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Salt Marshes: A Natural and Unnatural History

Author: Grosholz, Edwin D.

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Time and Tide

Salt Marshes: A Natural and Unnatural History. Judith S. Weis and Carol A. Butler. Rutgers University Press, 2009. 216 pp., illus. $23.95 (ISBN 9780813545707 paper).

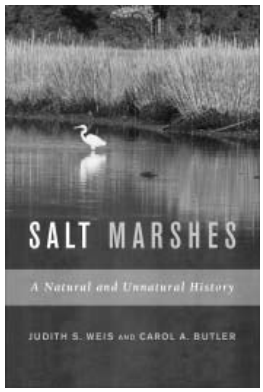
Following in the tradition of John Teal's classic *Life and Death of a Salt Marsh* is the new *Salt Marshes: A Natural and Unnatural History,* by estuarine ecologist Judith Weis and her writer colleague Carol Butler. In telling the natural history of salt marshes and their unnatural history of centuries of human abuse and mismanagement, Weis and Butler turn Teal's classic story of the life and death of the salt marsh into a story of rebirth, with a compelling narrative about salt marsh restoration.

In the first section of the book, Weis and Butler take the reader on a short tour of the natural history of salt marsh ecosystems. The first chapter covers salt marsh basics, including the primary physical and biogeochemical processes common to salt marsh ecosystems. In the next two chapters, the authors provide a primer of common and ecologically important plants and animals found in eastern salt marshes, with some examples from salt marshes in other regions. Here the authors do a good job of embellishing ordinary species descriptions with additional information about the organisms' ecology and behavior, bringing life to what might otherwise be a fairly dry section.

The book's second section focuses on human impacts and includes scholarly chapters on habitat alteration, pollution, and invasive species that show how these stressors affect salt marsh systems. The book closes with two chapters that explore the successes and failures of the restoration and management of salt marshes. Here the book's tone is very upbeat, and the authors present a positive outlook for the future of salt marsh restoration, rather than a litany of doom and gloom.

Overall, I found *Salt Marshes* to be a good resource and a pleasure to read. The authors balance an attention to detail with engaging stories about fiddler crabs, tidal regimes, and other subjects. They also weave important research results into the conceptual storyline, an approach that fosters a broader understanding of what controls these dynamic systems. But Weis and Butler really hit their stride in the final two chapters, on marsh restoration and management; the last chapter, "Death and Rebirth of an Urban Wetland," makes clear to the reader that this topic is a central interest of the authors. The pace and intensity of the prose pick up markedly here, as does the level of detail and documentation. The authors explore the history of the Hackensack Meadowlands as it rose like a phoenix from centuries of neglect and decades of assault, including dumping, filling, polluting, and invading. From the ashes of human abuse and mismanagement came rebirth in the form of salt marsh restoration. The book documents impressive growth in biodiversity and ecosystem function in both terrestrial and aquatic habitats of the Meadowlands, and makes a very compelling case for the future of salt marsh restoration. It's hard to imagine an estuarine landscape as heavily altered as this one—an area better known for the New Jersey Turnpike, toxic waste dumps, and sports stadiums—recovering so dramatically. However, as the authors repeatedly affirm in the final section: "Miracles do happen."

Salt Marshes does have some obvious limitations and omissions; for example, the natural history section of the book is somewhat light compared with the unnatural history portion. In addition, the discussion of the biology and ecology of salt marshes in regions other than in the eastern United States is woefully



inadequate. It is in this section that the authors argue everyone should care about salt marshes, so they perhaps should have included a deeper discussion of salt marshes elsewhere. Throughout the book, salt marshes in other regions are given a general treatment, but only eastern US salt marshes are covered adequately. For example, Weis and Butler state correctly that there are fewer salt marshes on the West Coast, but they conclude that the only western marshes of consequence are in California and Washington; they seem to ignore the extensive salt marshes of Oregon. The authors would have been well advised to focus simply on Atlantic salt marshes. The most unsatisfying idiosyncrasy of this book is the uneven and highly selective use of authors' names when discussing interesting research. In many cases, study results are presented in detail, but the authors provide no citations—nor are the names of researchers even mentioned. Weis and Butler do give other examples, however, in which they mention their colleagues or other researchers by name.

Overall, *Salt Marshes: A Natural and Unnatural History* is a well-written and compelling narrative of the past, present, and future states of salt marshes. The book is both scholarly and timely, and it outlines what is at stake if we do not tend to these threatened and ecologically important habitats. It is true that we are losing salt marshes at a less dramatic rate than in years past. However,

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the remaining salt marshes are diked, drained, fragmented, isolated, polluted, and invaded; we are still losing the battle for their survival. This book makes a strong case for salt marsh restoration as a means to reverse the destructive legacy of this "unnatural history."

