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Phylogeography: The History and Formation of Species by John C. Avise

Review by: Brian S. Arbogast

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## BOOK REVIEWS

Dynamics of Coral Communities. RONALD H. KARLSON, Kluwer Academic Publishers, 1999, x + 250 pp., Population and Community Biology Series #23.

Coral reefs are the biodiversity poster children of the marine environment, so it is not surprising that publishers have responded. The spectrum of available books ranges from kid's coloring books to multi-volume surveys of corals of the world, and in-depth monographs complete with CD. While Karlson states no explicit goals, nor describes the intended audience for the book, in his preface, he does set out his own primary interest in the "dynamic properties of living coral communities," with more emphasis on ecological than evolutionary considerations.

The book consists of nine chapters: an introduction, followed by chapters on a range of processes, and two chapters on his own area of specialization—the relationship of regional and local factors on community species composition. Each chapter opens with a section (2 to 5 pages) on general community ecology. These "general considerations" draw on both theoretical and experimental ecology studies in terrestrial, freshwater, and temperate marine systems. For coral biologists with no background in community ecology these sections might constitute a sort of instant primer to topics that have been the focus of community ecologists for decades. The introductory sections are followed by discussions of published studies of coral reef communities.

The introductory chapter is a survey of ideas of scale in ecology and the importance of disturbance, recruitment and biological interactions (themes that will be revisited throughout the book). By the end of the chapter the reader will have completed a cram-course in marine benthic community ecology that its reminiscent of many ecology textbooks in its intensive use of examples—almost to the point of overkill. Chapter 2, on diversity, is also loaded with results, mostly from transect-type studies, that are presented in a fairly undigested manner. If Karlson had devised some tables that extracted the points he was emphasizing the reader might have had a better chance at seeing the unifying theme to the studies selected. Chapters 3 and 4, on stability and succession, introduce dynamics of coral communities. The format, as elsewhere, is to present several general papers, typically classics, and to discuss them seminar-style. Whether it is a reflection of Karlson's stated intention to emphasize modern reefs or not, the underlying assumption throughout seems to be that reefs (as we saw them in the 1970s) are the end-state, and deviations from this ideal are, under good conditions, remedied by succession. Chapters 5 and 6 cover competition and predation respectively. The present-some-papers-and-discuss format is continued here. Interspecific competition among corals and among reef fishes are covered using mainly research from the 1970s and 1980s. Consumer-resource interactions dealt with include basic predator-prey relationships, but also include plant-an-

imal interactions. Major disturbances to coral reefs, *Acanthaster* outbreaks, *Diadema* die-offs, bleaching, and tropical storms grab headlines in the popular press. Karlson covers these, but also asks whether more intermediate level disturbances can enhance diversity of reefs. The approach here again reflects the viewpoint that there may be an ideal steady state condition for most reefs. The last two chapters deal with the topics most associated with Karlson's own research. The format used in the rest of the book worked quite well in these two chapters, giving Karlson the space needed to expand his ideas on the ways that communities reflect both local and regional sources of species. To my mind these chapters are the best in the book.

The question remains who is this book intended for and how well is this audience reached? This book could serve as an introduction to community ecology for coral biologists with no background in that field, or could introduce coral reef biology to community ecologists unfamiliar with reefs. While Karlson does a good job of presenting a lot of primary data which might not be familiar to non-reef types, the value of the book would be greatly improved if he had done more synthesis and analysis of the extensive data he surveyed.

Who should buy this book? It might appear that it could serve as a good basis for a graduate seminar course, especially for ecology students not too familiar with reef studies. Unfortunately, at the price of \$150 it is not only out of the price range of grad students, but most faculty as well. A comparison with several more specialized coral reef books shows Karlson's at 60 cents per page, compared with Charlie Veron's *Corals of Australia and the Indo-Pacific* (with color plates on every page) at 15 cents a page, and Rachael Wood's *Reef Evolution* in paperback is nine cents a page. Why a book with no special production needs should be so expensive is hard to imagine, but it certainly puts it out of the range that could be afforded by coral or community biologists. This fault lies with the publisher and not the author, but a reasonable price structure for this series would make it more likely to have an impact on the intended audience.

ROBERT KINZIE  
*Department of Zoology*  
*University of Hawaii*  
*2538 The Mall*  
*Honolulu, HI 96822-2233*

Phylogeography: The History and Formation of Species. JOHN C. AVISE. Harvard University Press, Cambridge, Massachusetts, 2000, viii + 447 pp., \$49.95, (ISBN 0-674-66638-0).

Breakthroughs in DNA sequencing technology in the 1980's revolutionized evolutionary biology, and out of this revolution emerged what has become a highly influential discipline known as phylogeography. Formally introduced a little more than a decade ago

by John Avise and his colleagues (Avise *et al.*, 1987), phylogeography is a highly integrative approach used to investigate the relationship between earth history, ecology, and biotic diversification. Phylogeography combines information from population genetics, phylogenetics, geoclimatic history, paleontology, population biology, molecular evolution, and historical biogeography in order to characterize the geographic distributions of genealogical lineages across the geographic landscape (referred to as phylogeographic patterns), and to infer the evolutionary, demographic and biogeographic processes that have shaped these patterns.

