

Cindy Hull · Emma Bennett
Elizabeth Stark · Ian Smales
Jenny Lau · Mark Venosta *Editors*

Wind and Wildlife

Proceedings from the Conference on
Wind Energy and Wildlife Impacts,
October 2012, Melbourne, Australia

 Springer

Wind and Wildlife

Cindy Hull • Emma Bennett • Elizabeth Stark
Ian Smales • Jenny Lau • Mark Venosta

Editors

Wind and Wildlife

Proceedings from the Conference on Wind
Energy and Wildlife Impacts, October 2012,
Melbourne, Australia

 Springer

Editors

Cindy Hull
Woolnorth Wind Farm Holding
Launceston, TAS, Australia

Emma Bennett
Elmoby Ecology
Creswick, VIC, Australia

Elizabeth Stark
Symbolix Pty Ltd
Williamstown North, VIC, Australia

Ian Smales
Mark Venosta
Biosis Pty Ltd
Port Melbourne, VIC, Australia

Jenny Lau
BirdLife Australia
Carlton, VIC, Australia

ISBN 978-94-017-9489-3 ISBN 978-94-017-9490-9 (eBook)
DOI 10.1007/978-94-017-9490-9
Springer Dordrecht Heidelberg New York London

Library of Congress Control Number: 2014955790

© Springer Science+Business Media Dordrecht 2015

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Acknowledgements

The Wind and Wildlife Conference organising committee comprised Emma Bennett (Elmoby Ecology), Cindy Hull (Hydro Tasmania), Jenny Lau (BirdLife Australia), Ian Smales (Biosis), Elizabeth Stark (Symbolix) and Mark Venosta (Biosis). Thanks to Tim Power (Herbert Smith Freehills) for his assistance to the committee and for facilitating the conference and to Paul Fulton of Joule Logic for providing a description of the engineering principles of wind farms at the conference. Recognition must also be given to the sponsors of the conference. Platinum sponsors: Biosis Pty Ltd and Ecology and Heritage Partners. Gold Sponsors: Acciona Energy, ngh environmental and Energy Australia. Bronze Sponsors: Elmoby Ecology, Symbolix, Hydro Tasmania, Herbert Smith Freehills, BirdLife Australia, Pacific Hydro and Joule Logic.

Contents

Part I Investigations and Assessments of New Wind Farms

Predicting the Weather-Dependent Collision Risk for Birds at Wind Farms	3
Henrik Skov and Stefan Heinänen	
Fauna Collisions with Wind Turbines: Effects and Impacts, Individuals and Populations. What Are We Trying to Assess?	23
Ian Smales	
Wind Farms and Biodiversity: Improving Environmental Risk Assessments	41
I.K.G. Boothroyd and L.P. Barea	
The Use of Aerial Surveys for the Detection of the Brolga <i>Grus rubicunda</i> Through South-West Victoria: Key Considerations for the Wind Industry	59
David Wilson and Aaron Organ	
Planning for Net Biodiversity Gains: A Case Study of Hauāuru mā raki Wind Farm, New Zealand	69
John L. Craig, Gerry Kessels, Peter Langlands, and Stephen Daysh	

Part II Monitoring, Mitigation and Offsets

Results and Analysis of Eagle Studies from the Bluff Point and Studland Bay Wind Farms 2002–2012	95
Cindy Hull, Chris Sims, Elizabeth Stark, and Stuart Muir	

**Observations from the Use of Dogs to Undertake
Carcass Searches at Wind Facilities in Australia 113**
Emma Bennett

**Key Learnings from Ten Years of Monitoring
and Management Interventions at the Bluff Point
and Studland Bay Wind Farms: Results of a Review 125**
Chris Sims, Cindy Hull, Elizabeth Stark, and Robert Barbour

Summary of Panel Session 145

Contributors

Robert Barbour Woolnorth Wind Farm Holding, Launceston, TAS, Australia

L.P. Barea Wingspan Birds of Prey Trust, Rotorua, New Zealand

Emma Bennett Elmoby Ecology, Creswick, VIC, Australia

I.K.G. Boothroyd Boffa Miskell Ltd., Auckland, New Zealand

John L. Craig School of Environment, University of Auckland, Auckland, New Zealand

Stephen Daysh Environmental Management Services Limited, Napier, New Zealand

Stefan Heinänen DHI, Hørsholm, Denmark

Cindy Hull Woolnorth Wind Farm Holding, Launceston, TAS, Australia

Gerry Kessels Kessels & Associates, Ecology and Environmental Planning Ltd, Hamilton, New Zealand

