Population Viability Analysis

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Reviews

Edited by R. Todd Engstrom

The following critiques express the opinions of the individual evaluators regarding the strengths, weaknesses, and value of the books they review. As such, the appraisals are subjective assessments and do not necessarily reflect the opinions of the editors or any official policy of the American Ornithologists' Union.

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Population Viability Analysis.—Steven R. Beissinger and Dale R. McCullough, Eds. 2002. University of Chicago Press. Chicago, Illinois. xvi + 577 pp. ISBN 0-226-04178-6. Paper, $35.—In the relatively young field of conservation biology, population viability analysis (PVA) has emerged as one of the key tools for endangered species management. It was a casual command in the U.S. National Forest Management Act (1976) to maintain viable populations of native vertebrates in National Forests that focused a long-term practice of modeling populations on the question of evaluating species persistence. Although everything from best professional guesses to sophisticated simulation modeling has been referred to as PVA, this book reflects a growing consensus that PVA needs to be some sort of data-based, quantitative analysis designed to ask particular questions about persistence. The first quantitative PVAs were published in the early 1980s, and were fairly straightforward approaches that are still in use. The rapid spread of PVA in conservation biology is probably attributable to its obvious application and to the widespread availability of software packages designed to do PVAs. In the past five or so years, however, the mathematical sophistication of models and modeling approaches has grown, as has widespread recognition of the limitations of applying model results, and challenges have arisen asserting that the basic goal of predicting extinction risk might be intractable. Consequently, this book is very timely. The book has 25 chapters, divided into four sections, including an overview of some basic aspects of PVA, parameterizing and constructing PVA models, integrating theory and practice, and where to go from here. The chapters are the selected proceedings from a symposium by the same name held in 1999, and the uniformly high quality of the chapters reflects the fact that they were selected, peer reviewed, and carefully edited. The chapters range from topic reviews, to detailed examples from already published work, to original work. The authors of the chapters constitute an impressive array of leaders in PVA research, and for the vast majority the authors' work lived up to expectations. Two excellent aspects to this book—and there are many—are that each chapter did a particularly good job providing context for what it contained, and almost without exception each chapter included at least one specific example depicting the issue being discussed. Although providing a good context in an introduction is supposed to be part of all scientific writing, often someone new to a field is not provided sufficient information to appreciate what is being done and why. Any reader who wants an introduction to the wide array of problems and applications of PVA before plunging into the details will find it for the book as a whole in the first chapter, and at the start of each subsequent chapter. I do not know if that is due to good editing or to selecting an excellent group of authors, but I suspect both. One of the fundamental themes of the book was well summarized by Samson (chapter 20): "PVA is not a mature science…." That is apparent in every chapter, and is obviously one of the reasons the symposium was held in the first place. That lack of maturity is evidenced by the fundamental issues addressed in the chapters, such as determining how to deal with uncertainty or missing data in PVA, how to incorporate loss of genetic variability in risk predictions, how to build a model when fundamental information remains unknown, such as how long seeds remain in a seed bank (Doak et al., chapter 15), and which basic approach to PVA is most appropriate. What comes out of this book is an impressive list of things we do not know, with guidance on the next steps to figuring them out. A pessimist might leave the book feeling as if PVA will never fulfill its promise in endangered-species conservation because of unsolvable problems like not having enough data. If so, pessimists should not be doing PVA (although they might be good for reviewing output and management recommendations!). An excellent analogy for the use of PVA comes from Goodman's chapter, pointing out that weather and economic forecasting are not exact

