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THE OPERATION OF HOMING INSTINCT

By FREDERICK C. LINCOLN

Biologist, U. S. Biological Survey

THE operation of the faculty known as "homing instinct" is not well understood. The term itself has long been loosely used although generally it is applied chiefly to that ability possessed to a greater or lesser degree by most forms of animal life and which enables them to return from a distance to their "homes." Among domestic animals it is probably best exemplified by the homing pigeon and the so-called domestic cat. Reduced to its simplest terms it appears to be nothing more nor less than a "sense of direction" and, accordingly, is the same sense or instinct that guides migratory birds with such unerring accuracy to their summer and winter quarters. The nervous seat of this "sense" is still unknown.

With this brief but definitive background concerning the meaning of the term, it is of more than passing interest to find that it has a most practical application in any plans that are considered for the restoration of depleted areas with migratory game birds.

Many persons appear to believe that it is necessary only to introduce a few pairs of birds of any particular species into an area that is environmentally suitable and—Presto! the species is established and, allowing for the natural mortality from all causes, will multiply to the full carrying capacity of the area. This belief undoubtedly has its basis in the success that has attended the introduction or transplantation of a few species of upland game and some song birds. Of these, the best known examples are the Ring-necked Pheasant (*Phasianus colchicus*), the Hungarian Partridge (*Perdix perdix*),the Bob-white Quail (*Colinus virginianus*), the English Sparrow (*Passer domesticus*), and the European Starling (*Sturnus vulgaris*). On various occasions other species on both the song-bird and the game-bird lists have been introduced or transplanted with passing success, but it should be noted that, almost without exception,

the experiments that have been successful or partially successful have been made with non-migratory species. It is true that the European Starling is migratory to some extent in its native habitat, and it is interesting to observe that, although for several years after its introduction into Central Park, New York City, in 1890 and 1891, it appeared to be strictly sedentary, it has since spread over a wide expanse of country, and banding data demonstrate that it now seems to be developing migratory habits comparable with the seasonal movements of the species in Europe.

An historic attempt to introduce an Old World migratory species in North America is the case of the Migratory Egyptian Quail (*Coturnix c. coturnix*), of which several thousand were imported and liberated in the Northeastern States during the period 1870 to 1880. There seems to be no doubt that some of these birds actually nested and raised broods during their first season, but when the time came for their regular autumnal migration, they departed southward and there is no evidence that any of them returned the following spring. Similarly, attempts to introduce the closely related Migratory Chinese Quail (*Coturnix c. japonica*) into the State of Washington were made first in 1904 and again in 1923, but the bird did not take hold and soon disappeared. While, of course, it is not intended to imply that these birds migrated back to their natural winter quarters in Africa, it is possible that they may have attempted the feat and so perished at sea. In November, 1877, some Egyptian Quail were reported to have come on board a ship several hundred miles southeast of Cape Hatteras, North Carolina, and this at least lends color to the probability of their destruction at sea.[1]

As stated above, almost all transplantation activities with native North American birds have been with a few different gallinaceous species, including quails, grouse, turkeys, etc. In the strict sense of the term these species are non-migratory as the movements of certain grouse and quail are not comparable with the true seasonal travels of the migratory birds. In recent years attempts have been made to transplant the Black Duck (*Anas rubripes*) into California, but the success of the experiment is not yet known. It is the opinion of the author this will prove a waste of time and money since, even if the transplanted Black Ducks do not attempt to return to their native habitat, they are almost sure to hybridize with

[1]Phillips, John C. Wild Birds Introduced or Transplanted in North America. Tech. Bull. 61, U. S. Dept. Agri., 1928, p. 28.

the closely related and abundant Mallards (*Anas platyrhynchos*), and within a few generations this continued crossbreeding will result in complete submergence of the Black Duck blood, at least in so far as general characters are concerned.

There is, however, much additional evidence that migratory birds have a strong attachment for the breeding site of the preceding season and for their accustomed winter quarters. Attachment to breeding ground involves only the adult birds, as it appears to be demonstrable that, generally speaking, homing instinct does not operate intensively in an individual migratory bird until *after* it has first nested, and that the location of the first nest is more or less a matter of chance *anywhere within the natural range of the species.* In other words, it is postulated that the successful breeding of pinioned migratory birds in an area ecologically favorable, but outside the natural breeding range, does not mean that their offspring will migrate and return to their natal area to build their own nests. On the contrary, the chances seem to be all against this, as there is very little evidence of young migratory birds returning to the area where they were hatched. An interesting exception is the case of a hen European Teal raised on Wenham Lake, Massachusetts, from captive parents. According to Phillips[2] this bird left its natal area on December 6, 1910, and returned on April 19, 1911. Remaining on Wenham Lake throughout that summer, it again departed on December 31, 1911, and returned for the second time on April 18, 1912.

