TAVERNER, P. A. and B. H. SWALES. 1911. Notes on the migration of the Saw-whet Owl. *Auk*, **28**: 329-334.

WOOD, N. A. 1951. The birds of Michigan. *Misc. Publ. Mus. Zool., Univ. Mich.*, No. 75.

Department of Zoology, University of Wisconsin, Madison, Wisconsin, and the Cedar Grove Ornithological Station, Route 1, Cedar Grove, Wisconsin. Present address of H. C. M.: Dept. of Zoology, Univ. of North Carolina at Chapel Hill.

Received May, 1966.

MORTALITY OF BLED BIRDS AS INDICATED BY RECAPTURE RATE

By Edwin C. Franks

The potential of wild bird populations to harbor such serious diseases as the encephalitides was discovered in 1938 (Stamm, 1963); public health personnel have subsequently sought methods of monitoring these wild populations for signs of the diseases (e.g., Sussman, *et al.*, 1966). Because the encephalitides do not produce easily visible symptoms in birds, their diagnosis in birds involves laboratory analysis of blood samples.

Detection of encephalitis in wild populations may begin at any of three points: (i) arthropod vectors may be collected and tested for the virus; (ii) caged domestic fowl may be placed in the open where mosquitoes can transmit any extant infection from wild birds to the fowl, blood samples then being taken from the fowl; or (iii) wild birds may be captured, identified with a band, and released after a blood sample is removed. The sampling by the last method has caused some concern among scientists involved with bird-banding records. If the taking of blood samples from wild birds increased their mortality rate, a bias would be introduced into return and recovery records, particularly if the bird had been previously reported as not bled (Baysinger, 1966).

The purpose of this paper is to report observations on the possible effect that removal of a blood sample may have on the mortality rate in wild birds.

METHODS

Birds were captured in a series of 64 mist nets located in woodland and fields during the spring, summer, and fall months of 1963, 1964, and 1965. While uncommon or very small birds were simply banded and released, many of the common birds were bled at the location of capture, removing up to 0.2 cc of blood from the right jugular vein by a method similar to that of Kerlin (1964). Upon withdrawal of the 27 gauge needle, excessive subcutaneous bleeding was prevented by momentary thumb pressure over the puncture. The birds were then released. Some individuals of even the common species were released without bleeding due to shortage of time, darkness, cold, condition of the bird, or other reasons.

Over the 3-year period, many repeats and returns were obtained. One would expect, if bled birds had normal survival, that the proportion of bled birds recaptured would be about equal to the proportion of unbled birds recaptured. Conversely, if the loss of 0.2 cc of blood adversely affected survival, then fewer of the bled birds would survive to be recaptured. To determine whether there was a relationship between bleeding and the proportion recaptured, the data for each species were arranged into a 2 x 2 contingency table: bled and not bled on one axis and recaptured and not recaptured on the other. If the sum of birds in any of the four categories just mentioned was less than 10 for a given species, that species was arbitrarily excluded from further analysis. Relationships within the 15 remaining contingency tables were checked for statistical significance with the precise tables presented by Finney (1948; Finney, *et al.*, 1963) when possible. However, his tables were generally useful only for those species in which (i) neither the number of birds bled nor the number of birds not bled exceeded 40, or (ii) neither the number of birds recaptured nor the number of birds not recaptured exceeded 40. Statistical significance for species not meeting either of these criteria was checked on a table of chi-square values. Since the biological question concerned only whether bleeding depressed the recapture rate, and not whether bleeding simply affected recapture rate, the one-tailed significance limit was applied in both cases. Because the proportion of each species released without bleeding did not vary with the season, and because the data from each species were analyzed separately, the inclusion of possible migrants in this study does not bias the results.

All data pertain only to the initial capture (banding) of each bird and its subsequent first recapture, if any. In this way, there is no bias from birds that have proved either their tendency to be recaptured or their ability to survive loss of blood. Any bird whose first recapture occurred on the day of banding was eliminated from the analysis.

