

In conclusion it is proper to refer to two "short time" returns obtained by Mr. Murie: the remains of the birds that carried nos. 5054 and 5056, banded at Igiak Bay on July 14, and which were found a few hours later at the nest of a Snowy Owl.

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ANGLES AND SPECULATIONS ON MIGRATION

By J. T. NICHOLS

PRIMARILY the line of bird migration is north (in spring) and south (in fall). It does not flow over the entire country as a uniform sheet of moving birds, but gathers in channels which tend to follow coastlines, river valleys, and sometimes ridges of high land. These channels are spoken of as fly-ways or migration routes. There is a main migration route along the ocean shore of Long Island, New York, not north and south but approximately east and west, following the trend of the coast. Such routes may be spoken of as *deflected* routes. Southbound this route joins that down the Hudson valley to continue down the Atlantic coast; and furthermore, northbound, the main Atlantic coast stream, whereas the larger part of it probably follows up the Hudson valley, sends a branch, though less strong than in autumn, eastward along the coast of Long Island. It is the purpose here to call attention to the branching character of migration routes and differentiate between the two types of branching, *afferent* in the first and *efferent* in the second case.

The writer's home lies in central Long Island, sufficiently back from the shore and away from any migration route to give it a minimum number of transient individual birds. Here, during the southward migration just passed, he noticed one morning a considerable number of Myrtle Warblers flying north. He explains this peculiar phenomenon as *distributional* movement away from the concentration in the migration route a few miles to the south. That such distributional movement is sufficiently general to entitle it to a place in the nomenclature of migration is not yet satisfactorily proved, but the probabilities are that it is. It is only reasonable to suppose that a converse *collective*, or *afferent* movement also exists tributary to each migration route and is equally, or more, general.

Here, at this particular point, in central Long Island, as has been said, the number of transient individuals is at a minimum. The Barn Swallow does not breed nearby and one sees but a few each spring, scattered birds flying steadily, slightly north of east in active migration, parallel with the main stream off to the south but too far removed to be in direct touch with it, visual or otherwise. The direction being east rather than north, these birds can not be classified as part of the primitive northward migratory drift. They are entitled to special classification as *parallel* migrants. The accuracy with which they keep the direction of the migration route they are paralleling is one of the details which leads one to question how far the travelers on such a route are dependent on the visual guides which would enable them to follow the same.

Shorebirds migrate very largely by day, and their passage along the aerial highway which follows the south shore of Long Island is therefore readily observable. Southward bound, the direction of flight is from east to west, but a minority of birds of the same species fly from west to east. This leads to an hypothesis that in concluding a migratory journey birds may retrace their course for a short space, perhaps seeking

again particular haunts just passed over. That there exists any *reverse* movement of this sort to be taken into account is by no means proved, but it is a chance that may well be considered.

Physiographically deflected migration routes, mentioned in an earlier paragraph, are familiar enough; that there exist meteorologically deflected routes is so far purely hypothetical, but a reasonable enough hypothesis supported by certain scattered data. In May, 1885, small sandpipers were observed some 500 miles off New York flying in a southeasterly direction when they should have been bound north (W. A. Jeffries, *Auk*, III, 1886, pp. 131-132). Sometimes at this season a succession of cyclonic disturbances parallels the Atlantic coast of North America, causing a succession of heavy northeasterly and northwesterly winds there. In such cases, farther out to sea favoring southeasterly and southwesterly winds would prevail; and the birds observed may have been seeking a northward route in these more easterly longitudes.

Study of the southward migration of those species of shore birds which return from the north in July and August leads to the view that at least many individuals of these have a late summer range within which they linger, and that their active southward flight is composed of two parts, first from breeding grounds to late summer range, second from late summer range to winter grounds. Probably the migrations of many birds are more or less composite in this way, and an increased abundance is frequently observed immediately preceding the final departure of a species, indicative of active migration following a period of comparative quiescence.

Considerable bird banding data recently reviewed by the writer tends to confirm his view, or perhaps it should be called an hypothesis, that the migration of any species, as a whole, is a composite affair made up of the independent behavior of individuals or groups of individuals, each such (conditions permitting) moving with remarkable precision in time. Admitting this precision in time (almost to a day from year to year) there are two obvious controls which might make it possible, a long range time sense very likely associated with glandular action, and the elevation of the sun (an astronomical consideration). Unlikely as it may appear off-hand, he is tempted to believe this latter an important factor. (See Cartwright and Harrold, *Auk*, XLII, 1925, pp. 233-241.)

In discussions of the underlying causes of migration there is sometimes expressed an inability to understand why birds leave the tropics to breed in high latitudes released by the retreat of winter. The simple law that nature abhors a vacuum is perhaps quite sufficient to account for it; but, in raising a family, the advantage of the long days, such as never occur in the tropics, should not be lost sight of.

Just one more point of view in closing: It is that there are migrant birds of any species which are pressing on their environment, attempting to breed or winter beyond the limits of their range, to migrate early or to linger late. These account in a measure for the fluctuations in character of the migration from year to year. When by chance the climate and other conditions spell success for their venture they tend to repeat in the ensuing year and one should look for an explanation of the occurrence of birds in one year as much in their dates and numbers, and in the weather, of the immediately preceding years, as in the weather conditions of the year in question.

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