

Where do Palearctic migratory birds overwinter in Africa?

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A new EU-funded project at the Zoological Museum, University of Copenhagen, is trying to establish a publicly accessible database on the geographical distribution of Palearctic migratory birds in Africa to guide conservation decisions.

Bird migration is one of the wonders of nature. The annual migration of millions of birds world-wide has enchanted humans for centuries. Some 200 species breeding in the Palearctic region migrate in numbers of an estimated 3000-5000 millions to their African wintering grounds (Moreau 1972, Curry-Lindahl 1981). Due to the work of scientists in conjunction with information gathered by thousands of bird-watchers and bird-ringers, we know today the principal migratory routes through Europe and the Mediterranean (Alerstam 1990, Berthold 1993). We also understand the flight mechanics (Pennycuik 1989) and the principal physiological regulators of avian migration and orientation (Gwinner 1990, Berthold 1996).

However, we still have a lot to learn about the causes of the significant variation in migration among species, populations, age groups and sexes, i.e. the ecological and evolutionary bases of migration as well as the physiology of migration. The European Science Foundation, supported by science-funding agencies in 13 different countries (including Denmark), has provided significant funds for the programme *Optimality in Bird Migration*. This project uniquely combines the efforts of more than a dozen research groups across Europe (including the Zoological Museum, University of Copenhagen), working on the same set of hypotheses from different angles (for more information, see http://www.esf.org/esf_article.php?language=0&article=92&domain=3&activity=1).

Another area where knowledge is still fragmentary concerns the geographical distribution of Palearctic migrants in Africa. For many species, our knowledge may be as superficial as the statement "occurs in eastern Africa" (Rahbek & Madsen 1999) or the necessarily oversimplified range maps in the otherwise impressive *Birds of Africa* series (Brown et al. 1982, Urban et al. 1986, Fry et al. 1988, Keith et al. 1992, Urban et al. 1997, Fry et al. 2000). For proper scientific analysis, and for conservation management, the spatial resolution is clearly not sufficient.

The need to map the distribution of Palearctic migratory birds in Africa

So far, we know very little about the geographical location of flyways, stop-over sites, and wintering areas, or the seasonal movements between wintering areas. We know even less about where, for example, the Danish populations of various species occur in Africa compared to populations of the same species from other regions in Europe; we are convinced, however, that significant geographical patterns are yet to be revealed.

While we have detailed knowledge about the distribution of migratory birds in Europe (e.g. Cramp 1998), the same detailed information is simply not available for Africa. However, such information is essential for the successful conservation of Palearctic migratory birds which are essentially African *and* European birds. This situation should basically be regarded as unacceptable. We simply need to know where migratory birds overwinter in Africa.

The information that do exist on the distribution of migratory species in Africa is widely scattered, and much is hidden in the "grey literature" or remains to be published. Two organizations have recently put much effort into collecting some of this information and using it to improve conservation decisions. Wetlands International (<http://www.wetlands.agro.nl/>) has organized the annual International Waterfowl Census, has published several wetland inventories, and is working to protect important wetland sites through the Ramsar Convention and other conservation programs. It is working in close association with BirdLife International (<http://www.birdlife.org.uk/>) in the effort to establish a global network of Important Bird Areas (IBAs) which are critical sites for conservation of birds at a global, regional or sub-regional level. Of the African IBAs some have been chosen because of their importance for migratory birds, mainly on the basis of data for non-passerines (e.g. Zalles & Bildstein 2000).

Therefore, as a supplement to these efforts, a new 2-year EU-funded research project at the Zoological Museum, University of Copenhagen, aims to map and analyse the distribution of Palearctic migratory birds in Africa which special emphasis on passerines. The completeness and quality of the database will depend on the information we can obtain from the international ornithological community. Thus, we hope to attract possible collaborators, who may be anybody having some experience in working with birds in Africa. To give interested ornithologists a quick overview, we here briefly describe the history and rationale of the project, list possible data sources, and outline the intended analyses and outcomes.

History and rationale of the project

For the last six years, the Zoological Museum in Copenhagen has accumulated a distributional database on sub-Saharan vertebrates in Africa, containing data on approximately 4000 species of

birds, mammals, snakes and amphibians (Burgess et al. 1997). The database forms the basis for collaborative projects focusing on a vast range of topics within zoogeography, macroecology and conservation (e.g. Burgess et al. 1997, Williams et al. 2000, Balmford et al. 2001, Brooks et al. 2001, Jetz & Rahbek 2001). However, distributions of migratory birds have proved difficult to map because of their wide-ranging movements and the fragmentary information, and thus require an independent research project. Migratory birds pose a problem in the analyses conducted so far because their published ranges overestimate their true distributions (Fig. 1).

