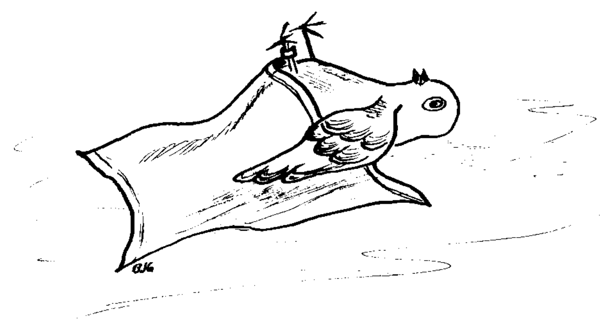
Handling-induced shock in migrant songbirds

Robert C. Leberman and Miriam A. Stern



The terms handling effect, handling trauma, and handling shock are all used to describe the physiological reaction that a bird may experience after it has been netted or trapped, banded, and released. This phenomenon has been noted and described elsewhere (Mueller & Berger 1966, Rogers & Odum 1966, Nisbet & Medway 1972) with the conclusion that handling may bring about a change in the behavior of some birds so as to render them incapable of normal feeding for at least a day afterward and thus cause a weight loss. Nisbet *et al.* (1963) observed a weight loss among a sizable percentage of the Blackpoll Warblers *(Dendroica striata)* they recaptured, and attributed this to a general metabolic decline among fall migrants "refueling" during stops on the flight south rather than to any direct effect of handling. Rogers and Odum (1966) performed their study primarily on winter residents in Central America and concluded, in contrast, that handling alone provoked these losses. The present study has been undertaken further to explore and describe this condition in migratory songbirds with respect to the length of "layover" time they may spend resting and feeding in a given area between migratory flights.

The data were extracted from the files of the banding station operated by Carnegie Museum of Natural History at its Powdermill Nature Reserve, three miles south of Rector, Westmoreland County, Pennsylvania. The senior author was responsible for gathering the data in the field. The junior author performed the analysis and prepared the first draft of the text and illustrations, which were then revised by the senior author.

Sample sizes large enough for analysis were found for three migrant species: Yellow-rumped (Myrtle) Warbler *(Dendroica coronata)* and Lincoln's Sparrow *(Melospiza lincolnii)* in the fall and Ruby-crowned Kinglet *(Regulus calendula)* in both fall and spring. These species were selected because none either breeds nor normally winters in the vicinity of the Reserve. The samples were analyzed for the following data: the number of days between the first and last handling for each bird that repeated at least once; the mean layover time per species; the difference between single and multiple repeats in layover time and weight change; and the mean net weight change of the birds between banding and the last recapture. All weights were taken with a triple-beam balance. It should be noted that layover period in these figures is not meant to represent the actual time the birds spend at this location before the next flight; that sort of precision is impossible from banding data when one is dependent on the random capture and recapture of birds. These "layover periods" between handlings do, however, give a measure of the minimum time the birds spend at the Reserve between flights. Changes in the quantity of visible stored fat were also analyzed, but are not presented here; we found that in this study the weight data offered a clearer indication of the physiological adjustments the bird was performing. The sample sizes for the various parameters within one species vary because not every bird was weighed each time it was handled.

In figures 1, 2, and 3a, representing fall layovers for Yellow-rumped Warblers, Lincoln's Sparrows, and Ruby-crowned Kinglets respectively, the solid bars represent those birds handled twice during their layover, once at the original banding and again at a single repeat. The hatched bars indicate birds handled three or more times. Although it is not shown here, the samples were originally analyzed by age and (except for the sparrows) sex. The sample sizes for these classes were found to be too small for these criteria to show any influence on

