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LITERATURE CITED

BALDWIN, S. P. 1922. Adventures in bird-banding in 1921. *Auk,* **39:** 210-224.
BEAUDETTE, F. R. 1941. The reasons for failures in immunization against laryngotracheitis and pox. *Proc. U. S. Livestock San. Assn.,* **45:** 127 ff. (cited in Biester and Schwarte, 1952).
BIESTER, H. E. and L. H. SCHWARTE. 1952. Diseases of poultry. Iowa St. College Press, Ames, Iowa, 3rd ed., 1245 pp.
COULSTON, F. and R. D. MANWELL. 1941. Successful chemotherapy of a virus disease of the canary. *Amer. Jour. Vet. Res.,* **2:** 101-107.
KOSSACK, C. W. and H. C. HANSON. 1954. Fowlpox in the mourning dove. *Jour. Amer. Vet. Med. Assoc.,* **124:** 199-201.
LOCKE, L. N., C. M. HERMAN and E. S. KING, JR. 1960. Pox in the mourning dove in Maryland. *Avian Diseases,* **4:** 198-202.
MANWELL, R. D. and F. GOLDSTEIN. 1939. A new and successful way of treating canary pox. *Proc. Soc. Expt. Biol. & Med.,* **41:** 554-555.
MUSSELMAN, T. E. 1923. Bird-banding at Thomasville, Ga., 1923. *Auk,* **40:** 442-452.———1928. Foot disease of chipping sparrow. *Auk,* **45:** 137-147.
OLIVE, J. R. and V. SCHULTZ. 1952. "Scaly leg" (Cnemidocoptiasis) in the red-winged blackbird, *Agelaius phoeniceus. Auk,* **69:** 90-91.
ROSEN, M. N. 1959. Killing them with kindness. *Outdoor Calif.,* **20:** 12-13.
SHATTUCK, S. G. 1898. Molluscum contagiosum in sparrows. *Lancet,* **(1):** 1055.
STAFSETH, H. J. 1931. Pigeon-pox in Michigan. *Jour. Amer. Vet. Med. Assoc.,* **79** (n.s. **32**): 822.
TALBOT, L. R. 1922. Bird-banding at Thomasville, Ga., in 1922. *Auk,* **39:** 334-350.
THOMPSON, D. R. 1950. Foot-freezing and arrestment of wing molt in the mourning dove. *Wilson Bull.,* **62:** 212-213.
WICHMANN, R. W. and D. J. VINCENT. 1958. Cnemidocoptic mange in the budgerigar (*Melopsittacus undulatus*). *Jour. Amer. Vet. Med. Assoc.,* **133:** 522-524.
WORTH, C. B. 1956. A pox virus of the slate-colored junco. *Auk,* **73:** 230-234.

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CHICKADEES ON BELL HILL

A TEN-YEAR STUDY OF A LOCAL POPULATION IN BEDFORD, N. H.

By JOHN H. KENNARD

In January, 1953, I received a banding permit and started operating a small banding station, with pull traps on the lawn of my newly built home in Bedford, N. H. The location is on a hill, more than 500 feet from the nearest house, and was about one-half mile from the nearest neighbor feeding birds. Since the beginning of the operation I have been particularly interested in studying the Black-capped Chickadee (*Parus atricapillus*) which is the most constant species in my feeders.

In 1957, after five seasons of banding, I reviewed my material and decided that I did not have enough to warrant publication. However, it appeared at that time that my rate of returns was relatively high, that my local population remained fairly constant and that there was no evidence of "my" chickadees migrating at any time.

At that time I became convinced that certain individuals would enter the traps many times, and clutter up my records with essentially useless data, while other individuals, more trap shy would avoid getting caught. I felt that if in some way I could mark my "regular" birds, and allow them to feed in the traps undisturbed, I could catch the remainder and obtain more valid statistics.

Therefore, in 1957 I began experimenting with various dyes and stains, using tissue dyes from the hospital laboratory, various commercial food and textile dyes, and a group of dyes made up for me in the laboratory of one of the local textile mills. I finally found that a commercial preparation called "Drimark" was the most efficient and easy to apply, and for the past two years have used this technique (*Bird-Banding,* 32: 228).

During the past two seasons, I have been staining each chickadee with a bright red spot on each cheek. This is clearly visible from the house, and I allow the bright red spotted birds to feed in my traps at will, without disturbing them. When an unmarked bird enters the trap, I pull the string closing the trap, record and stain the bird. In this way the marked birds lead the shy individuals into the trap, and I can maintain over 90 percent of the birds present with red spots. These marks last for 8-10 weeks, bright red, and are visible for another 8-10 weeks, so that they can be renewed every 2-3 months with no difficulty.

I am sure that this has improved my accuracy, and that my statistics for the second five year period are more accurate than for the first, and for the last two years most accurate of all. However, I have always tried to catch any unbanded bird, and even for the first few years most of the "regular" population was banded.

In this area during June and July chickadees apparently do not eat sunflower seeds, apparently subsisting almost entirely on insects, and so during these months I am unable to trap them. Therefore my "season" runs from late August or early September through the winter to the following May. My statistics are summarized in the following two tables. Table I shows the number of chickadees present by year banded. Table II is a rearrangement of the same figures to show in each column the number of birds by known age, or number of seasons each bird has returned. The figures for 1961-62 only include records to January 1, 1962, and will be higher at the end of the current season.

