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BOOK REVIEWS

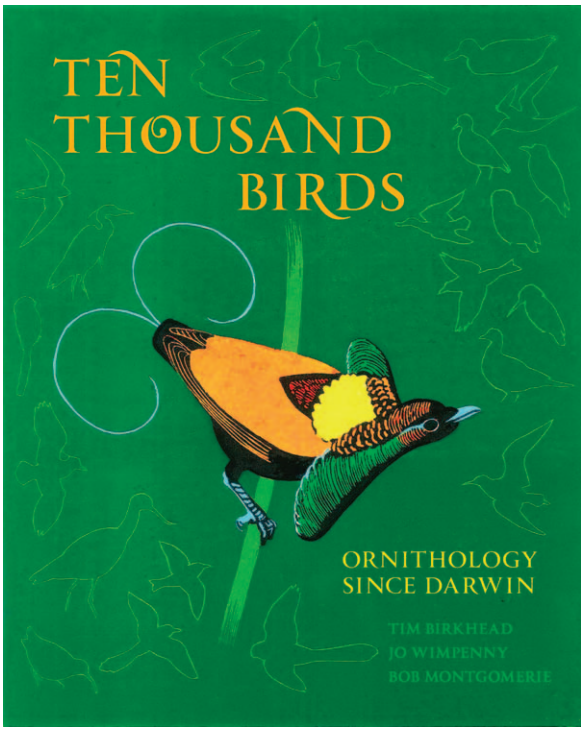
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Ten Thousand Birds: Ornithology Since Darwin by Tim Birkhead, Jo Wimpenny, and Bob Montgomerie. 2014. Princeton University Press. Princeton, New Jersey. 544 pages, color photographs, color illustrations. $45 (hardcover). ISBN 978-0-691-15197-7.

Well-researched and entertaining, *Ten Thousand Birds* describes the history of ornithology from the mid-nineteenth century, when Darwin's (1859) *On the Origin of Species* was published, to the present. This period witnessed the transformation of ornithology from a descriptive field dominated by studies of museum specimens that focused on the anatomy and classification of birds to a mature, rigorous discipline that has made substantial contributions to our understanding of general biological principles.



The authors aim to identify research areas in ornithology from the last century and a half that have advanced scientific understanding and transformed biology. Where would one begin such a herculean effort? To decide on the book's scope, the authors used citation reports from Web of Science to create a database of 325 prominent ornithologists since the 1960s. They also surveyed 31 senior ornithologists whose research foci span the breadth of ornithology and asked them to name the most influential ornithologists and books written by ornithologists since Darwin. David Lack was most identified with 30 votes, followed by Ernst Mayr (23), and Niko Tinbergen (21). The three most influential books were written by Lack: *Ecological Adaptations for Breeding in Birds* (1968), *The Natural Regulation of Animal Numbers* (1954), and *Population Studies of Birds* (1966).

From this starting point, 11 topics in ornithology that have broad importance for biology or that changed the course of ornithology emerged. These topics include the evolution of birds, feathers, and flight; speciation; systematics; migration; ecological adaptations for breeding (clutch size and timing of breeding); annual cycles, biological clocks, and hormones; ethology; behavioral ecology; sexual selection; population biology; and conservation. One chapter is devoted to each topic, and each chapter ends with a coda that summarizes the historical significance and recent developments in the field. In some cases, the authors describe gaps in current knowledge that warrant further investigation. For example, in the chapter on sexual selection, they assert that a critical reassessment of the benefits of precopulatory female choice and of extra pair copulations is needed.

The selected topics represent an excellent compilation of ornithological research that has widespread biological importance. Most chapters are reasonably comprehensive, but I found the chapter on conservation (Chapter 11, Tomorrow's Birds) mildly disappointing. The chapter covers extinctions, the plume trade, captive breeding, and politics, and dedicates many pages to describing the harmful effects of toxic chemicals such as DDT, dieldrin, and diclofenac. However, habitat fragmentation, edge effects, and climate change were largely ignored, and there was little mention of the impact of feral cats. Also absent was any discussion of the "rediscovery" of the Ivory-billed Woodpecker.