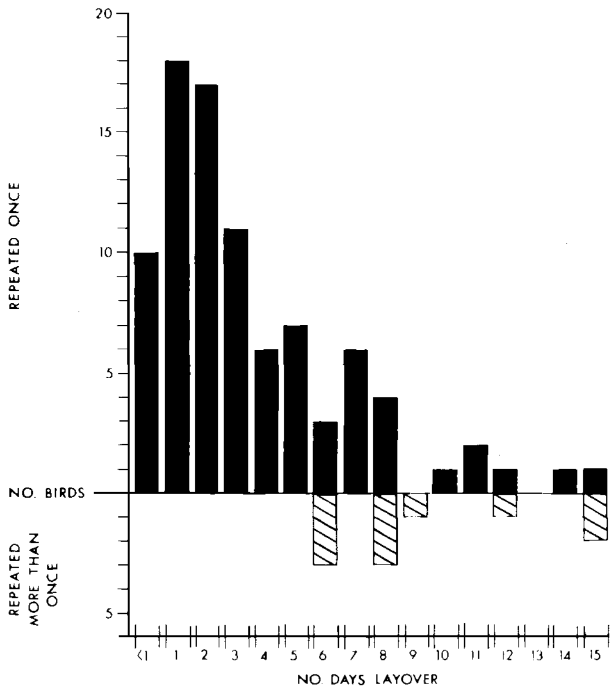


Fig. 1. Layover time between first and second capture: fall Yellow-rumped Warblers. Sample size = 98; mean layover for species = 4.1 days; mean for single repeats = 3.5 days; mean for multiple repeats = 9.3 days.

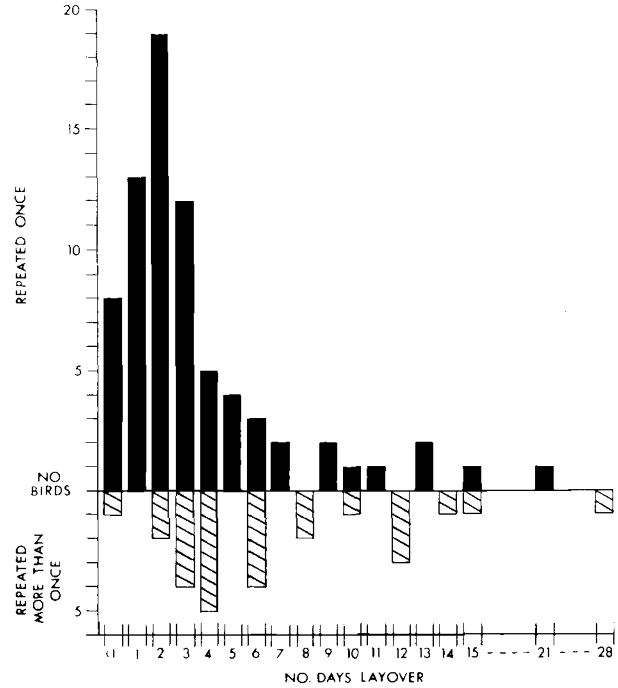


Fig. 2. Layover time between first and last capture: fall Lincoln's Sparrows. Sample size = 99; mean layover for species = 4.4 days; mean for single repeats = 3.3 days; mean for multiple repeats = 7.2 days.

