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Book Reviews

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A Critical Evaluation of Research Techniques in Animal Ecology

Boitani, Luigi, and Todd K. Fuller, editors. 2000. **Research techniques in animal ecology: controversies and consequences.** Methods and Cases in Conservation Science. Columbia University Press, New York. xxxii + 442 p. $75.00 (cloth), ISBN: 0-231-11340-4 (alk. paper); $32.00 (paper), ISBN: 0-231-11341-2 (alk. paper).

Research techniques in animal ecology: controversies and consequences is just that, a critical examination of some of the most commonly used means of assessing animal populations. Each chapter identifies limitations, common misuses, and possible solutions for gathering, analyzing, and interpreting data in a variety of research areas. The edited volume contains 11 chapters and results from a workshop held at the Ettore Majorana Centre for Scientific Culture in Erice, Sicily in December 1996. The preface starts out by reminding us that ecology is rooted in the scientific method, but as Charles Krebs points out in the first chapter, a paradigm that is often overlooked. Krebs appropriately starts off with a simple, clear, and concise review of the scientific method and the role of hypothesis testing in advancing our understanding of animal ecology. Krebs defines and distinguishes among key terms such as theory, hypothesis, models, experiments and facts. We are left with several key recommendations such as stating working (not null) hypotheses, removing value judgements and biases in research design, using statistical estimation more than statistical inference, and addressing ecologically significant and not trivial problems.

In Chapter 2, Dennis Murray and Mark Fuller cite over 300 references to provide a critical review of the effects of marking on the biology of vertebrates. An assumption that is often made in marking animals for identification is that marking has no significant effect on the animals, an assumption that lacks rigor in testing for most marking techniques and species. Fish tags, fin mutilation, radiotransmitters, leg band color, neckbands, and toe clipping have been shown to have significant effects on animals. The authors provide guidance on the best techniques to use and how to evaluate their effectiveness in achieving research goals.

Roger Powell (Chapter 3) provides a thorough analysis and critique of the various methods used in estimating home range size and space use in animals. The chapter focuses heavily on techniques used to estimate how rather than why animals use space. Eleven pages are devoted to reviewing methods for estimating home ranges and only three pages to territories. In that I think territories are much more interesting than home ranges, I would prefer to see these priorities reversed. I was disappointed that Powell misrepresented my paradigm on territoriality in female mammals by citing an opposing example of territoriality in male birds. But other than that, Powell is one of the experts on evaluating methods for estimating home ranges and should be commended for his treatise of this subject.

In Chapter 4, David Garshelis provides the best review I have read on habitat evaluations. This is ''must reading'' for all ecologists, especially wildlife managers and conservation biologists. Garshelis makes a special effort to point out the delusions in habitat evaluations by inappropriate measurements and use of the terms of ''use,'' ''selection,'' ''preference,'' and ''importance.'' Garshelis points out that habitat evaluations are often flawed because they do not take into consideration sex-age, social status, time of day, season, year, and they often group animals rather than look at individuals. Considering all the flaws and problems in evaluating habitat use by animals, I am skeptical that most habitat evaluations currently published have much relevance to ecology. The essence of this chapter can be summarized by Garshelis's qoute of E. M. Kirsch: ''Unfortunately, proximate habitat features may not indicate habitat suitability, nor do they reveal the possible selective pressures that influence habitat selection in a system. One must measure components of fitness, determine factors that influence fitness, and relate fitness and factors influencing fitness to habitats or habitat features.''

John Litvaitis starts Chapter 5 with the question ''Why study food habits?'' By the end of the chapter, neither I nor the author know the answer. It seems that nearly every field ecologist studies food habits of their beast at one time or another, but there is little evidence that food habits ever answers any important ecological question. Supposedly food habits should explain something about population parameters, competitive interactions, or optimal foraging, but results of food habits studies have never contributed much to any of these. Hundreds of papers have been published on food habits of animals and probably an equal number on food addition studies, yet the mammal, bird, and wildlife literature is inundated with a plethora of more of the same every year. Because of all the problems and limitations of food habits analyses, the author reminds us that the utility of the food habits analysis should be reconsidered before any such study is conducted.

Population ecologists seek to explain why some animals are rare whereas others are common, as well as what accounts for observed changes in density. ''Detecting stability and causes of change in population density'' is the subject of Chapter 6 by Joseph Elkinton. Elkinton provides us with a simple and easy-to-follow summary of analysis of data for time series and mortality and survival, and detection of delayed density dependence. As in all chapters in the book, the author identifies the limitations of various methods that ecologists use to study dynamics of populations making this chapter must reading before doing field studies in population ecology. Elkinton's advice to those ''... embarking on such studies is to maintain a healthy skepticism of all the techniques and to take a multipronged approach.''

In my research design class, I teach students to avoid research that involves terms such as ''census,'' ''monitor,'' ''count,'' and so forth. After reading James Gibbs' Chapter

7, ''Monitoring populations,'' now I know why. Like all chapters in this book, Gibbs' starts with the grandiose expectation of solving some major dilemma in ecology. By the end of the chapter we are even more skeptical than when we started that monitoring populations tells us anything meaningful about population ecology. Monitoring of populations is something that almost all wildlife biologists do at one time or another—the utility of their efforts is often questionable. Gibbs reviews the various methods used in monitoring populations, pointing out their weaknesses, of which there are many, as well as their strengths. Considering all the problems in assessing the validity of censuses, animals ecologists are reminded to ''... establish explicit and well-reasoned monitoring objectives before the initiation of any monitoring program.''

