

work that might matter from the amorphous mass of experimental reports. For good or ill, by the middle of this century American biologists had developed unusually discriminating standards.

PHILIP J. PAULY
Department of History,
Rutgers University,
New Brunswick, NJ 08903

Decades of Turtles

Life History and Ecology of the Slider Turtle.

J. WHITFIELD GIBBONS, with contributions by Harold W. Avery *et al.* Smithsonian Institution Press, Washington, DC, 1990. xiv, 368 pp., illus. \$60.

Outside of the atypical case presented by our own species, the demography and population biology of long-lived vertebrates is poorly known. Long-lived vertebrates include many of the "high profile" endangered species that serve as the rallying points for conservation efforts, and often we don't know enough about their population biology to understand why they are in decline. This embarrassing dearth of information probably reflects the reluctance of funding agencies to support (or of researchers to undertake) descriptive studies having a long duration and an uncertain payoff. As a result, the *sine qua non* of population biology, life tables of age-specific rates of birth and death, are unavailable for most long-lived organisms.

Few long-lived vertebrates are as amenable to quantitative demographic study as turtles. Adults can live for many years, and during their lives they can reproduce many times. Each individual carries in its shell annuli a record of its growth and age. The shell also provides a convenient substrate for marking, so that the fate of known individuals can be followed, and a wealth of methods exist for capturing turtles and monitoring their reproductive activity and population dynamics.

In this volume, J. Whitfield Gibbons has assembled the results of such a study of the slider turtle, *Trachemys scripta*. Most of the information concerns the turtles studied at the Savannah River Ecology Laboratory, where the population biology of this strongly defended shelled organism has been elucidated as a decidedly nontoxic by-product of the manufacture of another kind of defense, nuclear weaponry. The slider turtle is common in the lakes used to cool production reactors at the Savannah River plant, although it is more readily studied in smaller nearby ponds. The study was originally supported by the Atomic Energy Commission

to help understand the impact of thermal effluent on aquatic ecosystems and has been continued for over 20 years through the enlightened patronage of the managers of the plant. This book thus summarizes the results of a turtle population study of unprecedented duration, and these are supplemented with information about the turtle in other geographic areas.

Gibbons is an author or coauthor of 11 of the book's 24 chapters. Other chapters are authored by colleagues at the Savannah River Lab or by individuals working with the slider in other portions of its range. Apart from introductory and concluding chapters providing background information about the study, an overview of current theory regarding life history evolution in turtles, and recommendations for further research, the chapters fall into thematic groups: taxonomy and population genetics, reproduction and growth, population structure and demography, and bioenergetics.

Two broader themes emerge in the book's preface: the value of long-term descriptive studies, and the value of collecting data for their own sake in the course of research that is not hypothesis-directed. The suggestion that fruitful research need not be hypothesis-directed struck this reviewer as unfortunate. The literature in herpetology and population biology is littered with studies that would have benefitted from the clear articulation of testable hypotheses before the first datum was collected. A few of the chapters in this volume also fall into that category. Other chapters are far more successful.

One outstanding chapter presents a series of estimates for life table statistics for the best-studied population of slider turtles at the Savannah River Lab. Depending on the assumptions used, the population is predicted to be declining, in average and worst case scenarios, or approximately stable, in the best case. Mark-recapture data for the same population are in agreement with a precipitous population decline during eight years of the study. The conclusion is that this population, like the very few others that have been rigorously studied, is in a steep decline. Reasons for the decline are uncertain; possibilities include long-term climatic changes and habitat deterioration.

Other chapters contain a wealth of information on reproduction, growth, sex ratios, movements, feeding, and thermoregulation. There is much here to attract the interest of both herpetologists and ecologists. An extensive bibliography will also be useful to anyone with an interest in the biology of turtles. Consisting as it does of relatively independent chapters, the book provides a somewhat limited synthesis of the available information, however. Where the synthesis

succeeds, as in the chapter on life tables, the results are impressive. In other cases, one is left wondering whether information on feeding, movements, or bioenergetics might be used to identify reasons for the decline of the population.

Despite the unusual duration of the central study represented in this book, the turtle population still contains individuals that were born before the study began. This observation underscores the fascination and difficulty of studying long-lived organisms. The suites of adaptations that we call life histories may be sculpted by events operating on very long time scales, and short-term studies may badly mislead us about the frequency and selective importance of such events. Indeed, one wonders whether the decline exhibited by the Savannah River population is only a relatively short-term setback for a population that might regularly weather such events. The problem offers a compelling reason for even longer studies of long-lived organisms.

PETER J. MORIN
Department of Biological Sciences,
Rutgers University,
Piscataway, NJ 08855-1059

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