

with it back to its first winter home. Thus it seems not improbable that a wintering flock at Summerville may be chiefly composed of (1) young birds of the year, in many cases progeny of one or more old birds accustomed to winter here; (2) birds which have experienced one or more nesting seasons, and of which some are individuals which spent their first winter here and others are their mates which spent their first winter in other localities. If these assumptions are correct, there are presumably a number of banded birds, roughly comparable to the number of returns, which are scattered about in wintering flocks in other parts of the winter range of the species. This is a theory difficult of proof because of the probably wide distribution of these banded birds which have changed their winter residence after their first nesting season. In my own case, but two White-throated Sparrows banded by me at Summerville have been recovered elsewhere in the South, one too early (November 6, 1933) to be sure that it had then reached its wintering-ground, although the locality seems well off the northeast and southwest migration route usually followed. The other was shot on December 22, 1933, at Four Oaks, North Carolina, and may be presumed to have been wintering there, although Four Oaks is almost directly on a normal flight-line to Summerville. One Chipping Sparrow was taken at Plantersville, South Carolina, in February, 1932, the year after it was banded—evidently a wintering record. Thus there are no sufficient data at hand even to indicate that my theory is correct. For the present it must rest upon an almost purely conjectural basis, reinforced by trapping observations of many cases of apparent attachment of free birds to those temporarily in captivity. The fact that plumage and other external changes do not seem dependably to indicate relative ages of the species under consideration—with the exception of the iris-color of the Towhee—makes all the more difficult the accumulation of evidence to support my theory.

---

## BLOOD-PARASITES OF BIRDS AND THEIR RELATION TO MIGRATORY AND OTHER HABITS OF THE HOST

By REGINALD D. MANWELL and CARLTON M. HERMAN<sup>1</sup>

SINCE the earliest discovery of blood-parasites in birds by Danilewsky in 1885, a number of surveys have been made of the incidence of these microscopic "animalcules" in the avian hosts. A vast amount of research has been done on these parasites, particularly those closely related to human disease, such as the organism which causes malaria. Almost always the main concern has been the

---

<sup>1</sup>From the Department of Zoölogy, Syracuse University, Syracuse, New York.

parasite or its effect on the host, and very few attempts have been made to link these findings with the habits of birds.

Ever since fowl have been used for food and domesticated for the benefits of human needs and profit it has been of primary importance to see that health is maintained in these and in game-birds.

Ornithological literature has many citations of losses among birds. Many of these are attributable to abnormal weather conditions. The menace of lighthouses, beacons, and even the Washington Monument are well-known causes of considerable losses during migration. Diseases have also been recognized as often causing great depletion in the numbers of our wild birds. Kalmbach<sup>1</sup> recently called attention to great losses in crow roosts during the winter due to a disease erroneously termed roup. Many bacterial diseases also occur. The blood diseases, such as those caused by Leucocytozoon, Trypanosomes, Filaria, and Malaria, are of a great deal of interest because they are all, as far as is known, transmitted by insects and therefore greatly dependent on the habits of the birds. O'Roke has shown in a recent paper<sup>2</sup> that great losses have occurred in ducklings due to leucocytozoa, which is of particular importance at this time because of the current shortage of ducks.

Leucocytozoon is by no means common among the Anseriformes only. For the past two years we have been making a survey of birds captured chiefly in and around Syracuse and we have so far examined six hundred and fifty birds. Most of these have belonged to the Passeriformes, and among these this parasite has also been found quite common. No extensive survey on young birds has been carried out similar to the work of O'Roke on ducklings, but the fact that this parasite does occur in many species of our migratory song-birds would suggest that corresponding losses occur among these birds just as in the case of ducks. Swallows seem particularly susceptible.

Malaria is also a common disease among birds. Extensive study has been done on this parasite in canaries, and much has been learned which has proved applicable to human malaria. But as to the actual effect on the wild bird in nature practically nothing is as yet known. Whether malaria actually causes any great loss to the bird population is still an open question, but its presence in a bird probably breaks down its resistance to other diseases to a great extent. This parasite, and microfilaria, which are believed to be also spread by mosquitoes, present some interesting problems of the relation of incidence to the habits and migration of birds. Malaria is transmitted by certain species of mosquitoes which require a relatively high level of temperature and humidity, so it would be expected that birds which spend a part of their lives in regions where these mosquitoes breed in great numbers should be more commonly infected than birds which, for example, spend the winter in more northern regions. Thus it is found that Song Sparrows (*Melospiza*

*m. melodia*) and Robins (*Turdus m. migratorius*) are commonly infected with one or more species of this parasite while Slate-colored Juncos (*Junco h. hyemalis*) which spend their lives in a more northern range are less commonly infected. It also seems apparent that migratory birds are more commonly infected than those which do not migrate.

