Waterbirds around the world

A global overview of the conservation, management and research of the world's waterbird flyways

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EDINBURGH, UK: THE STATIONERY OFFICE

First published in 2006 by The Stationery Office Limited
71 Lothian Road, Edinburgh EH3 9AZ, UK.

Applications for reproduction should be made to Scottish Natural Heritage,
Great Glen House, Leachkin Road, Inverness IV3 8NW, UK.

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN 0 11 497333 4

Recommended citation:
Boere, G.C., Galbraith, C.A. & Stroud, D.A. (eds). 2006.
Waterbirds around the world. The Stationery Office, Edinburgh, UK. 960 pp.

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Cover photography: Whooper Swans *Cygnus cygnus* arriving at Martin Mere, England. Photo: Paul Marshall. (www.paulmarshallphotography.com)

Britain's first Winter River Bird Survey: a new approach to surveying waterbirds on linear waterways

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Robinson, J.A., Kershaw, M., Worden, J. & Cranswick, P.A. 2006. Britain's first Winter River Bird Survey: a new approach to surveying waterbirds on linear waterways. *Waterbirds around the world.* Eds. G.C. Boere, C.A. Galbraith & D.A. Stroud. The Stationery Office, Edinburgh, UK. pp. 476-477.

Rivers are essential to large numbers of wetland birds that visit the UK during the winter. The distribution and numbers of waterbirds using rivers need to be monitored so that correct and effective conservation action can be triggered if numbers decline. Currently, linear waterways such as rivers and canals are poorly covered by existing surveys compared with other wetland habitats. The aim of a national Winter River Bird Survey would be to increase the coverage of linear waterways to improve the accuracy of national population estimates for relevant species and to evaluate the extent to which current surveys underestimate these populations.

A pilot survey was undertaken in January and February 2000 and 2001 to investigate methods for a full national survey (Robinson *et al.* 2003). Since a full survey could not hope to

