Extinction in Our Times: Global Amphibian Decline

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the prevalence of "intelligent design," I particularly appreciated the pages spent explaining the evo-devo basis of our understanding of the molecular evolution of physiology and the structure of light-sensitive organs in animals. My only serious complaint is an incorrect diagram of sexual reproduction in figure 5.5. Meiosis is correctly illustrated but the chromosomes of the sperm and egg do not fuse as a result of fertilization.

The last five chapters are back to easier reading, especially given Zimmer's flowing style. Extinctions and radiations, symbiotic associations, and sexual selection are topics found in every evolution text and are particularly interesting to scientists. Most readers, however, will engage with the final two chapters, "Evolutionary Medicine" and "Minds and Microbes: The Evolution of Behavior." Readers will recognize the medical examples from recent news media, but Zimmer goes far beyond typical media coverage in providing the necessary background to understanding the often-predictable evolutionary basis of these diseases. And unlike the news media, he asks the reader to think of him or herself as a human Petri dish in which these evolutionary battles between microbes and human cells are played out.

Perhaps not surprisingly, the last chapter is the longest in the book. Behavior, particularly human behavior, is a biological topic of widespread interest to everyone—the author's target audience. As Zimmer notes at the end of the chapter: "We are only at the beginning of this particular chapter in the history of science…. But we can be excused for being especially interested in it. Evolution helps show us who we are, and how we got this way."

After turning the last page I had to stop and reconsider, who really should read this book? I teach a graduate/upper-level undergraduate course in evolution, and this is not the book I would use as a text. However, reading it for this review was a quick refresher outline of the major concepts I will be teaching next semester, and I made notes of examples and applications I will want to use. Those of you specializing in other areas of biology will find this to be a satisfying introduction to current evolutionary thought. But Zimmer specifically targets those *not* going on in biology. How does it fit that audience? In the best of all worlds, every educated American could and should read this book, and as a result, would have a much richer understanding of evolution as a force directly affecting our lives. My hope is that a great number of us who teach in colleges and universities will focus our introductory-level biology course for preservice teachers on evolution. After all, "Nothing in biology makes sense except in the light of evolution" (Dobzhansky 1973). *The Tangled Bank* would be an excellent textbook for such a course.

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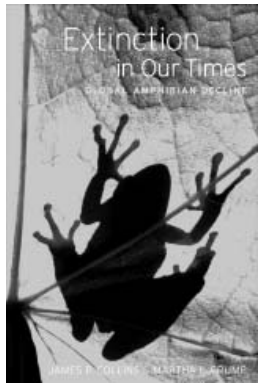
A LEVEL-HEADED DAMAGE ASSESSMENT

Extinction in Our Times: Global Amphibian Decline. James P. Collins and Martha. L. Crump. Oxford University Press, 2009. 273 pp., illus. $29.95 (ISBN 9780195316940 cloth).

This book, intended for both a scientific and informed lay audience, summarizes the big picture of scientific understanding of amphibian population decline and its probable causes. Both Collins, a professor at Arizona State University, and Crump, an adjunct professor at Northern Arizona University, have published extensively on amphibian biology and the enormous challenge posed by the decline of so many amphibian species.



Because I know the passion that the authors have for the subject, I was impressed first with the organization of the book, and then with the level line of logic that they followed. Facts and data, supported with citations (even though in a rather obtuse format) and emphasized with bulleted lists, current scientific opinion, and cogent syntheses, were standard. The many kinds of hyperbole that could have crept into such a discourse found no place in this book, and the authors analyzed information without lapsing into undue scientific terminology. Their style was surely intentional, and it certainly was the only one that would allow a variety of readers with inherent biases to read the book productively.

The font style and size of this sturdy book worked well with my old eyes, and the organization served to introduce, present, and summarize the complicated problem at hand. Some of the punctuation seemed odd, and I smiled when I noticed that one of the authors had pointed out a verb-subject disagreement in a

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quotation. I recommend this book to anyone who wants an informative read that will allow him or her to understand the problem discussed as well as gain a perspective on how biological scientists proceed with their pursuits.

Even so, there were points in the text where I hoped for more discussion, or at least a little more punch to the authors' presentations, particularly of "why" questions. "Reproductive characteristics and time of breeding... are unknown for a large proportion of amphibians," Collins and Crump write. In fact, basic information such as longevity and age at first reproduction could not be found for 33 to 50 percent of 60 common species of amphibians from the southeastern United States in a recent data compilation (Susan Walls, US Geological Survey, Gainesville, Florida, personal communication); the current attitude that natural history is passé inhibits a full understanding of many biological studies. Actually, nothing—from the details of a species' developmental genetics to the number of eggs it lays—makes total sense if we cannot understand how the organisms live their lives. "Finally, from an ethics standpoint, we are obliged to respect and protect amphibians," Collins and Crump suggest. Even with all the information provided, I would bet that many people will not see why they are obliged to do so; ethical arguments have to compete with hamburgers, blankets, and a new house in a flood-prone area.

Likewise, although this book was not the venue to discuss the modern mode of scientific progression, I would have liked to see a bit more emphasis on the research philosophies needed to solve this problem. For example, some herpetologists are exceedingly well equipped to study the biology of amphibians, but quite superficially prepared to study the interactions of amphibians and a fungus. The immediate and paramount demand for research integration and collaboration was not emphasized in the book to the degree I would have liked. I do not see a high level of interaction of amphibian biologists with epidemiologists and fungal biologists. Considering that a pathogen is involved in many of the declines, there are amazingly few studies of relevant amphibian immunology, and I think that this is an example of the failure of the model system of research. Much of the data on amphibian immunology is based on two model species (Carey et al. 1999), chosen because they are easily cultured and not because they are examples with potentially widespread impact on our immunological understanding. Phylogeny, not ease of culturing, should be our focal point.

Examples from other fields of study illustrate the benefits of research integration. It seems that it took the advent of molecular genetics to marry evolutionary and developmental biologists, and the flourishing concept of "evo-devo" was then born. The burgeoning field of bioinspired research, a philosophically laborious union of biologists and engineers, is starting to produce viable products (e.g., gecko tape based on the morphology of gecko toe pads). It struck me as a sad comment on the state of the integration of biological research that Cooke and Suski (2008) wrote, "There is growing recognition that opportunities exist to use physiology as part of the conservation and management of populations and ecosystems." The interaction of an organism's physiology with its environment is an elementary tenet of biology, so why did Cooke and Susuki feel compelled to suggest that this integration would surely be productive? Our overly partitioned, nonintegrated views of research, which often put it before phylogeny, may be our worst enemy. I support the very unpopular view that we should return to a concept of "biologist," or perhaps something of even wider scope, in the hope of gaining broad understanding. Integration of research efforts would then be more likely to occur by default. Yet the structures and goals of institutions and funding agencies force research into smaller, internally focused units.

In the last paragraph of the book the authors ask several questions about how humans will react to the loss of biodiversity, what these losses say about conditions on Earth, and what our role might be as custodians of this planet. The pessimism of my answers made me cringe, but I nonetheless came away with some intact optimism, or at least satisfaction from seeing the full scope of the problem. Fighting an ecological problem with ecology is the only viable option, and there are some recent studies that point toward ways to combat *Batrachochytrium dendrobatidis*, an apparent principal cause of many amphibian declines. They may offer small sparkles of hope (e.g., Woodhams et al. 2007, Lu et al. 2009).

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