A classic illustration of the return of an adult duck to its nest site of the previous year is the Mallard that carries Biological Survey band 555414. Banded in November, 1927, at a game refuge near Antioch, Nebraska, this duck has returned every year since and has occupied the same nesting site, which, curiously enough, is a box on the roof of a barn.[3] This bird is known to have produced more than one hundred ducklings, many of which have been banded. Thus far there has been no evidence that a single one of these young birds has returned to nest even in the State where it was hatched, though individuals of the broods have been recovered south to Arizona, Texas, and Louisiana, and north to Alberta. While only one record is available from the last-named

[2]Phillips, John C., *The Auk*, vol. 28, 1911, p. 366; and vol. 29, 1912, p. 535.

[3]This duck returned to the refuge on February 4, 1934 and remained all summer but failed to breed. In 1933 she produced a complete set of "runt" eggs which apparently marked the final effort of her ovaries. See *The Condor*, vol. 36, March, 1934, pp. 86-87.

Province, it is rather significant, since it pertains to a bird banded in October, 1928, and recovered in April, 1929, and was unquestionably a breeding bird at the time it was recaptured.

The case of these Nebraska Mallards is paralleled many times among the song birds. In fact, banding data are proving the general accuracy of the popular fancy that assumes that the same Robins, Bluebirds, and other species, return to reoccupy their nesting sites of the previous season. Though both members of the pair may not be the same, one of them is more than likely to be one of the adults of the last season, and its mate is *not* likely to be one of its own offspring.

At the Baldwin Bird Research Laboratory, at Gates Mills, Ohio, the common House Wren (*Troglodytes aedon*) has been for several years the subject of intensive study. Literally hundreds of adults and fledglings have been banded. The percentage of return of adult birds in successive seasons has been more than 42 per cent and some individuals have long records running over several years. It is, however, a rare occurrence for a young bird to be recaptured in a following season, only seventeen, or 2.6 per cent, of a total of 648 having been retaken at the laboratory. Systematic search through adjoining portions of the Chagrin River Valley, involving the capture of almost all of the wrens over a large area, failed to answer the question: What becomes of the young? While the mortality of the juveniles is admittedly very high, nevertheless it appears that the only tenable answer is that they spread indiscriminately throughout the natural range of the species and that it is pure chance if one should return to the area where hatched. It seems probable that this is but the operation of a natural law to prevent much of the inbreeding that might result were the offspring to return with their parents to the home-site of the previous year.

The occasional return of a young bird to its natal area or even to the exact nest site does not, in the opinion of the author, weaken the argument for the reason that the immature birds of many (if not most) species migrate in company with their elders and this group companionship may continue to some extent during the winter sojourn so that on the ensuing northward journey a yearling bird *might* travel in company with its own parents and it *might* actually mate with one of them. Such cases, however, are governed solely by the law of chance. Colonial birds, as the gulls, terns, and herons, which are more or less gregarious throughout the year, might be expected to furnish the majority of the exceptions and, as shown by band-

ing data, this is exactly the case, although such records are by no means numerous.

The attachment of migratory birds for the areas where they have nested seems also to extend to their winter quarters and, to some degree, to feeding and resting points while on migration. This was suggested several years ago when Baldwin[4], banding non-game birds near Thomasville, Georgia, found that White-throated Sparrows (*Zonotrichia albicollis*) returned to spend successive winters in the exact clump of shrubbery where they had been captured at the time of banding. That is, over a period of eleven years the group of these birds at this site was each year identified with the groups of previous years by the recapture of birds banded on one, two, or even three former years. They were believed to constitute a changing but continuing group, probably from the same general neighborhood in the breeding grounds. The number of birds in the group was naturally more or less variable but most of the losses were seemingly made up by young birds or by other individuals that formed a chance attachment to the group.

The operators of other banding stations have obtained much additional data to substantiate this theory and it seems not unlikely that individual North American birds wintering in tropical countries return to their exact winter quarters with the same fidelity exhibited in their return to their breeding areas. An example of this is presented in the case of six Indigo Buntings (*Passerina cyanea*) banded at Uaxactun, Peten, Guatemala, in April 1931, and which were retrapped at the identical spot during the period April 6 to 9, 1932. In the meantime these birds had made the round trip to the United States where (if adult in 1930) they probably had again built their nests in the same area. Another Indigo Bunting (F30330), banded at the same time and place, was not recaptured in 1932, but on April 16, 1933, it was retaken at the banding point.

