Hylocichla fuscescens. WILSON THRUSH.— A few pairs breed on the summit of Brasstown Bald, where they are confined to the dense rhododendron thickets on the cool slopes. One was secured July 16, and on the following day several were heard calling and singing faintly.

Planesticus migratorius achrusterus. CAROLINIAN ROBIN.— Occurs sparingly on Brasstown Bald and in the surrounding valleys. An adult and a young bird were taken at 4500 feet. The robin is mentioned as a breeder by Gerhardt.[1]

Sialia sialis. BLUEBIRD.— Fairly common; seen up to 4000 feet on Rich Mountain.

THE TAGGING OF WILD BIRDS AS A MEANS OF STUDYING THEIR MOVEMENTS.[2]

BY LEON J. COLE.

IT is needless in introducing this subject to dwell upon the so-called mysteries of migration. To call the facts of migration mysterious is merely to say that we do not understand them, for when we do come to understand them, though they may still remain marvellous, they can no longer be mysterious. That migration will nevertheless still probably remain a phenomenon to be wondered at is because it is, in all likelihood, of a nature widely different from anything in the ordinary experience of mankind. If man possesses any such homing sense, it is only in the most rudimentary and undeveloped condition. And it is probably for this very reason, this element of mystery, that man has from earliest time taken a lively interest in the question of the migration of birds.

But how much nearer are we to a real solution of the problem of migration than we were a hundred or two hundred years ago? Much data has been accumulated, many details have been learned as to where birds go and to a certain extent by what routes, and many poorly grounded theories have been overturned and left behind. But still the goal is ahead. For although the coming

[1] Naumannia, V, 1855, pp. 390–391.

[2] Read before the American Ornithologist's Union, Cambridge, Mass., November 18, 1908.

of the birds in the spring and their departure in the fall are among the most apparent of natural phenomena about us, and must be noticed by everyone, it is quite another matter when it comes to the details of their movements.

Most of the knowledge of the migrations of birds which has been gleaned up to the present time is of their *mass* movements; scarcely anything is known of what becomes of an individual bird after its departure in the fall from its summer home, or, I might even say, after it has reared its young. It is truly wonderful that birds can wing their way from the region where they breed to a far distant land, and then, with the return of proper conditions, find their way back again to the same region. But how much more wonderful if they come back to the very locality which they left the year before! And how little exact knowledge we have of their ability to do this! It is the purpose of the present paper to outline a plan by which it is hoped that much data of a definite kind can be secured, not only as to the great migrations of birds, but regarding their minor movements as well. Furthermore, it is believed that light may be shed on many subsidiary problems.

The fundamental basis of the plan is a simple one, and one which is not new at this time. It is, briefly, the attaching of identifiable tags or bands upon birds, together with directions so that they may be returned if again found. It may be of interest to those who are not already familiar with the fact to know that probably the first person in this country to try this method was no less than Audubon himself. In his 'Birds of America,'[1] after describing in a delightful way his intimacy with a nest of Phœbes, or, as he calls them, "Pewee Flycatchers," he says: "I attached light threads to their legs: these they invariably removed, either with their bills, or with the assistance of their parents. I renewed them, however, until I found the little fellows habituated to them; and at last, when they were about to leave the nest, I fixed a light silver thread to the leg of each, loose enough not to hurt the part, but so fastened that no exertions of theirs could remove it." His birds left duly in the fall, but he adds: "At the season when the Pewee returns to Pennsylvania, I had the satisfaction to observe

[1] Audubon, John James. Birds of America, New York and Philadelphia, 1840, Vol. I, p. 227.

those of the cave, in and about it. There again, in the very same nest, two broods were raised. I found several Pewees' nests at some distance up the Creek, particularly under a bridge, and several others in the adjoining meadows, attached to the inner parts of sheds erected for the protection of hay and grain. Having caught several of these birds on the nest, I had the pleasure of finding that two of them had the little ring on the leg."

In 1901,[1] the writer, unaware at that time of Audubon's experiment, suggested that much might be learned of the movements of birds by a system of tagging, if a suitable method could be devised. No definite steps were taken at that time, however, to carry out the plan.