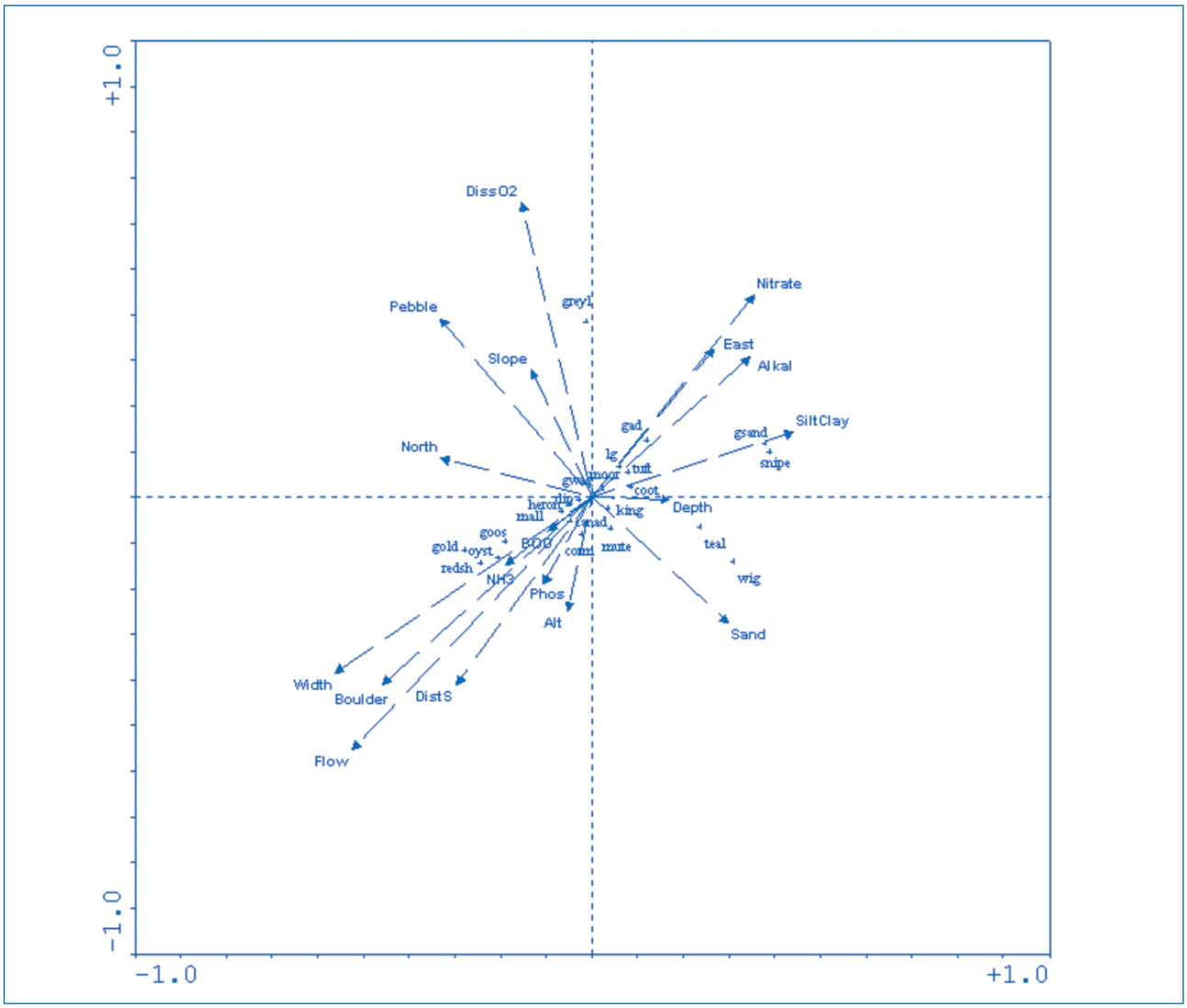

Fig. 1. A plot of the scores of the first and second axes of the CCA ordination of the environmental variables and bird scores (Abbreviations used: canad = Canada Goose *Branta canadensis*, corm = Cormorant *Phalacrocorax carbo*, dip = Dipper *Cinclus cinclus*, gad = Gadwall *Anas strepera*, gold = Goldeneye *Bucephala clangula*, goos = Goosander *Mergus mergus*, greyl = Greylag Goose *Anser anser*, gsand = Green Sandpiper *Tringa ochropus*, gwag = Grey Wagtail *Moticilla cinerea*, heron = Grey Heron *Ardea cinerea*, king = Kingfisher *Alcedo atthis*, lg = Little Grebe *Tachybaptus ruficollis*, mall = Mallard *Anas playtyrhynchos*, moor = Moorhen *Gallinula chloropus*, mute = Mute Swan *Cygnus olor*, oyst = Oystercatcher *Haematopus ostralegus*, redsh = Redshank *Tringa totanus*, tuft = Tufted Duck *Aythya fuligula*, wig = Wigeon *Anas penelope*; Alakl = Alkalinity, Alt = Altitude, DissO2 = Dissolved O2, DistS = Distance from source, Phos = Phosphate).

cover all river lengths in the UK, a randomised sampling approach would be used to derive population estimates. Stratified random sampling gives more accurate results than unstratified sampling, since bird density is predicted to vary according to factors such as region, river width, flow rate etc. The pilot survey identified the most suitable strata for a national survey, allowed selection of the most appropriate length of river to use as a count unit, and assessed the level of coverage required to generate estimates with a given confidence interval.

During the pilot, 30 rivers and canals were surveyed, representing a wide range of geographical, physical and environmental waterway types. Each river and canal was divided into 500 m sections and each stretch was visited once to record the numbers of each species present. Over 27 400 birds were counted, and data analysed for 22 species. The following environmental variables had been measured by the Environment Agency for each stretch in England and Wales and were used in statistical analyses: width; depth; alkalinity; % silt or clay; % sand; % pebbles or gravel; % boulders or cobbles; altitude; distance from source; slope; mean phosphate; mean nitrate; BOD; dissolved oxygen; ammonia; easting; northing; flow category; and General Quality Assessment biology grade.

Count data were used to identify suitable strata for the national survey, based on bird densities in river channels, so as to minimise the within-stratum variance in bird density. Multivariate analyses were used to identify major patterns of distribution for different species and the relationships between density, and the various environmental variables were quantified using Canonical Correspondence Analysis (CCA), a form of direct gradient analysis which attempts to explain species distribution patterns.

An indirect gradient analysis technique was used to test whether the measured environmental variables were adequate to explain the major variation in species composition. Unlike CCA, this technique does not attempt to constrain the species responses to any environmental variables. It therefore represents major patterns in the species data without making any assumptions about the factors associated with these gradients.

A biplot of the first and second axes of the CCA ordination of the river and bird scores is shown in Fig. 1. The first axis is primarily a width/flow axis separating stretches that are wide with high flow rates from narrower stretches with lower flows. Having run the CCA analysis with all variables included, forward selection was then used to rank environmental variables in terms of their importance for determining the species data. Automatic selection was used to sequentially select the best five variables on the basis of maximum extra fit. The five environmental variables most important in explaining the species data were: water flow, northing, easting, dissolved oxygen and % silt or clay.

A nine-level stratification was identified based on region and flow combinations. The full survey will aim to cover 8 000 x 500 m stretches of river across nine strata, based on low and high flows and regions within England and Wales, to produce population estimates with +/-10% precision for a variety of species. Means for stratifying coverage in Scotland are being pursued.

ACKNOWLEDGEMENTS

We thank Ron Thomas, Graeme Storey and Emily Orr for providing large amounts of environmental data from the Environment Agency's databases. This work was funded by a partnership between the British Trust for Ornithology, The Wildfowl & Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee.

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The River Nene in Northamptonshire, England, filling its floodplain after heavy rains. Photo: David Stroud.