Much can be learned from the banding returns on such birds. At present the relation of blood-parasites of birds to migration is a very new study. It was begun in 1928 by Huff<sup>3</sup> at the University of Chicago when he began by examining blood-smears supplied to him by bird-banders. O'Roke in his work on *Leucocytozoon* examined many ducks that were banded. In the work carried on by the authors at Syracuse University almost all the birds examined were banded and released in as good condition as when captured. That the migration of birds plays an important part in the spread of these diseases is quite evident, but just how much importance and stress should be placed upon this factor can be determined only by further and more extended study and banding returns.

It is interesting to note that birds such as ducks and swallows which spend at least a part of their life on or near water are more commonly infected with *Leucocytozoon*. The vector of this disease in ducks has been shown by O'Roke to be a black fly which breeds in running water. Young swallows while still in the region of the breeding-site have not often been found infected with this parasite, but young birds captured later in the summer, when they roost in large numbers in swamps in this region, are more commonly infected, suggesting that the infection is obtained at this time.

Of the eleven adult Robins examined by the authors every one showed malaria parasites of one or more species, while of the ten young examined none were infected. This would suggest that the infection is obtained while the birds are South during the winter and would perhaps indicate that all birds found infected had been South at some time.

There are at least seven valid species of malaria and several others that are as yet questionable<sup>4</sup>, and of these at least five have been found in birds from various parts of the world. Since these parasites can probably be transmitted in nature only by mosquitoes which can exist in temperate or warmer regions, a study of the migration-ranges of such infected birds may shed some light on the old question as to the possible location or origin of some of the families of birds which occur on both hemispheres, as do some of the species of malaria.

Further study of the movements of infected birds through banding returns may shed much light on the nature of the infection and its effect on the normal activities of the bird, while, on the other hand, a greater knowledge of the parasites of banded birds will undoubtedly expand our present knowledge of the migratory and other habits of the host.

BIBLIOGRAPHY

1. KALMBACH, E. R.  
1920 The Crow, Bird Citizen of Every Land. *National Geog. Mag.*, 37;  
322-337
  2. O'ROKE, E.C.  
1934 A Malaria-like Disease of Ducks Caused by *Leucocytozoon anatis*.  
Wickware. Bulletin 4. Univ. of Michigan School of Forestry and  
Conservation.
  3. HUFF, C.  
1932 Studies on *Haemoproteus* of Mourning Doves. *Amer. Journ. Hyg.*,  
16; 618-623.
  4. MANWELL, R. D.  
1935 How many Species of Avian Malaria Parasites are There? *American  
Journal Tropical Medicines*, 15; 265-283.
- 

GENERAL NOTES

**Notes on Eastern Song Sparrow Repeats.**—While carrying on a survey of the incidence of blood-parasites in the birds of the Syracuse region we obtained some interesting results with banded Eastern Song Sparrows (*Melospiza melodia melodia*). With one exception (34-140209 was released on April 22, 1935, at station D) all the birds were released at the laboratory. When first captured about two hundred fifty milligrams of blood were removed from each bird (for sub-inoculation into canaries for further study of malaria parasites), and they were in captivity for several hours. At each subsequent capture a blood-smear was made, and the bird was usually released within an hour after capture. The fact that the birds were repeatedly recaptured shows that they suffered no ill effects or fright from the removal of a sample of their blood.

During the course of this work three trapping stations were in operation; both drop traps and the simple Government funnel-type sparrow-trap were used. Station A and C were located in back yards of a densely populated residential section, A one block north of the laboratory, C one block east of the laboratory. A vacant lot with much undergrowth adjoins Station A, while Station C is entirely surrounded by residences. Station B was located about a mile and a half east of the laboratory at the edge of a residential section adjoining fields and open woods. Although the direct line of flight to Station B is over Station C, no Song Sparrows were trapped at the latter location.

Of the eight Song Sparrows banded from Station A, one repeated once while another returned four times after the original capture. Of the twenty-four Song Sparrows banded from Station B, six repeated once, while three others returned at least three times, 34-140209 returning seven times during six weeks.

Although Stations A and C were so close to each other and to the laboratory and Station C on the direct line of flight to Station B, no birds were captured at any except the trapping station of original capture. This, added to the fact that the birds were able to find their way back to the traps a mile and a half from the laboratory, tends to show that the individual birds are very specifically localized in habits. That the birds were able to find their way back to their original localities when released at a distance away is not an entirely new phenomenon to bird-banders. Several workers have reported such experiments, and in a recent number of *Bird-Banding* (Vol. VI, No. 1, Jan., 1935) Heydweiller reported that Tree Sparrows (*Spizella a. arborea*) returned to the original trapping stations when released as much as ten miles away. The homing instinct of these birds is a problem interesting to ponder over, and bird-banders might well investigate it further with other species to find if it is universal among birds and so shed more light on this question. A table giving a summary of the repeats follows.