Some two or three years later Mr. P. A. Taverner of Detroit, Mich., announced through 'The Auk'[2] that he proposed to attach small aluminum bands to the tarsi of young birds, in the hope that some of them might later fall into the hands of ornithologists and the records be returned to him. On his band was stamped the direction: "Notify The Auk, N. Y.," together with a serial number for identification of the individual band. Mr. Taverner writes me that comparatively few birds have been banded, and of these but a single record has returned to date. This was of a Flicker tagged by Mr. Chas. Kirkpatrick at Keota, Keokuk Co., Iowa, May 29, 1905.[3] On the following Christmas day this bird was taken by Mr. J. E. Roos at Many, Sabine Co., Louisiana. During the present year the capture has been reported[4] of two ducks, a Canvasback and a Redhead, both wearing bands marked with the initials "T. J. O. D." These were taken in New Jersey, within a week or two of each other, in the fall of 1907.

Up to the present time it has not been learned, so far as I am aware, who placed the bands upon these birds. Unless this person is found these last records can have no especial value, but they nevertheless help to emphasize the fact that a certain proportion

[1] Cole, Leon J. Suggestions for a method of studying the migrations of birds. 3d Rept. Mich. Acad. Sci., 1901, pp. 67–70, 1902.

[2] Auk, Vol. XXI, p. 410, July, 1904.

[3] Taverner, P. A. Tagging Migrants. Auk, Vol. XXIII, p. 232, April, 1906.

[4] Oldys, Henry. Capture of a tagged Canvasback Duck. Auk, Vol. XXV, No. 1, p. 80, Jan., 1908.

Woodruff, E. Seymour. Another Capture of a Tagged Duck. Auk, Vol. XXV, No. 2, p. 216, April, 1908.

of returns may be expected from this sort of work. The use of tags by Dr. Watson[1] to study the homing instinct of Noddy and Sooty Terns at the Tortugas, illustrates the way in which the method may be applied experimentally.

Now as to the sort of results that may be expected from this method of investigation: Not only will it aid in the study of the general migration of a species, but by giving us records of the movements of individual birds, will assist us in analyzing the factors connected with migration in detail. A moderate number of successful "returns" should help in settling such questions as: Are the residents of a locality, or the migrants going further on, the first to arrive in the spring? Do the residents leave before the northern contingent arrives in the fall, or are they the last to go? Do males, females and young travel together, or do one or another go ahead? What is the exact route taken from any locality, and is the same route travelled each year? Furthermore it must be borne in mind that the migration problem is probably but a special phase of the homing problem, and that such questions as whether birds commonly return to the same locality to breed, and whether the young return to the locality in which they were reared, are very pertinent to its solution. I should like to emphasize further the importance of the bearing of the homing instinct, both in birds and in other animals, were there time. I can only express it, however, as my firm belief that a comparative study (observational combined with experimental when possible) of such phenomena as the annual migrations of the fur seals, and of bats, and of many fishes, as well as of the homing of animals in general (toads, ants, bees, and in fact all animals which return to a definite place) is going to be of the greatest value in understanding the "mysteries" of the migration of birds, where the instinct appears to be developed in its highest form.

Answers to certain of the questions stated above have already been found, but most of them depend upon a knowledge of the *movements of individual birds*, and to ascertain these we must have some means of identifying the individual. This is the purpose served by the numbered bands.

[1] Watson, John B. 'The Behavior of Noddy and Sooty Terns.' Publication 103, Carnegie Inst. Wash., Paper VII, pp. 187–225, pll. i–xi, March, 1909.

There are several ways in which the banding may be carried on, but banding the young before they leave the nest is probably the most feasible. This can, of course, be done only with those birds which attain practically their full growth before they attempt flight. In these birds the tarsus is, as a rule, about as large when the fledglings leave the nest as it ever becomes; there is no danger, therefore, that the bands will ever become too tight. If one is inclined to doubt this one should recall that this is the method of recording individuals universally employed by breeders of pigeons and canaries, which once banded, carry the bands for life. In the case of chickens, turkeys, and similar fowls, it is necessary either to replace the bands by larger ones as the birds grow, or else to open them out.

Still another problem which might be attacked in this way is the geographical extension of certain species. What better way, for example, of studying the dispersal of the Starling, which is gradually extending its territory about New York and in Southern New England? Do the old birds leave the places where they were reared and seek habitation elsewhere, or are the young the pioneers? The length of time required to attain adult plumage, and many similar questions would also receive light.