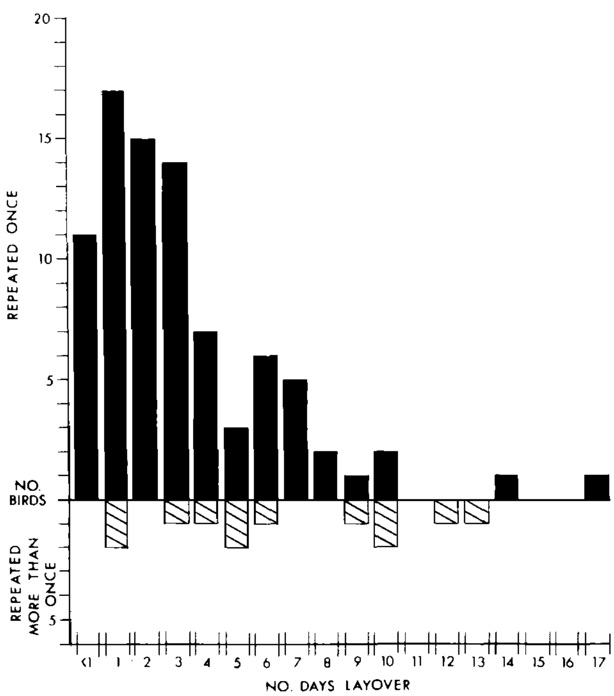


Fig. 3a. Layover time between first and last capture: fall Ruby-crowned Kinglets. Sample size = 97; mean layover for species = 3.7 days; mean for single repeats = 3.3 days; mean for multiple repeats = 6.6. days.

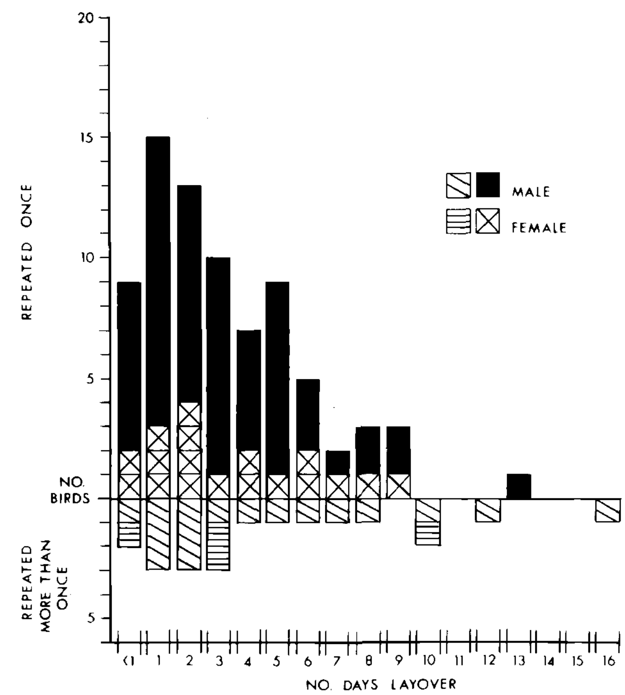


Fig. 3b. Layover time between first and last capture: spring Ruby-crowned Kinglets. Sample size = 97; mean layover for species = 3.6 days; mean for all males = 3.6 days; mean for all females = 3.6 days; mean for all single repeats = 3.3 days; mean for all multiple repeats = 4.9 days.

the distribution of the data; hence all classes were pooled for the final analysis of the fall migrants.

It was thought that sex might have some influence on the distribution of spring layover data for Ruby-crowned Kinglets (Fig. 3b), because at Powdermill the peak of migration of spring females is about ten days later on the average than that for males (Leberman & Clench 1971). The mean layover period for the entire sample was 3.6 days; the mean layover for the sample of all males was 3.6 days, identical to the mean for the sample of all females.

It is significant that in all four cases studied the birds tended to stay longer the more often they were handled. The mean layover for the whole sample of Yellow-rumped Warblers is 4.1 days, but the mean for the sample of single repeats is only 3.5 days, whereas the mean for the sample of multiple repeats is a much larger 9.3 days. Similar differences are presented for fall Lincoln's Sparrows, with a species mean of 4.4 days, and fall kinglets, with a species mean of 3.7 days; the samples of single repeats for these species both have a mean of 3.3 days, whereas the samples of multiple repeats have mean layovers of 7.2 and 6.6 days respectively. For spring kinglets the mean layover of the whole sample is 3.6 days, as noted above; the sample of single repeats, both male and female, has a mean of 3.3 days, whereas the sample of multiple repeats, both male and female, has a mean layover of 4.9 days. There is good evidence from a long-term study of migrant Swainson's Thrushes *(Catharus ustulatus)* in Wisconsin (Mueller & Berger 1966) that handling itself does tend to prolong the layover period of an individual bird, and repeated handling may seriously upset the metabolism of a few individuals. Generally speaking, the longer a bird remains in the area the more likely becomes its capture or recapture. On the strength of the weight change data, however, we believe that handling can increase the layover period of a migrant individual, rather than that a long layover actually increases the amount of handling a bird may receive.

