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A POPULATION BALANCE FOR THE BLACK-CAPPED CHICKADEE

By CHARLES H. BLAKE

As an illustration of a method of examining the annual balance of a bird population and to look for evidence of short period cyclic change I have surveyed my records of the Black-capped Chickadee for the past five years. Some tentative conclusions may be drawn from an attempt to balance the variations in number during the year against the calculated number of deaths. On tallying the birds known to be alive and banded on five specific dates, 1 February, 1 May, 1 July, 1 September, and 1 December of each year, one very striking fact emerged: the population was essentially constant from year to year on 1 July, varying only between 11 and 13 birds. There may be a question as whether the data for 1951 are actually all in, but except for the September records it must be very nearly all in and, in any event, would tend to make the July account more uniform rather than less. The figures that I obtained are set out in Table 1, together with the average figure for each date. It is evident that mathematically the plus and minus changes in the average must balance giving an amplitude of 11.2 birds. They need not, however, balance within any one year. If we turn our attention for the moment to the first day of July it would appear that the population comes to a constant level at this time. It has been nearly constant in

TABLE I

Numbers known to be banded and alive on dates shown

	1 Feb.	1 May	1 July	1 Sept.	1 Dec.
1946	—	—	—	—	29
1947	26	14	12	14	21
1948	19	13	12	15	15
1949	12	13	11	18	31
1950	20	11	13	18	20
1951	16	11	12	22	—
Average	18.6	12.4	12.0	17.8	23.2
Amplitude as % of Average	75	24	17	56	69

TABLE II

Changes from one date to next based on averages

Period	Net Change	Deaths	Gain (+) or Loss (—) allowing for deaths
1 Dec.-31 Jan.	—4.6	4.2	—0.4
1 Feb.-30 Apr.	—6.2	4.7	—1.5
1 May-30 June	—0.4	2.2	+1.8
1 July-31 Aug.	+5.8	2.2	+8.0
1 Sept.-30 Nov.	+5.4	4.5	+9.9

May. In other words, during the breeding season there are available to be trapped, then or later, the same number (12) of birds each year. This population is in some fashion maintained by immigration or by reproduction, as input and by emigration and death as outgo. There is no clear evidence here, for a period of five years, of any real cyclical change, in spite of considerable fluctuations at 1 December and 1 February. Of course I do not know how large the area covered by these five or six breeding pairs may be. It is large enough so that during the breeding season no more than two or three pairs appear at my traps, although known adult birds may appear very shortly after 1 July.

Of the four causes of change which I have just listed, only one, deaths, can be estimated with any degree of certainty as yet. I can only say as to reproduction that a good deal of the change from 1 July to 31 August does involve birds which are evidently young. From other data we can derive a mortality of 0.00323 birds per bird per day. I will attempt to justify this figure on another occasion. If we can accept it now, we obtain the results shown in Table II in which the net change is balanced off by deaths to give the gain or loss which must be due to one or more of the three other causes of change, namely, reproduction, immigration, and emigration. In the first interval, 1 December to 31 January, it would appear that the net change is almost entirely due to deaths, the difference being only 0.4 birds which may represent a net emigration. At present I would not lay much weight on so small a figure and suggest rather that between 1 December and 31 January the population is essentially constant except for death. In the next period, 1 February to 30 April, the occurrence of emigration is a little more clear since the net loss after allowance for death amounts to 1½ birds. Percentagewise this is about 10%. In the period 1 May to June 30, we have more deaths than net change. Here we have a gain of 1.8 birds which nearly balances the deaths as shown by the small difference of the averages. This may represent a net immigration of about 2 birds. At this point it may be remarked that in some years there appears to be a very definite movement of chickadees near the middle of May and perhaps a small one always occurs then. These may be birds looking about for breeding territory, and filling in the territories that have been rendered vacant by the winter deaths of former owners. However, in this same period there is a small amount of gain from reproduction, that is to say a few young birds appear which are free of their parents and can be trapped and banded. This amounts to 0.6 birds per year, and our migrational change is therefore reduced nearly to 1 bird if we take this latter source of input into account. As we would expect, there is a considerable gain of birds evidenced

in the July-August period, and I believe that most of these will be found ultimately to be the reproduction of the local population and relatively few of them birds from away. The last period, September-November, has a still larger input of ten birds which may well mostly be from some little distance, and by this time the winter stock which will furnish the breeding population of the area for the following year, is established. Adults reappearing in late summer tend to have been present the preceding winter.

