

AN AMERICAN'S VIEWS OF BIRD MIGRATION.*

BY

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SOME birds are resident the whole year throughout the areas they inhabit, while others move more or less northward or southward with the change of the seasons, while still others roam practically from pole to pole. The extent of the seasonal movement varies in different species mainly in accordance with the nature of their food, and is also more or less correlated with their powers of flight, the greatest wanderers being also strong of wing. Most of the Grouse tribe and many of the hardy, seed-eating, semi-omnivorous Passerine birds, are nearly or quite non-migratory, while such exclusively insectivorous and berry-eating species as Swallows, Flycatchers, Warblers, and many of the Shore-birds make semi-annual journeys of thousands of miles. Again, many birds that are resident as species over large areas are, in winter, more or less nomadic as individuals; in other species the more northern representatives move to a small extent north or south with the change of seasons. In the species of this latter class the individuals that breed in the southern part of the common range of the species are permanently resident throughout the year, while those that breed in the northern part move to lower latitudes at the approach of winter, returning to their breeding stations with the return of summer. Other species entirely leave their breeding ranges in winter, migrating often thousands of miles to reach their winter quarters. There is thus every degree of migratory movement in different species of birds, from slight nomadic movements to extended migration, in accordance with the physiological needs of the species.

* The present article, written by request, is a brief statement of the author's present views on the subject of Bird Migration, to which he has for many years given careful consideration. To go into a discussion of the whys and wherefores would require the space of a volume. It has therefore seemed sufficient to give here his conclusions, with merely a slight thread of argument and evidence.—J. A. A.

The life of the bird, like that of most animals and plants, is made up of annual cycles. The controlling force that governs these cycles and determines the manner of life of the species is the fundamental fiat of Nature, "to increase and multiply"—the perpetuation of the life of the species. As Mr. F. M. Chapman long since pointed out,* most birds seek seclusion during the period of reproduction, or, as in the case of birds that nest in colonies, like many of the sea-birds, resort to special breeding places.

In many instances they repair to some islet well within the usual range of the species; in others to some point more or less remote from their range during the non-breeding season. In the first case, where the resort is within the usual range of the species, the assembling of the birds at some long-used breeding station is not usually considered as migration; yet the nature and purpose of the movement is the same in both instances, namely, to secure a safe and congenial breeding place. In each case, also, the movement is characterized by the same periodicity and unanimity of action. The first class is illustrated by such species as the Brown Pelican, the Man-o'-War Bird, and various species of Boobies, Albatroses, Petrels, and Terns; the second by the White Pelican, various species of Auks, Guillemots, Petrels, Shearwaters, etc., as, for example, the Wilson Petrel, which inhabits the North Atlantic in summer and resorts to certain Antarctic islands to breed during the northern winter.

As in the case of migration, where there is every degree of seasonal movement between a strictly sedentary life and greatly extended journeys, there is here also every stage of differentiation between the gathering of the hordes to some near-by islet for reproduction to a journey of many thousands of miles to reach some favourite breeding resort. In the case of birds that do not breed

* "Auk," XI., 1894, pp. 12-17; see also his "Camps and Cruises of an Ornithologist," 1908, p. 88.

in colonies but are diffused in the breeding season over the larger part of a continent, the influence governing the selection of a breeding-site is the same as in the case of birds which nest in colonies, namely, the approach of the breeding season. The cause of the seasonal movement is thus beyond question physiologic, and hence periodic, and irresistible.

If climatic conditions were everywhere nearly uniform there would doubtless be no migration, as there is now practically no true migration among the indigenous birds of sub-tropical and inter-tropical latitudes near sea-level. The difference in physiographic conditions due to differences of altitude and latitude gives rise, of course, to the widely diverse biotic conditions of different parts of the earth's surface. It is generally believed that in pre-glacial times biotic conditions were vastly less diversified than at present; it hence seems reasonable to infer that the breaking up of this uniformity of climatic conditions by the glacial period greatly changed the distribution of animal and plant life, which to a large extent must have been either driven southward or exterminated over the glaciated regions. With the recession of the ice the habitable area at the northward became gradually extended, with marked seasonal changes from pre-glacial conditions. There was now established a distinct alternation of summer and winter, so that many birds found congenial homes in summer in districts which were uninhabitable to them in winter. As the recession of glacial conditions was gradual, the belt of new habitable land must have been at first narrow and the later increase gradual. Here, then, were just the conditions to develop a migratory habit in such birds as were able to extend their summer range to the northward. The necessity for migration would vary with different species in accordance with the character of their food and their adaptability to new conditions. Birds organized to subsist upon insects and pulpy fruits would find such food in summer far to the northward of where