Figures 4, 5, and 6 represent the net weight change between first and last capture of those individuals that were weighed each time they were handled. In each figure the vertical line reflects the range of net weight changes for the sample of that layover period; the number in parentheses below each range represents the sample size for that period; and the short horizontal line across each range stands for the mean net weight change of that sample. Single repeats are indicated as filled circles only at the extremes of the range, but all multiple repeats are depicted as open circles wherever they occur. The sample sizes were too small for a rigorous statistical analysis, but the ranges and means show definite trends with regard to net weight change during the layover period.

The majority of birds lost weight for a day or two after banding and had to regain it, which took another day or two, before they reached the weight recorded at first handling. Then they continued to add weight before resuming the flight. Such behavior supports the observations of Mueller and Berger (1966, Tables 3-5). If their data are graphed in the manner of Figures 4-6, the same general patterns of mean weight changes of both single and multiple repeats recur. The net increase in weight after banding is due partly to the replenishment of the subcutaneous fat stores which supply most of the bird's energy for migration; it may also represent the enlargement of the flight muscles with metabolic water and intramuscular fat deposits (Fry *et al.* 1972). The experience of handling seemed to traumatize these birds such that they did not feed or metabolize normally for the first day or two after banding. Fall Yellow-rumped Warblers, fall Swainson's Thrushes, and both fall and spring kinglets took three days on the average to recover their weight loss; fall Lincoln's Sparrows apparently required as long as four or five days.

Most of the rest of the birds that did not exhibit the above pattern steadily gained weight in spite of handling and apparently did not sustain handling shock. The data are sparse, but they suggest that these birds may have been ready to leave three to

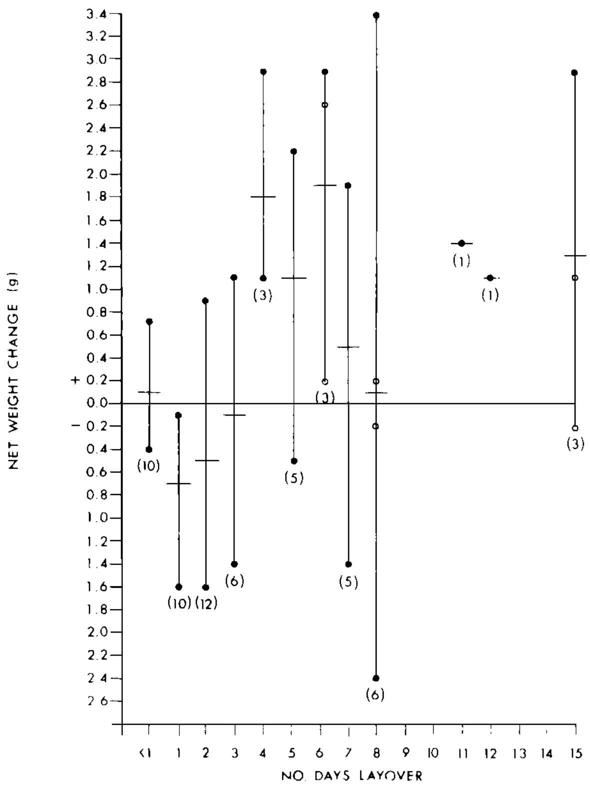


Fig. 4 Net weight change of fall Yellow-rumped Warblers during layover between first and last capture.

while migrating. Hence it is not surprising that the additional stress caused by handling, especially within a very short period of time following the completion of a long flight, might manifest itself as a temporary weight loss.

There is obviously no way of knowing what percentage of birds that are handled only at initial banding actually remains for a day or more, nor what percentage of birds that do lay over is recaptured during the layover period. *Most* individuals of the three species studied here are *not* recaptured (96% of Yellow-rumped Warblers, 89% of Lincoln's Sparrows, 83% of fall Ruby-crowned Kinglets, and 91% of spring kinglets). Part of this majority must consist of birds that do not linger at the Reserve and are thus not susceptible to recapture; for these individuals the trauma of being handled and banded was probably negligible.