Chapter 8 ''Modeling predator–prey dynamics'' by Mark Boyce, and Chapter 9 ''Population viability analysis: data requirements and essential analyses'' by Gary White provide mathematical treatments and models of population parameters. Like Galileo, Boyce insists that the book of predator-prey dynamics be written in mathematical form. Boyce reviews the pros and cons of noninteractive models, true predator-prey models, and stochastic models, admitting that all models are wrong, but still may be useful. Perhaps the best advice Boyce offers is for wildlife ecologists, regardless what model they use, to focus their research on testing ecological principles. When inconsistencies emerge between the models and field observations, the solution is not to reject the model or modelers, but to fix the models. White provides similar advice in his assessment of population viability analysis (PVA) models. This chapter focuses on computer simulation models to estimate population viability via numerical techniques. White discusses how stochastic, demographic, temporal, spatial, individual, and process variation affects population persistence. Like Boyce, White concludes that full evaluation of models will require a good understanding of mathematical as well as theoretical assumptions of variation within parameters that affect PVA. The chapter ends with a list of lessons to be learned by common mistakes and omissions in estimates of population viability.

Chapter 10 by David Macdonald and his colleagues provides an ecologist's guide to ethological methods. The chapter is by far the longest in the book, 56 pages, and provides a much more detailed assessment of the role of animal behavior to ecology than most ecologists will need to know. Four pages on grooming and four more pages on spacing in cats may be overkill. The chapter is extremely thorough, encompassing everything from ethograms and dominance to social structure, territoriality, and spacing. An excellent treatise is provided on behavioral sampling and analysis of observational data.

In the final chapter, Fabio Corsi et al. describe how to model species distribution using GIS. This is currently a hot area of research and application of a new technique that is not without problems, but nevertheless useful. The authors review the terminology and emphasize the importance of defining *habitat* before providing a synopsis of what a GIS model is and how it is used, the biological and statistical assumptions, use of scale, source of errors, and validity of assessment. The authors conclude that GIS is a valuable tool and when used properly can contribute significantly to our understanding of animal ecology.

The book is produced in a comfortable format, easy to read, with good illustrations. The chapters are well referenced, with several citations in 1999. The book is available in paperback and affordable for students. The editors have done a remarkable job at keeping uniformity among the chapters with each following a similar outline of introduction and review, criticism, consequences, and recommendations. I highly recommend this book to seasoned as well as new researchers working in any area of animal ecology. This would be an excellent book for a graduate seminar or a graduate orientation or research design course in ecology or field methods.

Because the book is wrought with skepticism of methods, techniques, procedures, models, and other assessments in ecology, it makes us wonder what we have actually accomplished in ecology over the past 50 years. But these criticisms are meant to be constructive and provide proper direction for future studies. Each chapter provides the reader with recommendations of the most viable assessment for measuring some ecological parameter. After reading this book, I am reminded that ecology is not rocket science, it is harder. Physicists have it easy, we ecologists have our work cut out for us.

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THE SEARCH FOR THE GOLDEN FROG: TRUTH AND BEAUTY IN NATURE

Crump, Marty. 2000. **In search of the golden frog.** University of Chicago Press, Chicago, Illinois. xiv + 299 p. $27.00, £17.50 ISBN: 0-226-12198-4 (alk. paper).

Marty Crump does for neotropical amphibians what George Schaller and Mel Sunquist have done for large cats, and she is a welcome addition to a group of scientists that are able to tell their tales to a large audience. Marty is an excellent story teller and her collection of ''tales from the field'' will delight those who do tropical fieldwork, will educate those who wonder why people actually work in ''green hell,'' and will be a valued resource for the next generation of tropical biologists. The book will serve as a guide for young women

trying to balance careers and families, and certainly will be used by educators as they introduce students to the tropics, to fieldwork, and to careers as academic scientists.

Crump's memoir summarizes 30 years of tropical field research and I am delighted she decided to share her experiences with a wide audience. The University of Chicago Press is a leader in bringing tropical biology to a large audience, and Crump's book is a solid acquisition for the Press. The ''search for the golden frog'' comes from the title of a 1970 paper by Jay Savage about herpetology in Central America. Harry Greene used the same phrase in a plenary address for a symposium at the 2000 meeting of the American Society of Ichthyologists and Herpetologists in La Paz, Baja California Sur, Mexico. Reading the quote in Crump's preface days after hearing Harry read it, provided a delightful start to Marty's book. The volume includes acknowledgements, a preface, 12 chapters, an epilogue, two appendices, a bibliography, and an index. Additionally the book is well illustrated with 59 black and white photos, 16 color plates, and eight maps. Crump uses common names for amphibians and reptiles and provides scientific names for taxa in Appendix A. The lack of scientific names makes the book ''readable'' to the non-herpetologist, and Crump provides herpetologists with precise information in the appendix. The volume is relatively error free. I found one printing error, a misspelled scientific name in Appendix A, and one common name not listed in Appendix A.

Crump's ''search for the golden frog'' begins with her first trip to the jungles of Santa Cecilia, Ecuador following graduation from the University of Kansas. Her book ends with reflections on her career, and she points out that her ''search for mystical truth and beauty in nature'' continues. As Crump describes her search for the golden frog, she introduces the reader to Ecuador, Brazil, Costa Rica, Argentina, and Chile. There are country maps for Central America and South America, and detailed maps of the countries she worked in. Crump is an excellent photographer and she selected splendid photos to illustrate her tale. As Crump's field research moves from Ecuador to Chile, she provides geographical and historical information for each country. She also writes about how her exposure to a variety of cultures affected her. Her insights and collection of experiences will speak to anyone who has spent a substantial amount of time abroad, especially for those who have worked in developing tropical countries.