it would be available in winter, while those able to subsist upon a more varied diet would be less affected by the change of season and hence make shorter migrations.

It is obvious that migratory birds, of whatever class, which seek high latitudes for breeding stations, find there the conditions most favourable for reproduction, as regards not only food but the general environment. Otherwise they could not have successfully persisted for possibly millions of generations in the selection of a breeding station at which they can live for barely a fourth of the year. Migratory birds that breed in the temperate and colder latitudes are wanderers for from seven to nine months of the year; while some change their residence by a journey of only a few hundred miles, others travel thousands of miles, as do many Warblers, Tanagers, Swallows, Flycatchers, and Shore-birds. It is therefore by no means a mere figure of speech to call a bird's breeding station its real and only home, for here it is not only a settled resident for a definite period, but is occupied with the most important function of its life, the reproduction of its kind.

As already said, the district selected by a large proportion of migratory birds as a breeding station is climatically uninhabitable to them beyond the short period required for the duties of procreation. The reason why they leave it is therefore not far to seek, and it is hardly worth while to waste words over the question whether the return to milder latitudes is due to a fall of temperature, to the failure of the food supply, or to both combined. Neither is it material to inquire whether the species might or might not be able to withstand the environment at the breeding station for a few days, or even weeks, after the young of the year are sufficiently mature to start on the long journey to a milder country; for, since the purpose for which the long journey to the breeding station was undertaken has been accomplished, why should they linger? Much more time, however, is usually taken for the autumnal journey than for the

vernal, which, as the breeding season approaches, is prosecuted with increasing rapidity till the goal is reached, whereas in autumn it is only necessary to make such progress as the advancing season demands. The fall journey is only a part of the round trip to and from the breeding station, the one journey being the complement and necessary consequence of the other, the two together constituting the full cycle of migration.

As already shown, the sole and all-sufficient cause of migration is the necessity of a congenial environment for the reproduction of the species. This need may be met in the seclusion and isolation of a rocky islet or cliff, or the proper conditions may be afforded by an Arctic tundra. The inception of the movement is the periodic necessity of reproduction, and the journey to the breeding station, be it long or short, is made in obedience to physiologic changes which the bird is powerless to resist or control; the return journey is obviously a natural and necessary sequence. The return of a bird to its particular ancestral breeding station, and the character of the station selected, are as distinctive of the species as are the colour of its eggs, the character of its nest, the peculiarities of its song and call-notes, or the markings of its plumage. It becomes, therefore, unnecessary to ascribe, except figuratively, the cause of the movement to "strong home love," notwithstanding the fact that the individual bird not only returns to the region of its birth, but will often, as is well substantiated, return year after year for many successive years to absolutely the same nesting site. It is also well-known that during the non-breeding season different local races (subspecies) of a widely distributed species are often found associated during their migratory wanderings, and that when the season of reproduction approaches they will take different migration routes to their respective and often very remotely separated breeding stations.

It is a well known fact than in many species the old birds migrate first, both in spring and fall, the immature

birds following, sometimes, in the case of the fall migration, much later. An instance that has attracted attention is the European Cuckoo, in which the parents depart from their summer home long before the young leave. This condition, however, is by no means unusual, since, in North America at least, it has been found to be the rule rather than the exception. This has led to the question, How do the young birds of the year, left behind by their parents, find their way in migration? In Mr. William Brewster's memorable paper, "Bird Migration," published many years ago,* and based on long field experience, he states (referring to North American birds) that "the adults of many, or, as [he] believes, *all* species migrate southward first, and often several weeks in advance of the young. It is perfectly true, nevertheless, that a few old birds are always to be found in the larger flights, although the latest of these are certainly composed mainly of young." Young birds, when left behind by their parents, it is believed, join the general throng of southward migrants, which always includes birds of many species.

