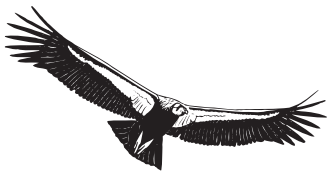

# BOOK REVIEWS

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**Bird Migration and Global Change**.—George W. Cox. 2010. Island Press, Washington, D.C. 304 pp. ISBN-13: 978-1-59726-688-8. $45.00 (paperback).

Chronicling the arrival and departure of migrating birds has provided a wealth of phenological data for more than two centuries. The reasons for such record-keeping have moved from agricultural concerns, with arrivals of certain species a signal that planting crops is safe, to a general interest in natural history to current efforts to monitor global climate change. Bird migration is rivaled only by data on leaf-out and flowering for their scope and power in serving as signals of changing climate.

Much research on changes in the timing of migration has the goal of finding signals of climate change. Less emphasis has been given to predicting the effect of climate change on migratory birds. A wealth of ornithological papers has been published over the past two decades, mostly focusing on spring arrival dates and how they have changed over time. Spring arrival dates (the first record for a species that season) are easier to compile than fall departure dates, for which continuous records must be kept to determine the last occurrence of a species.

Papers based on spring arrival dates have provided mixed results. Some studies show contemporary arrival dates nearly universally earlier than arrival dates in previous decades, whereas other studies indicate earlier contemporary arrival of relatively few species. All of us who pursue this avenue of research must be opportunistic in using data from earlier time periods and adapting those data for purposes not originally intended. Thus biases such as increased observer effort, better identification skills, and changing population sizes in modern times may yield earlier apparent arrival dates that do not reflect actual changes in the timing of migration.

Monitoring the earliest points in a distribution rather than the median or mean arrival date introduces another potential bias. Banding stations where effort is quantified and all individuals are considered might be expected to provide more compelling data on the effect of climate change on migration schedules. Even here, however, results are mixed.

George Cox has two goals for his fine book, *Bird Migration and Global Change*. First, he thoroughly reviews data on changes in migration in relation to climate change. Second, he considers possible effects of climate change on migratory birds, offering his insight into both the ecological and evolutionary changes we might expect as our globe continues to warm.

Cox begins by surveying all birds of the world and identifying species that are migratory. This task is not a simple one because some species are migratory in parts of their range and, even within a particular area, partially migratory in others, in which only some of the individuals depart for the winter. Altitudinal migration is probably more frequent than we know in poorly studied tropical areas. Using an appropriately liberal definition of migration, Cox finds that 2600 of the 9930 birds surveyed are migratory, representing 141 of 204 families. His percentage of migratory species is higher than the 19% that BirdLife International published in 2008.

Cox then devotes three chapters to the climate changes reported to date and those expected in the future. Broad-scale climate cycles that might be affected by global climate change are treated in these chapters. The El Niño–Southern Oscillation cycle is widely known, but the North Atlantic Oscillation and the Pacific Decadal Oscillation, which are less well known, are well described by the author. All of these cycles affect migration of some bird species. I found Chapter 3 particularly interesting. In it Cox compares predicted climate-change scenarios for different parts of the world and considers the effect of climate change on freshwater and marine environments as well as continents.

The bulk of the book is a review of the burgeoning literature on changing bird migration as a function of climate change. The author arranges this review partly geographically and partly taxonomically. He devotes chapters to short-distance migrants in the Northern Hemisphere, nearctic–neotropical long-distance migrants, palearctic long-distance migrants, landbirds of the temperate Southern Hemisphere, tropical landbirds, raptors, shorebirds, waterfowl and other waterbirds, North Atlantic oceanic birds, North Pacific oceanic birds, and Southern Hemisphere oceanic birds. To my knowledge, this survey is the first to assimilate all of the literature for such diverse assemblages of birds. One great value is pointing out the dearth of information we have for the migration schedule and destinations of some migratory birds in some areas; South Africa and South America are two examples of such under-studied areas. In other words, austral migrants remain poorly known relative to their northern counterparts.

Cox continues with two chapters on the adaptability of birds to climate change. One considers landbirds, the other waterbirds. The rapidity (30 years) with which some Blackcaps (*Sylvia atricapilla*) switched from wintering in Iberia and northern Africa to the British Isles gives reason for hope. On the other hand, one must be dismayed by the failure of Pied Flycatchers (*Ficedula hypoleuca*) in central Spain to advance their spring arrival on the breeding grounds from 1984 to 2001, even though local phenology of resources had advanced by about 8 days. The abundance of insect food peaked earlier, so nestlings' peak demand for food was mismatched with availability of the resource. As a consequence, breeding success diminished significantly, most substantially when the spring was warm and insect abundance peaked earlier.

We regard migrants' spring arrival on the breeding ground to be set by stabilizing selection. The urge to procure a good territory or find a mate selects for early arrival, while lower food abundance earlier in the season selects for a later arrival. Climate change is predicted to select against later arrival. Will birds be able to respond effectively given the pace of climate change? Cox considers this question in the penultimate chapter of his book.

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The final chapter, *Conservation in the Era of Global Change*, argues that a two-pronged approach will be a key strategy for conservation. These prongs are monitoring the ecological and evolutionary responses of migratory birds to the changing climate and devising international plans for habitat protection that have the necessary flexibility to keep abreast of changing environments.

The book is well organized and the prose is clear, although particularly in the chapters detailing documented changes in migration as a function of climate change, the text is dense and occasionally tedious. The level of the text is about the level of an article in a major ornithological journal. Portions of the final chapter in which the author describes in detail how a Breeding Bird Survey is conducted seem unnecessary, particularly when he often cites BBS data in the review of responses of various bird groups to climate change earlier in the book.

My major complaint about the book is its lack of citations in the text of the chapters. As an active researcher on the effect of climate change on landbird migration, I could identify the source for most of the statements Cox summarized in those chapters, but a nonspecialist or student would not be able to do so. For each chapter, 10 to 15 key references are given, but those are a small subset of the literature that Cox reviewed. The lack of full referencing diminishes the book's utility.

While I fully endorse Cox's goal of assessing the ability of migratory birds to respond to global climate change, I had some initial difficulty in making the connection between his early chapters on changing climate with the many chapters on the responses of migratory birds to those changes. My confusion stemmed from climate changes being challenges not only to migratory birds but to all birds, indeed to all organisms.

The argument is sometimes advanced that migratory birds are at a more significant risk than nonmigratory species because the former depend on different habitats for nesting, for wintering, and for migration. But as Cox shows, migratory species may be safer than nonmigratory species. He used the 2008 IUCN Red List to compare migrants and nonmigrants. Using the three Red List categories with highest risk (critically endangered, endangered, and vulnerable), he found that 12.0% of all migratory species are at risk compared to 23.8% of nonmigratory species. Some migratory species are at much higher risk; according to these criteria, about a third of all seabirds are at risk. The greater vagility of migratory species may allow them to adapt more rapidly than nonmigratory species.

Cox has written a valuable overview of our present knowledge of the effect of global climate change on migratory birds. The book is timely and informative and will be a valuable resource for field ornithologists, wildlife managers, and environmental scientists.—W. HERBERT WILSON, JR., Department of Biology, Colby College, Waterville, ME 04901. E-mail: whwilson@colby.edu.

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