EDWIN D. GROSHOLZ
Edwin D. Grosholz (tedgrosholz@ucdavis.edu) is professor and Swantz Specialist in Cooperative Extension with the Department of Environmental Science and Policy at the University of California, Davis.

RECONSTRUCTING THE ROOTS OF THE AMPHIBIAN TREE

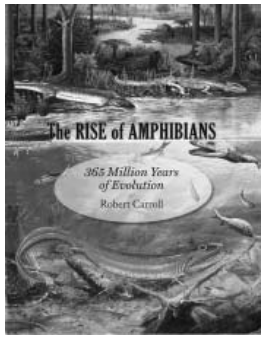
The Rise of Amphibians: 365 Million Years of Evolution. Robert Carroll. Johns Hopkins University Press, 2009. 392 pp., illus. $65.00 (ISBN 9780801891403 cloth).

Amphibian systematics is experiencing an era of change. Integrative taxonomy and increased exploration, especially of tropical regions, have led to an explosion in species numbers, with more than a thousand species discovered and described between 2000 and 2009. Some of these new species were breakthroughs of great biogeographic importance, such as *Karsenia koreana*, the first Asian plethodontid salamander, or *Nasikabatrachus sahyadrensis*, a representative of a morphologically unique family of frogs in India. Furthermore, important advances in our knowledge of the deep phylogeny of extant amphibians have been achieved through the analysis of DNA sequences, and molecular clocks are coming to a consensus in dating the major nodes of the amphibian tree—leading to an improved understanding of how vicariance and dispersal shaped the current distribution of amphibians and created opportunities for their radiations. These major breakthroughs are reflected in new proposals for amphibian classification at the genus and family levels, which, although still partly disputed, reflect evolutionary history better than previous schemes.

These novel developments all concern extant amphibians—a clade named the Lissamphibia that comprises salamanders, frogs, and caecilians. However, back at the roots of amphibian evolution, lissamphibians were just one—eventually very successful—offshoot. A diverse array of early amphibians dominated terrestrial habitats of Earth in the Carboniferous and Permian periods, and paleontologists have in recent years compiled extensive new data on these first vertebrate conquerors of land. *The Rise of Amphibians: 365 Million Years of Evolution*, by Robert Carroll, aims to bridge the gap between paleontological and neontological advances in amphibian research and invites the reader to join a fascinating voyage of discovery into the early origins and more recent evolution of these animals.

The book starts deep—very deep—in the past. The first of 14 chapters reviews the early history of Earth and the origins of life. The second chapter, on the ancestry of vertebrates, exemplifies one major strength of the book: Although Carroll's main expertise and research are on the paleontology of vertebrates, he admirably integrates evidence from other disciplines, as in the case of early metazoan and vertebrate evolution. The result is a detailed overview of the importance of *Hox* gene duplication for vertebrate evolution. Evidence from evolutionary developmental biology is also an excellent complement in following chapters (e.g., in the discussion of the genetic bases of changes in the locomotion system).

The third chapter starts with an overview of the transition of sarcopterygian fishes to the first Devonian amphibians. This is one of the chapters in which the recent advances in knowledge, from both fossils and molecules, are most obvious. It was only a few years ago that we witnessed fierce discussions about whether, among extant taxa, the coelacanth or the lungfishes are the closest relatives of tetrapods, and complained about missing links in the transition from aquatic to terrestrial vertebrates. Carroll's tree summarizes the current consensus. Lungfishes are closer than the extant actinistian coelacanth *Latimeria* to tetrapods as indicated by molecules, but the extinct rhipidistian coelacanths, such as *Eusthenopteron*, are the last



aquatic taxa splitting off the branch that further includes *Pandrichthys* and the spectacular, recently discovered *Tiktaalik*. This is of course the branch that led to the first creatures that can be considered amphibians—the probably largely aquatic *Acanthostega* and the more terrestrial *Ichthyostega*. Missing links? Yes, they exist: Fossils are scant that would link the first Devonian amphibians with the diverse faunas recovered from the upper Carboniferous, and the Paleozoic radiations with lissamphibians. But it is exciting to realize that the transition from water to land, from "fishes" to amphibians, is now well documented by many no-longer-missing links.

Chapters 4–6, devoted to the wealth of Carboniferous and Permian amphibians, are the most important; they make up roughly one-third of the book (114 pages). Chapters 7 and 8 look at the escape to and from land; that is, the origins and early evolution of amniotes, and the radiation of largely aquatic stereospondyl amphibians in the Triassic. Being myself mainly interested in recent amphibians, I found these chapters stimulating because of their valuable discussion of the importance of extinction in understanding the biogeography and morphological evolution of amphibians. Today, many basal amphibian lineages are species poor and range restricted, indicating they may be but weak shadows

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