All this goes to show that the present breeding stations of birds are, generally speaking, of the highest antiquity, and are an inseparable part of the evolution of the species; that the habit of migration in migratory species is likewise inseparable from the history of their differentiation, and has become as much a specific trait as any of their physical characteristics. The origin of migration and its doubtless gradual development is so remote that the explanation must ever remain hypothetical, but an hypothesis may be so well grounded that it may be accepted as a reasonable certainty. Many birds not much unlike existing types—belonging in many instances to the same genera—existed in tertiary times. Since this period the earth's surface has undergone great physical and climatic changes, which have in turn immensely modified not only the distribution but the physical

* Memoirs of the Nuttall Ornithological Club, No. 1, 1886, pp. 1-22.

characters of its inhabitants. These facts furnish good ground for the belief that bird migration, possibly already incipient at this remote period, became emphasized and mainly developed by the recession of glaciation in the northern hemisphere. Nor is it improbable that somewhat similar climatic changes in past geologic times afford a similar explanation of migration in birds and other animals in the southern hemisphere.

That birds, and many other animals, perform long migrations at regular periods, is a fact not open to cavil. It is also evident that a reasonable cause for these periodic journeys may be assigned. Hence a large part of the "mystery" that has hitherto enshrouded the general subject of bird migration may be fairly regarded as having been dispelled.

The manner of migration, as regards season, routes, and extent, is now also known with considerable detail for a large number of species. There still remains for consideration the much discussed question of how the migratory hordes find their way.

While we are unable to fathom the workings of the bird mind, or to take the measure of their mental and sensory equipment, it must be recognised that birds are endowed with the ability to remember and recognise landmarks, since otherwise it would be impossible for them to return year after year to the same nesting site, after months of absence and thousands of miles of travel. With the abundant evidence we have of their ability to remember landmarks and to revisit former nesting sites, it seems unnecessary still to regard their ability to find their way in migration as a "mystery."

It is generally conceded that birds are endowed with great sensitiveness to atmospheric conditions, and readily recognise approaching changes in the weather. As was long since made known by Cooke,* and has since been repeatedly confirmed by independent investigation, in Europe as well as in America, birds migrate from areas of high barometric pressure to areas of low barometric

* "Report on Bird Migration in the Mississippi Valley," 1888.

pressure. In general this direction is northward (in the northern hemisphere) in spring and southward in autumn. In other words, in general the migratory movements of birds in spring are coincident with the alternation of warm and cold waves, the former favouring and the latter retarding or checking the movement. Thus the "waves" or "rushes" of bird migration in spring are not only necessarily from the south northward, but are coincident with a warm atmospheric wave and a southerly wind.

While these are the favourable conditions for bird migration, birds move more or less under the ordinary conditions of the weather proper to the season, and are only held in check by the unfavourable conditions of a cold wave and northerly winds. The conditions of the autumnal movement are in a sense reversed, the birds moving southward with, or just in advance of, a cold wave and a northerly wind.

Many recent writers, as well as those of earlier days, delight to refer to bird migration as a "great mystery," "a mystery of mysteries," as surrounded "with a halo of mystery," etc. While there is still much to learn regarding the general subject, and the faculties and mental attributes of birds, it would seem that enough is known to remove migration from the realm of mystery. The origin and present inducement to migration seem open to reasonable explanation, and some light seems also to have been thrown upon the subject of how birds find their way during their migratory journeys. In addition to keen powers of vision, a memory for landmarks, and remarkable sensitiveness to meteorologic conditions, they seem also to be endowed with a sense of direction, which recent experiments with Noddies and Sooty Terns on the south-eastern coast of the United States* seem to demonstrate as present, if as yet unexplainable. With these facts in view it seems not difficult to believe that while the ability of birds to find their way in migration is truly wonderful, it implies little that is really mysterious

* *cf.* "Bird-Lore," Vol. X., 1908, p. 134.