It is not the purpose of the plan systematically to shoot birds in order to recover the bands, nor to encourage the same, but fate sooner or later brings many birds into man's hands. However deplorable it may be, many of our birds (such as Robins and Bobolinks) are shot when they go South in the fall, and while such a condition exists advantage may as well be taken of it.

Directions for the return of the band are stamped upon it. Probably almost anyone finding a bird bearing a tag with a definite address would know what was desired of him, but possibly it may be advisable to offer a small reward to the finder as an additional stimulus. A certain amount of advertising in sporting and similar journals might aid as well.

In other cases it may be possible, as Audubon did, to catch the birds upon the nest and examine them without harm. Furthermore (as Mr. Taverner has suggested to me in a letter), anyone in a suitable locality could trap small birds, band them and release them. This continued systematically through successive seasons

and migration periods could hardly fail to yield valuable results. If a bird previously banded were trapped, the record could be made and the bird again released.

Birds which nest in large colonies, such as the gulls, terns, herons, etc., offer especial advantages for banding and making subsequent observations, and excellent work can be done by anyone who has an opportunity to carry on the work at one of their breeding places.

Finally, as to the scheme of coöperation which is proposed. Last winter the New Haven Bird Club decided to undertake the banding of birds upon a small local scale. A committee was appointed for the purpose of organizing the work, bands were secured, and a plan of records drawn up. The plan is very simple. Upon the top half of a card approximately 5×8 inches in size, is a printed blank form for recording the data of banding, number of band, species of bird, locality, date, and similar facts. On the lower half is a similar form for recording the data in connection with the return of the band, in case it ever comes back. Small booklets containing perforated detachable slips bearing the same form as the upper part of the card are supplied to those who propose to do banding, and when a bird is banded the data are recorded in this book. In the fall the books and all the surplus bands are called in, and the records are then transferred to the permanent cards. Since the numbers on the cards corresponding to those of the bands are arranged consecutively, the record for any band can be turned to directly. A separate index of species is all that is needed to make the system complete.

As to the bands themselves, it was the idea of the Committee at first to use closed or seamless bands whenever possible, and to use open bands only in the case of adult birds. The bands are of aluminum, and are stamped "Box Z, Yale Sta., New Haven, Conn.," in addition to the number. For several practical reasons it will probably be better, as Mr. Taverner has done, to use long open bands, which can be clipped off to make them the proper size, and it is also probable that the "return" address used by him will be adopted.

It was found that the number of birds tagged this year was rather disappointingly small, and it seemed desirable to enlist the help, when possible, of persons outside the Club who were in a position

to help. Further discussion with ornithologists from other sections resulted in a determination to make the plans of much wider scope. Now if the work is to be done generally, it seems greatly to be desired that only one kind of band be used, and to avoid confusion in the numbers, that all bands be distributed and records kept by a central organization. With this in view, the Committee asked for an extension of powers, which now enable it to push the work as seems best, to invite the coöperation of anyone who can help, and furthermore gives it jurisdiction over the records, thus placing them in the hands of those who do the work. The Committee as appointed by the Club consists of Dr. Louis B. Bishop, Mr. Clifford H. Pangburn, and the writer.

Upon its part, the Committee has agreed to be no further expense to the Club, since it has determined to throw itself for support and assistance in carrying on the work entirely upon the generosity and coöperation of such persons as are interested. Among others, Mr. Taverner has generously offered his hearty coöperation, agreeing to act as an advisory member of the Committee, and has volunteered to turn all his bands and records over to the central depot. Similar support has already been offered by others. It is intended now to prepare a large number of bands for the coming season, together with directions for using them. It is hoped to secure a number of interested persons in different sections of the country who will coöperate with the Committee, and act as local distributing agents for bands.[1] It will be their business to attend to the distribution of bands and blank recording forms to any in their locality who are willing to aid in tagging; and at the close of the season to call in the records and unused bands, and to forward the records for transference to the permanent cards.

If the present paper shall have aroused any interest in this plan of attacking the problems of migration, and similar little-understood phenomena, it will have accomplished its purpose, and the Committee will be very glad to correspond with any who are willing to coöperate in the work.[2]

[1] A number of well-known ornithologists have already agreed to act in this capacity.

[2] Address Dr. Leon J. Cole, Yale University, New Haven, Conn.