In addition to information on geography, history, politics, and sociology, Crump describes her first tropical experience, life in graduate school, life as a woman in a male-dominated field, the experience of an intensive graduate field course, and living abroad to complete her dissertation research. She describes what it is like to have a tenure-track job, to be the first woman on the faculty to have a baby while working (and never miss a lecture), to mix motherhood and field research in Costa Rica, and to decide to leave academia for a life dedicated to education, conservation, and research in the tropics. Crump pioneered ecological studies of tropical amphibian communities in the New World, conducted a variety of experiments to better understand ecology and behavior of adult amphibians and their larvae, was one of the first researchers to document amphibian decline, is an expert on amphibian parental care, and has served as a mentor for countless tropical biologists. Her book touches on all of these aspects of her career, and she recounts several classical natural history stories of the New World tropics (from drinking Ayahuasca to botfly extraction to the evolution of life history strategies in amphibians). Marty's journey from ''pig-tails to bifocals'' is a story worth reading.

In the preface, Crump sets the stage for how she embarked on her search. Her early interest in biology and natural history was encouraged by her father (a geologist) and a ninth-grade biology teacher. Her interest in tropical herpetology was nurtured by her university mentors, William Duellman and Linda Trueb. Crump states that ''fieldwork is the glue that holds my being together'' and anyone who does fieldwork will agree with her sentiment. Chapter 1 describes her first tropical experience in Ecuador doing survey work, and Chapter 2 recounts her Master's research in Brazil. Crump supported her research on dispersion of amphibians and reptiles while working as a research assistant for Tom Lovejoy. Chapter 3 describes her experiences as a student in an Organization for Tropical Studies (OTS) field course, a course she describes as ''the most stimulating one I took in graduate school.'' For the thousands of OTS alumni, this chapter will remind you of your memorable OTS experiences. Crump describes her life as a doctoral candidate conducting fieldwork in Ecuador in Chapter 4. Crump returns to Ecuador in Chapter 5 and describes what it was like to be one of two female biologists on a survey team, and how handling a viper changed her image for male co-workers. In Chapter 6, Crump describes how she met and married Peter Feinsinger and their sabbatical leave in Monteverde, Costa Rica. Any woman who mixes motherhood with an active field program will empathize with Crump's experiences of ''expressing in the rain.'' Crump describes the remarkable tale of the golden toad and the early stages of amphibian decline in Monteverde, Costa Rica (Chapter 7). In Chapter 8, Crump recounts her sabbatical year in Argentina and her work with predaceous anuran larvae. Crump and Feinsinger resigned from the University of Florida in 1992 to pursue research, education, and training in Latin America (Chapter 9). Chapter 10 describes a conservation project in the Ecuadorian lowlands, Chapter 11 describes her cancer experience and fieldwork in Chile, and the last chapter reflects over 30 years of fieldwork in the tropics.

There is a tremendous amount of tropical biology in Crump's book. In the 48 classic natural history stories I tallied, only 22 of those are about amphibians and reptiles. Additionally, the book illustrates much more than neotropical amphibians and reptiles. Of the 59 black and white photos and 16 color plates, 27 and 10 are of amphibians and reptiles, respectively. Crump emphasizes information on her specialty (amphibians) but her breadth is refreshing in times of increasing canalization of interests. When I was a graduate student finding my way as a tropical herpetologist, Marty Crump was one of my heroes and served as the best type of mentor. I look forward to her continuing quest for the golden frog and hope she shares those experiences with us.

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Ecology Readings from the University of Wisconsin

Dodson, Stanley I., Timothy F. H. Allen, Stephen R. Carpenter, Kandis Elliot, Anthony R. Ives, Robert L. Jeanne, James F. Kitchell, Nancy E. Langston, and Monica G. Turner, editors. 1999. **Readings in ecology.** Oxford University Press, New York. ix + 461 p. $35.00, ISBN:0-19-513309-9.

Readings in ecology is a selection of papers meant to serve ''as examples of excellent and insightful research that greatly contribute to our grasp and exploration of ecological questions.'' While developed as an accompaniment to the University of Wisconsin at Madison team's textbook, *Ecology*, also offered by University of Oxford Press (1998. $55.95), *Readings in ecology* easily stands alone as supplemental material for general and advanced undergraduate ecology courses, and I will likely draw many examples from it in my general ecology course.

The collection follows the same format as the Dodson et al. *Ecology* text, which uses a novel, questions-based approach to introduce students to ecological concepts rather than a laundry-list of established ''truths.'' Unlike most other texts, these books begin with the broadest scales of ecological inquiry (humans and nature and landscape ecology) and end with population and community ecology. Each author has selected and introduced several publications that highlight ecological thought in their specific area of expertise. I like the fact that there is very little overlap between the selections in *Readings in ecology* and the examples and references cited in the *Ecology* textbook; readers of both will come away a broader view of each ecological sub-discipline.

In general the chosen papers represent clear, concise examples of good ecology. Readers searching for the classics will be sorely disappointed: the selections include few old ''stand-bys'' like Connell's seminal work ''The influence of interspecific competition and other factors on the distribution of the barnacle *Chthamalus stellatus*.'' The majority of selected papers were published in the 1990s, and represent exciting, up-to-date ideas. There is a fairly good balance between experimental, observational, and theoretical approaches to ecological questions. The chapter ''Readings for community ecology'' is the least well balanced—all of the chosen papers are theoretical in nature, and faculty teaching from a text other than *Ecology* may have a hard time incorporating these papers in their existing syllabi.