At no time should handling shock be construed as an argument against banding and handling birds; it is clearly a temporary condition in most individuals in which it has been observed. We plan to accumulate more data toward documentation of this phenomenon in other species and hope that other banders handling large samples will make similar studies.

five days earlier on the average than those that underwent handling shock.

A few birds had an extended layover period without showing significant net weight changes, and others continued to lose weight long after the normal recovery period for their species. Some of them, particularly the multiple repeats, seemed to show an excessively adverse reaction to handling, while others may not have been in normal health when they were first captured (e.g., the four fall kinglets [Fig. 6a] that remained underweight after a layover of 12 to 1[illegible] days). A smaller sample of Tennessee Warblers *(Vermivora peregrina)*, while insufficient for this analysis, also seemed to conform to this pattern, with some birds apparently showing no effects of handling, some undergoing handling shock and recovering, and a few staying in the banding area for an extended length of time either showing little net weight change or steadily losing weight.

Why some birds show handling effect and some apparently do not is open to conjecture. Any bander who has handled migrants is well aware of the physiological stress that some birds undergo

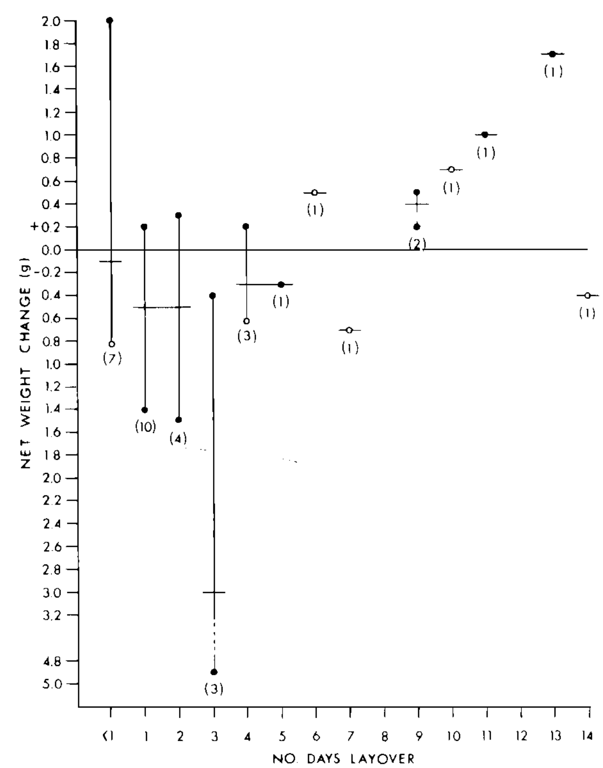


Fig. 5. Net weight change of fall Lincoln's Sparrows during layover between first and last capture.

The authors would like to thank Mrs. Cordelia Scaife May for establishing the Powdermill Research Fund, through which this analysis of banding data was made possible; Mr. A.C. Lloyd for his years of diligent volunteer banding and record keeping in the Powdermill program; and Drs. Kenneth C. Parkes and Mary H. Clench for their advice on the problem and help on the manuscript. Mr. James Senior prepared the figures.

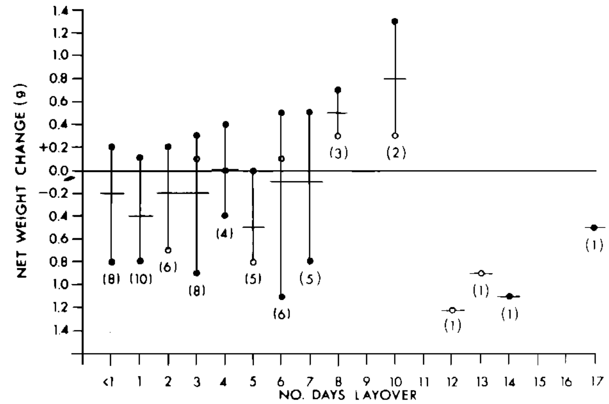


Fig. 6a. Net weight change of fall Ruby-crowned Kinglets during layover between first and last capture.

