Upscaling wind and wildlife interactions to population impacts

Finlay Bennet

marinescotland science

Acknowledgements

Considerations for upscaling individual effects of wind energy development towards population level impacts on wildlife

Currently in submission: Renewable and Sustainable Energy Reviews
Authors: May, R.[1], Masden, E.A.[2], Bennet, F.[3] & Perron, M.[4]

[1] Norwegian Institute for Nature Research (NINA), P.O. Box 5685 Sluppen, N-7485 Trondheim, Norway;
[2] Environmental Research Institute, North Highland College-UHI, University of the Highlands and Islands Ormlie Road, Thurso, Caithness KW14 7EE, UK;
[3] Marine Scotland Science, Marine Laboratory, 375 Victoria Road, Aberdeen AB11 9DB, UK;
[4] nateco AG, Sissacherstrasse 20, CH-4460 Gelterkinden, Switzerland

The manuscript was produced as part of the WREN collaborative. For more information on WREN visit: http://tethys.pnnl.gov

NINA Norwegian Institute for Nature Research

eri environmental research institute

University of the Highlands and Islands Oilthigh na Gàidhealtachd agus nan Eilean

nateco

WREN Working Together to Resolve Environmental Effects of Wind Energy

What the talk covers

Why upscale effects from individuals and populations?

Key considerations for assessment:

- Theoretical foundations,
- Defining populations,
- Predicting the population level impact

Techniques to verify change

Setting impact thresholds

Summary and conclusions

Working Together to Resolve Environmental Effects of Wind Energy

Why upscale from individuals to populations?

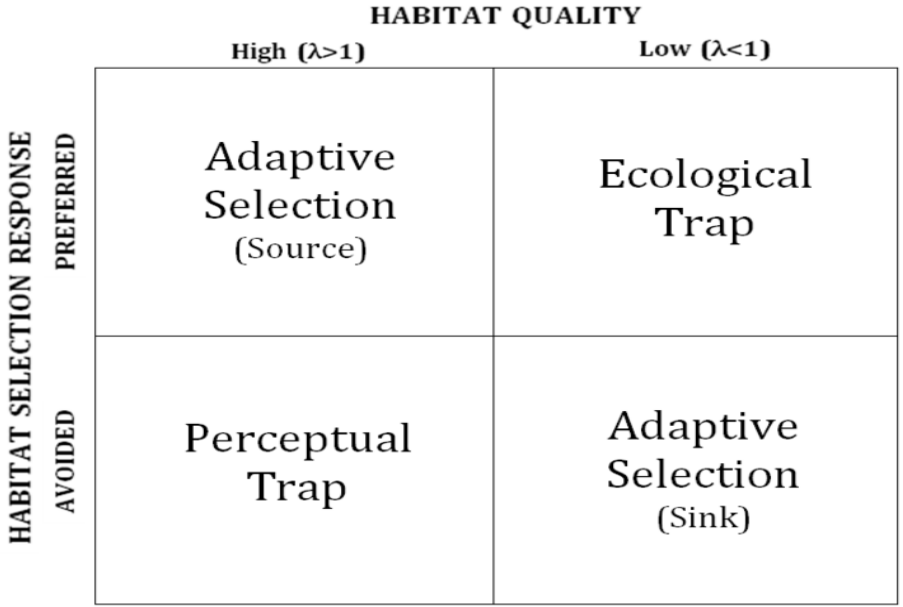
- Loss of individuals may lead to population level consequences
- Licensing frameworks generally focus on assessing effects to individuals with a restricted temporal and spatial scope of assessment
- Balancing the costs of wind energy to wildlife in a sustainable and socially acceptable way:
  - Predicting the population level consequences
  - Verifying the impact
  - If necessary, mitigation

Working Together to Resolve Environmental Effects of Wind Energy

Theoretical foundations

Pressures
- Collision
- Displacement
- Barrier effects

Responses
- Metapopulation dynamics
- Ecological and perceptual traps
- Life history strategies

