AN OVERALL ANALYSIS OF RETURN RATES

BY CHARLES H. BLAKE

For a long time it has been held that banded nestlings yield very few returns. This seems to be true. I know of no further, general inquiry into the relation of return rates to age and status. The latter tends to be mixed or variable for many species. For the practical purposes of this discussion I depart a little from the usual definitions of age and status classes.

Nestlings are young banded while still in the nest or in one or two cases known to have left the nest within a few minutes preceding banding.

Immature birds are young of the season banded before 1 October in any year. I regard later banded birds as sufficiently experienced to be counted as adults. Furthermore only a limited number of species can be aged with any certainty after about 1 October by banders.

All evident adults are counted as such and also all determinable immatures banded between 1 October and 31 May. The few determinable immatures of the previous season are easily distinguished from those of the current season after 31 May. I have not taken a current season young bird except in the nest before 1 June. The only exception to the adult definition applies to the Slate-colored Junco where a few dozen late September birds are counted as adult although they are actually young of the year. Only the last five days of the month are involved.

The above age classes are taken as mutually exclusive. This does not hold for the following status classes, however, any one of the 75 species and subspecies is assigned as a whole. No attempt is made to distinguish migrant from breeding individuals, for example. To do this would require assessment of every individual, a proceeding whose accuracy would be quite low. For the purposes of this discussion I define four status classes.

"Part wintering species" are those that are characteristically present in winter and do not breed in the region or do so only very infrequently. This class contains appreciable numbers of transmigrants and terminal migrants. Transmigrants are those birds which are in active migration through the area in question. Terminal migrants have essentially completed their migration but are not yet settled into a winter (or breeding) territory. When this territory is taken up it may or may not be within the zone of attraction of the station where the bird was banded. In general, a single station cannot distinguish between transmigrants and terminal migrants on the one hand nor between terminal migrants and winterers on the other.

"Pure migrants" are those species whose occurrence in the area in question as either wintering or breeding birds may be regarded as very exceptional. This is the most homogeneous of the four status classes and all its individuals are to be considered transmigrants.

"Breeding species" are those species which nest with reasonable regularity in the region in question but without regard to abundance. This class contains the continuously present species and hence a large proportion of migrant and wintering birds. For such species as Goldfinch

and Purple Finch these latter elements greatly exceed with me the bandable breeders.

The "pure breeders" are summer species and, in addition, at my station seem hardly to occur as migrants. Wintering individuals are rare exceptions. This class is a segregate from the preceding class.

The table sets forth the results of banding 3,723 birds at Lincoln, Massachusetts during the last six years. These birds are all small land birds except for two nestling Barn Owls and one adult Screech Owl. Less than two hundred were banded away from my own station. Second and subsequent returns are not counted in.

The major problem presented by the table is the complete want of returns from nestlings. If nestlings reacted like older birds, how many returns should have been registered? There is no simple answer to this question. It depends on our base of prediction. If we use the returns of immatures of the species providing nestlings the result is minimal, about two returns. If we use both immatures and adults of these same species we secure the maximal result, about 28. Using the same two categories for all breeding species the results are intermediate. The reason for this situation is that, for the first group of species, the immatures show a low return rate of 3 per cent, while their adults have the very high rate of 14 per cent. The rate for immatures of all breeders would afford a return of eight nestlings. I take this to be a reasonable maximum. There is, then, less cause for wonder that no nestlings have returned. A further point is that, for various reasons, more than half the nestlings have been banded at some distance from my station. However, the "grenade effect" (Austin, 1951, p. 162) should react against the effect of distant banding.

The birds classified as immature follow the same pattern as the adults of corresponding status but at a lower return level. I suggest that this lower level is related to the combined action of the "grenade effect" and higher immature mortalities. Both causes would tend to lower the return rate. In connection with the "grenade effect" it should be pointed out that a nestling or immature can know two facts about its natal site, where it is and that it is an occupied site.

The differences between status classes are best discussed in relation to adult return rates since only among adults are all status classes represented. The part wintering species contain a more or less large proportion of migrants. We would expect these migrants to show practically no returns as is true of the pure migrants. It is possible for the Junco to separate transmigrants from terminal migrants or winterers with moderate accuracy and the apparent transmigrants afford no returns. It has been supposed, and may well be true, that the attachment of a passerine to its wintering site is of the same order of strength as its attachment to its breeding territory. On this basis we would expect a population composed in part of wintering birds and in part of migrants to show a return rate intermediate between that of breeding species and that of pure migrant species. This is indeed the case.

I have already (Blake, 1951) shown statistical reason why transmigrants should show very low rates of return. These figures are a practical illustration. Further, about half my "pure migrants" are warblers

and thrushes for which the zone of attraction of a banding station is very narrow. The statistical situation will be even less favorable to returns than the hypothetical one which I have previously described.

The category of "breeders" includes such birds as the Blue Jay and Blackcapped Chickadee with high return rates. The effect of including such species seems clear for the immatures but I am loath to consider the adult return rate of "breeders" as really higher than that of "pure breeders." We note that one return for the adult "pure breeders" means 0.3 per cent in the return rate. This also impels caution in assessing

TABLE I

BANDINGS, RETURNS, AND PERCENTAGE OF RETURNS

	Nestlings	Immatures	Adults	Totals
Part wintering species	0 0 0	0 0 0	1383 52 3.8	1383 52 3.8
Pure migrants	0 0 0	51 0 0	316 0 0	367 0 0
Breeders	210 0 0	450 18 4.0	1313 115 10.2	1973 133 6.7
Pure breeders	195 0 0	314 7 2.2	336 43 12.8	845 50 5.9
Overall totals	210 0 0	501 18 3.6	3012 167 5.5	3723 185 5.0

Notes: The columns under the age classes are, respectively, the number of banded individuals which could have returned, the number of individuals which did return to station and the percentage of returns based on the first two columns.

In the line "overall totals" all duplications between status classes are eliminated.

the significance of all small absolute differences among the rates shown regardless of their proportionate differences.

Few individual species are represented by sufficiently large samples to allow useful discussion of specific rates. There is evidence in the high proportion of subsequent returns among adult-banded breeders and obvious winterers of the importance of site tenacity (Austin, 1949) among small land birds.

I conclude that present techniques of capture for banding yield significantly higher rates for adults than for immatures. The very highest return rates appear to be those of adults banded on previously occupied territory. I also conclude that present methods yield extremely low rates for nestlings and transmigrants.

There are several obvious questions to which we need answers. Much more information is needed on the time distribution of mortality within each year and particularly within the first year of life. The amount and timing of the dispersion of young birds is still uncertain. We also need surer methods for placing individual birds, as opposed to species, in status classes. The answers to these questions will not come easily.

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