

## REVIEW

**Diamonds in the Rough: Natural History of the Eastern Diamondback Rattlesnake**, by D. Bruce Means. 2017. Tall Timbers Press, Tallahassee, Florida. ISBN 978-0-9703886-5-0. \$100 hardcover. 416 pages.

For students of herpetology in the state of Florida, no animal is more iconic of the southeastern coastal plain than the eastern diamondback rattlesnake (*Crotalus adamanteus*). The geographic range of *C. adamanteus* extends from southeastern North Carolina, south through peninsular Florida, and west through southern Alabama, Mississippi, and Louisiana. This species is not only the largest rattlesnake in the world, but also the largest venomous snake in the United States and Canada, and exceeded only by the bushmaster (genus *Lachesis*) as the longest venomous snake in the New World. It has gained recognition in the southeastern United States due to its large size, diamond-shaped dorsal pattern, potential danger to humans, and economic worth. Even though the species is widely discussed, surprisingly little has been accurately recorded about its basic biology and natural history. Similar to many species that inhabit the longleaf pine ecosystem (e.g., Florida Scrub-Jay, gopher tortoise), eastern diamondback rattlesnakes have experienced substantial population declines over the past century. Fortunately, an important new resource has been published to shed light on this charismatic species that will inspire future generations to study and conserve the eastern diamondback rattlesnake and its endangered habitats.

D. Bruce Means' *Diamonds in the Rough: Natural History of the Eastern Diamondback Rattlesnake* (hereafter *Diamonds in the Rough*) is a truly impressive monograph on the biology of *Crotalus adamanteus*, synthesizing over 40 years' worth of scientific data collected from multiple long-term field studies in northern Florida and southern Georgia and over 700 dissected specimens. The 416-page book is organized into 24 chapters and begins with a forward by Joe Hutto and a preface by Means. A fascinating historical perspective is provided in Chapter 1, which begins with the earliest published illustration of any New World snake: the eastern diamondback rattlesnake (by Theodor de Bry in 1591). The following text demonstrates how little was learned about *C. adamanteus* over the next ~375 years, largely due to superstitions and the spread of misinformation. Next there is a short chapter on Means' inspiration to study the eastern diamondback rattlesnake, followed by information on his study areas (Tall Timbers Research Station, Florida; Alligator Point, Florida; Little St. Simons Island, Georgia) and his methods (Chapters 3-4).

The ensuing 14 chapters are the meat of *Diamonds in the Rough*, providing information on the morphology (Chapter 5), growth (Chapter 6), crypticity (Chapter 7), overwintering strategies (Chapters 8-9), daily and seasonal activity (Chapter 10), thermal biology (Chapter 11), sex ratio, annual range, and density (Chapter 12), habitat and geographic distribution (Chapter 13), food and prey acquisition (Chapter 14), enemies and defensive behavior (Chapter 15), combat, courtship, and copulation (Chapter 16), reproductive biology (Chapter 17), and birth and early life (Chapter 18) of the eastern diamondback rattlesnake. These chapters are based on a staggering amount of long-term field data, which are illustrated in 124 high-quality figures and 41 tables. For example, the daily and seasonal activity periods defined by Means are based on 4,077 radiotelemetry observations (Figs. 10.4, 10.5), the thermal biology variation is based on 1,980 body temperature measurements (Table 11.1), and the diet characterization for the species is based on the stomach contents of 725 specimens (Table 14.3). The conclusions

generated from these data have resolved many longstanding mischaracterizations about the eastern diamondback, firmly establishing instead its largely diurnal nature (p. 111-114; anecdotal reports of nocturnality were published in 1936, 1940, and 1972) and its primary defense mechanism of crypsis and flight (pp. 214-219; the aggressive posturing, rattling, and striking often observed in eastern diamondbacks is their last line of defense). Detailed field anecdotes are also included throughout *Diamonds in the Rough*, such as multiple “close encounters”, in which Means found himself within striking range (or standing on!) a hidden *C. adamanteus* (pp. 84-90; these incidents, even those in which Means stepped on the snake, never resulted in a strike) and the only published observation of courtship and copulation in the species (pp. 223-229), which Means observed for over 9 hours!

Following the comprehensive natural history and ecology sections, four chapters are presented that explore eastern diamondback rattlesnake-human relations (Chapters 18-22). Means concludes that *C. adamanteus* is the most dangerous venomous snake in the United States due to its size and venom toxicity, and he received two venomous bites during his career working on the species (both occurred while handling animals). Chapter 19 tells the story of his first venomous snake bite and continues by reviewing the venom delivery system and venom complexity of rattlesnakes. A valuable section follows, entitled, “What to do if you are bitten by the eastern diamondback rattlesnake.” Chapter 20 discusses the direct and indirect impact humans have on *C. adamanteus*, which includes road kills, hunting, commercial exploitation (for venom, skins, and meat), habitat loss, and habitat mismanagement. Chapter 21 reviews the depressing history of southeastern rattlesnake roundups, which started in the late 1950’s following the discovery that gasoline could be poured through a hose into gopher tortoise burrows to expel rattlesnakes. The management actions that will likely be required to conserve *C. adamanteus* populations into the future are discussed in chapter 22, which focuses on preserving and restoring the native habitats associated with the species, namely longleaf pine-wiregrass communities. The two concluding chapters provide a discussion on rattlesnake comparative ecology (Chapter 23) and future directions for research (Chapter 24). The ecology of *C. adamanteus* is briefly juxtaposed with what is known about the western diamondback, the prairie rattlesnake, and the timber rattlesnake. To conclude *Diamonds in the Rough*, Means urges future researchers to investigate certain aspects of eastern diamondback biology especially in need of attention: juvenile life, homing and navigation capabilities, role in vertebrate food web, and the diamondback populations in the Everglades, to name a few. A works cited and index is provided.

*Diamonds in the Rough* is an excellent book that will be an essential resource for scientists, naturalists, and wildlife management professionals alike. If you have never observed an eastern diamondback rattlesnake in the wild, you will have an itching to do so by the end of this book. *Diamonds in the Rough* is well-bound with good paper, the many images are of high quality and appropriately captioned, and the text is well edited. It is surprisingly readable, considering that it is a technical work containing a tremendous amount of data and information. The stories and observations from afield provide the reader a close look at life as a field biologist in the southeastern United States. Some sections could have been expanded. The morphology chapter is mostly on external features (e.g., scales, rattle, coloration) and largely lacks internal anatomy (e.g., osteology, myology). The comparative ecology chapter discusses four species of *Crotalus*, yet over 40 species are currently recognized. Notwithstanding, *Diamonds in the Rough* is a colossal work that will be regarded as the principal reference on the eastern diamondback rattlesnake and is well worth having on your bookshelf.

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