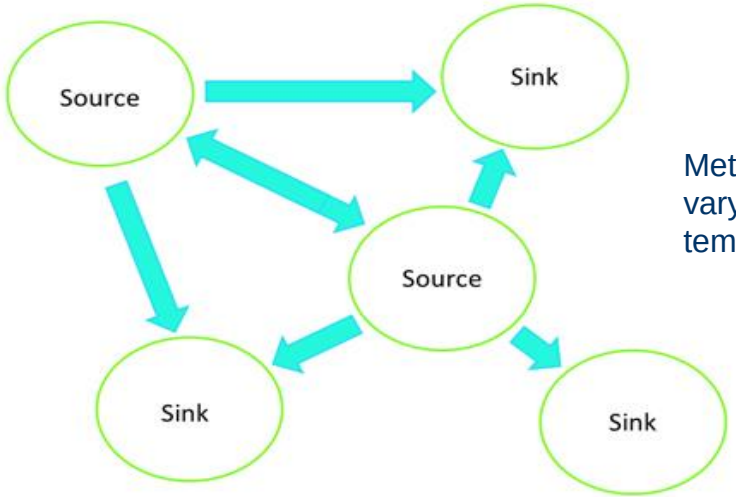


WREN
Working Together to Resolve Environmental Effects of Wind Energy

What is the population?

“a group of individuals from the same species which live in the same space at the same time and reproduce”

- Spatial and temporal scale



BioResilience.com

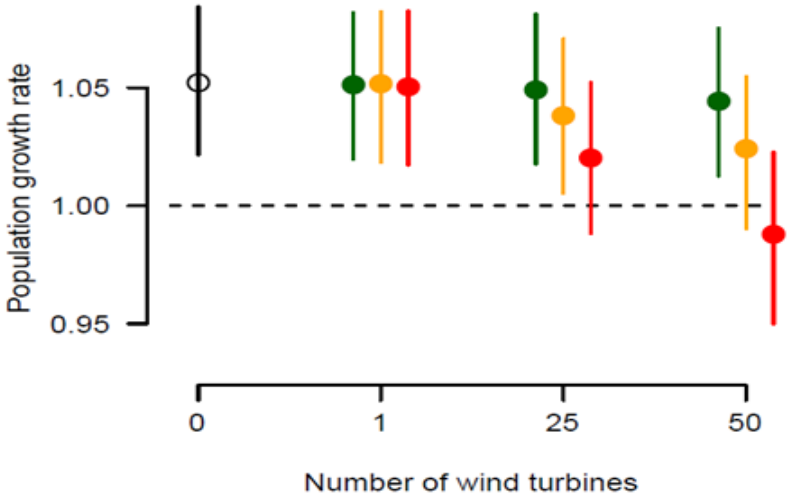
Metapopulation dynamics can vary at different spatial and temporal scales

Working Together to Resolve Environmental Effects of Wind Energy

Assessing the population impact

- Individual-based models
- Matrix population models (including population viability analysis)
- Summation and extrapolation

From: Schaub 2012
Spatial distribution of wind turbines is crucial for the survival of red kite populations
Biological Conservation



