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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

Extract only - complete publication at www.jncc.gov.uk/worldwaterbirds

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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)

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Using predictive modelling to investigate large-scale shorebird migration in the Russian Far East for Great Knot *Calidris tenuirostris*, Red Knot *Calidris canutus* and Bar-tailed Godwit *Limosa lapponica*

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Kusch, K. & Huettmann, F. 2006. Using predictive modelling to investigate large-scale shorebird migration in the Russian Far East for Great Knot *Calidris tenuirostris*, Red Knot *Calidris canutus* and Bar-tailed Godwit *Limosa lapponica*. *Waterbirds around the world*. Eds. G.C. Boere, C.A. Galbraith & D.A. Stroud. The Stationery Office, Edinburgh, UK. p. 345.

Predictive modelling allows the presentation of relative probabilities of occurrence for species of interest. This approach is particularly useful for large areas which have only been poorly studied. The Sea of Okhotsk in the Russian Far East is such an area with a huge coastline along the East Asian-Australasian (EAA) Flyway. It comprises large mudflats, estuaries and wetlands; some of them never inventoried. Detailed shorebird survey data are missing or only locally known for this region. We used "presence only" and "confirmed absence " information from an extensive review of Russian literature (Huettmann 2003) as the basis for predicting the occurrence of shorebirds in this large region. In addition, the predictive model used six years of data from an international field research project that investigated shorebird migration in spring and autumn based on identified, representative mudflats and estuaries in eastern and southern Kamchatka, Magadan region, Sakhalin Island and southern Kurile Islands (Antonov & Huettmann 2004). These compiled sources in a GIS (ArcView) format represent the best available digital data set on shorebirds in the region. For data transparency reasons they are described with FGDC NBII metadata in XML format, available for public review, quality review and further extension.

A progressive modelling approach was used (Manly *et al*., 2002, Scott *et al*. 2002) using GIS, modified S-PLUS code (Huettmann and Linke 2003) and statistical linear and non-linear modelling algorithms (Huettmann & Diamond 2001, Yen *et al*. 2004) in order to predict where Great Knot *Calidris tenuirostris*, Red Knot *Calidris canutus* and Bar-tailed Godwit *Limosa lapponica* occur during autumn and spring migration on the shores of the Sea of Okhotsk. Significant model predictors such as tidal range, river type and size, substrate type and mudflat size were derived from Remote Sensing layers, software tools, hardcopy maps and others.

From the compiled locations with known shorebird occurrences, it appeared that the three species prefer tidal saltwater locations with organic matter and freshwater inflow. The model showed a difference between spring and autumn migration, suggesting different migration strategies.

The models indicated a good agreement with known shorebird migration "hotspots". This is important for obtaining population estimates and quantifying turn-over rates. However, more field work is needed to further improve these quantitative prediction accuracies and to learn more about the migration strategies. This predictive shorebird GIS model is the first of its kind, and can contribute greatly to conservation decisions and advanced field research. Together with other it can support development and implementation of conservation strategies for shorebird species along the EAA Flyway. Eventually, it could be used in a spatial Population Viability Analysis (PVA) framework and for environmental impact studies. These modelling applications should become further recognized and improved, and eventually be used to support international conservation management policy decisions such as through the Ramsar and Bonn Conventions.

REFERENCES

Antonov, A. & Huettmann, F. 2004. On the southward migration of Great Knot in the western Sea of Okhotsk: results and conclusions from coordinated surveys on northern Sakhalin Island and in Schastia Bay-Mainland Russian Far East, 2002. Stilt 41: 14-20.

Huettmann, F. 2003. Literature Review: Shorebird migration in the Sea of Okhotsk region, Russian Far East, along the East Asian Australasian flyway for selected species (Great Knot *Calidris tenuirostris*, Red Knot *Calidris canutus*, Bar-tailed Godwit *Limosa lapponica*). Report for Environment Australia, Wetlands International, Canberra.

Huettmann, F. & Diamond, A.W. 2001. Seabird colony locations and environmental determination of seabird distribution: A spatially explicit seabird breeding model in the Northwest Atlantic. Ecological Modelling 141: 261-298.

Huettmann, F. & Linke, J. 2003. An automated method to derive habitat preferences of wildlife in GIS and telemetry studies: A flexible software tool and examples of its application. European Journal of Wildlife Research 49: 219-232.

Manly, B. J., McDonald, L. L., Thomas, D.L., McDonald, T. L. & Erickson, W.P.. 2002. Resource Selection by Animals. Kluwer Academic Publishers, Dordrecht.

Scott, J.M., Heglund, P.J. & Morrison, M.L. 2002. Predicting Species Occurrences: Issues of Accuracy and Scale. Island Press, Washington, D.C.

Yen, P., Huettmann, F. & Cooke, F. 2004. Modelling abundance and distribution of Marbled Murrelets (*Brachyramphus marmoratus*) using GIS, marine data and advanced multivariate statistics. Ecological Modelling 171: 395-413.