TABLE 1. RECAPTURE RATES OF BIRDS WHICH WERE NOT BLED AND OF BIRDS WHICH WERE BLED

Species	Birds released		Proportion recaptured	
	Not bled	Bled	Not bled	Bled
Downy Woodpecker (*Dendrocopos pubescens*)	11	39	.36	.23
Blue Jay (*Cyanocitta cristata*)	10	35	.30	.29
Black-capped Chickadee (*Parus atricapillus*)	89	52	.25	.37
Tufted Titmouse (*Parus bicolor*)	12	44	.42	.43
Catbird (*Dumetella carolinensis*)	33	153	.27	.20
Robin (*Turdus migratorius*)	56	161	.11	.14
Wood Thrush (*Hylocichla mustelina*)	53	132	.38	.39
Red-eyed Vireo (*Vireo olivaceus*)	30	58	.30	.31
Ovenbird (*Seiurus aurocapillus*)	56	105	.21	.19
Brown-headed Cowbird (*Molothrus ater*)	15	23	.33	.26
Scarlet Tanager (*Piranga olivacea*)	10	53	.10	.30
Rufous-sided Towhee (*Pipilo erythrophthalmus*)	25	94	.28	.20
Chipping Sparrow (*Spizella passerina*)	26	32	.35	.16
Field Sparrow (*Spizella pusilla*)	58	57	.38	.28
Song Sparrow (*Melospiza melodia*)	18	29	.17	.31

RESULTS

The 15 species suitable for analysis are listed in Table 1. For each species, the table lists the number of birds not bled, the number bled, and the proportion of each of those values which were later recaptured. For example, 50 Downy Woodpeckers were banded and released, 11 of which were not bled and 39 of which were bled at the time of banding. Thirty-six per cent (4/11) of the unbled birds were later recaptured, compared with 23 per cent of the bled birds. In no species was the proportion of bled birds recaptured significantly lower than the proportion of unbled birds recaptured at the five per cent level of probability; this level was approached, however, in the data from the Chipping Sparrow.

An examination of Table 1 shows that bleeding was negatively related to the recapture rate in eight species, and positively related in seven species. Thus, averaging the direction of influence for 15 species, bleeding appeared to have little net effect. If the raw data for all 15 species are pooled and treated in a single analysis with 1067 bled birds and 502 unbled birds, 25 per cent of the bled birds were recaptured as opposed to 27 per cent of the unbled birds, the difference not being significant. Of the four species studied in the family Fringillidae (Rufous-sided Towhee, Chipping Sparrow, Field Sparrow, and Song Sparrow), the first three showed a lower recapture rate among the bled individuals. A pooling of the data for these four species into a single contingency table revealed that the recapture rate for bled fringillids (.23) was significantly lower than the rate for individuals which were not bled (.32). Pooling the data for both species from the family Turdidae (Robin and Wood Thrush) showed that bleeding had essentially no effect on recapture rate, while in the family Paridae (Black-capped Chickadee and Tufted Titmouse) the relationship was positive.

DISCUSSION

The usefulness of the comparison of recapture rates assumes that the only factor which may consistently cause discrepancies between the two proportions of recapture is the fact that a blood sample was taken from some individuals. This implies that other factors affecting a bird's survival did not influence the decision of whether to bleed the bird or not. While this assumption holds generally, birds in poor health at the time of banding were rarely bled. Because some of these birds probably died soon after banding, the data are biased in a direction which would indicate that unbled birds had the lower chance of survival. A similar biasing occurred in the rare instances when the bander was unsuccessful in obtaining any blood from a bird; such a bird was classified as unbled even though the jugular vein was punctured. Another possibility is that bled birds, because of their traumatic experience, may have more aversion to the net than do birds which are simply banded and released. If this differential net-shyness did exist, it would introduce a bias indicating that bled birds had the lower chance of survival, thus partially compensating for the biases mentioned previously.

Since the data for no species showed a significantly lower recapture rate among the bled birds, and since the species were about equally distributed with regard to positive or negative relationships of bleeding to the recapture rate, it is reasonable to suggest that there is no consistent relationship between the bleeding of a bird and its possible subsequent recapture. And insofar as the recapture rate can serve as an index to the mortality rate, the mortality of a released bird is generally independent of the removal of up to 0.2 cc of blood.

However, if the four species of Fringillidae are analyzed together, bled individuals had a significantly lower recapture rate. Assuming that bled fringillids do not become unduly net-shy, the most reasonable cause of a lower recapture rate is a higher mortality rate. Mortality among bled fringillids might be expected to be more than in other families studied on the basis of the open type of habitat characteristic of the four species analyzed. Because most of the field work was done in warm, dry weather, the loss of blood might be more serious to a bird living in a sunny old-field habitat than to one living in a shady woodland, particularly, as in the present case, if the nets are not watched continuously.

