

INTRODUCTION TO
THE STUDY OF
ANIMAL
POPULATIONS

H. G. ANDREWARTHA

Introduction to the Study of Animal Populations

by

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Preface

My interest in animal ecology was first aroused by reading Elton's *Animal Ecology*. His definition of the scope of ecology which I quote in section 1.0 is still the best that I have met.

Notwithstanding the breadth of Elton's original definition the tendency of modern theoretical ecology has been to stress the inter-relationships between animals at the expense of other components of environment which may also influence the 'distribution and numbers of animals in nature'. On the other hand the published works of practising ecologists, in such fields as economic entomology or the conservation of wildlife, have provided a wealth of information about how the distribution and numbers of animals in nature are in fact determined. Andrewartha and Birch attempted to systematize this information in *The Distribution and Abundance of Animals*.

The course in animal ecology that I teach in Adelaide makes use of Andrewartha and Birch's theory of environment. But I have felt the need for a compact text that the students may use. Also when the theory of animal ecology is taught this way it seems natural to join it to a practical course that is quantitative and largely experimental. In writing this book I have had these two objectives in mind. Part I gives a compact exposition of Andrewartha and Birch's theory of environment; Part II is a manual of practical exercises that arise from and are related to this theory.

Section 9.3 is addressed primarily to teachers and advanced students. If ecology is to be taught narrowly with the emphasis on the relationships between the animals in communities the issue of 'density-dependent factors' may not have to be faced seriously. But if ecology is to be taught broadly giving proper emphasis to all aspects of environment then the teacher must decide for himself what part, if any, the concept of density-dependent factors may play in a general theory of environment. I hope that section 9.3 may help him to reach a critical decision. The undergraduate should read section 9.33 as an introduction to Part II even if he does not read the rest of section 9.3 as an extension of Part I.

The experiments which are described in Part II may be divided into those dealing with methods for measuring dispersal, distribution and density and those dealing with physiological and behavioural responses of animals to particular components of environment such as temperature, food, other animals, etc. The theoretical background for the experiments in Part II is discussed in Part I, in relation to its proper place in the general theory. This arrangement has allowed me to set out the experiments in Part II with economy, as in a laboratory notebook; with respect to each group of experiments I have indicated the sections in Part I that are relevant; and then each experiment is set out under stereotyped headings viz. — (a) Purpose, (b) Material, (c) Apparatus, (d) Method, (e) Analysis of results. This arrangement also has the advantage of weaving theory and practice closely together.

Ecology, by its very nature, deals with populations of living animals and it becomes a dull subject unless it can be related to natural populations. Ideally the methods of estimating density, dispersal and distribution should be taught with populations that are living naturally in the field. I do this so far as it is practicable. But, in some instances the methods can also be taught by means of 'laboratory models', as, for example, in experiment 10.25 where we estimate the density of a population of *Tribolium* by the method of capture, marking, release and recapture. The laboratory model has the advantage that it can be done indoors during bad weather or during winter. Also it can usually be relied upon to give results that can be analysed.

Most of the animals that are available for study and the sorts of places where they live are characteristic of particular climatic or zoogeographic regions. This poses the problem of how to write a manual of practical animal ecology that might be useful outside the region where it was compiled. But ecological principles and techniques can be demonstrated with a wide variety of experimental animals, and I have chosen species that are cosmopolitan, or at least, are similar to those that are distributed widely in other continents, e.g. grain beetles, white cabbage butterfly, the garden snail and the house mouse. But, apart from these, there must be, in any region, many local species that are suitable for quantitative ecological experiments.

I have been helped not only to think but also to write more clearly by many long discussions with Dr T. O. Browning. My wife has read and criticized the text, and helped with the preparation of indexes. Many of the illustrations have been taken from *The Distribution and Abundance of Animals*, but a number are original. They were drawn by

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Mrs P. E. Madge. I am grateful to Mr G. Wilkinson and Dr A. James for help with statistics, especially with the method for estimating dispersal.

H. G. A.

Adelaide 1959

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PART I

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