Working Together to Resolve Environmental Effects of Wind Energy

Verifying change

The importance of study design

- Before-after
- BACI
- fuller spatial analysis of ecological gradients

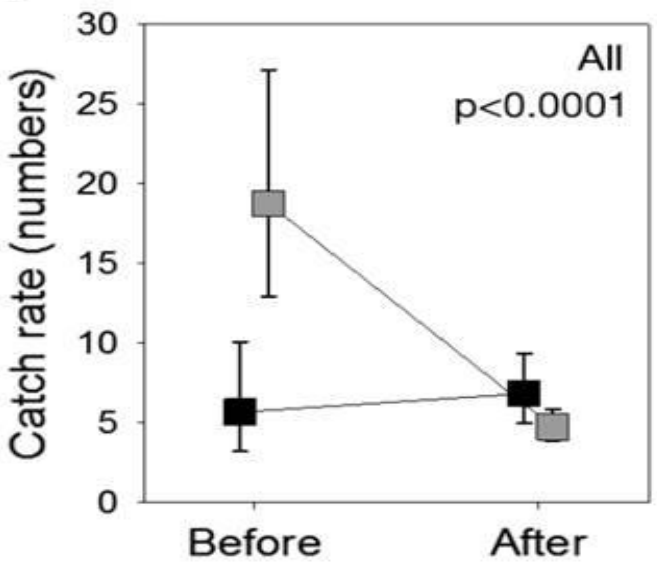


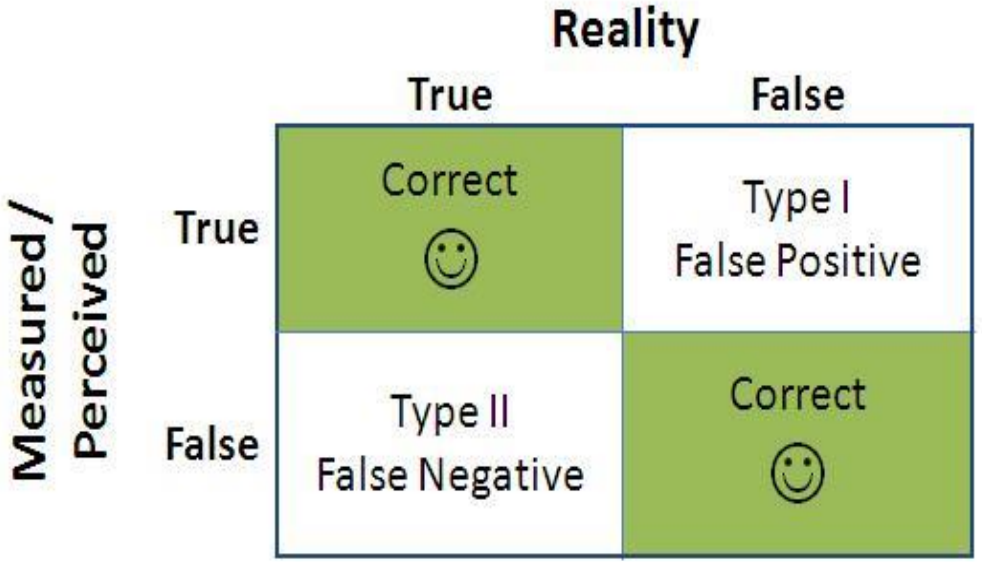
Figure of mean estimated catch (no. ind.) ± 95% CI (squares) from: Stenberg *et al* 2015 Long-term effects of an offshore wind farm in the North Sea on fish communities. Marine Ecology Progress Series

WREN
Working Together to Resolve Environmental Effects of Wind Energy

Verifying change

Balancing the need to protect populations from change with the value of becoming better informed about the risk of change.

- Underpowered studies



Source: analyticsdemystified.com

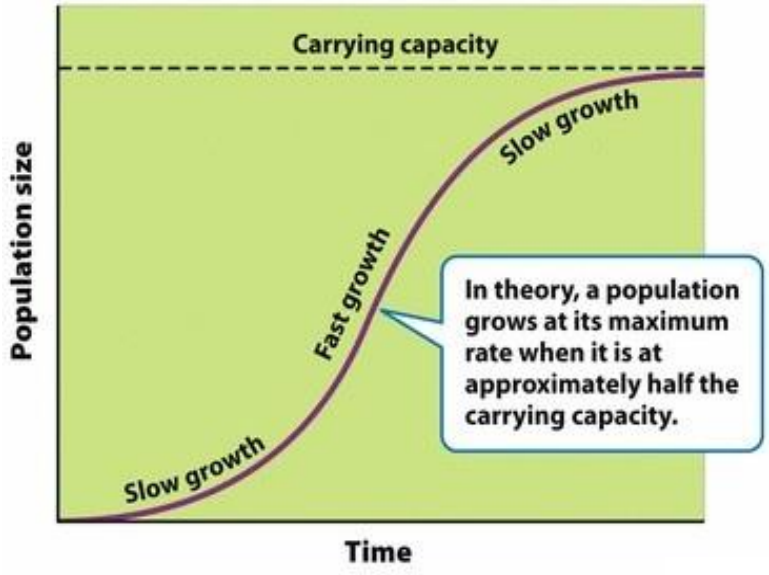
Working Together to Resolve Environmental Effects of Wind Energy

Setting impact thresholds

Are they needed?

