Locality in Miles					Total
	0-25	25-50	50-100	100-200	More than 200	
Retrapped	120[2]	0	0	0	1	121
Other records[1]	267[3]	13	10	10	7	307
All records	387	13	10	10	8	428
Doubtful records	0	0	0	0	6	6
Corrected total	387	13	10	10	2	422
Retrapped (%)	99.2	0	0	0	0.8	100.0
Other records (%)[1]	86.9	4.2	3.3	3.3	2.3	100.0[4]
All records (%)	90.5	3.0	2.3	2.3	1.9	100.0[5]
Corrected total (%)	91.6	3.1	2.4	2.4	0.5	100.0[5]

[1] "Found dead," "killed," etc.
[2] All reported from original banding stations.
[3] 192 reported from original banding stations.
[4] 62.5 percent were reported from original banding stations.
[5] 72.9 percent (corrected, 74.0 percent) reported from original banding stations.

Among the retrapped birds 120 out of 121 (99.2 percent) were retrapped at the banding locality. As indicated in a previous paragraph, these data doubtless exaggerate the apparent tendency to return to the birthplace. *However, they are significant in indicating that there is by no means a random dispersal of the first-year birds since, if this were true, the 121 recaptures would be more or less evenly distributed among stations throughout the breeding range of the Robin.*

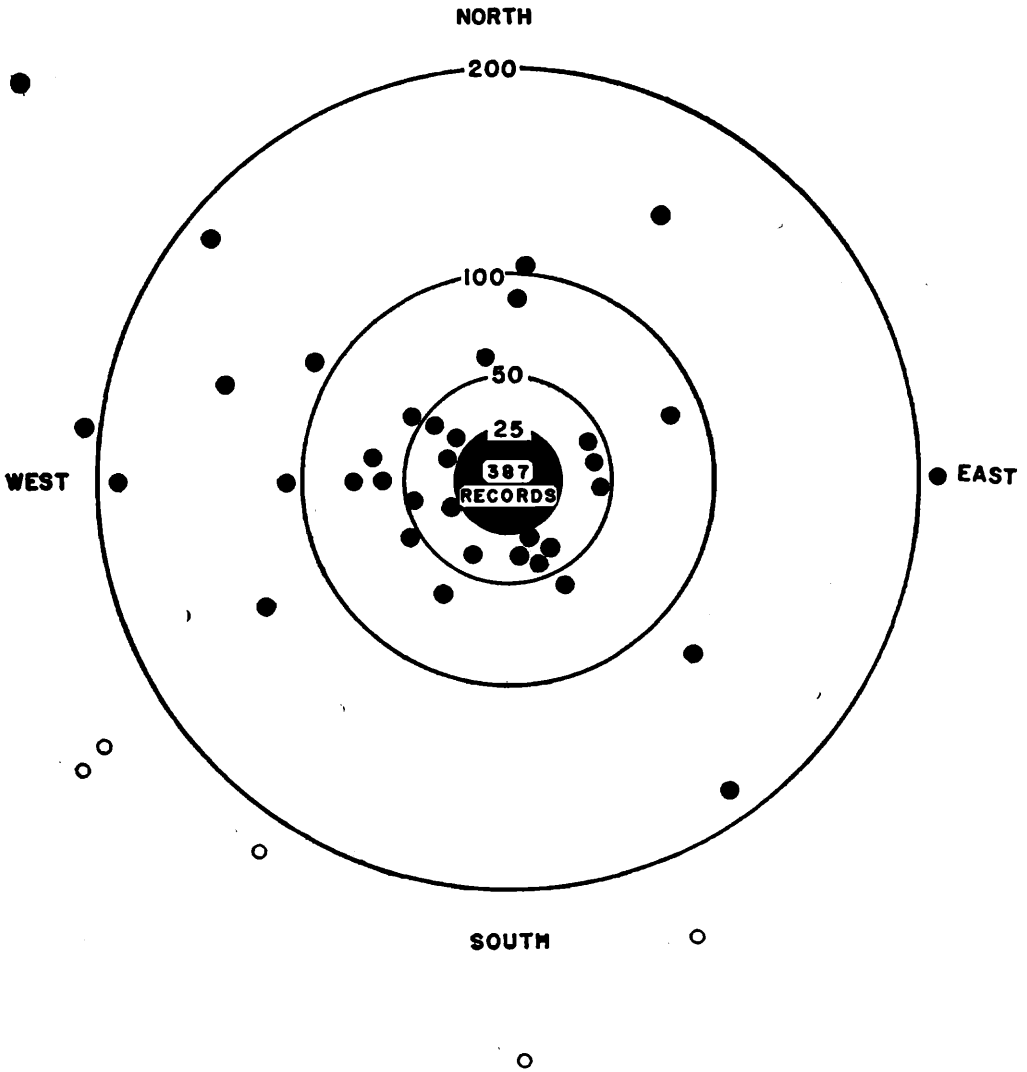

FIGURE 1. RELATION OF BREEDING LOCALITIES TO BIRTHPLACES AMONG ROBINS. Black dots are accepted breeding records (387 occur within the 25 mile circle); open circles are doubtful breeding records (Table 2). Numerals on the concentric circles are distances in miles from the birthplace. Records outside the 200-mile circle are not placed to scale; for their actual distances see Table 2.

