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BOOK REVIEW. . .

The Ecology of Wildlife Diseases. Edited by P. J. Hudson, A. Rizzoli, B. T. Grenfell, H. Heesterbeek, and A. P. Dobson. Oxford University Press, New York, USA. 2002. 197 pp. ISBN 0.19.850620.1 (hard cover); 0-19-850619-8 (soft cover).

Publications such as Anderson and May (1978) and May and Anderson (1978) heralded the emergence of a sophisticated mathematical modeling approach to understanding the dynamic relationships between parasite and host populations. The subsequent quarter century has witnessed an explosion of research in this area, some strictly theoretical but others blending theory with empiricism, and publications in this field now probably number in the high hundreds. Over the years there have been several workshops, conferences and symposia that assembled top researchers in the field to assess recent progress and perhaps suggest new areas of focus for future research. This volume resulted from such a workshop held 13–17 July 1998 in Trento, Italy. The emphasis of this workshop, rather than the intricacies of the underlying mathematical models, was on the actual application of modeling to understanding disease processes in wildlife populations caused by pathogens ranging from viruses to helminths, and on the integration of evolutionary, immunological and genetic processes with those that are ecological *sensu stricto.*

The workshop organizers selected a limited number of broad topics dealing with the ecology of wildlife diseases, and proceeded by way of formal presentations followed by group discussions on each topic. A synthesis of each topic was prepared as a separate chapter and these were edited into a cohesive volume, no easy feat considering there were different lead authors, and 5–14 authors, for each of the nine chapters. The product reads smoothly, much more like an advanced textbook on the topic than the uneven proceedings often published from workshops or symposia.

A brief Chapter 1 introduces the philosophy behind the workshop, the format of the book, and introduces microparasites, macroparasites, and the concept of R_0. Chapter 2 deals with parasite aggregation and the general topic of heterogeneity, including processes that generate it and methods of quantifying it. Chapter 3 moves on to the topic of basic host and parasite population regulation, involving both microparasites and macroparasites, in single host–parasite species pairs. The more complex topic of parasite communities circulating within host communities is introduced in Chapter 4, which deals with macroparasites. Advanced treatment of microparasite transmission is presented in Chapter 5. A landscape ecology approach to studying epidemiology is offered in Chapter 6 which integrates this with the notion of host and parasite metapopulations. Chapter 7 concentrates on tick-borne diseases, presenting the case that they involve fundamentally different types of transmission processes than insect hosts. A brief Chapter 8 examines disease (mostly of microparasite origin) from a conservation biology perspective, emphasizing disease management concepts. The volume concludes with Chapter 9, which presents a case for integrated studies of wildlife diseases that include significant input of immunology, genetics and evolutionary biology.

Although largely written by individuals with reputations as mathematical modelers, this book is highly readable for the stated target audience of non-specialists: individuals with "biological interests," such as clinicians, molecular biologists or biology students. This is accomplished by emphasizing concepts in the text, and making use of numerous side-boxes to provide the mathematical basis for those statements. These boxes do not go into extensive detail, but do provide basic discussion of the structure and major assumptions of the underlying models. For the most part these boxes are well-structured and provide the background explanation necessary to follow the text. For those desiring more detail, the primary literature on which the boxes are based is referenced.

Side-boxes are also used extensively to provide case studies of wildlife diseases that reinforce the concepts being discussed in the text. These boxes tend to be quite focused, providing details on one aspect of the disease, or presenting background information on the particular disease agent just sufficient to understand the concept being discussed. As a consequence, some diseases appear in multiple boxes e.g., phocine distemper virus, which appears in boxes 3.3, 5.2 and 6.4. This is probably unavoidable in a concept-based book, and in general these instances do not come across as overly repetitious.

While written (quite successfully) for a diverse audience of biologists, there is a noticeable bias on the authors' part to give greater weight to the conclusions of modeling studies compared to empirical studies. The early chapters in particular discuss numerous examples where data from published empirical studies is criticized as having multiple alternative inter-

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pretations, not all of which were noted by the original authors. These examples are instructive to those who may feel compelled to casually dissect the complex mechanisms underlying host–parasite population interactions simply from observational data. However, the same rigor is not applied when evaluating results of modeling studies, which seem to be accepted as long as they seem to make sense.

Although the overall organization of this book is well thought out and effective, its production qualities are somewhat disappointing. Typographical/grammatical errors, although not numerous, are frequent enough to be noticeable. Figures, the bulk of which appear to be redrawn after ones in the primary literature, have not been standardized with respect to layout or font, even within a chapter. There is also evidence of sloppiness in the reporting and interpretation of literature sources, even involving some of the authors' own papers. Chapter 6, co-authored by J. Harwood and J. Swinton, incorrectly reports authorship of Swinton et al. (1998) as J. Swinton, J. Harwood, B. T. Grenfell and J. Harwood. Chapter 4, co-authored by R. C. Krecek, refers to Krecek et al. (1987) in support the statement that in zebras infections of 100,000,000 *Crossocephalus viviparus* and 3,800,000 *Probstmayria vivipara* "are not uncommon in individual animals" (p. 65). Krecek et al. (1987) actually states that these are the upper ranges of abundances, and also that the 100,000,000 abundance value applies to *P. vivipara* and the 3,800,000 value applies to *C. vivaparus*.

This book contains 30 pages of references. This is certainly not an exhaustive list on the subject and many key papers are not cited, but it does provide a good breadth and depth of coverage that make it a valuable resource for those wishing to pursue further any of the topics. The vast majority of references are for 1999 and earlier.

Notwithstanding the shortcoming of this book as noted above, it is still to be recommended as an introduction to, and overview of, modern quantitative methods of evaluating the impact of pathogens on wildlife populations. It is thought-provoking and should be of interest to wildlife managers and researchers, disease specialists, and students (*sensu lato*) of wildlife biology and parasitology. Those who seek details on the techniques of mathematical modeling will probably be disappointed in this book, but it is not intended for them. Rather, it is practical biologists, who may be aware but skeptical of the theoretical methods, who will find that this book is an informative, fairly easy read that makes a strong case for integrating theoretical and empirical research on wildlife diseases. Morever, the practical biologist should be convinced, after reading this book, that the complexities of host-parasite relationships may produce non-intuitive consequences on parasite and host population dynamics. Properly integrated modeling/empirical studies can contribute to understanding existing disease situations, as well as enhance the ability of researchers to predict the outcomes of emerging disease problems.

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