BOOK REVIEWS

Perspectives on Lizards

Lizard Ecology. Historical and Experimental Perspectives. LAURIE J. VITT and ERIC R. PIANKA, Eds. Princeton University Press, Princeton, NJ, 1994. xii, 403 pp., illus. $39.50 or £33.50. From a symposium, Austin, TX, 1993.

Imagine a terrestrial vertebrate that lives for 15 years, gives birth each year to a few large young, and eats flowers, berries, and insects. Individuals recognize each other and pair for life. Each spring, mates spend weeks together foraging, resting, and basking. This glimpse of the complex social organization of sleepy lizards is just one of many new views of lizards included in this collective volume. The topics represent an impressive diversity of approaches, ranging from detailed life-history studies of single species and in-depth analyses of lizard communities to broad-based comparisons of multiple traits across all groups of lizards.

Based on a 1993 symposium entitled "Lizard Ecology: The Third Generation," the work includes 14 chapters organized into four groups: on reproductive, behavioral, evolutionary, and community ecology. Each section is introduced with a commentary by a contributor to previous volumes on the theme, *Lizard Ecology: A Symposium* (W. W. Milstead, Ed.; University of Missouri Press, 1967) and *Lizard Ecology: Studies of a Model Organism* (R. B. Huey *et al.*, Eds.; Harvard University Press, 1983). Taken together, these books—*Lizard Ecology* I, II, and III—span nearly three decades of lizard biology and reflect the changing focus of three academic generations. The new volume emphasizes the explicit integration of phylogeny into historical analyses and highlights the increasingly important role of experiments in ecological studies.

For instance, in Bull's decade-long study of sleepy lizards in Australia, the possible functional bases of monogamy and pair fidelity were tested by "divorcing" lizards from their mates. As part of another long-term study, Andrews and Wright employed a large network of sprinklers to simulate rainfall in patches of tropical forest. Lizard abundances were altered, but in unexpected ways, by affecting egg production, predation, and survival in relation to ambient conditions. Such population fluctuations are underappreciated in tropical species and yet are crucial to their management and conservation. Guyer studied another species of anole in Costa Rican rainforest by supplementing food or mates and demonstrated that the population densities of females were food-limited, whereas those of males were primarily mate-limited. The need for high-quality life-history data in order to discern the "rules" by which individual lizards allocate time and energy is stressed by Dunham in his commentary on reproductive ecology. In a review of costs of reproduction in 16 species, Schwarzkopf identifies the survival risks and fecundity trade-offs of various reproductive strategies.

Experimentation has also produced new views of population-level differences and the role of the environment in shaping phenotypes. Overall's study of how thermal and hydric conditions during incubation affected hatchlings underscores that nest environments may be critical determinants of life history. In her study, egg temperature affected survival, whereas soil moisture influenced hatchling growth. The reciprocal transplants devised by Niewiarowski illustrate yet another experimental avenue, that is, disentangling environmental and genetic sources of variation in juvenile growth by exchanging animals between local ities. Using "allometric engineering," Sinervo has hormonally manipulated lizard clutch size, egg size, and total clutch mass to investigate what constitutes optimal offspring size.

Lizard and prey. [From *Lizard Ecology*]

How and why lizards disperse are topics that Clobert and co-workers have approached with a series of innovative experiments. Young lizards either disperse or stay at home; dispersers are favored under good conditions whereas under poor conditions the reverse holds. How such changes within a species affect other species in the community at large is one of the questions posed by Case in his commentary on lizard population and community ecology. He emphasizes the importance of lizards as both food and predator in ways that affect community patterns. The extraordinary species richness (39 species) of a lizard assemblage in desert Australia is analyzed over a range of spatial and temporal scales by James. In his study, stochastic processes had effects over hectares and seasons, whereas at larger scales processes were more deterministic. Losos enlarges the spatial and temporal scales to include continental comparisons and then refocuses on Caribbean anoles, using phylogeny as the basis for analysis. He constructs plausible hypotheses to explain why lizard diversity is so low in North America and why Jamaica has one less anole than Puerto Rico.

In a wide-ranging commentary on evolutionary ecology and lizards, Huey is generally enthusiastic about advances in understanding selection and phenotypic plasticity, but less optimistic about predicting future evolutionary scenarios until more information about the genetic architecture of lizards is available. He expects that lizard ecology will continue to contribute in major ways in the demographic and systematic arenas.

Comparative studies have recently been invigorated by incorporating phylogenies, using new statistical techniques developed by some of the contributors. Miles's historical analysis of phrynosomatid lizards suggests multiple transitions among habitats, with only minimal change in locomotor performance and limb morphology. Garland examines the endurance capacities of lizards across all taxa and concludes that stamina tends to increase with body size and temperature, despite very real species-specific differences that relate to habitat and life-style. According to Martins, who explored the evolution and function of territorial behavior, home-range defense is ancestral in lizards; but in several groups, the amount of area defended has decreased with changing life-styles. Cooper's broad-based analysis of foraging mode and prey discrimination suggests a functional coupling with chemoreception in active foraging and herbivorous species, but not in ambush foragers dependent on crypticity. In his commentary on behavioral ecology, Rand points out that these two stud-

ies, considered together, suggest that sit-and-wait foragers generally defend home ranges whereas defense of territory by active foragers is usually limited. Such analyses can readily be extended to include other squamates, and doing so sharply focuses comparisons between lizards and snakes.