In this book, Avise provides an overview of the historical development of phylogeography, from its early stages when animal mitochondrial DNA (mtDNA) was used (almost exclusively) to examine phylogeographic patterns within single species, to today, when an increasingly wider range of additional molecular markers are being used to compare phylogeographic patterns among co-distributed taxa (comparative phylogeography). As the principle founder of the field, no one is better qualified to write a book recounting the history of phylogeography, and Avise excels at providing examples and figures to illustrate the key concepts which lie at the heart of the discipline. In particular, many of the previously unpublished figures in the first half of the book are exceptionally well done and informative.

The book is divided into 3 sections, each containing 2 chapters (plus a preface and works cited), and is filled with over 100 figures. The first section of the book concentrates on the history and conceptual background of phylogeography, and includes a chapter on coalescence and the connection between population phylogeny and demography. This is perhaps the strongest section of the book, and serves as a great primer for beginning graduate students and non-specialists. This section also provides a wealth of information and examples for those interested in teaching principles of phylogeography. The second section reviews empirical studies that have examined phylogeographic patterns at the intraspecific level, and is divided into one chapter on humans and one on non-human animals. As such, this section reviews much of the early empirical work in phylogeography. Relative to humans, non-human animals tend to have deeper (older) phylogeographic subdivisions, and it is here that Avise compares and contrasts the phylogeographic patterns that have been observed in a variety of organisms. These cross-taxon comparisons are facilitated by Avise's division of types of phylogeographic structure into 4 basic categories (of which more than one can occur within a given species' overall gene tree). Special attention is given to different expected and observed patterns of phylogeographic subdivision as they relate to life history traits, such as those associated with dispersal ability. The final section deals with comparative studies and the issue of genealogical concordance (when co-distributed taxa exhibit the same general phylogeographic pattern) and includes a final chapter on the speciation process and the extension of phylogeographic analyses to higher taxa. Some of the comparative phylogeographic studies reviewed include those on Australian rainforest vertebrates, Hawaiian birds

and arthropods, North American birds, plants of the Pacific Northwest, and cold-water marine faunas of the Northern Hemisphere. The final chapter includes a review of species concepts, an overview of the durations of species through geological time, and applications of phylogeography beyond the species level. The book concludes with a brief synopsis and commentary on the future of phylogeography.

In some ways this book can be viewed as an update and expansion of chapters 6 and 8 of Avise's previous book, *Molecular Markers, Natural History, and Evolution* (1994). However, there have been so many developments in phylogeography over the past five years or so, especially in coalescent theory and comparative phylogeography, that much of the information presented is new. Therefore, despite some overlap, Avise's two books are largely complementary.

Throughout *Phylogeography: The History and Formation of Species* there is a bias towards multicellular animals, as Avise acknowledges in the preface (this reflects a bias in existing empirical phylogeographic studies, rather than that of the author). However, since many phylogeographic principles should apply equally well to any taxon, researchers interested in other types of organisms also should find the book useful. Many of the multicellular animal examples used are taken directly from previous studies by Avise and his colleagues (including approximately a third of the figures in the book), and quite a few also appeared in Avise's (1994) earlier book. Thus, for those researchers who have followed Avise's work closely over the last decade, these examples may be somewhat redundant. However, a wide range of studies by other authors are also included (*i.e.*, reviews of many recent publications in comparative phylogeography), and only those researchers who are deeply involved in phylogeographic research are likely to be familiar with most of the examples presented in this book.

Shortcomings of the book include a decidedly qualitative treatment of genealogical concordance, the failure to discuss among-lineage rate heterogeneity and ancestral polymorphism when interpreting variation in the depths of the gene trees of co-distributed taxa, and the inclusion of several examples wherein strong conclusions have been drawn from dates of speciation and biogeographic separation estimated from the use of the "conventional" 2% per million year clock for mtDNA (there is a great deal of evidence for substantial rate heterogeneity across taxonomic groups and the concept of a generalized mtDNA clock is outdated). Statistical approaches for evaluating phylogeographic congruence across taxa (such as likelihood tests) and testing for contemporaneous diversification of lineages across a common phylogeographic discontinuity are not addressed. In addition, the issue of error associated with the use of molecular clocks (even if they are appropriately calibrated for a particular taxonomic group) is largely ignored. However, these issues are likely to be most important to practicing phylogeographers, and do not appreciably affect the quality of the book as an excellent introduction and overview of the field.

Overall, this book is an impressive work, emblematic of Avise's ability to synthesize and clearly present the many diverse and complex issues that characterize

modern phylogeography. As a primer for non-specialists this book is excellent, and it should find a broad audience among biologists interested in evolution, biogeography, and biodiversity. Although researchers deeply entrenched in phylogeography are unlikely to find a great deal of novel material, they too should find the book quite valuable as a general reference or as a text for a course or seminar in phylogeography.

## REFERENCES

Avise, J. C. 1994. *Molecular markers, natural history and evolution*. Chapman and Hall, New York.

Avise, J. C., J. Arnold, R. M. Ball, E. Bermingham, T. Lamb, J. E. Neigl, C. A. Reeb, and N. C. Saunders. 1987. Intraspecific phylogeography: The mitochondrial DNA bridge between populations genetics and systematics. *Ann Rev Ecol Syst.* 18: 489–522.

BRIAN S. ARBOGAST  
*Burke Museum and Department of Zoology  
University of Washington  
Seattle, Washington 98195-3010  
E-mail: arbogast@u.washington.edu*