Avian diversity in Southern Africa: patterns, processes and conservation

by

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Submitted in partial fulfilment of the requirements for the degree of
Doctor of Philosophy (Zoology)

in the Faculty of Natural & Agricultural Sciences
University of Pretoria
Pretoria

July 2002
"If we give our very best to all the children of today, and if we pass on our planet in the fullness of her beauty and natural richness, we will be serving the children of the future."

Nelson R. Mandela (2001)
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Abstract
Understanding the mechanisms, both biological and anthropogenic, that account for changes in environmental variables and that translate into altered species richness and species turnover (β-diversity) patterns is an important component of efficient conservation planning. However, several issues need to be addressed to understand these mechanisms. First, at which scale(s) should species richness and turnover patterns be examined? These patterns, as well as the role of variables explaining them, may differ across scales. Second, what influences do landscape transformation and human population size have on species biogeographic patterns? These factors pose the single most important threat to biodiversity, and are often overlooked. If anthropogenic land transformation plays a dominant role in determining species richness and turnover patterns, then using present patterns to understand biological processes could provide erroneous answers. Third, despite the dynamic nature of the environment, studies that take the manner in which humans may affect biodiversity patterns into account are often based on static perspectives. Environmental change could therefore also precipitate changes in the relationships between species richness, environmental variables and human densities. Consequently, it is crucial for land-use decision makers to incorporate such changes into conservation strategies to achieve effective long-term conservation. Fourth, spatial autocorrelation in ecological data results in lack of data independence and, consequently, may lead to spurious results in statistical analyses. Finally, are ecological transition zones spatially congruent and are these adequate conservation areas? This thesis addresses these issues by combining South African avifaunal, environmental, human population and land use data in a GIS and statistically analysing the emergent patterns. The potential effects of climate change on these species and human patterns and their conservation implications are also investigated. The results indicate that: (i) bird richness is correlated with, and hence likely a function of several environmental variables including primary productivity, precipitation, absolute minimum temperature, and, at coarser resolutions, habitat heterogeneity; (ii) spatial resolution and extent must be considered during investigations of these relationships; (iii) species richness and human density are positively correlated, apparently because both respond positively to increased levels of primary productivity; and (iv) conservation area selection procedures tend to identify high ecological transition areas as important for biodiversity conservation. Elevated β-diversity in the avifauna is found in biome transition areas but not in land
transformation transition areas, suggesting that the latter has little influence on the avifauna. Finally, although current human demands on natural resources are high in and around most conservation areas, there are some areas important for biodiversity conservation outside formal protected areas with lower than expected human population densities both prior to and after considering climate change. These latter areas could minimize potential future conflict between human resource and conservation needs.

**Keywords:** biological mechanisms, anthropogenic mechanisms, species richness, species turnover, β-diversity, conservation, scale, human population, biogeography, spatial autocorrelation, ecological transition zones
Acknowledgements

This project was conducted under the auspices of the Department of Zoology and Entomology of the University of Pretoria, South Africa.

My sincerest thanks and appreciation go to my supervisors Steven Chown, Albert van Jaarsveld and Kevin Gaston, for their generosity of advice, stimulating, creative ideas, and the way in which they amalgamated academic science with practical conservation implications was a very enjoyable learning experience for me.

To all my fellow friends at the University of Pretoria, both past and present, Abraham Addo-Bediako, Marinda Dobson, Barend Erasmus, Louise Erasmus, Dean Fairbanks, Human BuIrski, Jennifer Jones, Mark Keith, Jaco Klok, Stephanie Koch, Mrigesh Kshatriya, Richard Mercer, Kate Parr, Belinda Reyers, Ed Stam, Marié Warren and Fernando Zapata, I express my appreciation and thanks for your help in making this study a big success. Special thanks to Barend Erasmus and Mark Keith for sharing their knowledge of GIS so generously and for providing ample humour during our days together at varsity and to Marié Warren for providing useful comments on an earlier version of this thesis. Fernando Zapata is thanked for his many valuable ideas and his interest regarding aspects of this study. Much appreciation goes to Belinda Reyers for her help in the final stages.

Many thanks to the personnel and students of the Biodiversity and Macroecology Group, Department of Animal and Plant Sciences, University of Sheffield, United Kingdom who provided accommodation in Sheffield, logistic support and contributed towards this study. A special word of thanks to Andy Brewer, the Gaston family, Patricia Koleff and Ana Rodrigues for assisting me, and making me feel at home in Sheffield.

This work was supported by grants provided by the South African National Research Foundation, Andrew W. Mellon Foundation Mentoring Program and the University of Pretoria, and is gratefully acknowledged. GIMS® and ESRI are thanked for their Geographic Information Systems (GIS) software, training and support.

The Avian Demography Unit (University of Cape Town) and especially Les Underhill kindly provided access to the Southern African Bird Atlas Project data, F.I. Woodward (University of Sheffield) supplied the data on primary productivity, and the Computing Centre for Water Research (University of Natal) provided the climatic data.

Finally, my warmest thanks to my friends and family: to my parents, Jannie and Pamela, my brother, Werner, my sister, Stephanie, and to my girlfriend Ilze van Eck for their love, support and unwavering belief in me, and to Wayne Matthews for his friendship and long history of encouragement in my life.
Disclaimer

This thesis consists of a series of chapters that have been prepared for submission to, or publication in, a range of scientific journals. As a result styles may vary between chapters in the thesis and overlap may occur to secure publication entities.
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