A631458, banded at Irvington, Calif., on April 8, 1931, by Nion R. Tucker, was shot at the mouth of the Taltson River, Great Slave Lake, Mackenzie, on June 4, 1931.
A631721, banded at Irvington, Calif., on March 2, 1930, by A. D. Trempe and Nion R. Tucker, was proably shot at Gurneyville, Alta., on July 23, 1931.
A632579, banded at Irvington, Calif., on February 15, 1931, by Nion R. Tucker, was caught in a muskrat trap at Bear River Marshes, Utah, on April 13, 1934.
A634693, banded at Irvington, Calif., on March 2, 1930, by Nion R. Tucker, was killed at Winnipegosis, Manitoba, on April 27, 1930.
A658489, banded at Avery Island, La., on March 4, 1930, by E. A. McIlhenny, was recovered at Foam Lake, Sask., on September 14, 1932.
A658266, banded at Avery Island, La., on February 14, 1930, by E. A. McIlhenny, was killed at Selkirk, Yukon, about September 1, 1930.
A665150, banded at Avery Island, La., on November 5, 1930, by E. A. McIlhenny, was killed at Le Goff, Alberta, on May 9, 1932.
A666392, banded at Avery Island, La., on January 26, 1931, by E. A. McIlhenny, was shot at Ochre Pit Cove, Bay de Verde Dist., Newfoundland, on August 29, 1931.
A692718, banded at Lake Merritt, Oakland, Calif., on January 23, 1934, by E. W. Ehmann, was caught in a muskrat trap at Poplar Island Creek, Mackenzie, in the spring of 1934.
B656993, banded at Avery Island, La., on November 16, 1932, by E. A. McIlhenny, was shot at San Lucas de Toliman, Guatemala, on November 30, 1932.
B657379, banded at Avery Island, La., on November 9, 1932, by E. A. McIlhenny, was shot at Labrados, Sinaloa, Mexico, on December 15, 1933.
B687951, banded at Campbellsport, Wis., on October 26, 1932, by Frank Hopkins, was caught by a hawk at Fernandina, Fla., on December 13, 1932.
*B688896, banded at Munuskong State Park, Mich., on August 16, 1933, by H. D. Ruhl, was shot at The Bight, Cat Is., Bahamas, on November 30, 1933.
B697753, banded at Avery Island, La., on December 20, 1932, by E. A. McIlhenny, was retrapped January 19, 1934 and again on May 8, 1937.
B697870, banded at Avery Island, La., on December 20, 1932, by E. A. McIlhenny, was retrapped February 16, 1934, January 18, 1935, January 18, 1936, and December 12, 1936.
C607221, banded at Avery Island, La., on February 16, 1933, by E. A. McIlhenny, was shot at Orange Lake, Fla., on December 23, 1933.
C632678, banded at Lansing, Iowa, on May 2, 1935, by W. E. Albert, was shot at Bahia Honda, Pinar del Rio, Cuba, on February 26, 1937.
34-550090, banded at Avery Island, La., on December 20, 1934, by E. A. McIlhenny, was caught in a muskrat trap at Little Playgreen Lake, Norway House, Manitoba, about May 20, 1935.
34-616120, banded at Irvington, Calif., on February 21, 1934, by Nion R. Tucker, was found dead at Rinistino, Sask., about October 30, 1934.
36-613384, banded at Avery Island, La., on March 28, 1936, by E. A. McIlhenny, was probably found dead at Mineral Point, Mo., about October 23, 1936.

Biological Survey, Washington, D. C.

SOME PARASITOLOGICAL PROBLEMS WHICH THE BIRD BANDER MAY HELP TO SOLVE

By WOLFDIETRICH EICHLER

THE advent of bird banding has opened up many new problems for the ornithologist. The chief difference between the field ornithologist and the bird-bander is that the former can only observe the living bird from a distance while the latter has an opportunity

to examine the bird at close range while it is in the hand. Among the problems which present themselves is the study of the little animals that live as parasites on the birds. Not only is the bird-bander able to collect the ectoparasites occurring on the bird, but also he is able to observe their ill-effects on the nestlings, their place of attachment on the birds, and possibly their food habits.

Proof that bird-banders have become interested in the ecto-parasites is evidenced by the rich aviparasitological content of ornithological journals and especially of journals for bird-banders (see page 20 of the index for Vol. I to VI of *Bird-Banding*, which was published in 1936, and also the author's bibliography of titles concerning all parasitological articles and notes which have appeared in ornithological journals, published in *Ornithologische Monatsberichte*). The advantages of coöperation between the bird-bander and the entomologist toward increasing our knowledge of the bird parasites are shown by Mr. Peters' article "A list of external parasites from birds of the eastern part of the United States" in *Bird-Banding*, Vol. VII, No. 1, pp. 9–27.

