Living on the Edge: Wetlands and Birds in a Changing Sahel

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Source: The Condor, 114(2) : 430-432

Published By: American Ornithological Society

URL: https://doi.org/10.1525/cond.2012.114.2.430

BOOK REVIEWS

The Condor 114(2):430–432

Living on the Edge: Wetlands and Birds in a Changing Sahel.—L. Zwarts, R. Bijlsma, J. van der Kamp, and E. Wymenga. 2009. KNNV Publishing, Zeist, Netherlands. 564 pp. ISBN 978-90-5011-280-2. € 64.95 (hardcover).

Living on the Edge by Leo Zwarts, Rob Bijlsma, Jan van der Kamp, and Eddy Wymenga is a very important book describing what we know about the winter ecology of the one third of European breeding species that winter or stage in the Sahel region of Africa. As the quality of the environment changes and human populations soar, so populations of migratory birds are plummeting. *Living on the Edge* details why this is happening, both generally and for specific species.

There are few areas of ornithology where you could become an expert by reading a single book, but the winter ecology of Afro-Palearctic migrants, described in this book, is one of them. This is a testament both to just how little basic ornithological research has been carried out on the winter grounds of those African species that migrate to breed within Europe each year and to the detail, depth, and precision of this book. This scientific worth and detail are all disguised within one of the most readable and beautifully presented technical books that I have ever seen. It just doesn't look like a proper scholarly scientific work. Instead, it looks like a coffee-table book of some birder's travels in Africa. Every page is covered with brilliant, informative, and artistic bird photography; graphs, maps, and other figures are small works of art, and there are many beautiful paintings and drawings. The text is also written fluidly and from a personal perspective, with points often illustrated with interesting anecdotes. You are completely drawn in to the problem and the region's birds without realizing that this is a profoundly serious scientific book. I think this approach is masterly. It is not sufficient to discover the reasons for the problems with migratory birds breeding in Europe and wintering in Africa; these reasons need to be communicated. And, perhaps most important, people then have to care enough to do something about it. Why we should care is communicated on every single page. You cannot fail to both be informed and motivated by this book.

Living on the Edge is very timely. In my lifetime I have watched species such as the Spotted Flycatcher (*Muscicapa striata*) and the Turtle Dove (*Streptopelia turtur*) decline from being common sights and sounds of the British summer to unusual species with restricted ranges. Recent studies (for example, Sanderson et al. 2006) have identified that European migrants wintering in Africa are almost universally declining, some, particularly of western Europe, declining by more than 80% over the last 30 years. Resident birds, in contrast, are not declining, or not to the same degree (Berthold et al. 1998), demonstrating clearly that causes relate to either sites where migrants stage or their winter range in Africa. These data suggest that there must be general reasons linking population declines of most migrants in addition to species-specific reasons. This book deals with the generalities first, then with specific habitats and areas, and finally treats a variety of species individually.

Living on the Edge starts with the biggest issue in the Sahel—its rainfall, a central theme of the whole book. The Sahel is a classic example of a region whose fundamental ecology is determined by a single abiotic factor. Everywhere you go in the Sahel you are confronted with the consequences of both intra- and inter-annual variation in rainfall. Much of what we understand about population declines of Palearctic migrants is based on correlations between rainfall patterns in the Sahel (or proxies for these) and European breeding populations. Many papers demonstrate, for example, that overwinter survival and subsequent breeding populations are dependent on the level of rainfall in the Sahel. For example, if there is good rainfall during a winter in West Africa then lots of Sedge Warblers (*Acrocephalus schoenobaenus*) return to Europe the following spring (Peach et al. 1991). It is easy for European researchers to examine such correlations, as no field work in Africa is necessary. Ultimately, however, we cannot answer the question of how reduced rainfall leads to lower populations without studying the birds' detailed autecology within Africa. Nevertheless, rainfall is crucial, and, as a starting point, the authors of *Living on the Edge* discuss the dynamic pattern of rainfall in detail before they move into discussions of the ecology of the Sahel and its migratory birds.