In the group of other types of recoveries and returns 387 of the 428 records (86.9 percent) occurred within 25 miles of the banding locality; the rate is 89 percent when the doubtful breeding records (Table 2) are removed. It is possible that this sample may give a slightly exaggerated picture of the tendency to return to the birthplace in that the chances of detection and recording of a dead banded bird are better in the vicinity of a banding station, where there is an active observer, than elsewhere. On the other hand, this slight increase in apparent return may be offset easily by the number of non-breeders which have not returned to their birthplaces but which, with the available data, cannot be detected and removed. Nevertheless, an absolute minimum estimate (actually probably *considerably* below the minimum) can be obtained by eliminating all records of birds found dead or retrapped at the original banding stations. Of the 115 recovered away from the banding localities 75 (65 percent) were recorded within 25 miles of their respective banding localities (birthplaces); the rate is 69 percent when the doubtful breeding records are eliminated. As indicated above, this rate (69 percent) is the *lowest possible* percentage of return to the vicinity of the birthplace. In view of the mass elimination of those which returned to the banding stations, the rate is doubtless considerably higher.

An important consideration in the interpretation of such data has been discussed by Nice (1937, p. 184.) She presents some evidence among Song Sparrows which suggests that first-year birds tend to return to the last place occupied prior to southward migration rather than to the birthplace itself. The data on which the present study is based neither support nor confirm this hypothesis. The same observation was made by Hickey (1943, p. 41) with his study on Robins. Clarification of this question insofar as it concerns Robins must await a careful re-examination of the existing records and, more important, the accumulation of additional quantities of records of birds banded as nestlings. Intensive studies at individual stations over a period of years are needed.

The fact that many (exact number cannot be determined) of the birds in this study were banded as nestlings together with the absence of summer recoveries of banded young birds at appreciable distances from the banding localities indicates that there is an empirical tendency to return to the vicinity of the birthplace whether it be acually to the birthplace or to the last place occupied prior to southward migration. Further information is needed on premigratory dispersal among young Robins. The available evidence indicates that the dispersal distances are small; however, the data are very scanty.

An analysis of the relation of age at recovery to the distance from the banding locality is given in Table 4. With the exception of the 200+ group, none show unusual age-group relations. The fact that

seven of the eight recoveries in the 200+ group are first-year birds (six recovered dead) lends weight to the suggestion that they are largely non-breeding strays which failed to survive.

Despite the pronounced tendency of Robins to return to their birthplaces, there are nevertheless numerous examples of birds recovered during the breeding season at considerable distances from their birthplaces. The percentages of recoveries according to displacement groups are given in Table 3. Of the seven recoveries (after elimination of the doubtful records, Table 2) at distances of 148 miles or more during the breeding season, five occurred on the opposite side of Lake Michigan from the banding locality. It is of further interest to note that there is not a single record of a bird recovered on the opposite side of the Appalachian Chain, indicating that, from the standpoint of breeding populations, these mountains form an effective barrier.

TABLE 4

DISTANCES FROM BANDING LOCALITIES ACCORDING TO AGE GROUPS

Breeding season recovered	Distance from Banding Locality in Miles					Total
	0-25	25-50	50-100	100-200	200+	
I	208[1]	6	5	5	7	231
II	106[2]	3	4	2	0	115
III	49	1	0	1	0	51
IV	18	1	1	0	1	21
V	3	2	0	2	0	7
VI	1	0	0	0	0	1
VII or more	2	0	0	0	0	2
Total	387	13	10	10	8	428

[1] One also recovered again in VI; 3 recovered also in III.
[2] One also recovered again in II and one also in III.

DISCUSSION

Hickey (1943, p. 41) selected from the files of the U. S. Fish and Wildlife Service 61 records of Robins banded as young and subsequently recovered during the breeding season by laymen and regarded them as a random sample of the population. Of these 45 (about 74 percent) were recovered within 10 miles of the birthplace. His data are also calculated on the basis of densities per square miles, a device which shows well the isolation of breeding populations of Robins.