Peter Langlands Wild Capture, Christchurch, New Zealand

Jenny Lau BirdLife Australia, Carlton, VIC, Australia

Stuart Muir Symbolix Pty Ltd, Williamstown North, VIC, Australia

Aaron Organ Ecology and Heritage Partners, Ascot Vale, VIC, Australia

Chris Sims Operations, Hydro Tasmania, Hobart, TAS, Australia

Henrik Skov DHI, Hørsholm, Denmark

Ian Smales Biosis Pty Ltd, Port Melbourne, VIC, Australia

Elizabeth Stark Symbolix Pty Ltd, Williamstown North, VIC, Australia

David Wilson Ecology and Heritage Partners, Ascot Vale, VIC, Australia

Mark Venosta Biosis Pty Ltd, Port Melbourne, VIC, Australia

List of Figures

Predicting the Weather-Dependent Collision Risk for Birds at Wind Farms

Fig. 1	The sites where the study was conducted.....	5
Fig. 2	Observed altitude plotted against distance to closest wind turbine for northern gannets at Horns Rev. The different colors indicate head winds (<i>red</i>), tail winds (<i>blue</i>) and side winds (<i>green</i>). The rotor height (<i>lowest tip</i>) of the turbines at Horns Rev 2 is indicated with a <i>dashed black line</i>	11
Fig. 3	Response curves of the GAMM for the northern gannet displaying the relationship between the flight altitude and predictor variables. The values of the environmental predictors are shown on the X-axis and the probability on the Y-axis in logit scale. The degree of smoothing is indicated in the title of the Y-axis. The <i>shaded areas</i> and the <i>dotted lines</i> show the 95 % Bayesian confidence intervals	12
Fig. 4	Mapped results of the predicted altitude of birds at two wind farms (Horns Rev 2, upper and Horns Rev 1, lower), along a “theoretical” transect through the investigated area for the northern gannet during head winds, tail winds and side winds, with all other predictor variables set to mean conditions. The <i>dashed lines</i> around the predictions indicate the standard errors. The rotor swept area is defined by the <i>rectangle with shading red lines</i>	13
Fig. 5	Observed altitude plotted against distance to closest wind turbine for common scoters at Horns Rev. The different colors indicate head winds (<i>red</i>), tail winds (<i>blue</i>) and side winds (<i>green</i>). The rotor height (<i>lowest tip</i>) of the turbines at Horns Rev 2 is indicated with a <i>dashed black line</i>	15

Fig. 6 Response curves of the GAMM for the common scoter displaying the relationship between the flight altitude and predictor variables. The values of the environmental predictors are shown on the X-axis and the probability on the Y-axis in logit scale. The degree of smoothing is indicated in the title of the Y-axis. The shaded areas and the dotted lines show the 95 % Bayesian confidence intervals 16

Fig. 7 Mapped predicted altitudes of common scoters at the Horns Rev 2 wind farm during tail wind (*upper left*) with associated model standard errors (*lower left*). The same predictions are visualised along a “theoretical” transect through the investigated area (see *upper left*) during head winds, tail winds and side winds, with all other predictor variables set to mean conditions. The dashed lines around the predictions indicate the standard errors. The rotor swept area is defined by the rectangle with shading red lines 17

Fig. 8 Response curves of the GAMM for the red kite at Rødsand 2 displaying the relationship between the flight altitude and predictor variables. The values of the environmental predictors are shown on the X-axis and the probability on the Y-axis in logit scale. The degree of smoothing is indicated in the title of the Y-axis. The shaded areas and the dotted lines show the 95 % Bayesian confidence intervals 18

Fig. 9 Mapped predicted altitude of birds in autumn, in relation to distance from the coast of Hyllekrog (island of Lolland), for the red kite during tail winds (0°, *red line*) and head winds (180°, *blue line*), with all other predictor variables set to mean conditions during the specific wind conditions (either tail or head winds). The dashed lines around the predictions indicate the standard errors. The GAMM model is based on data from left of the dashed black line (n=1,313). The rectangle with shading red lines indicate the rotor swept area 19

Wind Farms and Biodiversity: Improving Environmental Risk Assessments

Fig. 1 Distribution of snow-tussock grassland vegetation within the Mahinerangi Wind Farm development envelope 53

Fig. 2 Distribution of vegetation and habitat quality within gully systems of the Mahinerangi Wind Farm development envelope. See text for gully vegetation quality criteria 54

The Use of Aerial Surveys for the Detection of the Brolga *Grus rubicunda* Through South-West Victoria: Key Considerations for the Wind Industry

Fig. 1 Typical brolga *Grus rubicunda* nest 60

Fig. 2 The distribution of brolga in Victoria (location records from the Victorian Department of Environment and Primary Industries' Victorian Biodiversity Atlas) and the area where aerial surveys occurred in south-west Victoria 63

Fig. 3 Nest sites (species unknown) appear as circular areas cleared of vegetation within wetlands when observed from the air 64

Fig. 4 Active brolga *Grus rubicunda* nest period for the 2009–2010 (Biosis Research 2011) and 2012 (Ecology and Heritage Partners unpublished data) breeding seasons. Dates of aerial surveys for the 2009/2010 season are shown as *solid lines* (*white* Biosis Research, *black* Ecology and Heritage Partners)..... 65