The aim of the project presented here is to improve our knowledge of migratory bird distributions in Africa by collecting point-locality data and using computer-based geographical information systems to look into the possibilities of overcoming collection gaps and biases through modelling approaches. The resulting database and the models are expected to be valuable tools in

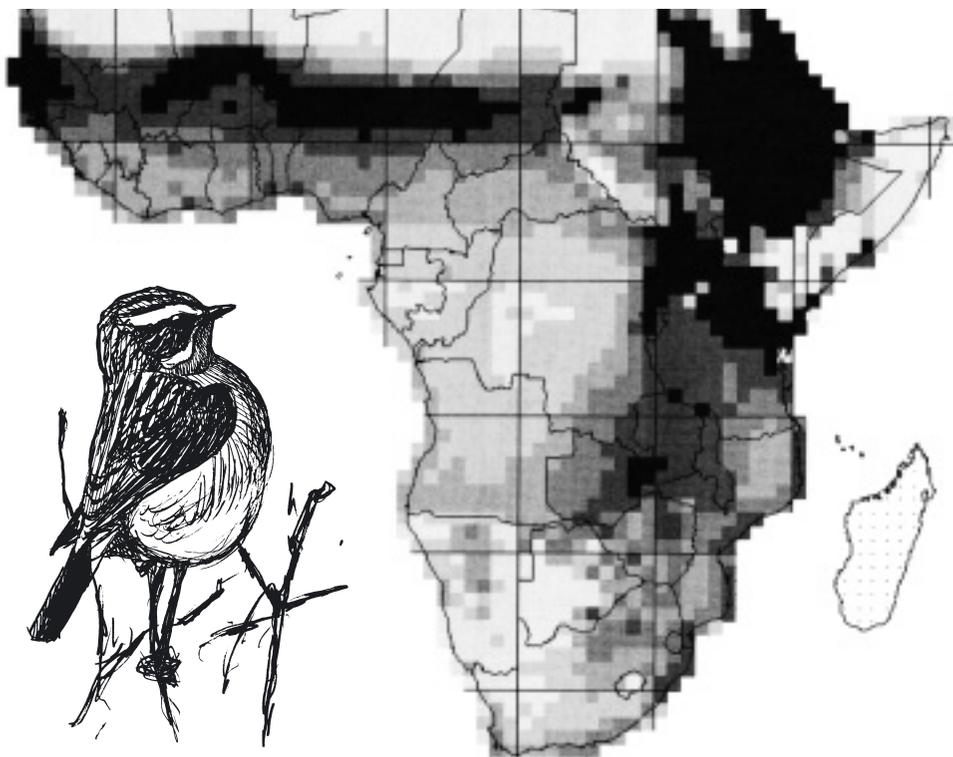


Fig. 1. Species richness of Palearctic migratory birds in sub-Saharan Africa. Darker shades reflect higher species richness. Species richness is probably exaggerated for many areas because published range maps often overestimate true distributions. The figure was generated by use of the program *WorldMap* (Williams 1996).

Artsrigdom af palæarktiske trækfugle i Afrika (jo mørkere skygning, desto højere artsrigdom).

efforts to specify distributions of migratory species more exactly, and as useful guides in informed conservation decisions. In addition, the project will also fill a gap in the ongoing project *A continent-wide blueprint for conservation in Africa*, which aims at assessing conservation priorities for all vertebrates across the African continent (for more information, see <http://www.zmuc.dk/commonweb/research/blueprint-africa.htm>).

Data and distributional analysis

The project will only be feasible if a large number of colleagues are willing to share relevant data with us. We hope to accumulate two types of data, reflecting the two types of analysis we are planning to perform.

Verified data. We intend to dig up as much information from primary sources as possible, starting with such classic references as Hall & Moreau (1970), Moreau (1972), Zink (1975), Snow (1978), Curry-Lindahl (1981), and *The birds of Africa* series (Brown et al. 1982, Urban et al. 1986, Fry et al. 1988, Keith et al. 1992, Urban et al. 1997, Fry et al. 2000). We will also search all standard journals of African ornithology such as the *Bulletin of the African Bird Club*, *Ostrich*, and many others. In addition to relying on published sources, we also hope to be able to compile a vast amount of unpublished data collected by ornithologists working in Africa over the years. We hope to be able to access grey literature and unpublished data through correspondence with collaborators from museums, universities, research institutes, governmental institutions and NGOs world-wide, and with independent experts. We will be thankful for any assistance with hard-to-find references, unpublished reports, contacts or any other information that might help with this project.