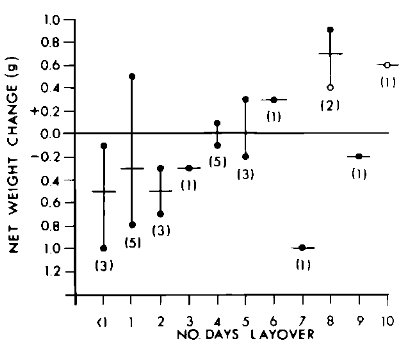


Fig. 6b. Net weight change of spring Ruby-crowned Kinglets during layover between first and last capture.

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Powdermill Nature Reserve, Star Route South, Rector, Pa. 15677, and Carnegie Museum of Natural History, Pittsburgh, Pa. 15213.

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The recommended band size for Evening Grosbeaks

Martin K. McNicholl

The North American Bird Banding manual lists size 1A as the recommended band for Evening Grosbeaks *(Hesperiphona vespertina)*. In March and April 1975 I banded 21 Evening Grosbeaks while mist netting at the home of F.C. Zwickel near Sherwood Park, Alberta. I used size 1A bands as recommended but felt they were rather snug. During these banding operations, I also caught birds previously banded by J.C. Finlay, all banded with size 2 bands. Finlay (pers. comm. 1975) told me he was sometimes unable to fit a size 1A band on these birds, especially those infected with scaly-leg, or knemidokoptiasis, a disease not infecting any of the birds I had banded.

During the fall and winter of 1976-1977, I again banded Evening Grosbeaks, this time at the cottage of Prof. W. Ray Salt at Pigeon Lake, Alberta. I used size 1A for the first three birds caught on 7 November 1976 but then encountered a male on which a size 1A could not be fitted. The others had also seemed fairly tight, so I then changed to size 2 bands. None of these birds banded that day had scaly-leg, but I have since had several cases of infected birds. Size 1A will not fit on infected birds, and even size 2 was tight on one badly infected male.

Since Evening Grosbeaks seem highly susceptible to scaly-leg (see Carothers *et al.* 1974; Balph 1976), and tight bands could seriously harm infected birds, I recommend that banders, at least of western populations, use size 2 bands on this species. Size 1A seems a bit too tight even for healthy birds.

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Department of Zoology, University of Alberta, Edmonton, Alberta T6G 2E9.

Unusual numbers of White-throated Sparrows

Lawrence R. Pharo

Banding White-throated Sparrows *(Zonotrichia albicollis)* from 1 October through 31 December during 1975 and 1976 showed quite an interesting contrast. All banding took place at my home, located in Whiting, New Jersey (Co-ord. 395-0742).

Using two 9-meter nets, with approximately the same net-hours, 62 White-throats were banded during 1975. During 1976, 784 were banded. Before beginning this note, I wrote to quite a few other banders located in all parts of New Jersey. After receiving answers from them, I was surprised to learn that all advised that they had no unusual numbers of White-throats. Also, after going all over Ocean County where Whiting is located, I discovered no unususal numbers of White-throats could be found.

Island Beach State Park is located in this area, and I contacted Bud Cooper, the Banding Co-ordinator, to compare his statistics with mine. I was surprised to learn that, for approximately the same period of time, I had banded 538 less in 1975 and 131 more in 1976 than banders who were banding in a major flyway area.

Table 1 shows dates the birds were banded; sex data is given in Table 2.

Table 1: Monthly comparisons of bandings

	1975	1976
October	21	200
November	29	489
December	12	95

Table 2: Sex Data

	1975	1976
Male	42	457
Female	3	45
Unknown	17	282

303 Lakewood Ave., Whiting, NJ 08759.