3 different types:

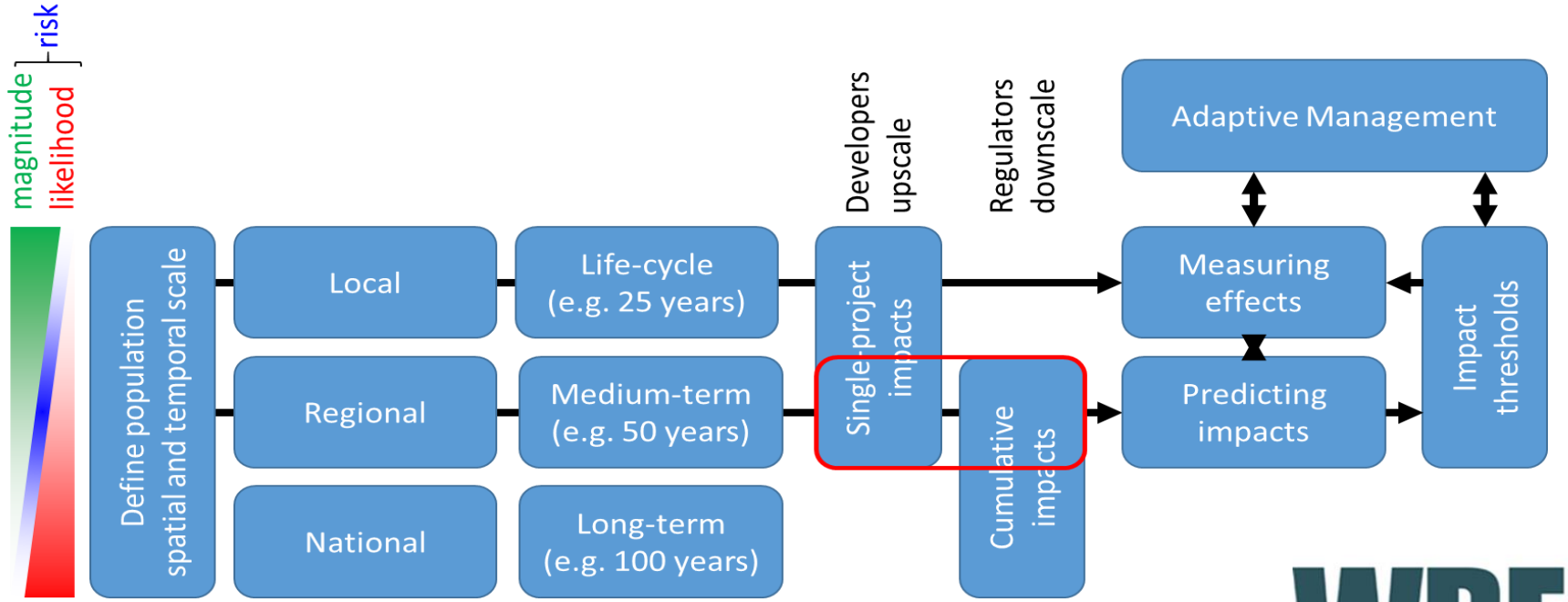
- Utility thresholds
- Ecological thresholds
- Decision thresholds



source: Pinterest.co.uk

Working Together to Resolve Environmental Effects of Wind Energy

Summary & future directions



Working Together to Resolve Environmental Effects of Wind Energy

Conclusion

A shift from assessing individual effects to assessing population consequences.

Improvements in methods used to assess potential effects (especially cumulative) and to validate changes that have occurred.

Adaptive management provides the necessary policy framework.

Decision making needs to openly and transparently balance costs that reflect societal choices

- means balancing the precautionary approach with risk-based approaches

Working Together to Resolve Environmental Effects of Wind Energy