Unlike many texts in ecology, *Readings in ecology* places a refreshingly human spin on the science. The first two chapters, ''Readings for what is ecology?'' and ''Readings for people and nature,'' address interactions between humans and their environment. Vitousek et al.'s ''Human domination of Earth's ecosystems'' and Cohen's ''Population growth and Earth's human carrying capacity'' appear in later chapters. Each author has written a personal introduction to their selections, highlighting why each paper has been chosen as work that exemplifies excellent thought in ecology. Furthermore, a photograph of each smiling author graces each chapter beginning (with the exception of Elliot, who oddly appears in the back of the book). Rather than exemplify arrogance or vanity, these are pictures of happy people that show students how happy ecologists can be!

To answer the difficult question ''What is ecology?'' authors Dodson and Elliot chose essays from Aldo Leopold and Jean Henri Fabre that highlight the importance of observation and natural history as foundations of ecology. This was my favorite section of the book—all too often we become bogged down in experiments or statistics and forget why we became ecologists. ''Thinking like a mountain'' by Leopold and ''The pine processionary'' by Fabre should remind practicing ecologists of why we are here in the first place, and just might spark interest in the next generation.

Some of the papers may require more time to present to beginning ecology undergraduates than others. For example, logistic regressions are used in the paper by Mladenoff and Sickley in ''Assessing potential gray wolf restoration in the northeastern United States'' and other mathematical models are found in papers by Olson and Boggs (''Apex predation by yellowfin tuna''), Brockmann et al. (''Evolutionary stable nesting strategy in a digger wasp''), and Schmid-Hempel et al. (''Honeybees maximize efficiency by not filling their crop'').

In general, the figures are clear and adequately reproduced from the originals. I found some of the gray-scale map images in the chapter on landscape ecology difficult to read, but this did not detract from the main message of the papers. The volume is carefully edited with similar formatting throughout. The only error I found was a missing date on the bibliographic reference for one of the papers.

Readings in ecology deserves a place on all ecology teachers' bookshelves. The book works well as a companion to Dodson et al.'s *Ecology* text, and because of its fresh, up-to-date selections, *Readings in ecology* can revitalize courses taught with the more traditional ecology texts.

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Coral Reef Diversity and Ecological Theory

Karlson, Ronald H. 1999. **Dynamics of coral communities.** Population and Community Biology Series. Volume 23. Kluwer Academic Publishers, Norwell, Massachusetts. x + 250 p. $150.00, £88.00, NLG 250.00, ISBN: 0-412-79550-7 (acid-free paper).

Coral reefs have long been known as the ''rainforests of the sea,'' displaying legendary diversity and supporting marine food webs and economies throughout much of the world's tropics. Their famous primary productivity supports perhaps the best marine example of community consequences of a symbiotic interaction (between the coral animal and its dinoflagellate endosymbionts). Coral reef communities are exploited for fisheries, limestone building materials, jewelry and curios, industrial byproducts of algae, aquarium organisms, pharmaceuticals, and ecotourism. Like many other habitat types on earth, they have also been subject to intense and increasing anthropogenic destruction and disturbance.

Previous book-length treatments of coral reefs have been comprehensive attempts to describe what makes these communities tick. They have typically started with the geologic history and biogeochemisty of corals, moved into the physiology and autecology of coral-algal symbioses, perhaps had a chapter or two on coral reef fishes and fisheries, and summed up with some chapters on coral community conservation. This book is decidedly different from the others, and it is largely successful in being so. It is aimed primarily at ecologists working in tropical or temperate marine communities, or any ecologist interested in empirical tests of ecological theory. Marine ecologists familiar with temperate intertidal and subtidal habitats will feel at home reading this book, as will any ecologist familiar with theory and recent debates on the importance of scale in ecology. The author argues that reefs are ideal for testing theory that integrates local, short-term effects with regional, historical processes. Recent attempts to do so in the temperate benthos (e.g., collaborations between intertidal ecologists and coastal oceanographers) are yielding exciting results. This book is a compelling call for this kind of integrative approach in coral-dominated tropical marine systems.

In contrast to other books about coral reefs of the past decade, this is much more a book about coral reef *ecology*, specifically community ecology, than about coral reef *biology*. In fact, at times it reads like an extended essay on issues of scale in community ecological theory, albeit one with many examples from coral communities. It would make excellent fodder for graduate student discussion groups in programs that emphasize tropical or marine ecology. If coupled with a comprehensive volume on coral reef biology, it would make an excellent text in an advanced undergraduate or graduate course on the biology and ecology of coral reefs. At nearly a dollar a page, however, the price of this slim volume will place it beyond the reach of graduate students who haven't recently inherited a large windfall.

The book begins with a chapter on marine ecological community structure, with specific treatment given to insights generated in rocky intertidal, kelp forest, and cryptic encrusting communities. The chapter forcefully introduces the book's twin themes of the scale-dependency of biotic and physical processes influencing reef diversity, and the need to integrate across scales if we are to understand how coral communities function and why, indeed, they are so diverse (but not uniformly so). Subsequent chapters address issues that have preoccupied community ecologists for decades, providing a tidy review of key conceptual issues (with coral examples) in diversity, stability, succession, interspecific competition, consumer-resource interactions, and disturbance. The book's real insights come in the final two chapters, called ''Large-scale perspectives'' and ''Integration across scales,'' which attempt to build upon the mechanistic, interaction-focused, square-meter-scale roots of modern experimental ecology. The author's stated objective is to address local species richness from a variety of spatiotemporal scales.