either, but both still provide important, useful information. In the last sections, Ralls et al. (chapter 25) and Possingham et al. (chapter 22), for example, provide conditions and guidelines for when, why, and how PVA should be used in endangered species management. Here, and throughout the book, researchers and resource managers are provided excellent lessons about where the field is going, what needs to be done, and the appropriate use of what is available. A review of each chapter would be excessive, and support for my enthusiasm for the book can be given with particular highlights. Even the introductory chapters, which are intended as reviews, provide extremely useful information beyond the value of a review itself. For example, Allendorf and Ryman (chapter 4) critique the evidence available to support (or not) general attitudes about the role of genetics in population viability, such as, even though in theory genetic load can be "purged" from a population, is there any evidence that it occurs? And, is there evidence for the loss of evolutionary potential from small populations? They also provide good guidelines for when to incorporate genetics into PVA, and they give advice on what to do when no data exist for a target population. The final chapter in this section by Shaffer et al. (chapter 7) focuses on the disconnect between current uses and needs for PVA, and actions by resource agencies and legal communities. Although the ideas raised are not new, the authors did a particularly effective job at laying out important needs, and offered specific recommendations to increase the utility of PVA for the policy-based portion of conservation. One intriguing theme is the still-apparent disconnect in incorporating genetics into PVA. There were four chapters on genetics and conservation (Allendorf and Ryman [chapter 4]; Waples [chapter 8]; Hedrick [chapter 17]; Haig and Ballou [chapter 18]). A particularly insightful observation is that of Hedrick, who pointed out that molecular genetic techniques have greatly expanded the ability to statistically distinguish populations, but our understanding of the biological significance of such differences lags behind. When allozyme markers were used, statistical significance and biological significance were considered equivalent because allozyme markers are not generally very variable—the same relationship is not yet established for molecular markers. Although authors of those four chapters demonstrated the importance of population genetics to population viability, and offered various tools and techniques to integrate genetics into PVA, it is uncommon to do so outside of captive populations. That is particularly ironic because much of the early work in conservation biology—and in PVA in particular—focused on maintaining genetic diversity and used genetically based viability models. There is regularly expressed concern about the inability of PVA to predict extinction times unless data are extraordinarily good. Most PVAs to date have been done as stochastic simulation models using demographic data. In comparing a variety of PVA models to a laboratory experiment of actual replicated extinctions under various conditions, Belovsky et al. (chapter 13) find some accurate models under conditions unlikely in wild populations (e.g. no environmental stochasticity), and under relatively realistic conditions the better models were less than an order of magnitude off in their predictions. Although the authors seemed pleased by that, it is doubtful a resource manager would be. It is unknown right now if differences between prediction and reality were due to the species used, which by necessity had a short generation time and high reproductive potential (which might explain the surprisingly low importance of initial population size), or if this might be as good as models might be expected to perform. A variety of alternative approaches to evaluating persistence are presented in this book, including Bayesian PVA (Wade [chapter 11]; Taylor et al. [chapter 12], Goodman [chapter 21]), incidence function analysis (Hanski [chapter 5]), a mark–recapture approach (White et al. [chapter 9]), and population prediction intervals (Sæther and Engen [chapter 10]). It was informative to have all those methods in one volume, because they have had limited application and often are published in symposia or in taxon-specific journals. As a general approach, and possibly from an accuracy perspective, it appears that Bayesian PVA might be superior (there was no one in the book who took the task of arguing against it), but until there are simple, viability-designed software packages, the approach will probably not be used widely. One problem in PVA that became evident across chapters is that the time frame for doing PVAs is problematic. Several chapters explicitly state that the actual patterns of extinction risk in some analyses only become evident after time periods >100 years, whereas other chapters state (or imply) that the usefulness of the projections declines rapidly after 20–50 years. That problem needs to be explored. Another central question that was never addressed was the actual definition of a viable population. Shaffer et al. raised the issue of needing a legal definition that is biologically based, and a number of chapters state that the arbitrary designations of viability (such as 95% probability of persisting 100 years) should be changed—but no definition was offered. Perhaps that is because the definition of "viability" is a societal problem regarding the amount of risk society at large is willing to take, in which case the concept of biological defensibility might be moot. However, conservation biologists and resource managers should take the lead in the discussion, and do it soon, before policy makers decide. Were there topics not covered? Of course—PVA is a huge topic—but not many topics were omitted. For example, there was no discussion about the effects of incorporating individual behaviors into PVA and catastrophes were not dealt with explicitly.