The positive relationship between bleeding and recapture in the parids appears to lack a reasonable biological explanation. Perhaps the data are substantially biased by a selection of only the healthiest individuals to be subjected to bleeding, or by severe juglar vein damage in some individuals which were classified as not bled.

With the possible exception of the fringillids studied, no real effect of bleeding on recapture rate has been demonstrated. In many species, therefore, the bleeding and release of previously banded birds should not introduce a significant bias into the bird-banding records. This does not mean that bleeding is essentially harmless to birds, but only that bleeding does not cause substantial mortality among those individuals that are released. Some birds, especially among the smaller species and particularly under adverse weather conditions, do not survive the bleeding operation. If such an unfortunate accident should happen to a previously banded bird, proper reporting of how the band was obtained prevents any biasing of the records.

The field work on this research was shared by approximately 15 university students, none of whom had had previous training in the bleeding of birds. Therefore, the bleeding represents work by persons of a wide array of talent, and conclusions drawn from this study should be widely applicable.

ACKNOWLEDGMENTS

This study was done while a postdoctoral trainee on Public Health Service grant number 5T1 GM 00736 to David E. Davis. Field data were gathered by a number of graduate students in the Department of Zoology at The Pennsylvania State University. William Harkness suggested the statistical treatment of the data, and helpful criticisms of the manuscript were received from David E. Davis and Earl B. Baysinger.

SUMMARY

Wild birds were caught in mist nets and banded over a period of three years. A small blood sample (0.2 cc) was removed from many individuals of the more commonly captured species, while other individuals of the same species were released without being bled. To determine whether the bled birds which were released suffered an increased amount of mortality compared with the birds which had not been bled, the recapture rates of the two groups were compared. Data from 15 species, varying in size from Black-capped Chickadee to Blue Jay, failed to demonstrate that bleeding

depressed recapture rate in any single species. Data pooled by family, however, showed that the recapture rate of four fringillids, when analyzed as a group, was significantly depressed by bleeding.

LITERATURE CITED

BAYSINGER, EARL B. 1966. Limitations on the handling of previously banded birds. *Bird Bandina Notes* **6**(1): 13-18.

FINNEY, D. J. 1948. The Fisher-Yates test of significance in 2x2 contingency tables. *Biometrika* **35**: 145-156.

FINNEY, D. J., R. LATSCHA, B. M. BENNETT, and P. HSU. 1963. Tables for Testing Significance in a 2x2 Contingency Table. The University Press, Cambridge. 103 p.

KERLIN, RAYMOND E. 1964. Venipuncture of small birds. *Jour. Amer. Vet. Med. Assoc.* **144**: 870-874.

STAMM, DONALD D. 1963. Susceptibility of bird populations to eastern, western, and St. Louis encephalitis viruses. *Proc. XIII Intern. Ornithol. Congr.*: 591-603.

SUSSMAN, OSCAR, RAYMOND E. KERLIN, WILLIAM C. CARTER, JEFF SWINEBROAD, and MARTIN GOLDFIELD. 1966. Ecology of arbovirus infection in New Jersey. *Bird-Banding* **37**: 183-190.

Department of Zoology, The Pennsylvania State University, University Park, Pennsylvania. Current address: Dept. of Biological Sciences, Western Illinois University, Macomb, Illinois 61455

Received October, 1966.

FALL DEPARTURE OF THE YELLOW-BREASTED CHAT (ICTERIA VIRENS) IN EASTERN NORTH AMERICA

By John V. Dennis

Through a program of intensive mist netting, I established to my satisfaction that Yellow-breasted Chats begin to leave their breeding territories along the Potomac in northern Virginia by early July (Dennis, 1958). Family groups appeared to leave one at a time, and about half the population had left by the end of July. Birds departing in July had not completed their molts.

To several examples from the literature that I gave in my paper, it is worth adding another indicating early departure. Merrill Wood, speaking of the region of State College, Pennsylvania, tells me that the Chat breeding population appears to leave in July. The occasional Chat seen in August, he feels, has remained only because of a physical defect or some other impairment.