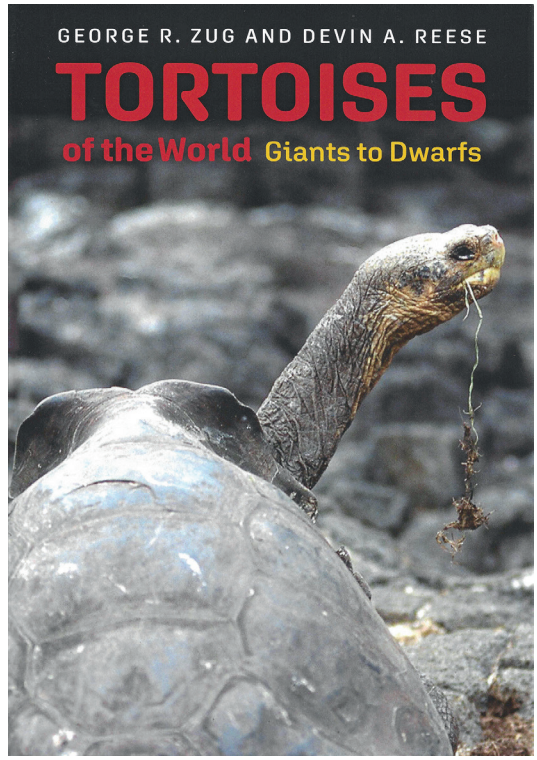
Zug, G. R. and D. A. Reese. 2024. **Tortoises of the World: Giants to Dwarfs.** Johns Hopkins University Press, Baltimore, Maryland, USA (www.press.jhu.edu). x + 228 pp.

Hardcover and e-Book. US $49.95 ISBN: 978-1-4214-4835-0 (Hardcover), 978-1-4214-4836-7 (eBook).




The tortoise wins again. Any time you put the tortoise in a race against the hare, the tortoise wins. The best case is the race home; tortoises carry their homes with them. This book explains why in many ways, tortoises come up winners but why they are faring so very badly in the modern world.

The title suggests that the book is focused on size and perhaps the mechanisms involved in the evolution of giants (*Megalochelys* was 2 m long) and dwarfs (adults < 20 cm) that are found in various land tortoise lineages, but the focus is instead quite broad, summarizing essentially all of the biology of land tortoises, the Family Testudinidae. The authors provide a "deep look" at land tortoises using a sound-bite approach. Topics are broken down into very short sections, often half a page or less, with catchy titles. The overall message of the book is the very interesting biology and diversity of tortoises and the perils that have threatened and continue to threaten them on a global scale

There is much in this book about the biology and anatomy of tortoises that explains their success as a group over tens of millions of years. Most are herbivores and their low metabolic rate allows them to tolerate conditions that mammalian herbivores (e.g., rabbits) cannot. The importance of the shell and how tortoises can move while carrying a large box are well explained. The very large bladder and large lungs in the top of the shell turn out to be very important in survival and dispersal. Dorsal lungs explain why tortoises float so well and land tortoise physiology includes multiple advantages that allow them to go for long periods without food or water. Among the very nice set of color plates, is the photo of the Aldabra tortoise that walked up a beach in Tanzania covered with goose barnacles (plate 20). It provides definitive illustration that tortoises are capable of very long distance, open ocean dispersal (740 km from Aldabra to Tanzania) and supports the books contention that over-water-dispersal has been a major feature of tortoise evolutionary history.

The authors consider the biological importance of a long life for which tortoises are famous, and then point out that this is no longer the case for many populations in the modern world. Those individuals that do survive are able to continue to reproduce for their entire lifetime which improves the likelihood that they will eventually produce offspring that survive and maintain populations.

Although it likely adds to the readability of the book, it is unfortunate that there are no citations in this volume. Instead, a .url for an

online bibliography of source material is provided. The absence of citations is unfortunate on multiple fronts. First it keeps the reader from pursuing the exact source of information for statements in the text and the authors of those works don't receive the credit they are due. It also means that the timing of discoveries about tortoise biology is lost to the reader. Perhaps most unfortunate is that a large part of the work that the authors put into the book is not available to the reader; the authors knew exactly which sources they were citing but that connection has been lost.

The evolution and diversity of tortoises is treated via chapters on modern diversity and evolution. It is pointed out that tortoises as a family are the youngest major group (~50 million years) in the turtle lineage that is at least 220 million years old. There are useful descriptions of variation in size, shape and thickness of the shell that led to the remarkable differences among species. It might have been of interest to point out that all tortoise species start out with exactly the same bones in the shell and nearly the same scales. It is remarkable that such morphological diversity should arise from a single basic starting point. The book also makes it clear that our understanding of the diversity of living tortoises is still changing. For example, in recent decades the number of *Kinixys* species has gone from 3 to 8 and the western-most gopher tortoise in North America (formerly placed in *Gopherus agassizii*) actually represents three species.

For this reviewer, a cladogram of living land tortoises would have been a very useful addition to the coverage of tortoise evolution. Although there is frequent consideration of relationships among tortoises and between tortoises and other turtles, there is nothing like a branching diagram to illustrate these important concepts. It is also unfortunate that only family-level distribution maps by continent are included. More detailed range maps would have added greatly to the volume by illustrating such points as the remarkable diversity of tortoises in southern Africa and Madagascar and the very limited ranges of many of the species that make up that diversity.

Tortoise conservation is taken up in the final chapter. It covers topics like legal protection for tortoises, translocation, head-starting and captive colonies. It highlights some of the major ongoing conservation programs like those for Galapagos tortoises, Aldabra tortoises, the Bolson gopher tortoise, and the many African and Malagasy endemics that are among the most threatened species of turtle in the world. But the key to keeping land tortoises in the wild will be to maintain the natural ecosystems that they require. As human populations grow, and the effects of climate change result in changes in land use, the problem of maintaining good tortoise habitats will get even more serious than it is now.

There are some minor errors that should have been caught before publication. It is stated that all turtles have scutes, two families do not. It is stated that scutes are dermal in origin, they are epidermal. *Astrochelys yniphora* is said to be the world's rarest turtle, what about *Rafetus swinhoei?* It is reported that forearms are thickly scaled, but it is more than scales, many species have limbs that are armored with bone that is covered by scales.

These small problems do not detract from the very important message that land tortoises face a very challenging survival outlook. The family has a long history of remarkable dispersal and diversity, with size being a major component of variation among lineages. Tortoises help to shape entire ecosystems, and their disappearance reflects badly on the human race. The fact that interactions with humans over millennia have led to the extinction of many species and in some cases, entire lineages, is well documented. The absence of giant tortoises from continents is shown to be related to the rise of human populations and the diversity of island-dwelling giants has also been sharply reduced. A summary table of tortoise species shows that two-thirds of modern forms are extinct or face some serious

level of threat. This book clearly makes the case that without concerted conservation efforts, land tortoises will no longer be able to win the race by running slowly.

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