Throughout, the book is organized around persistent themes in ecological theory. Graduate students (especially those with chronologically challenged advisors) will recognize references to classical names like Clements, Gleason, and Elton. Part of the book's appeal is that it explicitly incorporates insights developed on temperate rocky-shores—e.g., the Paine-Levin and Menge-Sutherland models linking disturbance and biotic interactions, and Wootton's recent work on indirect effects—into coral reef biology. The book is very much focused at the community level of organization; it pays scant attention to natural history, conservation, ecophysiology, or ecosystem-level approaches to reefs. While this focus emerges as both a strength and a weakness, this book is still the best recent single-authored treatment of coral ecology in the past decade, and it avoids most of the pitfalls of multiauthored volumes. Karlson's explicit goal is marrying the local/experimental approach on one hand, and emerging ''macroecological'' perspectives on the other. While experimental intertidal ecologists will applaud the former approach, the latter attention to large scales is particularly germane given that coral genotypes may live for centuries or millennia, and that scleractinian corals display some of the world's best documented geographic diversity gradients.

The book has a few, relatively minor, shortcomings. While a taxonomic index would have been a nice addition, the book, with a bit over 200 pages of text, contains an impressive 30 pages of references; of these, close to half refer to literature from the last 10 years. Perhaps most disappointing was the omission of a section on reef conservation or restoration; this is particularly striking given that ecologists are increasingly attuned to the applications of their science in a biologically degraded world. The book's real strength is its scale-sensitive, community-level focus; this approach would be particularly applicable to the current perils that many of the world's reefs face. Karlson does address overfishing, nutrient loading, and crown-of-thorns starfish outbreaks, but mainly as examples of the kinds of disturbance that can be incorporated into models of coral community diversity and dynamics. Though it is not the primary intent of the volume, a more prescriptive discussion of community-level insights into reef conservation—a discussion that one did not have to hunt throughout the book to find—would have been a welcome addition. Finally, more attention to recent work on symbioses between corals and their symbiotic algae (zooxanthellae) *as interacting species* would have helped to integrate the perspectives of

ecophysiologists, population and community biologists, and ecologists advocating the ''macro'' perspective.

There are some very appealing features of this book. It is short and to-the-point. While it omits many topics in coral reef biology, it is theoretically grounded and up-to-date. The book is largely well written, though occasionally it strays into lengthy confusing discussions or statements of the obvious. Its conceptual framework (and takehome message) is to encourage an integrated consideration of the full variety of temporal and spatial processes structuring the dynamics of coral communities. Karlson urges small-scale experimental ecologists to delve into the biogeographical literature for historical and geographic insights into their own work, and conversely, he urges coral paleobiologists and macroecologists to gain an understanding of biotic interactions and disturbances that explain so much on local temporal and spatial scales. This is a powerful message that could well be heeded by ecologists studying the dynamics of *all* sorts of communities.

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Hormonally Active Agents in the Environment: A Tool for Policy Makers

National Research Council, Committee on Hormonally Active Agents in the Environment, Board on Environmental Studies and Toxicology, and Commission on Life Sciences. 1999. **Hormonally active agents in the environment.** National Academy Press, Washington, D.C. xx + 430 p. $59.95, ISBN: 0-309-06419-8.

It has been hypothesized that contaminants in the environment can mimic or block hormone actions in humans and wildlife and thereby disrupt the endocrine system. Due to increasing public concern over Endocrine Disrupting Compounds (EDCs), the National Research Council (NRC) was asked by the EPA, DOI, CDC, and the U.S. Congress to critically review the current knowledge of EDCs to aid policy makers in addressing the concerns over this difficult issue. The consensus report resulted in the publication of this peer-reviewed book in 1999. The NRC was asked to: ''review critically the literature on hormone-related toxicants in the environment; identify the known and suspected toxicological mechanisms and impacts on fish, wildlife, and humans; identify significant uncertainties, limitations of knowledge, and weaknesses in the available evidence; develop a science-based conceptual framework for assessing observed phenomena; and recommend research, monitoring and testing priorities. . . . [The committee was also asked to] identify particular chemical substances, geographic areas, contaminant sources, human subpopulations, and fish and wildlife populations of special concern. . . . ''

The NRC was not asked to present risk-management policy options, but rather to present an objective evaluation of the state-of-the-science. To accomplish this task, the NRC formed a committee on hormonally active agents (HAAs) which included preeminent scientists in the field. Each of them brought diverse views that lead to different interpretations and evaluations given the limitations and uncertainties in the data. There have been many discussions regarding the definition of ''endocrine disruptor,'' and the committee came to a consensus to use the term ''hormonally active agent'' to attempt to eliminate bias and emotion. This book was not intended to be an all-inclusive literature review, but rather to give a good grasp of the overall issues using peer-reviewed scientific literature. Some difficulties encountered included the questions of cause/effect, extrapolation to other species, and the interaction of mixtures of chemicals. To attempt to solve some of these difficulties, it became clear that the mechanism(s) of action of each HAA must be understood.