TABLE I

CHICKADEES BY SEASON

Band Year	52-53	53-54	54-55	55-56	56-57	57-58	58-59	59-60	60-61	61-62
52-53	15	12	6	3	2	3	1	3	1	1
53-54		21	12	8	6	5	1	2	1	1
54-55			40	10	6	4	2	2	4	3
55-56				30	14	12	2	3	4	3
56-57					49	28	8	7	6	5
57-58						38	2	2	1	1
58-59							31	17	15	13
59-60								45	24	11
60-61									44	12
61-62										49
Returns		12	18	21	28	52	16	36	56	50
New	15	21	40	30	49	38	31	45	44	49
Total	15	33	58	51	77	90	47	81	100	99

TABLE II

CHICKADEES BY AGE

Year	1	2	3	4	5	6	7	8	9	10
52-53	15	12	6	3	2	3	1	3	1	1
53-54	21	12	8	6	5	1	2	1	1	
54-55	40	10	6	4	2	2	4	3		
55-56	30	14	12	2	3	4	3			
56-57	49	28	8	7	6	5				
57-58	38	2	2	1	1					
58-59	31	17	15	13						
59-60	46	24	11							
60-61	44	12								
61-62	49									
Total	363	131	68	36	19	15	10	7	2	1
Avg.	36.3	14.5	8.5	5.1	3.1	3.0	2.5	2.3	1	1

The bottom line in Table I shows the total number of birds present each season, starting with 15 in '52-53, and in general with the exception of '58-59 gradually increasing until for the last two years it will be 100 or more. This I believe reflects an actual increase in the population on my hill, and is probably due in part to the fact that with an increased food supply due to my feeders, a greater proportion of birds are surviving the winter. This is certainly reflected in a corresponding increase in my bills for sunflower seed.

There is obviously no way of determining the ages of the birds banded the first season, but as at the end of each season virtually all of the local birds are banded, I believe that the newly banded birds after the first season must represent either first year birds, or immigrants from another area.

Of the 15 birds present the first year, 12 returned the second season; and of 33 the second, 18 returned the third, showing that most of the living birds return year after year. Of 77 birds in '56-57, 52 returned the following season, reflecting a far lower mortality than one would expect from the literature. Kluyver suggests that the mortality in chickadee population approaches 50 percent per annum and states that this figure is true of European Tits.

The figures form a fairly consistent pattern until we reach the 38 birds banded in '57-58, when something different happened, as we see that in spite of a regular return rate exceeding 50 percent, of these 38 birds only two returned; of these two both returned for a third year, and one for a fourth and fifth. Beyond this, of the 52 old birds present in '57-58, only 14 returned in '58-59.

In trying to explain this phenomenon several theories have occurred to me, none of which alone seems entirely satisfactory. First, was there a general southward migration of all chickadees that year, and the 38 birds banded here represent immigrants from further north that returned to their regular habitat the next year? A further study of these 38 birds banded in '57-58 shows that they can be broken down into two groups: Group A is composed of birds banded between August 23 and September 30, 1957. In Group A only one bird was ever trapped after October 3, 1957. (That one bird was still here in November, '61.) Group B is composed of ten birds banded November 11 to January 26, '58, seven of which apparently wintered here, but not a single one returned in a later season. #38 was banded March 4, 1958, and remained until March of 1960.

A second theory is that there was an epidemic or some other event that caused an unusally large mortality in '58. This is supported by the marked drop from 52/77 to 16/90 in the number of older birds returning after the summer of '58. However, during the next winter ('59-60) several birds showed up that had not been present in '58-59, giving an apparent mortality rate of birds banded 1952-57 of less than zero. (Of birds banded 1952-57, 14 were present in '58-59, and 17 in 1959-60). This suggests that some of my birds may have emigrated south in early '58, and not returned until the fall of '59.

My present tentative explanation of these figures is as follows. From 1952 to 1957 there was no significant migration in my local population of chickadees. About October 1, 1957, something unexplained happened, and all of my first year birds, represented by Group A, took off, probably south, and never returned.

These birds were replaced by Group B, probably birds originating further north, that immigrated into this area and returned northward, or at least somewhere else, at the end of winter. A few of the older birds later took part in this migration, and some of these did not find their way home for two years. The mortality among the migrating birds was much higher than among those that stayed, but the population was rapidly built up by very successful breeding seasons in the summers of '59 and '60. The mortality was much higher in the first year birds than in the older individuals. The migration itself was composed chiefly of young birds.

Of 155 birds banded 1952-57, there were 77 present in the winter of '56-57; there were none that missed the '56-57 season but returned in the next two years; there were 28 which were present in '57-58 but did not return in a later season. There were 11 birds that missed the winter of '58-59, but returned in a later year; six of these returned in '59-60, and five did not return until '60-61. There were only three of the 16 "old" birds present in '58-59 that did not return the next year.

Studying these same figures rearranged as in Table II, one can get a better idea of the mortality and longevity of the chickadee. Taking the total figures in the next to last line, it is apparent that the largest mortality is in the first year birds, and that after a bird is two years old, the mortality is far less than 50 percent per annum. Because I have progressively less years to study as the age of the bird increases, I have computed the average number of birds of a given age present, and the figures on the last line, showing this average, give a flatter curve than the figures for total birds. Considering that the number of birds banded has in general increased, and that I only have 36 individuals banded in the first two seasons, compared to 93+ in the last two, obviously the true curve will be flatter still. Even so, it is obvious that while the mortality during the second year may exceed 50 percent, after a bird is 4-5 years old the mortality is much less, and that some will survive to an age of at least ten. If I can maintain my banding operation I hope to follow this with a continuing study that by 1972 will give much more valid statistics.

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