Modelled distribution based on verified data. The most precise method for representing geographic distributions is by mapping point-localities. The major drawbacks of this approach are incomplete sampling and the enormous effort required to compile such data (Petersen et al. 1998). To circumvent the first problem, one can map point-localities into grid cells: the atlas approach (Udvardy 1981). A disadvantage of this method is that in poorly sampled areas (such as much of Africa) it will be necessary to use a very coarse grid to circumvent errors of omission. Another attractive approach is to model species distributions, exploiting the potential of geographical

information systems (GIS). Usually, two types of analytic models are used, deductive and inductive models. Deductive models, applicable for well-known taxa such as birds, use a species' presumed environmental preferences (e.g. derived from expert opinion) to extrapolate suitable areas from the environmental-variable layers available in a GIS database. In contrast, inductive models use point-locality data to derive the species' environmental preferences, then use these preferences to map suitable areas. Inductive models generate maps based on the distribution of point-localities within various environmental data sets (Petersen et al. 1999) or, alternatively, at the resolution of atlas grid cells (Brito et al. 1999). To overcome sampling biases and lack of information, we plan to explore the modelling approach in addition to gathering a database of verified records. We will therefore need to collect information on the environmental preferences of each species in Africa, and as many point-locality data as possible. Again, we will be thankful for any help in gathering these data.

Conservation analysis

Since many of the Palaearctic migratory species are endangered, their conservation is of utmost concern (Salathé 1991, Crick & Jones 1992). We intend to use the results from the above analyses to determine priority sets of conservation areas for migratory birds within Africa. These analyses will be performed with the program *WorldMap* (<http://www.nhm.ac.uk/science/projects/worldmap/>). Priority areas determined for migratory birds will then be compared to priority areas determined for non-migratory birds to establish whether conservation directed towards non-migratory birds will be sufficient to also conserve migratory birds. Again, we will need input from field ornithologists when the results are to be evaluated.

Outcomes

The project will run until the summer of 2003, by which time we intend to publish the database, making it accessible through the internet and in scientific publications (possibly as an atlas). We are fully aware that data sharing may imply problems, and that there exists a widespread pressure to publish first, and therefore decided that it is in everyone's interest clearly to state from the outset that we would like to make data publicly accessible. We hope this policy will not discourage possible collaborators. However, contributions from collaborators who want us to withhold data, either

indefinitely or for a certain period of time, will only be used in our analyses, but not made public in any form. Results from our analyses on priority conservation areas will be disseminated in scientific journals and among conservation agencies world-wide, but especially in Africa, for example through conservation workshops.

Resumé

Hvor overvintrer de palæarktiske trækfugle i Afrika?

Det anslås, at i størrelsesordenen 3-5 milliarder palæarktiske ynglefugle (fordelt på 200 arter) hvert år trækker til deres vinterkvarterer i Afrika. Vi kender i dag trækruerne gennem Europa og middelhavsregionen, men har stadigvæk meget at lære om disse fugles udbredelse i selve Afrika. For mange arter er vores viden så overfladisk kendt, at den kan formuleres i udsagn som "forekommende i det østlige Afrika". Oplysninger med en så grov geografisk opløsning er uanvendelig for en videns- og databaseret naturforvaltning af disse trækfugle og deres levesteder i Afrika.

Det meste af den viden, der trods alt gennem årtier er indsamlet om forekomsten af vore trækfugle i Afrika, er desværre spredt over et virvar af afhandlinger, rapporter og anden "grå" litteratur. For at afhjælpe denne mangel på let tilgængelig data og få et overblik over, hvad vi

egentlig ved, er Ringmærkningsafdelingen på Zoologisk Museum i København gået i gang med at indsamle og sammenstille eksisterende information om forekomsten af palæarktiske trækfugle i Afrika. Målet er at gøre denne database tilgængelig for alle via internettet (formentlig gennem det nyoprettede *Global Biodiversity Information Facility*) for herigennem at medvirke til, at det bedst mulige videns- og datagrundlag er til rådighed for fremtidige naturbeskyttelsesbeslutninger og prioriteringer.

Omfang og kvalitet af en sådan database vil i stor udstrækning afhænge af oplysninger, som vi modtager fra alle dele af den ornitologiske verden – fra fuglekikkere til forskere. Vi er derfor yderst interesserede i alle relevante data og oplysninger om kilder til sådanne, og i samarbejdspartnere, som kan være alle med erfaringer fra fugle-relateret arbejde i Afrika.

Projektet er et forskningsprojekt finansieret af EU. Som sådant vil arbejdet ud over at indsamle data og gøre dem tilgængelig også indbefatte egne videnskabelige analyser og publicering af resultaterne. Vores anvendelse af data fokuserer på 1) at prøve at modellere den "komplette" udbredelse (inkl. trækruer og rastepladser) i Afrika for de enkelte trækfuglearter på basis af de eksisterende, men sparsomme og geografisk ukomplette data, 2) at bruge resultaterne i bestræbelserne på at få oprettet et optimalt system af beskyttede områder, under hensyn til økonomiske og sociologiske begrænsninger, samt 3)

Photo: Carsten J. Andersen.



Kendskabet til hvor de europæiske og vestasiatiske trækfugle er fordelt på det store afrikanske kontinent er fragmenteret og upræcist. Skovpiber.

at sammenholde disse prioriteringer med tilsvarende resultater fra analyser, Zoologisk Museum har gennemført for afrikanske ynglefugle, og derved få et overblik over hvorvidt beskyttelsesarbejdet for disse også vil tilgodesse trækfuglene.

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