

references are useful for the research worker who wants a lead to the literature and will not be content unless he reads the original contributions. The veterinary surgeon in practice will, if selective, obtain help. To each reader and user of the *Annual* there is the warning of the need for caution and care.

R. LOVELL

ANALYSIS OF ANIMAL ECOLOGY

Animal Ecology

Aims and Methods. By A. Macfadyen. Second edition. Pp. xxiv+344+6 plates. (London: Sir Isaac Pitman and Sons, Ltd., 1963.) 42s. net.

THE old days when ecology was largely descriptive seem far away. Because of modern advances in techniques and methods of analysis, animal ecology is now in a very interesting stage of development, which makes a general ecological synthesis by no means an easy task at the present time. Field workers are slowly elaborating specialized methods for the investigation of different classes of problems and tend to get deeply immersed in these technicalities so that it is hard for them to take a broad view of the whole subject the methods of analysis of which and even methods of thought are at present so diverse.

In *Animal Ecology: Aims and Methods*, Mr. Macfadyen has made a very interesting and valuable survey of ecological methods. He is a specialist in the investigation of the fauna of the soil and has made considerable advances in the understanding of energy relationships. These aspects of ecology were emphasized in his successful book of 1957 and the present book is an enlarged and extensively revised second edition. Within the limits of a moderate-sized book full coverage of all aspects of ecology cannot be expected and this is a selective rather than a comprehensive work. Although some examples are quoted from freshwater and marine investigations and chosen papers on mammals, birds, fishes and invertebrates are reported and discussed, the emphasis lies quite firmly on the terrestrial ecology of temperate regions. Tropical ecology is virtually omitted. The work of the large teams of agricultural and medical entomologists investigating the ecology of locusts, tsetse flies and mosquitoes gets almost no mention. However, the emphasis on temperate terrestrial ecology is an important reason for the book's popularity with British and North American students who can use it in connexion with class exercises.

The first part of the book deals with the ecology of individuals and relates the animal to its physical, plant and animal environment. There is a chapter on distribution (but migration is scarcely mentioned) and one on animal metabolism. The second part of the book is on single species populations. Here the reader is introduced to collecting methods and the estimation of animal numbers, demography, population regulation and the biomass and metabolism of populations. The third part, on the ecology of animal communities, occupies half the book and is divided into seven chapters of which the largest is on the application of population dynamics. Here the author selects a dozen miscellaneous ecological investigations, provides a detailed report on each and discusses their general significance in relation to theories of population regulation. One could have wished for a rather more critical approach here, because the author has not reduced all his examples to a common system of terminology and concept and some confusion in their interpretation remains.

Unfortunately the book is marred by a few errors, which have slipped through unchanged from the first edition, such as the minus sign in the equation on p. 70, and the misleading statement about the advantages of saturation deficit as a method of expressing atmospheric humidity. One also regrets the needlessly restrictive definition of K

as a population *maximum* on p.133. Had it been defined as an *equilibrium* population which in fact it is, the arguments about population change which follow could have been far more logically stated. These defects are minor ones and the book can be recommended as probably the most useful modern text of ecology for its size.

G. C. VARLEY

LEARNING BEHAVIOUR IN ANIMALS

Learning and Instinct in Animals

By Dr. W. H. Thorpe. Second edition. Pp. x+558. (London: Methuen and Co., Ltd., 1963.) 63s. net.

DURING the six years that have elapsed since the first edition of this book went to press a great deal of experimental work has been published, and several provocative theories have been proposed by members of the ethological school as well as by representatives of other disciplines interested in the study of animal behaviour. This is, therefore, an appropriate time for the publication of a revised version of the original work. The author has taken his self-assigned responsibility seriously, with the result that the second edition represents a considerable enlargement and re-casting of the initial presentation. The bibliography includes three hundred new references.

Part 2, entitled "Learning", has been increased by sixteen printed pages, and Part 3, "The Learning Abilities of the Main Animal Groups", has been lengthened by thirty pages. The section dealing with cephalopods has been extensively re-written to incorporate recent work dealing with relationships between the nervous system and behaviour in these organisms. Similarly, the section dealing with bird orientation has been completely revised and brought up to date.

Dr. Thorpe's general philosophical orientation, as reflected in the chapter entitled "Directiveness and Purposefulness", remains unchanged. The presentation of "The Nature of Drive and its Place in the Theory of Instinct" retains the original point of view, but is considerably enhanced by an illuminating consideration of physiological mechanisms, other than those involved in learning, which may influence behaviour—as, for example, the coding in the gene in terms of deoxyribonucleic acid.

The treatment of conditioning and trial-and-error learning has been expanded to include references to work done in the U.S.S.R. In some cases the references are to secondary sources but in others primary reports are cited. The treatment of latent learning now includes a discussion of new work dealing with concepts of expectancy and exploratory behaviour.

The chapter on mechanisms of learning contains a great deal of new material, including a review of theories involving the role of ribonucleic acid in connexion with the memory trace. This chapter is also improved by additions to the introductory section in which various neurophysiological theories of learning are discussed.

All in all, Dr. Thorpe's book remains a unique reference source for readers who wish to familiarize themselves with both the historical and modern ethological approaches to an understanding of animal behaviour. It is of additional value because of the careful and detailed attention directed to the experiments and theories which have been published by non-ethological workers.

At the present time there is no competitive volume to *Learning and Instinct in Animals*. It is safe to predict that no successful competitor will be forthcoming for a considerable span of time. This is an excellent book which deserves a place in the library of every serious student of the science of animal behaviour.

F. A. BEACH