It is of interest to compare the results of this study with data which have been recorded for other species of *Turdus*. Precise comparisons are somewhat difficult because of differences in the presentation of data

by the various European banding organizations. Data published in *British-Birds* (1925-1935)[5] contain records of at least 58 Blackbirds, *Turdus merula merula* L., banded as young and ultimately recovered as adults during the breeding season. Of these 46 were retaken or found dead at the respective banding localities; none of the remaining twelve were recovered at distances greater than 25 miles from the banding localities.[6] Likewise with the Song Thrush, *Turdus ericetorum ericetorum* Turton, there are data on 40 birds banded as young and recovered as adults during the breeding season; 30 of these were retaken or found dead at their respective banding localities; only one was found more than 25 miles from the banding locality.[7] These data also contain single records of returns to the birthplace of a Ring Ouzel, *Turdus torquatus torquatus* L., and a Mistle Thrush, *Turdus viscivorous viscivorus* L. In Belgium, Verheyen (1939) found that all 19 records of *Turdus ericetorum ericetorum* Turton, banded as nestlings and recovered as adults during the breeding season, were within 15 kilometers of their banding localities.[8] The fifty similar records of *Turdus merula merula* were all recovered within 10 kilometers of their birthplaces.[9] Skovgaard (1930) recorded data on 14 *Turdus merula* banded as young in Denmark and recovered during the breeding season; seven were recovered at the original banding localities and the others within 25 miles of their respective banding localities. The data of Verheyen, Skovgaard, and those from *British-Birds* doubtlessly exaggerate, as Kluijver (1935a) has suggested, to a certain degree the tendency of the young to return to their birthplaces. However, they obviously demonstrate that the return of first-year birds is definitely not a random dispersal. Lönnberg (1930, 1936) has recorded single examples of the return of *Turdus musicus* and *Turdus pilaris* to their birthplaces in Sweden. Vestergren (1938) has given a similar record for *Turdus merula* in which the recovery was but a few miles of the banding locality. Hoerring (1938, 1939), in Denmark, has also recorded single examples of the return of *Turdus merula* and *Turdus musicus*. In the case of the former, the recovery was within ten miles

[5] 18:186-191; 19:165-174; 20:43-52; 21:52-60; 22:176-187; 23:108-125; 24:179-188; 25:45-51; 26:48-54, 208-220; 27:87-102; 28:36-48. After 1934 only data on birds recovered away from the banding localities were recorded.

[6] Lack (1934) has shown that *Turdus merula merula* is a partial migrant in Britain with the principal migration being westward to Ireland.

[7] Lack's analysis (1943) shows that the migratory status of *Turdus ericetorum ericetorum* is similar to that of *merula* but with more birds migrating to the continent.

[8] Dupond (1934) describes *Turdus ericetorum* as mostly migratory in Belgium.

[9] Dupond (1934) states that the Belgian breeding population of *Turdus merula* is non-migratory. This is in agreement with Mayaud (1936).

of the banding locality. The specimen of *Turdus merula* was recovered at the banding locality. Although the data on other species of *Turdus* are fragmentary, they seem to demonstrate a tendency to return to the place of birth similar to that of typical *migratorius*.

In drawing conclusions from percentages of returns of young birds as breeding birds to their birthplaces as an indication of a characteristic tendency to return, several factors must be considered. This is especially important in comparing the returns of birds banded as young with those banded as breeding birds. It is unfortunate that precise information on most of these factors is unavailable; consequently, statements cannot be made concerning their importance, either relatively or collectively. (1) *Earlier return of old males in spring.* This is apparently true of *Turdus migratorius* and has been demonstrated by Krüger (1938, 1940) in Denmark to be true for *Turdus viscivorus*, *Turdus torquatus*, and *Turdus merula*. It would seem that the earlier return of old males would tend to result in a certain degree of displacement of the first-year birds from their birthplace. Studies concerning this point in the case of the Robin are needed. (2) *Differences in mortality rates.* Farner (1945) has, by calculation, estimated that about 20 percent of the fledged Robins survive to breed in the following season, whereas the survival among the adult breeding birds is 50 percent. This means, other things being equal, that two and one-half times as many birds banded as breeding adults as birds banded as nestlings or fledglings should be recovered. (3) *Actual differences between the return of adults to their previous breeding places and the return of first-year birds to their birthplaces.* It is highly probable that there is a greater tendency among adults to return to their previous year's breeding place than there is for the young to return to their birthplaces. Rüppell (1938) in experiments with Starlings obtained results which would seem to indicate that such is true in this species. *It seems possible in Robins that the tendency among adults is to return to the immediate locality of the previous breeding season whereas among first-year birds the tendency is one to return to the general vicinity of the birthplace.* However, until a study on the return of adult Robins to their previous breeding localities is made, this suggestion will be without sound scientific basis. In this connection it is important to note that Kendeigh and Baldwin (1937) concluded that the shift from one breeding area to another is among the first-year House Wrens.