Clearly, after another decade, lizard ecology is alive and well. But are lizards still "model organisms" for ecological studies? The response now seems to be tempered—yes for some questions, no for others. In fact, a number of "herpetological defections," in the words of Huey, have occurred among investigators who initially posed questions with lizards and who now find bacteria, *Drosophila*, and other organisms more suitable as models. Another important change during the past decade has been the rapid growth of ecological studies on snakes especially, and to a lesser extent on turtles and crocodilians. Interesting and intriguing contrasts are already apparent in such areas as life history, sex determination, and sexual dimorphism. Lizard envy, or the notion that other reptiles have less to offer the ecologist than lizards, is rapidly dissipating. Integrative studies that include these other reptile groups are already a reality or soon will be, as evidenced by the comments of some of the contributors here, including Losos, James, and Cooper. No doubt this trend will continue, and it promises to enlarge and enrich perspectives on lizards.

Peter Grant's commentary at the conclusion of *Lizard Ecology* II accurately foreshadowed the increasingly important role of long-term life-history studies coupled with experimental manipulations in advancing understanding of population phenomena and their evolution. The initial emphasis on physiological ecology evident in the first two volumes provided a solid foundation for the current growth apparent in behavioral and evolutionary ecology. The editors of *Lizard Ecology* III have done an excellent job of organizing, editing, and introducing these representative contributions by a third generation of ecologists working with lizards. The volume is attractively designed and is embellished with lizard drawings by Pianka. The commentaries by Dunham, Rand, Huey, and Case are particularly welcome. Taken together, their perspective not only provides a context in which to view these individual studies but opens a unique window on lizard ecology past, present, and future.

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Endangered Millions

Insect Conservation Biology. MICHAEL J. SAMWAYS. Chapman and Hall, New York, 1994. xvi, 358 pp., illus. $81.95 or £49; paper, $29.95 or £17.50. Conservation Biology Series.

On 9 October 1986 President Miguel de la Madrid of Mexico issued a decree that clearly defined the extent and level of protection to be accorded to five overwintering locations of the North American monarch butterfly in Mexico. These forested slopes, high in the mountains west of Mexico City, provide a winter refuge for hundreds of millions of butterflies and represent the annual coalescence of practically all members of a single species from an almost continent-wide summer distribution. Such a dramatic aggregation, coupled with seemingly inevitable overexploitation of timber from the overwintering forests, led to monarch overwintering's becoming the first "threatened phenomenon" designated as such by the International Union for the Conservation of Nature in 1983. These inspirational conservation measures are a wonderful example of the roles that legislators, scientific researchers, and conservation organizations such as Monarca A.C., the Xerces Society, the World Wildlife Fund, and the IUCN can play in insect conservation.

In *Insect Conservation Biology*, Michael Samways gives us a global insight into the biology, theories, and research methods and results that are essential for moving legislators to such action. The goal of the book is to provide a "broad introductory text" that highlights the "ecological, economic and intrinsic value" of insects "within the context of the human-pressurized world." Toward this goal, the book looks for ways of resolving the conflict between control of a small minority of serious insect pest species and conservation of a large number of threatened and endangered insect species. Samways frames this examination with an effort to be upbeat about the depressing demise of biodiversity by emphasizing the importance of an individually responsible worldview and sustainable conservation.

Insect Conservation Biology is successful as a broad introductory text, clearly written, informative, and enjoyable. All the expected and choice acronyms are there, from SLOSS and SLOPP to PVA and MVP, so that we know something about the lively debate over "single large or several small" and "single large or plentiful patchy" reserves, "population viability analysis," and "minimum viable population" sizes—although, regrettably, we do not learn very much about the underlying shift from island biogeography theory to considerations of metapopulation dynamics and experimental manipulations. Nevertheless, the concepts expounded are important ones that provide a fascinating backdrop for the discussion Samways provides of how we might go about counting the insect species in the world and then make objective decisions about their conservation. Whether there are 1.84, 2.57, 8.75, or even nearly 80 million insect species on Earth, there is no doubt that insects are essential, small to mid-sized components of all terrestrial and freshwater ecosystems. With only 1.1 million insect species named they face a desperate plight of being lost to extinction faster than we can name them, as environments they inhabit have been stripped of their natural resources by our species over the last thousand years. This well-illustrated book makes many intriguing comparisons among insect communities around the world and describes in some detail the impact of different degrees of anthropogenic habitat modification. Thus, although most of the examples come from the author's work in western Europe and southern Africa, the text does describe most of the insect ecology relevant to understanding what needs to be done for effective conservation of insects around the world.

Samways's attempt to address "what needs to be done" meets with less success. Effective conservation requires considerable political, sociological, economic, legislative, and legal wisdom, and very few biologists can hope to master the requisite skills. Although monarch butterfly overwintering sites are legally protected in Mexico, these forests are being exploited commercially, and no biologist as such could navigate the current turmoil of Mexico's political and economic transition into the North American Free Trade Agreement. Perhaps the monarch should be taken as an environmental symbol for NAFTA and focus the inspirational efforts of Monarca A.C. to develop a strongly interdisciplinary approach to insect conservation, based on the sound science described in Samways's book. But such books, and conservation biology in general, should focus on providing the objective information that is necessary for effective implementation. Such information need not present as much of a "doom and gloom" scenario as Samways intimates, and we do not have to be upbeat "greenies" either. What we need is a sound, objective, and thorough appreciation of insect conservation ecology and make sure that we communicate the information. Samways does a good job of communicating the science, but I wish he had steered clear of the simplistic, sustainability-oriented worldviews characteristic of introductory environmental science textbooks. Like the familiar but bogus "Chief Seattle" letter extract that follows