But this book covered a tremendous range of topics, and did it well. Decades of research are outlined in those chapters and I enthusiastically recommend this book to anyone interested in the practice or application of PVA, or in wildlife management in general, and the book should appear in libraries of universities, government agencies, and many nongovernmental agencies.—J. Michael Reed, *Department of Biology, Tufts University, Medford, Massachusetts, 02155, USA. E-mail: mreed@tufts.edu*

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Shrikes and Bush-shrikes: Including Wood-shrikes, Helmet-shrikes, Flycatcher-shrikes, Philentomas, Batises and Wattle-eyes.—T. Harris and K. Franklin. 2000. Princeton University Press, Princeton, New Jersey, and Christopher Helm.—A. and C. Black, London. 392 pp, 41 color plates, 114 color distribution maps, 13 figures and dendograms, and 31 line drawings. ISBN 0-7136-3861-3. Cloth, $49.50.—Tony Harris showed his mettle as a field biologist and taxonomist in his first book on the shrikes of Southern Africa (Harris and Arnott 1988). In this very impressive book he gave a very in-depth look at a group of birds that had, although interested many a researcher, not presented before in book form. Hence, the sequel, *Shrikes and Bush-shrikes*, was only a question of time. However, LeFranc and Worfolk (1997) and Fry et al. (2000) beat Tony to the press and made his job all the more difficult, and us shrikeologists all the more curious to see what the end product would be like. The ornithological community was not disappointed and the end result surpassed all our expectations. Not only did the authors give a in-depth perspective into the lives of the shrikes of the world, but also into the complexities and pit-falls of their taxonomic status, and best of all included not only the true shrikes (Laniidae) as in LeFranc and Worfolk (1997), but also all the associated species found almost exclusively in Africa (wood-shrikes, helmet-shrikes, flycatcher-shrikes, philentomas, batises, and wattle-eyes) ending up with an impressive list of 114 species of 21 genera being included in the book.

The book starts out with a section on layout and methods. I strongly recommend the reader not to ruffle through these pages uninterestedly if you wish to truly understand the authors' methods and arguments further along in the book. The introduction comprises two sections, the first presenting the history and characteristic features of the shrikes, and the second a summary of the communication behavior of the 21 genera included in the book and taxonomic relationships are discussed. The authors examine shrike taxonomy under a very different light to that presented in literature to date. The second section of the introduction devotes one or two pages to each genus, accompanied by relevant line drawings, and uses vocal communication to discuss species relatedness. The latter consists of 11 page pairs of appendices discussing problems in defining species limits and the comparative characters of the genera reviewed. The methods used by Harris are novel, bordering on unusual, but present a perspective into the subject we lack to date. A piece of advice for the taxonomists amongst the readers of this book, I recommend you refer to Harris (1995) to further understand his concepts and chain of thought for the true shrikes. A glossary at the end of this section helps the reader understand the terminology applied by the authors.

As a person who has worked on true shrikes, the choice of species to be included in the book appears to be arbitrary. All of the 114 species included are part of the Corvoidea superfamily and are mostly Afrotropical. Only 17 of the true shrikes are Holarctic. All of the others are either Afrotropical (93) or Asian wood-shrikes or Philentomas (17).

The 41 color plates are impressive and give an impression of an artist who knows the birds in the field. The gizz, behavior, and habitat in which they can be found are well portrayed. The species are well spaced out and for each species between 2–10 plumages and color-morphs or variances are presented. Also of great help is that for most of the species a bird in flight is included. Opposite each plate, a key to the drawings, a short descriptive note, and color-coded distribution maps are presented. The latter are one of the few complaints I have in the book—although ample space is available on the page, in many cases the maps are cramped and cover large geographical regions making it difficult to discern range limits.

The next section consists of 215 pages of species accounts. Each species account ranges from one (for the lesser-known species) to four pages, for the better-studied species. Those accounts include headings such as "Field Identification," "Geographical Variation," "Moult," "Range," "Habitat and Status," "Movements," "Social Organization and General Behavior," "Sounds," "Breeding Biology," and "Measurements and Weights." Also included is information pertaining to hybrids and abnormal plumage. Species accounts are quite exhaustive based on the literature available.

The text is well referenced and, although they may appear a hindrance to the casual reader, is a treasure trove for those who wish to look into specific topics in further detail. The bibliography includes 1,086 references and it is arranged in a cumbersome manner.