An adequate discussion of the sensory and other physiologic processes involved in this remarkable ability of first-year birds to return to their birthplaces is beyond the scope of this paper. Griffin (1944), in a comprehensive review of the theories of homing instinct in birds, has rightfully concluded that no adequate explanation has as yet been proposed. In addition, the reader is referred to the experiments of Rüppell

(1934a, 1934b, 1935, 1937, 1938), mostly with passerine species, and to those of Schifferli (1942). Other references are given by Griffin (1944). Of considerable interest are the experiments of Välikangas (1933) in Finland with duck eggs imported from England. Birds hatched from these eggs showed a remarkable tendency (73-76 percent of those not known to be dead at beginning of the following breeding season were recovered at the birthplace) to return to their birthplace in Finland, indicating, in ducks at least, that this function is not hereditary. Kluijver's experiments (1935b) with anesthetized birds are interesting. He found that among birds captured during the breeding season and released some distance away, those transported under anesthesia returned as well as the controls. He concluded, therefore, that the kinesthetic senses played no role in the homing instinct. Griffin (1944) has criticized these and his own similar experiments in pointing out that the birds were not transported beyond the area in which they were familiar with landmarks, although one cannot be certain that this is true with Kluijver's Starlings. Further discussions of theories and experiments dealing with homing instinct and migration may be found in Hickey (1943, p. 41). The physiology of migration and homing instinct, in young and adults alike, still remains as one of the most challenging of biological problems.

The data and conclusions of this study have an interesting relation to systematic ornithology. They indicate that, in spite of migration, a relatively small amount of mixing occurs among the Robins in the various parts of the range of typical *migratorius*. For example, as stated previously, the data indicate that Appalachian Mountains are an effective barrier since the sample contains not one record of a bird banded on one side and recovered on the other during the breeding season. It even seems possible that, throughout the range, sufficiently isolated, slightly differentiated populations could exist. It would be of interest to ascertain if any consistent detectable differences, either in color or measurements, do exist in the range of typical *migratorius*. Doubtless, such differences, if they do exist, could be established only with large numbers of specimens and would be too slight to warrant even subspecific nomenclatorial recognition. The presence or absence of such differences would indicate what importance, if any, a return to upwards of 90 percent of a population to its birthplace or vicinity to breed, has in the evolution of races or subspecies. In any consideration of this question it will be necessary also to give attention to the relative homogeneity or heterogeneity of the selective factors throughout the range of *migratorius*. If the Robin can be regarded as a typical migratory passerine species, there is ample reason, based on banding data, to support the contention of systematists that the races of migratory passerine species do represent reasonably exactly delineated and isolated breeding groups.

SUMMARY

There is a marked tendency among Robins, *Turdus migratorius migratorius*, to return, as breeding birds, to their birthplace or its immediate vicinity. Among the retrapped birds, 120 of 121 were taken at the station where they were banded. Although these data may exaggerate the tendency to return to the birthplace, they show definitely that there is no random dispersal among the first-year breeding birds. The data from returns and recoveries other than those retrapped show that the absolute minimum estimate of birds whose breeding localities are within 25 miles of their birthplace is about 70 percent. The actual rate is doubtless considerably higher, probably between 87 percent, the rate for non-trapped recoveries and returns, and 92 percent, the corrected rate for all recoveries and returns. It is obvious, therefore, that there is little interbreeding among Robins in different parts of the range of typical *migratorius* although it may be sufficient to maintain a homogeneous race unless there are considerable variations in selective factors in various parts of the range.

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ASPERGILLOSIS AND PARASITISM IN A GULL[1]

BY F. R. BEAUDETTE

A Herring Gull *(Larus argentatus)* was received Sept. 27, 1943, for examination. It had been found dead at Oyster Bay the day before.

The bird was very thin and on autopsy showed white caseous masses in the thoracic and pericardial air sacs, and a few smaller patches attached to the abdominal air sacs. Cultures taken from the air sacs on agar plates yielded a pure growth of a fungus which was identified as *Aspergillus fumigatus* by Dr. S. A. Waksman.

Although the fungus infection was undoubtedly the primary cause of death, a variety of parasites must have been a contributing factor. Thus, beneath the serous covering of the proventriculus could be seen small dark spots suggesting an infestation of Tetrameres, and careful dissection made possible the removal of six females. The female is readily distinguished by the globular shape and the red color in contrast to the elongated shape and white color of the male.

When the proventriculus was opened a small nematode seemed to be partly buried in a gland and, because of the presence of female Tetra-

[1] Journal Series paper of the New Jersey Agricultural Experiment Station, Rutgers University, Department of Poultry Husbandry.