Planning for Net Biodiversity Gains: A Case Study of Hauāuru mā raki Wind Farm, New Zealand

Fig. 1 Location map of the HMR Wind Farm envelope 71

Fig. 2 Indicative routes of migratory shorebirds in New Zealand, between the North and South Islands (*red*) and the Rangitata River and Nelson in the South Island (*yellow*); *filled triangles* indicate the locations of the HMR and Taharoa C windfarm sites 73

Fig. 3 Actual and Assumed Internal Migrant flock trails from shorebird migration surveys during Summer 2009..... 77

Fig. 4 Actual and Assumed Internal Migrant flock trails from shorebird migration surveys during Winter 2009 78

Fig. 5 Actual and Assumed Internal Migrant flock trails from shorebird migration surveys during Summer 2010..... 79

Fig. 6 Actual and Assumed Internal Migrant flock trails from shorebird migration surveys during Winter 2010 80

Fig. 7 Density of trails (trails/km²) for the Winter 2009 (*left*) and Winter 2010 (*right*) periods 81

Fig. 8 Density of trails (trails/km²) for the Summer 2010 survey..... 81

Results and Analysis of Eagle Studies from the Bluff Point and Studland Bay Wind Farms 2002–2012

Fig. 1 Location of the Bluff Point and Studland Bay Wind Farms 96

Key Learnings from Ten Years of Monitoring and Management Interventions at the Bluff Point and Studland Bay Wind Farms: Results of a Review

Fig. 1 The risk matrix derived from the review process 130

List of Tables

Predicting the Weather-Dependent Collision Risk for Birds at Wind Farms

Table 1	Significance and t- and F-values for the fixed parametric (wind directions, wind farm and survey year) and smooth terms included in the GAMM for the northern gannet.....	13
Table 2	Collision risk estimates for wintering northern gannets at HR1 and HR2 offshore wind farms, along with species-specific values of key input parameters	14
Table 3	Significance and t- and F-values for the fixed parametric (wind directions, wind farm and survey year) and smooth terms included in the GAMM for the common scoter	14
Table 4	Collision risk estimates for wintering common scoters at HR1 and HR2 offshore wind farms, along with species-specific values of key input parameters	17
Table 5	Significance and t- and F-values for the fixed parametric (wind directions and survey year) and smooth terms included in the GAMM for the red kite.....	18

Fauna Collisions with Wind Turbines: Effects and Impacts, Individuals and Populations. What Are We Trying to Assess?

Table 1	Documented wind turbine collision fatalities of all bird and bat taxa and percentage that each taxon represents of the total for eight wind farms in south-eastern Australia	27
Table 2	Annual numbers of eagle mortalities estimated by modelling compared with numbers of actual mortalities detected for two species at two Tasmanian wind farms.....	34

Wind Farms and Biodiversity: Improving Environmental Risk Assessments

Table 1	Kernel home range sizes (ha/km ²) for the adult male, adult female and juvenile female falcons tracked at the proposed Hurunui Wind Farm	48
---------	--	----

Table 2 The number of 200 m turbine buffers intersecting the home range kernels (95, 75 and 50 % kernels) of the falcons studied during the autumn/winter 2010 and summer 2010/2011 tracking periods 48

Table 3 Mean number of estimated mean number of collisions per modelled period and number of years (1/mean collision rate) between potential collisions for the falcons radio tracked 49

The Use of Aerial Surveys for the Detection of the Brolga *Grus rubicunda* Through South-West Victoria: Key Considerations for the Wind Industry

Table 1 Effectiveness of aerial surveys, and subsequent ground-truthing, for detecting brolga nests in south-west Victoria 64

Planning for Net Biodiversity Gains: A Case Study of Hauāuru mā raki Wind Farm, New Zealand

Table 1 A summary of the species of internal migratory shorebirds recorded as migrating along the Waikato coastline, their threat status, the estimated population size and the number potentially passing through or past the proposed HMR wind farm..... 83

Table 2 Summary of predicted annual collision mortality rates of internal NZ migrant shorebirds under DoC, Council and Contact scenarios 85

Results and Analysis of Eagle Studies from the Bluff Point and Studland Bay Wind Farms 2002–2012

Table 1 Long-term eagle collision rate, with confidence intervals (CI), based on data collected up to October 2012 102

Table 2 Breeding survey results for wedge-tailed eagles 2002–2009, inclusive 103

Table 3 Breeding survey for white-bellied sea-eagles 2002–2009, inclusive 104

Observations from the Use of Dogs to Undertake Carcass Searches at Wind Facilities in Australia

Table 1 Summary of factors that influence a dog’s ability to detect carcasses..... 116

Table 2 Interaction of weather conditions and the suitability for undertaking mortality searches with dogs 119