On New Year's Day, 1926, the author arrived at Crane Lake, Illinois, and erected a banding trap for migratory waterfowl. Nearly 1,000 ducks chiefly Mallards, were caught and banded during the next few days, and in the first catch was one that had been banded only a few miles away, during the winter of 1922.

For many years there has been a waterfowl refuge at Lake

[4]Baldwin, S. Prentiss. Bird-Banding by Means of Systematic Trapping. Abstr. of Proc., Linn. Soc. of N. Y., no. 31, pp. 37 and 43, 1919.

Merritt in the city of Oakland, California, and since 1926 this also has been operated as a banding station. E. W. Ehmann, the Biological Survey coöperator in charge of the work at that point, has banded more than 5,000 ducks, chiefly Pintails (*Dafila acuta*) and Baldpates or Widgeons (*Mareca americana*). In commenting upon his operations in 1933 Mr. Ehmann reported to the Survey that more than 50 percent of the birds trapped in that season had been banded previously at that station, showing conclusively the strength of the attachment and of the guiding instinct that caused these birds—many of which undoubtedly came from breeding grounds north of the Arctic Circle—to make Lake Merritt their focal point for the winter season.

The largest and oldest waterfowl banding station in the United States is that operated at Avery Island, Louisiana, by E. A. McIlhenny. During the past fourteen or fifteen years, nearly 20,000 waterfowl of several species have been banded at this station, and the records of recovery extend from the Atlantic to the Pacific and north into the Sub-arctic region. The breeding grounds of the ducks wintering in the region of the station, are clearly shown north through Canada to Alaska. Nevertheless, during the trapping period of the last season (1933–34) Mr. McIlhenny recaptured 716 ducks banded by him in previous seasons.

In order to test the strength of the homing instinct, Mr. McIlhenny has, in coöperation with the Biological Survey, made several shipments of banded ducks (chiefly Pintails) to prearranged points where they were received and liberated in favorable areas. During the season of 1933–34, banded Pintails were retrapped at Avery Island that in previous seasons had been trapped there, shipped by express, and liberated at Washington, D. C.; Blackwater Migratory Bird Refuge, Cambridge, Maryland; O. L. Austin Ornithological Research Station, North Eastham, Cape Cod, Massachusetts; Berkeley, California; Lake Malheur Migratory Bird Refuge, Voltage, Oregon; and the National Bison Range, Moiese, Montana. Here were groups of birds indigenous to the Mississippi Flyway, which has been forcibly removed and liberated in the Atlantic and in the Pacific Flyways, and in succeeding seasons were found back in their original winter quarters.

Summary and Conclusions—From the data at hand it appears that homing instinct in most migratory birds does not operate until after they have nested for the first time, and that the selection of the first nest-site is fortuitous, anywhere within

the natural range of the species. In the case of the adult bird, however, the homing instinct is a powerful influence operating not only to bring it back to the site of its nest of the preceding year, but even to its original winter quarters and probably to feeding and resting areas while en route.

From the evidence presented it appears unlikely that efforts to restock depleted waterfowl marshes with pinioned or hand-reared ducks will be successful. It is desirable, however, to have further data on this subject, to accomplish which all birds liberated for restocking purposes should be banded, and special efforts should be made to capture and band any young that may result from such liberations. The Biological Survey will be glad to furnish bands and otherwise assist in any operation of this character that may be contemplated.

THE STATUS OF CAPE COD TERNS IN 1934[1]

By OLIVER L. AUSTIN, M.D.

THIS season, the Cape Cod tern colonies have experienced an unprecedented prosperity, surpassing what was thought to have been the cyclic peak of 1929. This was subsequent to the occurrence to an almost ideal degree of the major essential ecological conditions, both natural and artificially controlled, which determine the degree of success of a nesting. The elements and the food-supplying ocean were benignant; reclamation work at the site of the Cape's largest colony, Tern Island, adjuvanted greatly. Notwithstanding this, the opinions advanced by the station's staffs in 1932 and 1933 that the success of all tern colonies is cyclic and that the curve for the Cape's tern population is and will continue to be regressive remain unchanged. During the last four breeding seasons the banding of chicks in all the tern colonies has been sufficiently comprehensive to warrant the use of totals for statistical comparisons. Environmental conditions of natural origin have been practically commensurate for all nestings this year. Since the Tern Island chick-banding comprised this year 76 per cent of the total bandings on the Cape, whereas in the total of the three preceding years they were but 34.3 per cent, the difference must be charged in part to constructive human intervention at Tern Island. The sum of immature bandings for the entire

[1] Contribution No. 18 from the Austin Ornithological Research Station.