

books are not limited to those of the geographer." This short text (64 pages) is packed with facts about the Galápagos Islands: location, volcanic origin, currents, weather, discovery and settlement, Darwin's voyage, origin of the plant and animal life, sea life, and man and the Galápagos today.

The history of the Galápagos Islands is well done, covering the buccaneers, the whalers, the early settlers, and the importance of the visit by young Charles Darwin.

The sections on the life on land and in the sea cover food webs, speciation, niches, and island ecology. This is a big undertaking, but the examples are good. There is an informative chapter on how the different animals and plants may have arrived on the Islands.

Scattered throughout the text are questions which the reader is supposed to answer with newly acquired knowledge from the text, through deduction, or by using a reference such as an atlas. This makes the book seem like a "school book." The drawings add

to the text, but some use very small print or are complicated.

The book has a major weakness in that it lacks a definitive focus. The text tries to cover a large scope in very few pages. It tries to be all things to all readers. The last chapter attempts to discuss man's impact on the Galápagos today. As a summary chapter, it is not adequate, lacking in depth. The book needs an effective summation, but instead ends with a fizzle.

However, the book does not talk down to teenagers and it is a serious effort. It would be appropriate in a science, social studies, or history class. It would be a good resource book for "across the curriculum" projects and classroom or school libraries. It would not be the best choice if it were the only source of information on the Galápagos Islands, but this book would be a good addition to a collection of books about the Islands or about geography. **Gay Ver Steeg, Route 4, Porterville, California 93257, USA.**

REVIEW: GALAPAGOS: DISCOVERY ON DARWIN'S ISLANDS

Authored By: David W. Steadman and Steven Zousmer

Artwork By: Lee M. Steadman

Published 1988, 208 pages, 74 figures, 51 color plates, 2 appendices, and bibliography, US - \$24.95. Smithsonian Institution, Washington, D.C./London.

Reviewed By: Robert I. Bowman

This new "coffee-table" volume, in 8.5 x 11.0 inch format, is a gem! It conveys to the reader in photographs, paintings, and prose, the enchanted feeling of these isles of evolution. This end was achieved through the cooperative efforts of David W. Steadman, a scientist with a "well-honed professional instinct;" Steven Zousmer, a professional writer with two "prestigious film projects" about the Galápagos under his belt; and Lee M. Steadman, a promising young artist whose full-page, lifelike watercolors, depicting all native vertebrate groups (except fishes), are spread lavishly over half the pages of this book.

This ambitious publishing venture begins with a 4-page color spread of dramatic Galápagos photos, followed by a title page, table of contents, 4 more pages of color photos, a page of explanatory remarks

about the writing of this book, a 2-page listing of the color plates, a charming 3-page foreword by S. Dillon Ripley—Secretary Emeritus of the Smithsonian Institution and a longtime champion of Galápagos conservation and founding member of the Charles Darwin Foundation for the Galápagos Islands—who recounts his first visit to the Galápagos in 1937, and finally 1.5 pages of acknowledgments. The succeeding pages, forming the bulk of the book, are divided into two parts. Part I is composed of five chapters cooperatively penned by David Steadman and Steven Zousmer. Part II is devoted to the watercolor paintings of Lee Steadman, with accompanying descriptions of habitats, behaviors, and evolution by David Steadman.

Part I begins with the story of David Steadman's

encounter with the introduced black rat on Isla Pinzón, the impact of this and other exotic animals on the endemic biota, the significance of isolation in the arrival of colonizing propagules in the Galápagos, and the historical breaching of the isolation by man. The chapter concludes with a statement of his research objective in the Galápagos, which was to trace evolutionary histories of contemporary endemic species using a prodigious number of fossils he excavated in the Galápagos.

In Chapter 2, titled "Colonizers," the authors review the now-debunked theories on the origin of the Islands, principal means of transport of terrestrial Galápagos colonists, pointing out that colonization is a function of time, distance to be covered, size of the target area, and suitability of the ancestral propagules for chance long-distance travel and for establishment on foreign terrain. Steadman agrees with the generally held view, based on paleomagnetic datings of lavas and biochemical analysis of animal proteins, that the Islands are only a few million years old and that the ancestors of most resident species of reptiles, birds, and mammals arrived less than one million years ago.

In Chapter 3, titled "At Last Gleams of Light Have Come . . .," there is a recounting of the historical facts leading up to the publication of Darwin's *Origin*. The authors set to rest the erroneous idea that Darwin was converted to an evolutionary perspective of living things during his 6-week stint in the Galápagos in 1835. Rather, as the recent historical findings of the distinguished Darwin scholar Frank Sulloway have shown, Darwin's conversion to an evolutionary theory of life took place in the second week of March in 1837, after hearing from the experienced British ornithologist John Gould, who examined Darwin's Galápagos specimens, that all except one of the land birds were peculiar to the Galápagos and that different species of mockingbirds lived on different Islands. It was this identification of the mockingbirds which Darwin had previously said would "undermine the stability of Species."