This book is based on peer-reviewed scientific literature covering mechanistic, reproductive, developmental, neurologic, immunologic, carcinogenic, and ecological effects attributed to HAAs in vertebrates. The first chapters are easy-to-understand overviews of potential mechanisms of action, and sources and routes of exposure of HAAs, including diet, pharmaceuticals, and environmental contaminants. Because most of the known data on HAAs is on environmental estrogens, the focus of this book is often on (anti-)estrogenic compounds. Although attempts are made to discuss other hormone targets, there is little or no discussion of interactions with androgenic steroids or peptide hormone systems. Chapters include discussions of primary target organs (e.g., brain, placenta) and secondary targets (e.g., changes in liver enzymes, serum binding proteins), which are useful for differentiating between direct and indirect mechanisms of action. Included in the dosimetry chapter (Chapter 4) is a discussion on (inverted) U-shape dose-response and low-threshold effects.

Chapters 5–10 cover human and wildlife studies on reproduction and development, and neurologic, immunologic, and carcinogenic effects. These case studies are by no means all-inclusive, but are well rounded. Not only are the endocrine-disrupting effects noted, but studies that show a lack of effect are also included. When possible, mechanisms of action are discussed. It was concluded that adverse reproductive and developmental effects of HAAs have been observed in wildlife, both in the field and in the laboratory, and in human populations. In humans, neurologic and cognitive deficits and lower birth weight after prenatal exposure to PCBs from maternal consumption of contaminated food have been shown in several instances (Great Lakes, Japan, Taiwan). However, immunologic and carcinogenic effects in humans have not been found to date. In fish, birds, and marine mammals, there is evidence

of immunosuppression resulting in increases in infections and mortality.

The conclusions reached in some chapters are contrary to the endocrine disruptor hypothesis. For example, although it is a reasonable hypothesis that there may be an association between the introduction of HAAs and increased rates of reproductive system/endocrine-related cancers in humans and animals, the committee concluded that the evidence from the laboratory and epidemiological studies does not support this hypothesis. It is noted that some HAAs are carcinogens in other organ systems, such as liver, but that an endocrine-cancer relationship is not supported. It was also noted that current data on carcinogenicity does not cover prenatal exposure periods, which is a major limitation. On the other hand, some chapter conclusions support the endocrine disruptor hypothesis, especially the ecological studies that show a strong effect of HAAs on wildlife populations and communities. It is concluded that wildlife can serve as environmental sentinels, and that monitoring of both subtle and obvious effects should be continued.

The final chapter covers screening and monitoring of HAAs that includes a short overview of current in vitro and in vivo methods. The numerous tables are easy to read and an excellent overview of the data discussed in each of the chapters. However, it would have been useful to have a list of tables after the Table of Contents. The appendix on DES effects is a useful summary, as is the addendum on the summary of final recommendations of the Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC).

The goal of this publication was to cover the current scientific literature and to present an objective review of the topic of hormonally active agents in the environment. This goal is accomplished, and this book is a good resource for those who wish to get an overview on the topic. The references cited are an excellent starting place for more in-depth coverage, although there are some notable omissions of some laboratories, especially in the area of wildlife HAAs. This book also tackles the more controversial (and emotional) human case studies, including declines in human sperm counts and developmental and neurological declines in children exposed to PCBs. The intended audience of this book is policy makers, and is appropriate reading for an educated audience. The writing style is technical, and it may be a stretch for the interested public. One strength of this publication is that each chapter ends with specific recommendations for points of further research, monitoring or assessment.

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ANIMALS WITHOUT BOUNDARIES

Turner, J. Scott. 2000. **The extended organism: the physiology of animal-built structures**. Harvard University Press, Cambridge, Massachusetts. x + 235 p. $47.50, ISBN: 0-674-00151-6 (alk. paper).

In his book, *The extended organism*, Scott Turner cites extraordinarily well-documented examples to support his primary thesis that an animal's physiology does not stop at the body wall, but is extended through the structure an animal builds. He uses the first three chapters to set up his basic premise and provide background information to the reader. In them he argues that the boundary between the living organism and the non-living external surroundings is ill-defined at best. With physiological functions that extend beyond the outer wall of an organism, he proposes that the surrounding space can work much like an external organ.

The body of the book, Chapters 4 through 11, delves into specific examples of animal structures and how these function in aiding gas exchange, temperature regulation, waste elimination, and overall individual and colony-wide homeostasis. Chapters include discussions of bioconvection systems, sponge and Cnidarian external physiology, burrowing marine worms, earthworm impacts on soils, aquatic insects and spiders, gall formation and photosynthesis rates, insect megaphones, and termite mounds. A mere listing of the main topics of the chapters does not accurately summarize this portion of the book because of the thoroughness with which each area is considered. An example will have to suffice. In Chapter 6, Scott Turner explores the interesting world of burrowing polycheate worms. He relates the evolution of burrowing behavior, the various ways by which worms dig their burrows, the build-up of oxygen in the atmosphere with the advent of photosynthesis, the consequences this build-up had on existing organisms, and the chemistry and energy production of anaerobic and aerobic respiration. He describes how anaerobic and aerobic organisms have become layered in the soil due to oxygen concentration and how this establishes a vertical redox potential differential between soil layers. He then concludes the chapter by showing how marine worms with vertical feeding burrows can take advantage of connecting these layers together and feeding at the top of the enriched food chain. These chapters exploring specific examples of animal systems are well written, and the easy writing style makes for enjoyable reading.

The final chapter of the book expands the idea of the extended organism to a world view, promoting the concept of Gaia, the Earth as a superorganism with interacting and interdependent parts, both living and non-living. The epilogue presents the author's view that molecular biology has become an applied handmaiden of industry and that evolutionary biology has ''become scholastic, with all its best insights behind it.'' He argues that a new ''Golden Age'' for biology would flourish

with a return to holistic biology and the elimination of the arbitrary boundary between organisms and the environment.