The book then follows the logical progression from rainfall to vegetation, desertification, and land use, describing a classic case study of how abiotic effects are substantially modified by biotic effects. Where in the past this factor may have been tens of thousands of large mammalian herbivores (remaining in only a few places), today it is humans and their livestock that dominate the vegetation and hydrology of the area. In addition to the amount of rainfall, its variability and collection in wetlands is crucial. Much of the book's initial focus is on the wetlands of the Sahel, which act to concentrate Palearctic migrants in the winter, and, of course, the anthropogenic effects on these wetlands. There are separate chapters on the Inner Niger Delta, the Senegal Delta, the Hadejia–Nguru floodplains, the Lake Chad Basin, and the Sudd. Each is a compelling descriptive account of the area as a habitat for birds and humans and the anthropogenic effects on the habitat. There are detailed quantitative data on bird counts through time (some in perhaps too raw a form) and the reasons for their change. There are also details of the priorities for monitoring and research and of any current conservation efforts. Much of this section of the book will serve as a baseline record of the state of these wetlands for the future. Although we are used to long time series of data for sites of ornithological interest in Europe or North America, time and time again it is clear from reading *Living on the Edge* that there is almost nothing of

The Condor, Vol. 114, Number 2, pages 430–433. ISSN 0010-5422, electronic ISSN 1938-5422. DOI: 10.1525/cond.2012.114.2.430

this kind of data for West Africa. Clearly what we see now is a snapshot during a period of very rapid change, and we can only guess at what the Sahel was really like for birds even 40 years ago. At least we have some chance now of properly documenting the change in Sahelian wetlands even if we do little about it. A final chapter in this wetland section details how rice fields might act as substitutes for the wetlands they replace.

The rest of the book (the last two-thirds) consists of chapters covering 27 species. The book could have dealt with up to 84 of the trans-Saharan migrants that commonly winter in the Sahel, but the selective list represents those for which we have any kind of reasonable data. Again we are reminded of how little we actually know about the winter ecology of many common "European" birds, even of those species included. Take the Common Redstart (*Phoenicurus phoenicurus*), for example. This widespread and iconic summer visitor has declined spectacularly in Europe, with some of the decline being linked to rainfall patterns in the Sahel. The chapter on the redstart starts with a survey of range data. We know well where it lives in Europe, but only four banded birds have been recovered in sub-Saharan Africa, all in Senegambia. Yet we know from occasional species lists and sporadic banding that it occurs throughout the Sahel of West Africa wherever there is woody vegetation. These limited data are detailed in the book, but it soon becomes clear that most specific studies are barely more than anecdote, or with conclusions having to be drawn from small-scale studies. Are redstarts site-faithful within and between winters? Do they use separate areas of their winter range to fuel up prior to migration? These types of questions, which ultimately inform us of the degree of resilience that the species might have to large-scale habitat and climate change and so its prospects for the future, are answered as best as possible in the book, but our best current knowledge is very limited.

At least 50% of the 10-page chapter on the redstart details the evidence of its decline in Europe and its links to Sahelian rainfall rather than describing how habitat change in the Sahel itself directly affects overwinter survival and the condition of returning migrants. The reasons for this become clear as the rest of the chapter details that there have only been, being generous, eight studies of the redstart in its wintering range, and nearly all of these deal with the species peripherally, are limited to a single site, or are based on small samples. And this for a species that is iconic in Europe, as much a part of Europeans' quality of life 60 years ago as the Barn Swallow (*Hirundo rustica*) continues to be. In the 1950s, European populations of the redstart were probably 20 times larger than they were in the 2000s. Most monitoring schemes in Europe were started too late to catch the scale of this decline, and although some awareness of the decline has spurred much research in Europe, this has not been matched by efforts in Africa. The driver of this change may be simple. Redstarts like trees in the Sahel, trees are being cut down as human populations increase, and redstart populations may be limited by availability of suitable habitat. Yet it may also not be that simple. The redstart may be ecologically flexible in winter, moving to new areas of habitat easily, and because it occurs at low density is not habitat-limited except perhaps at one crucial bottleneck, such as during the pre-migration period. We just don't know because the studies haven't been done. At the moment we can only document the disappearance of another beautiful part of our daily life during the summer.