In Chapter 4, titled "Beneath the Surface," we come to the heart of the material of Steadman's research in the Galápagos, namely, species extinction as evidenced by the fossil record. We learn about the treasure-house of fossilized vertebrate remains that

he uncovered in lava tubes on five major Islands. The fossil evidence indicated that some species became extinct suddenly, recently, and all at about the same time, such as on Isla Floreana. This he correlates with the history of human colonization beginning in 1832, and the introduction of domesticated animals, many of which became feral and destroyed the habitat of such species as the Large-billed Ground Finch, or preyed directly upon it and the mockingbirds, thus leading to their extinction.

Relying once again on the research of Sulloway, Steadman reviews the tangled history of labeling and identifying the Island sources of the finches collected by Darwin in the Galápagos, which explains why Darwin, the serious scientist, was unable to use his finches as evidence of evolution through natural selection in his writing of the *Origin*.

In the concluding chapter of Part I, titled "On Friends and Enemies of Species," Steadman deals with the vulnerability of insular species to the destructive influences of man, both direct and indirect. The lack of fear of humans (i.e., tameness toward man) of Galápagos animals has led him to remark that "Galápagos creatures have *forgotten* fear." This notion is partly in error. Darwin was careful to point out that the lack of fear of man on oceanic islands is not related to any fear reaction that they show towards other enemies in their environment with which they evolved. For example, the finches, although tame by human standards, show mobbing responses toward their Galápagos predators (hawks, owls, and snakes) just as continental species do to similar predators. The native birds were especially vulnerable to man as a newcomer whose destructive habits were unknown to the finches. The fact that man is a relative newcomer to the Islands, whose destructive habits were foreign to the finches, made insular residents vulnerable to attack by him, because of their tameness toward him. Similarly, feral dogs and cats did not initially elicit evasive reactions in the native terrestrial vertebrates.

Although conservation of natural resources has never been a top priority of man in any culture, the Galápagos today may be an exception. Even though there has been significant damage by man, "by comparison with other islands, the state of nature in the Galápagos is healthy and as promising as it can be

in a dangerous world.” This optimistic state of affairs is credited to the conservation efforts of the Government of Ecuador as early as 1935, and more recently to its joint efforts with the Charles Darwin Research Station. Quite properly and deservedly, the authors give high praise to the leadership role of the Galápagos National Park Service as exemplified by its recently retired Superintendent, Miguel Cifuentes.

In concluding this chapter, the authors make a case for the reintroduction of tortoises and land iguanas to Isla Rábida where they once were known to occur (based on Steadman’s fossil finds) and thereby restoring the Island’s ecosystem to a more natural state by including large herbivores that once lived there. Despite this suggested intervention, it is Steadman’s philosophy that conservation “must concentrate on what is rather than what was: the Galápagos remains comparatively unspoiled and we should apply our energies to keeping it that way.”

A few criticisms of Steadman’s evolutionary commentary are in order. On page 42 he states that “Largely because of Darwin’s visit, many scientists have regarded Galápagos as hallowed ground supporting species so distinct that their evolution would never be grasped. I disagree . . .” The author seems to have erected a “straw dummy” because he fails to state who these persons are or to put some of the early opinions into a framework that speaks to the limitations of the intellectual perspectives of the times. Certainly, within the past two decades, biologists have been searching for clues to ancestries of Galápagos vertebrates through new analytical techniques involving morphology, genetics, biochemistry, and behavior. To be sure, for modern scientists, the Galápagos is “hallowed ground” in the sense that they are honored because of their physical beauty, as revealed by the relative simplicity of the patterns of diversity displayed by the endemic plants and animals, as well as by the geological constructions, a situation which makes them so attractive for evolutionary studies, as first recognized by Darwin!

The senior author, presumably, has implied that, in the past, scientists have devoted little attention to the relationships between Galápagos and mainland species, being more concerned with the divergences seen among the endemic insular forms. While this is not true of the focus of all past evolutionary studies,

it was prompted by the fact that knowledge of the structure, distribution, and relationships of mainland species was rather poorly known, and therefore links between them and their possible Galápagos derivatives were difficult to discern. Caution was considered to be a scientific virtue. Today, the objective tools for assessment of relationships have brought about a radical change in the evolutionary biologist’s *modus operandi*. Confusing “look-alikes,” resulting from superficial evolutionary convergences in such structures as beaks and plumages of birds, have often led ornithologists down the path of incorrect phylogenetic interpretations. Indeed, David Steadman himself would seem to have fallen victim of this “convergence hazard” by suggesting that the mainland Blue-faced Grassquit (*Volatinia jacarina*) is the living direct ancestor of Darwin’s finches. Recently, Baptista and Train (1988, *Auk* 104:663-671) have concluded from their detailed analyses of 10 behavioral character states of Darwin’s finches and the grassquit, that “the bulk of the available evidence does not support Steadman’s identification of *Volatinia* as the congener and direct ancestor of geospizines.” Ongoing biochemical analysis of proteins also gives support to this conclusion.