This sort of analysis could be extended to as much detail as one liked but it seems needless to do so at the present time. The dates were selected with a definite eye on the character of the population movement, that is, so as to avoid picking dates which fell, except for 1 September, within a period of marked change but rather dates which seem to be within periods of constancy. In so doing the bulk of the probable migration is eliminated. Roughly speaking, we have accounted here for an input of 20 birds although I band an average of 51 a year. The bulk of these are birds which arrive and depart never to be seen again within the intervals which have been chosen, particularly July-August and September-November, with marked maxima in August and November.

Table III considers what we may term the throughput of birds whose stay and total record is short. It consists of two parts: (1) birds which are banded and leave within one period and (2) the few birds banded in one period which have not been taken after the end of the following period. These last birds are referred to the period of banding.

TABLE III

Average new bandings and throughputs
Throughputs

Period	New Bandings	Within a Period	Over a Tally Date	Total	% of New Bandings
1 Dec.-31 Jan.	3.6	2.6	0.2	2.8	78
1 Feb.-30 Apr.	6.4	4.8	0.0	4.8	75
1 May-30 June	2.0	1.4	0.2	1.6	80
1 July-31 Aug.	12.7	5.2	1.0	6.2	49
1 Sept.-30 Nov.	26.8	10.7	3.0	13.7	51

We may note that a rather high proportion of newly banded birds in winter and spring are on the move but the absolute numbers are quite small. In the summer and fall more birds tend to settle down for the following winter but the greater total number of birds available leaves a relatively large number of moving birds, as would be expected. Even though the distances traveled may be small I would regard these moving birds as true migrants especially since they are not seen again.

On the basis of this balance sheet, it seems probable that the winter population consists almost entirely of birds which, if then alive, will breed somewhere in the vicinity. Perhaps ten per cent of the wintering birds will move some distance away. We may further estimate that six breeding territories will support a winter population of about 20 birds.

Some final points may be made. As stated above, no real variation in total population from year to year is yet evident and since the minimum percentage amplitude (bottom line of Table I) occurs on 1 July,

it is this date which may be expected to yield the evidence of such changes. In my area the winter carrying capacity seems to vary much more than the summer capacity. I believe the area has been working at its maximum capacity in terms of breeding pairs although it does not always seem to have produced the maximum number of young birds. However, since chickadees are essentially independent of their parents before they can be trapped the variation in numbers on 1 September may represent, in part, a variable amount of wandering off by the young.

I have assumed that the death rate does not vary with season. This may not be entirely true but there is not yet any way of stating the variation accurately.

The loss during a period (Table II) may be mostly from birds which move away and never return to my vicinity even though they may live months or years longer. On the other hand, the gain must consist of new bandings less any moving away. That the second effect is rather small may be concluded from the fact that the sum of the gains (Table II) and the throughputs within a period (Table III) is 44.4 while the average number of new bandings is 51.5 per year. Seven birds per year are unaccounted for. The method of tallying and calculation is such that the figures in Table III are independent of those in Table II.

The small number of birds banded in one period and last recorded in the immediately succeeding one compared with those banded and last recorded within one period validates my choice of tally dates as dates of population stability.

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GENERAL NOTES

New Age Record for a Blue Jay.—Blue Jay *(Cyanocitta cristata)* No. 35-336385 was banded by me at 5833-85th Street, Elmhurst, Long Island, New York, on May 11, 1939. This bird was retrapped by Leonard Llewellyn on January 16, 1948, in a boxtrap at the Patuxent Research Refuge at Laurel, Maryland. On March 4, 1952, the Blue Jay was again caught in a boxtrap which was set out on the Patuxent Research Refuge during the month of March for the capture of small mammals alive. Mr. Oscar Warbach, a biologist at the Refuge, writes me that the trap was baited with an ear of corn and a piece of smoked herring.

When Mr. Warbach handled the bird he noticed nothing unusual in its actions that would indicate that it was an old bird. It jumped about the trap as he approached it in the same manner as other younger birds. The edges of the band were worn thin but the numbers were still very legible and the band showed little wear.

Mr. Warbach states that the bird lay quietly in his hands while he was examining it and made no attempt to peck him or to escape. When released, it flew into the nearby pines and disappeared without a scolding note.

This second recovery at the Refuge of the bird was about 1700 feet away from the place where it was trapped on January 16, 1948.

Mr. Seth Low reports that according to the files at Washington, D. C., this is the oldest Blue Jay on record.—Marie V. Beals, 165 South Marengo Avenue, Pasadena 5, California.

Robin Movements in North Dakota.—On July 14 a woman reported a dead robin found on the other side of town about two miles away. This proved to be one which I had banded September 26, 1948, and was the fourth of about 100