The other chapters on individual species are repeats of the format, with generally similar conclusions as for the redstart, although not all species are as poorly studied or have such a pessimistic outlook. Each chapter emphasises the importance of rainfall and population changes in Europe linked to rainfall, but each chapter also provides specific detail. Each species is different, those covered varying from the Gray Heron (*Ardea cinerea*) to the Common Whitethroat (*Sylvia communis*), so that many species-specific problems and potential solutions are highlighted. This all makes a general point that if we are to do anything for a species wintering in the Sahel, there may well be local and species-specific solutions. We cannot change rainfall patterns (at least in a controlled way), but we can, for example, reduce habitat destruction and hunting in key wetlands, or advocate retention of trees within the farmed landscape that may conserve some populations of the Garganey (*Anas querquedula*) and Common Whitethroat, respectively.

The book contains a number of synthesis chapters, one of which examines the Sahel as an area for wintering of Eurasian birds and recaps our knowledge of the concentration of Palearctic migrants in the savannah habitats of Africa, particularly the Sahel, and the relationship between these species' breeding and winter grounds. One interesting chapter, on locusts and grasshoppers, points to the crucial role that these invertebrates play in sustaining very large numbers of wintering species such as the Lesser Kestrel (*Falco naumanni*), Montagu's Harrier (*Circus pygargus*) and Woodchat Shrike (*Lanius senator*) and these birds' role as an ecosystem pest-control service. Two chapters deal superficially with the complexities of migration itself: crossing the Sahara as the major barrier to successful migration for most species and the carry-over effects of migration into the breeding season. Again our lack of knowledge is highlighted. The spatial and temporal scale over which Palearctic migrants need to have intact links of habitat along the chain of their migration is largely unexplored.

One last chapter deals with the effect of the Sahel on Eurasian bird populations. It poses the question: to what extent is the Sahel more important than Europe to the population dynamics of the birds that live in both areas? Populations are being badly stressed in both regions, so this is rather like a competition to find out the lesser of two evils. But if we find that regardless of what is done in Europe populations will still decline because of what happens in the Sahel, clearly we need to refocus on the Sahel, and this is certainly the case for many species. My quality of life in Scotland is directly linked to that of my friends and colleagues in Nigeria, for example, and so we both need to work to study and to conserve these birds throughout their range. The massive declines in bird populations as a consequence of agricultural intensification and habitat destruction in Europe over the last 150 years are being repeated in the Sahel. However, many Palearctic migrants are probably resilient. Some may actually benefit, and there are many sustainable-development solutions that could lead to the retention of good populations of many species. What is clear, however, is that without basic monitoring and research we can do nothing about this. *Living on the Edge* shows us what we know, but most importantly what we don't.

The core message of this book is that Africa matters, although it emphasises how we have largely ignored this fact. As I watch my local summer birds disappearing in my lifetime I can only hope this book prompts research based in Africa and the conservation solutions that might arise. But this aside, *Living on the Edge* is a beautiful scientific account of the European birds that winter in the Sahel that will stand as a record of what we are losing, and perhaps what we have to gain.—WILL CRESSWELL, School of Biology, University of St. Andrews, Bute Building, St. Andrews, Fife KY16 9TS, UK; E-mail: wrlc@st-and.ac.uk.

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The Condor 114(2):432–433

The Flexible Phenotype: A Body-Centred Integration of Ecology, Physiology, and Behavior.—Theunis Piersma and Jan A. van Gils. 2011. Oxford University Press, Oxford, UK. 256 pp. ISBN 978-0-19-959724-6. $52.95 (paperback).

Scientists write books for a variety of reasons, including to garner some freedom from the too often suffocating world of journal editors and peer reviewers, although there are some equally pugnacious book editors. Writing scientific books provides us a chance to summarize science from a personal perspective, to present ideas in a liberating manner, to reach audiences who rarely venture to our favorite scientific journals, and, in the best of cases, to integrate established ideas in creative and unifying ways that provide new insights. Piersma and van Gils have successfully accomplished this in their impressively well-written new book *The Flexible Phenotype*.