Although references are not cited in the text, a readings section at the back of the book provides a solid list of references for the topics in each of the chapters. This section is followed by a credits for figures and an index, which are all helpful.

The extended organism is intended to appeal to students and scientists in the areas of physiology, behavior, evolution, and ecology. The depth of detail and background material accompanying each topic, however, best suits the level of an undergraduate student. For others willing to skim through some of the more familiar details, there is still a wealth of information and a novel perspective on animal construction that makes the reading worthwhile.

The idea that animal-built structures can moderate adverse environmental fluctuations, improve prey capture rates, or aid in gas exchange is not new. Those studying animal architecture might argue that a particular nest form protects the colony from predators or elevates the internal temperature to increase the rate of brood development. Water flow through a caddisfly larval case can aid in food capture. There are many examples. But Scott Turner looks beyond the short or simple answers and examines the process of how the structure actually alters the surrounding conditions and the resulting interplay between the chemical, physical, and biological processes on an animal's physiology. Founded on a detailed analysis of empirical studies, he extends our perception of the structure's function in such a way that it truly is a novel view of animal architecture and its physiological role.

Unfortunately, the quality of the book is marred by belabored arguments about such issues as the lack of difference between living organisms and non-living entities and the need to view the body wall of an organism as only a vague boundary. Turner's premise that an organism's physiology may be extended beyond the body wall through modification of the environment is a scientifically beneficial perspective of animal-built structures, because it will lead to new avenues of investigation. His arguments, however, go well beyond this point and are unconvincing.

Scott Turner uses the terms adaptation, group selection, and symbiosis in unusual contexts, which might confuse students reading the final chapter and epilogue. Given the careful and thoughtful writing style throughout the main body of the book, the loose use of these concepts comes as a surprise.

The author argues for the need to study the Earth using a holistic approach, despite the admitted success of a reductionist approach. Although the sum of the parts often does not equal the whole, the reductionist approach is not used because scientists prefer small, obscure topics and avoid broad, comprehensive topics. Perhaps the holistic view may someday be a productive approach, but as with the superorganism concept of social insect colonies, it is valuable as a perspective, but not particularly useful in application at the present time.

Overall, I recommend this book to the average science reader interested in physiology, behavior, ecology, and/or evolution. *The extended organism* would also provide a good supplemental text for undergraduate classes in these disciplines. The more controversial chapters of the book would create the opportunity for productive class discussions.

HOLLY DOWNING

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Spotlight

RECENT PUBLICATIONS OF PARTICULAR INTEREST

Johnson, Evert W. 2000. **Forest sampling desk reference** CRC Press, Boca Raton, Florida. 985 p. $149.95, ISBN:0-8493-0058-5 (alk. paper). This enormous book is aimed at students and foresters. It is derived from notes in a two-semester course that addressed both sampling (experimental design) and statistics for forest mensuration.

Murkin, Henry R., Arnold G. van der Valk, and William R. Clark, editors. 2000. **Prairie wetland ecology: the contribution of the Marsh Ecology Research Program.** Iowa State University Press, Ames, Iowa. xiv + 413 p. $79.95, ISBN: 0-8138-2752 3 (alk. paper). This book describes studies of prairie wetland ecology that have been conducted by the Marsh Ecology Research Program (MERP) since its inception in 1979. The major sections focus on history and goals of the MERP, nutrient budget studies, wet-dry cycle effects on different groups of organisms, and management implications of the work of MERP.

Books and Monographs Received Through August 2000

Arnett, Ross H., Jr. 2000. **American insects: a handbook of the insects of America north of Mexico.** Second edition. CRC Press, Boca Raton, Florida. xvii + 1003 p. $99.95, ISBN: 0-8493-0212-9 (alk. paper).

Avise, John C. 2000. **Phylogeography: the history and formation of species.** Harvard University Press, Cambridge, Massachusetts. viii + 447 p. $49.95, ISBN: 0-674-66638-0 (alk. paper).

Beniston, Martin. 2000. **Environmental change in mountains and uplands.** Key Issues in Environmental Change. Oxford University Press, New York. x + 172 p. $72.00 (cloth), ISBN: 0-340-70638-4; $29.95 (paper), ISBN: 0-340-70636-8.

Berenbaum, May R. 2000. **Buzzwords: a scientist muses on sex, bugs, and rock 'n' roll.** Joseph Henry Press, Washington, D.C. xviii + 298 p. $24.95 (cloth), ISBN: 0-309-07081-3 (alk. paper); $14.95 (paper), ISBN: 0-309-06835-5 (alk. paper).

Bosselaar, Laure-Anne, editor. 2000. **Urban nature: poems about wildlife in the city.** Milkweed Editions, Minneapolis, Minnesota. xx + 265 p. $16.95, ISBN: 1-57131-410-5 (acid-free paper).

Bossomaier, Terry R. J., and David Geoffrey Green, editors. 2000. **Complex systems.** Cambridge University Press, New York. v + 413 p. $90.00, ISBN: 0-521-46245-2.

Chichilnisky, Graciela, and Geoffrey Heal, editors. 2000. **Environmental markets: equity and efficiency.** Columbia University Press, New York. viii + 298 p. $55.00, ISBN: 0-231-11588-1 (alk. paper).

Committee on Intrinsic Remediation, Water Science and Technology Board, Board on Radioactive Waste Management, and the Commission on Geosciences, Environment, and Resources. 2000. **Natural attenuation for groundwater remediation.** National Academy Press, Washington, D.C. xiv + 274 p. $47.95, ISBN: 0-309-06932-7.