But this treatise is not just a history of our discipline or a summary of ornithological discoveries—*Ten Thousand Birds* is a story about people. The authors use biographies, interviews, and written correspondence to explore the personalities, strengths, weaknesses, and ambitions of these pillars of ornithology. The book's emphasis on people is perhaps best illustrated by the autobiographies at the end

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of each chapter. In addition to highlighting the personal stories of leading researchers, these short autobiographies show remarkable commonalities. Most researchers reflect on their early interest in birds or nature, and several mention the expectation that they would pursue a career in medicine. Nearly all describe the importance of mentors, and many cite their good fortune. These autobiographies largely omit the importance of hard work, but several emphasize the importance of asking good questions. They also reveal modesty and gratitude and a deep-seated excitement for understanding nature that these researchers continue to harbor. Some are touching and inspirational.

Following the topic-based chapters, the Afterword describes how ornithology has progressed as a discipline since the mid-19th century and examines its development into a mature science with a focus on hypothesis-driven research and experimentation. The authors attribute the rise of ornithology to four factors: people, education, funding, and technology, in this order. While the book admirably selects and discusses the most influential topics in ornithology, I think the authors could have aimed higher in the Afterword. To their credit, they painstakingly researched each topic and its major contributors, and from this close examination they extract some general observations from our discipline's history. For example, they attempt to identify the traits that make a great scientist. They note that Darwin attributed his own success to a love of natural science, a desire to explain observed phenomena, and open-mindedness. To this list, the authors add hard work and mentors. They also correctly cite the importance of technological advances (e.g., comparative methods, cladistics, molecular genetics, GPS/GIS, and cameras) in some disciplines. And in various chapters, they describe or allude to barriers in communication. A divide existed between poultry researchers and academics, with several discoveries from the poultry industry (e.g., female reproductive physiology and egg shell thinning) remaining unknown in academic circles. Other divisions sometimes arose between European and American scientists and between opposing sides of a controversy. Some divides might still exist. Except for recent discoveries of fossils pointing to the origin of birds, few scientists from Asia were mentioned in this book, perhaps reflecting persistent language barriers.

The authors' efforts and insights are laudable, but such a detailed history of ornithology could have been embedded in a larger framework to examine generally how sciences advance. Since Darwin, ornithology as a discipline evolved and became less species-oriented and more question-oriented. Scientific rigor increased, quantification and statistics improved, and descriptive studies were replaced with experimental tests of hypotheses. The discipline changed, but what about the people? Did individual ornithologists change positions in response to new data or novel ideas? Or did our discipline advance primarily with the passing and replacement of the older generation? The authors describe how Vero Wynne-Edwards' seemingly maniacal zeal for group selection driving population regulation caused him to interpret mistakenly most data as evidence of his ideas, and how Alexander Skutch's philosophical leanings swayed his interpretations of behavior. The authors note that many of Lack's ideas (e.g., regulation of populations by density-dependent mortality) were often intuitive, and that he argued for them without much evidence. Hostile reactions to inclusive fitness in the early 1970s may have been based largely on conservatism. Examining the extent to which scientists incorporate new information and abandon ideas would have been difficult but tractable given the research needed to complete the book. A detailed examination of the ongoing birds-as-dinosaurs (BAD) and birds-are-not-dinosaurs (BAND) controversy might have been especially insightful.

In addition, exploring the extent to which advances in ornithology have been limited by ideas or by data would have been an important contribution. Has ornithology historically needed better models to explain existing observations or has it needed better tests of existing theory? For example, despite some experimental evidence refuting Lack's hypothesis that clutch size is limited by the ability of parents to feed young, ornithologists continued to accept it, perhaps because there was no competing hypothesis that could explain smaller clutch sizes. Examining ornithology as a case study for how sciences advance, whether individuals abandon old hypotheses for new ones, and what limits scientific progress would have made a truly exceptional book. Even without this broader context, this book is impressive.

Ten Thousand Birds highlights the major scientific advances in ornithology since Darwin and brings to life the scientists who made these discoveries. The selection of topics is superb. Well-researched, clearly written, and nicely illustrated, this book is enjoyable to read and would make a wonderful addition to personal and institutional libraries alike.

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