Part II of the volume is devoted to the watercolor paintings of Lee M. Steadman, with accompanying descriptions of the habitats, behaviors, and evolution of the subjects illustrated by David Steadman. This gallery of plates depicting all resident mammalians, reptilians, and the avian groups is presented as “the first comprehensive ‘fieldguide’ to Galápagos wildlife.” Considering the fact that none of the fully aquatic vertebrates—fishes—is illustrated, and the page size is 8.5 x 11.0 inches, one wonders why this 2.5-pound volume is so incorrectly portrayed by the publisher! Nevertheless, the watercolor paintings are a truly novel and beautiful complement to the textual and photographic materials in Part I.

David Steadman introduces this portfolio of paintings as “both art and science,” and the artist, Lee Steadman, in a four-page essay, describes his methodology and philosophy of Nature.

Some of this reviewer’s impressions of the paintings are prompted by his experience in working with his wife who has also used the watercolor medium to illustrate a children’s book about the

Galápagos. Firstly, as the artist correctly states, "watercolor is such an unforgiving medium" requiring considerable skill to do things correctly the first time. Secondly, there is the matter of deciding how much detail one should include in order to project scientific accuracy of the subject matter. Thirdly, how well does the finished painting radiate the qualities of a vibrant Nature? If one judges Steadman's paintings by these perspectives, it is clear that his work is stylistically uneven. For example, the eyes of his subjects often lack the sparkle typical of the living animal, as in the case of the Red-footed Booby and Flightless Cormorant, with the latter showing none of the turquoise green so typical of the adults of the species. Regarding scientific accuracy and detail, the tortoise painting fails to show the otherwise conspicuous toenails on the feet or the leathery texture with scales on the neck (plates 1 and 42). The scaly skin of the marine iguana (plate 5) is not well shown, although this feature is handled somewhat more skillfully in the land iguana painting (plate 4). Among the most artful and scientifically pleasing paintings are the Waved Albatross (plate 12), with its excellent rendition of feather detail on the flanks, and the pale yellow wash on the neck and head, and the realistic texture of the water-worn lava on Isla Española. Plate 18 of the Brown Pelican and Brown Noddy shows an interesting behavioral interaction between these species, along with realistic colors and details. The Swallow-tailed Gull (plate 26) is outstanding for the realistic posture of the adult and fledgling birds and for the realistic colors and feather detail.

In general, there seems to be a problem with consistent handling of the light source and with concomitant highlights and shadows, as in the Paint-billed Crake (plate 33), bats (plate 7), Barn Owl (plate 39), and Oystercatcher/Lava Gull (plate 25). The lack of lifelike qualities seems most apparent in the finch plates 49 and 51, and the Black Rail plate 32. Poor composition distracts from the esthetic quality of the penguin (plate 11), the Audubon's Shearwater (plate 14), the stilt and pintail (plate 34), the flamingo (plate 35), the hawk (plate 36), the

Galápagos and San Cristóbal Vermilion Flycatchers (plates 41 and 42), and finch (plate 51). The vegetation and backgrounds are rather poorly executed, especially in the penguin, crake, and dove plates (numbers 11, 33, and 37, respectively).

Not to be overlooked are the elaborate captions to the color plates, with their wealth of intriguing information (much of it speculative) about the origin of many Galápagos vertebrates. Many comments excite one's curiosity because they open up new lines of thinking about ancestral relationships of classical Galápagos species.

Two appendices containing English and Spanish names of the Galápagos Islands, and lists of resident species of reptiles, birds, and mammals with their common and scientific names, are followed by a two-page list of references to a variety of popular and scientific publications on the natural history of Galápagos and related topics. The book closes with a one-page list of picture credits. The endpapers have a simplified map of the Galápagos with English and Spanish names applied to the Islands (except for Culpepper and Wenman).

Overall, this is an impressive volume, written in free-flowing literary style, which brings a fresh approach to a general natural history of terrestrial vertebrates of Galápagos. As a paleontologist, knowledgeable about his science, with a broad base of field experience in the Galápagos and other oceanic islands of the Pacific, David Steadman has both unearthed and illuminated fossil evidences of vertebrates which have given new temporal and evolutionary dimensions to our understanding of such important problems as biological extinction and conservation of insular biotas. Although intended for a general audience, this book has much to offer both amateur and professional naturalists. It will stand as one of the more enduring of the many glamorous natural history books about the Galápagos to have appeared in the last two decades. **Robert I. Bowman, Department of Biological Sciences, San Francisco State University, San Francisco, California 94132, USA.**