NOTES AND COMMENT

RELATIVE ABUNDANCE OF SPECIES AND THE PYRAMID OF NUMBERS

The fact that some species are more abundant than others is so self-evident, even to the casual observer, that it is quite generally taken for granted and not considered worthy of further demonstration. In recent years, contributions by Fisher, Corbet, and Williams ('43), Williams ('44), and Preston ('48) have done much to renew an interest in the problems of relative abundance in nature and to increase our understanding of them.

It is obvious that differences in the relative abundance of animals are implicit in the gen-

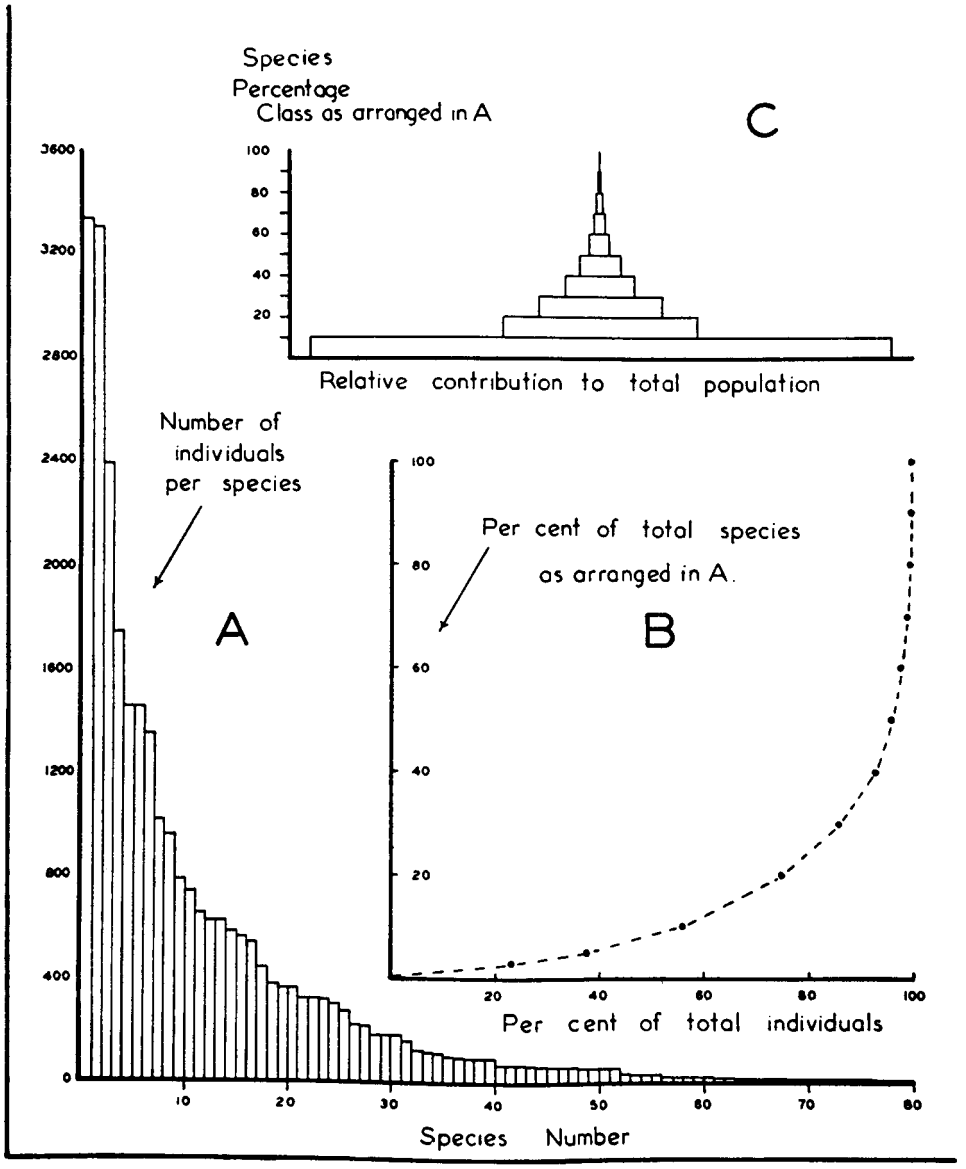

FIG. 1. Relative abundance of species in a population of breeding birds on a 17,000-acre tract. (Data from Saunders, 1936.)

eral concept of the pyramid of numbers as proposed by Elton ('27), along with differences in size and in food habits. Numerous diagrammatic illustrations of the pyramid have appeared in ecological literature, based either on grouping according to size or according to the trophic levels of the various species. Failure to find any examples based on relative abundance has prompted the writer to provide one. This is presented in the accompanying diagram (fig. 1), which is based on an estimate by Saunders ('36) of the numbers of pairs of nesting birds occurring on a 17,000-acre tract. If each of the 79 species is assigned a rank, and if the species are then arranged in order of decreasing numbers of individuals, we obtain a frequency distribution like that shown in A. The range of variation is considerable, with the most abundant species represented by 3,340 individuals and the least abundant by 2. If now we plot the per cent of the total number of species as arranged in A, we obtain an empirical curve like that shown in B. In this particular case, 5 per cent of the species account for 37.3 per cent of the individuals, 10 per cent of the species account for 55.9 per cent of the individuals, and 50 per cent of the species account for 96.0 per cent of the individuals. Finally, if the 79 species as arranged in A are now grouped in classes, each class representing an equal percentage of the total number of species, the relative contributions of each class to the total number of individuals can be shown graphically as in C. It is evident that this population pyramid has a broad base consisting of a few abundant forms.

These data were not derived from a single natural community but represent a combination of several communities. Nevertheless, there appears to be some correspondence between this arrangement of species according to relative numbers and groupings based on size or food habits. This shows most clearly in the upper part of the pyramid; the 23 (30 per cent) least abundant species included all of the hawks and owls present and only 2 species (purple finch, bobolink) that can be called plant-eaters. However, no great degree of conformity can be expected, since this population comprises a single taxonomic class and not an entire community.

Unfortunately, a complete count for every one of the species present in any community so far studied by ecologists is not yet available. Studies of relative abundance have been largely confined to particular taxonomic groups, for example, to series of snakes collected in Panama (Dunn, '49), and to Hemiptera and Lepidoptera taken at light-traps (Fisher, Corbet, and Williams, '43). These have shown relative abundance very much like that illustrated above, which is, after all, what one might naturally expect to find. There can hardly be many situations in which a majority of the species present live together in more or less equal abundance. Nor is it likely that one would find an evenly graded series running from most to least abundant. Differences in the numbers of those species which are intermediate in abundance would result in either a deepening or a flattening of the hollow curve shown in A and B, and no doubt each case shows its own variation. It seems likely, however, that the type of frequency distribution shown above is "normal" for many situations. If it is characteristic of component populations, it may also be characteristic of whole communities. Consideration of relative abundance, then, may be helpful in describing the structure of natural communities.

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