The opportunities presented to bird-banders wishing to promote aviparasitology are numerous. It is not only a question of which species of birds are parasitized and by which species of parasites. Other important and interesting problems are as yet unsolved. It is well known that many parasites are restricted to a single species of bird. From this fact we may predict a great number of parasites which have not yet been described and from many species of birds. On the other hand, some species of parasites do not seem to be specific for a single host. Birds-of-prey are often found with parasites which normally parasitize the birds upon which they feed: there are numerous instances listed in the mallophagan literature. A very interesting record appertaining to this problem and published here for the first time is that of a *Laemobothrion* sp. in my Mallophaga-Collection (under No. WEC 300), which was taken from the ear of a lizard, *Varanus albigularis* (Daud.), April 1917 at Grootfontein (German South-West Africa), along with the tick *Aponomma exornatum* C. L. Koch. Professor Dr. P. Shulze was so kind as to send me the parasite for identification. Cold-blooded vertebrates such as *Varanus* are not known to harbor lice and the genus *Laemobothrion* is exclusively confined to birds-of-prey (Falconidæ and Aquilidæ). However, *Varanus* being a predacious animal, it may be possible that the parasite was obtained from the nest of a bird-of-prey, and that the insect was still alive when the *Varanus* was examined for parasites. It has not yet been solved whether such stragglers are able to feed on the new host or must die in their newly acquired environment, or if it is really possible for them to maintain their existence on the new host. The entomolgist is handicapped because of lack of material when he attempts the solution of these problems by experimental methods. Such problems must be solved by one who has the opportunity of examining birds'

FIGURE 1, Upper. FIGURE 2, Lower.

nests or of catching living birds, often the same individual bird many times.

Another problem which bird-banders can help to clarify is the geographical distribution of parasites. That the interesting scientific branch of studying the geographical distribution of animals is realized in ornithology is evidenced by the nomenclature of geographically varying subspecies and by studies of vagrant wanderings among different populations of one and the same bird species. In regard to aviparasites, the problems are much more complex. There are all stages of transition between parasitic species which have only one bird as a host and are to be found throughout the entire geographical range of this host, and parasitic species which are restricted to a relatively limited geographical area, but are not particular in their choice of a host. The situation is even more complex among the endoparasites because of their involved evolutionary cycles. This is especially true of some of the helminths (worms) which may infect a single host species but use different intermediate hosts in different countries or continents.

Still another field of investigation which I might mention in connection with this survey is that of the epidemiology of ectoparasites. Our present knowledge of parasitic animals allows us to estimate their abundance and diversity. However, we know very little of their harmful effects. I do not mean, here, the damages caused by endoparasites, firstly, because endoparasitology does not belong to my pursuits, secondly, because bird-banders do not often have the opportunity of studying the action of endoparasites on the living bird. The ectoparasites, themselves, present some interesting problems. One might mention that ectoparasites—especially many of the blood-sucking insects—serve as intermediate hosts for many of the endoparasites as well as transmitters of other diseases. The pathogenic role of louse-flies, for example, as the vectors of *Haemoproteus*, has long been known. (See Wuelker, G., 1925, Zur Biologie der Lausfliegen der Vogel und ihrer Rolle als Protozoenuebertraeger; Sencken bergiana VII, 224–234, and Herman, "Ectoparasites and bird diseases," *Bird-Banding*, VII, 163–166.)

Furthermore, there are inter-relations between different ectoparasites of the same birds. The interpretation of this is not yet clear. One of these examples is the Michrolinchus- and Myialges-mites which deposit their eggs on the wing surface of louse-flies. It is not known whether these mites are really parasites of the bird or of the hippoboscid fly.

Very little is known of the direct effect of the ectoparasites on the birds. However, it seems plausible to assume that blood-sucking louse-flies may cause the death of undernourished birds. During bad weather nestlings of insect-eating birds are often underfed and consequently suffer much more from loss of blood than

do healthy, well-fed young. Even the conclusions of different authors concerning the harmfulness of *Protocalliphora*-larvae for bird-broods are divergent, though American bird-banders have made some excellent observations on this parasite (see several articles in *Bird-Banding*).

How little we know of the life-history of biting lice, the most striking of the bird parasites, is shown by a review of the recent literature. The two photographs, figures 1 and 2, are examples of the epidemiology of Mallophaga:

Figure 1. Eggs of *Mallophaga* on an Eagle-Feather (from *Aquila Aquila nipalensis* Hodgson., 2d Brooke Dolan Expedition, 1934–36, Academy of Natural Sciences of Philadelphia, U. S. A.); Seshugomba (upper course of the Ja-lung-kiang), Western China, 10.3.1935; underside of wings. Probably eggs from *Laemobothrion* sp., Magnified 6/5 times. Photo Wd. Eichler. Feather in my own collection under No. WEC 218B. See also p. 102 in Eichler, WD., 1937c, Einige Bemerkungen zur Ernährung und Eiablage der Mallophagen, in: S. B. Ges naturf. Fr. Berlin (1937), p. 80–111. *Laemobothrion* is that genus which contains the largest of all known mallophagan species.

Figure 2. Feather-holes, probably produced by *Mallophaga*, on a Swallow-Feather (from *Hirundo rustica rustica* Linn., ♀, 11.8.1897 Rossitten, East Prussia) in the collection of the Berlin Zoological Museum (no. B 164). Third right primary, seen from underside, Object-contact-method (in my own collection under No. WEC 455). For further information concerning this subject see p. 232 and 233 in Eichler, WD., 1937g, Untersuchungen zur Epidemiologie der Aussenparasiten—I—Federlöcher und ihre Deutung, Archiv für Tierheilkunde (Berlin) LXXII, p. 230–234.

It is being more generally admitted that a knowledge of the parasites of an animal is a necessary component of the picture of an animal's life-history. This knowledge would remain incomplete if merely name-lists of parasites were given. Exact observations and investigations of the interactions between host animal and parasitic animal must be sought if one is to correctly estimate the life-sphere of host and parasite.

Berlin-Wilmersdorf (Germany), Hindenburgstrasse 35, III r.