Committee on the Causes and Management of Coastal Eutrophication, Ocean Studies Board and Water Science and Technology Board, Commission on Geosciences, Environment, and Resources, and the National Research Council. 2000. **Clean coastal waters: understanding and reducing the effects of nutrient pollution.** National Academy Press, Washington, D.C. xvi + 405 p. $54.95, ISBN: 0-309-06948-3.

Cowlishaw, Guy, and Robin Dunbar. 2000. **Primate conservation biology.** The University of Chicago Press, Chicago, Illinois. xi + 498 p. $75.00, £47.50 (cloth), ISBN: 0-226-11636-0 (alk. paper); $27.00, £17.50 (paper), ISBN: 0-226-11637-9 (alk. paper).

Dale, Mark Randall Thomas. 2000 (originally published 1999). **Spatial pattern analysis in plant ecology.** Cambridge Studies in Ecology. Cambridge University Press, New York. x + 326 p. $69.95 (cloth), ISBN: 0-521-45227-9; $35.95 (paper), ISBN: 0-521-79437-4.

Goulding, Michael, Nigel J. H. Smith, and Dennis J. Mahar. 1996. **Floods of fortune: ecology and economy along the Amazon.** Columbia University Press, New York. vi + 193 p. $16.50, £10.50, ISBN: 0-231-10421-9 (alk. paper).

Hochberg, Michael E., and Anthony R. Ives, editors. 2000. **Parasitoid population biology.** Princeton University Press, Princeton, New Jersey. xiv + 366 p. $75.00, £47.00 (cloth), ISBN: 0-691-04981-5 (alk. paper); $24.25, £15.95 (paper), ISBN: 0-691-04982-3 (alk. paper).

Irwin, Paul G. 2000. **Losing paradise: the growing threat to our animals, our environment, and ourselves.** Square One, Garden City Park, New York. xiii + 224 p. $14.95, ISBN: 0-7570-0003-7.

Johnson, Evert W. 2000. **Forest sampling desk reference.** CRC Press, Boca Raton, Florida. 985 p. $149.95, ISBN: 0-8493-0058-5 (alk. paper).

Lacey, Eileen A., James L. Patton, and Guy N. Cameron, editors. 2000. **Life underground: the biology of subterranean rodents.** The University of Chicago Press, Chicago, Illinois. xi + 449 p. $65.00, £41.00 (cloth), ISBN: 0-226-46727-9 (alk. paper); $24.00, £15.50 (paper), ISBN: 0-226-46728-7 (alk. paper).

Laurance, William. 2000. **Stinging trees and wait-a-whiles: confessions of a rainforest biologist.** The University of Chicago Press, Chicago, Illinois. x + 196 p. $25.00, £16.00, ISBN: 0-226-46896-8 (alk. paper).

Lek, Sovan, and Jean-François Guégan. 2000. **Artificial neuronal networks: application to ecology and evolution.** Environmental Science. Springer-Verlag, New York. xxvi + 262 p. $92.00, ISBN: 3-540-66921-3 (alk. paper).

Margulis, Lynn, Clifford Matthews, and Aaron Haselton, editors. 2000. **Environmental evolution: effects of the origin and evolution of life on planet earth.** Second edition. The MIT Press, Cambridge, Massachusetts. xvi + 338 p. $65.00, £43.50 (cloth), ISBN: 0-262-13366-0 (alk. paper); $27.95, £18.50 (paper), ISBN: 0-262-63197-0 (alk. paper).

May, Peter H., and Ronaldo Serôa da Motta, editors. 1996. **Pricing the planet: economic analysis for sustainable development.** Columbia University Press, New York. x + 220 p. $20.00, £12.50, ISBN: 0-231-10174-0 (alk. paper).

Murkin, Henry R., Arnold G. van der Valk, and William R. Clark, editors. 2000. **Prairie wetland ecology: the contribution of the Marsh Ecology Research Program.** Iowa State University Press, Ames, Iowa. xiv + 413 p. $79.95, ISBN: 0-8138-2752-3 (alk. paper).

Portney, Paul R., and Robert N. Stavins, editors. 2000. **Public policies for environmental protection.** Second edition. Resources for the Future Press, Washington, D.C. x + 294 p. $29.95, ISBN: 1-891853-03-1.

Reynolds, John E., Randall S. Wells, and Samantha D. Eide. 2000. **The bottlenose dolphin: biology and conservation.** University Press of Florida, Gainesville, Florida. xv + 288 p. $34.95, ISBN: 0-8130-1775-0 (alk. paper).

Schaefer, Carl W., and Antônio Ricardo Panizzi, editors. 2000. **Heteroptera of economic importance.** CRC Press, Boca Raton, Florida. 828 p. $94.95, ISBN: 0-8493-0695-7 (alk. paper).

Silberstein, Jane, and Chris Maser. 2000. **Land-use planning for sustainable development.** Sustainable Community Development Series. CRC Press, Boca Raton, Florida. 203 p. $49.95, ISBN: 1-56670-325-5 (alk. paper).

Stearns, Beverly Peterson, and Stephen C. Stearns. 1999. **Watching, from the edge of extinction.** Yale University Press, New Haven, Connecticut. xv + 270 p. $35.00 (cloth), ISBN: 0-300-07606-1; $15.95 (paper), ISBN: 0-300-08469-2.

Wilson, Will. 2000. **Simulating ecological and evolutionary systems in C.** Cambridge University Press, New York. xv + 301 p. $85.00 (cloth), ISBN: 0-521-77228-1; $29.95 (paper), ISBN: 0-521-77658-9.