These two outstanding Dutch scientists have written a book that champions the perspective and studies of Dutch evolutionary ecologists. As they note in the final chapter of the book, they foster the views that "organisms and their particular environments are inseparable" and "phenotype–environment interactions need to be studied functionally" (p. 174). The authors draw heavily from their own ground-breaking studies of the Red Knot (*Calidris canutus*) and other shorebirds, as well as the original work of Rudi Drent (to whom the book is dedicated), Serge Daan, Nikko Tinbergen, and the many other animal ecologists associated with University of Groningen (the list is long and illustrious). This perspective of animal ecology includes, as the subtitle of the book implies, an integrated view of animal physiology, behavior, and evolution.

Consistent with this Dutch perspective, the vast majority of the original figures in the book were produced in collaboration with Dick Visser, whose creativity, graphic talent, and unique style enhance the value of the work immensely. Any of us who have read even a few of the hundreds of animal ecology papers produced by students and faculty from the University of Groningen can appreciate Dick Visser's stamp on the figures. The ideas described in the text are illustrated regularly and to great effect throughout the book. The figures alone are worth the purchase price.

While we were reviewing the book, a plant ecologist colleague noticed it on our desk and was quite excited by the title since her work addresses the importance of plants' flexible phenotypes given certain genotypes and the evolution of invasiveness. But this is not such a book even though the concept of phenotypic flexibility is so broad. Instead, this is a book mostly about flexible phenotypes of vertebrate animals, about how the behavior, physiology, and morphology of animals respond to environmental variability and predictability. The majority of examples are from birds, especially the Red Knot, but there are enough examples from other critters (barnacles and *Daphnia* to astronauts and cosmonauts) to satisfy many animal ecologists.

The book begins with a brief introductory chapter that describes the main characters (migratory birds, in general, but usually Red Knots), the general perspective of the authors (integrative biologists who view the behavior, physiology, and behavior of organisms within an ecological and life-history context; see their Fig. 1), and the rationale for the authors' choice of content and organization of the book. The next two chapters (Part I) introduce "rules of organismal design," including a basic introduction to animal energetics and nutrition, heat and water balance, and how these relate to functional capacity, spare capacity and symmorphosis, and allometry. These short reviews are well organized and succinct yet often lack discussion of alternative hypotheses and criticisms of some of these basic concepts.

In Parts II and III, the authors explicitly relate the physiology of animals (Part I) to their environment, and both how (proximate) and why (ultimate) this creates limits (metabolic ceilings) to animal performance. These chapters provide good reviews of phenotypic plasticity in morphology and physiology (Chapter 5) as well as behavior (Chapters 6, 7). The authors provide a useful summary of the various types of phenotypic plasticity and a taxonomy of sorts for characterizing how environmental predictability and variability are related to different types of plasticity in physiology, morphology, and behavior. As promised, each of these general concepts is simply but adequately described, and then usually studies of the Red Knot (the "empirical backbone" of the book) are used to illustrate these concepts (exclusively so in Chapter 7). However, Chapters 5 and 6 include examples of how a variety of animals change their morphology and physiology (i.e., their phenotype) during ontogeny, across seasons, during their life-cycle stages, and in direct response to environmental conditions. The book to this point provides the introduction that the authors deem necessary for a more fully integrated view of flexible phenotypes to be understood and appreciated (Part IV).

The last three chapters, which constitute Part IV, provide a review of how studies of the Red Knot have enlightened our understanding of the functional significance of phenotypic flexibility: examples include body-composition change in relation to predation risk and migration strategy in relation to disease risk and investment in the immune system. These studies are impressive in their breadth and depth, although this myopic focus on one species neglects other important work that would enable a more complete consideration of alternative hypotheses in relation to the evidence. The chapter on disease risk and the immune system is full of ideas unrestricted by empirical data and in sore need of testing. Chapter 9 highlights the applied aspects of these types of studies and the important implications of phenotypic flexibility for the conservation of our study species. The final chapter acknowledges the work of others in the development of Piersma and van Gils' perspective on the importance of both genetic and epigenetic inheritance in evolution and the central role of phenotypic variation and the flexible phenotype in how the actors (our beloved animals) are influenced by the theater (the environment) and vice versa.

We always expect from a good book review some complaints or at least an enthusiastic critique, given that