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Distribution modelling of *Lutra lutra* (Eurasian otter) in the UK

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Abstract

Lutra lutra remain a high priority species despite recent increases in UK populations. For effective conservation, it is key to know the distribution and causal factors influencing populations. Species distribution models (SDMs) have become increasingly important as a cost-effective means to identify favourable habitat for species. The observations of *L. lutra* between 2001-2015 were assessed and influence of ecological drivers investigated (MaxENT). Sex-specific analysis was also used to determine the strength of the difference in habitat preference between genders. This study aims to provide a baseline of *L. lutra* habitat suitability throughout the UK and expose areas for future conservation in habitat management and research efforts.

Introduction

For effective conservation, it is key to understand the distribution and causal factors influencing a species to be able to effectively monitor population trends⁽¹⁾. Species Distribution Models (SDMs) have become increasingly important and commonplace in biological studies, as a cost-effective means to identify what habitats are favoured by a species⁽²⁾. Assisting the prediction of when and where a species could occur.

Whilst the population of *Lutra lutra* in the UK continues to steadily increase the species still remains a high conservation priority⁽³⁾. National otter surveys occur across the UK.

Using SDMs to understand the drivers that act upon the distribution of *L. lutra* will allow for more targeted conservation efforts.

Objectives

- Identify potentially suitable habitat for the *Lutra lutra* in the UK.
- Determine ecological drivers influencing the distribution of *L. lutra* in the UK.
- Explore intraspecific variation.

Methods

- Use MaxENT to conduct the SDM (Figure 1) using presence data (2001-2005, 2006-2010, 2011-2015) provided by 40 UK record centres.
- Model performance assessed using AUC value and habitat suitability maps.
- Jack-knife models of variable contributions used to assess the individual importance of environmental factors.
- Pearson's correlation used to analyse differences in temporal distributions and individual variations.

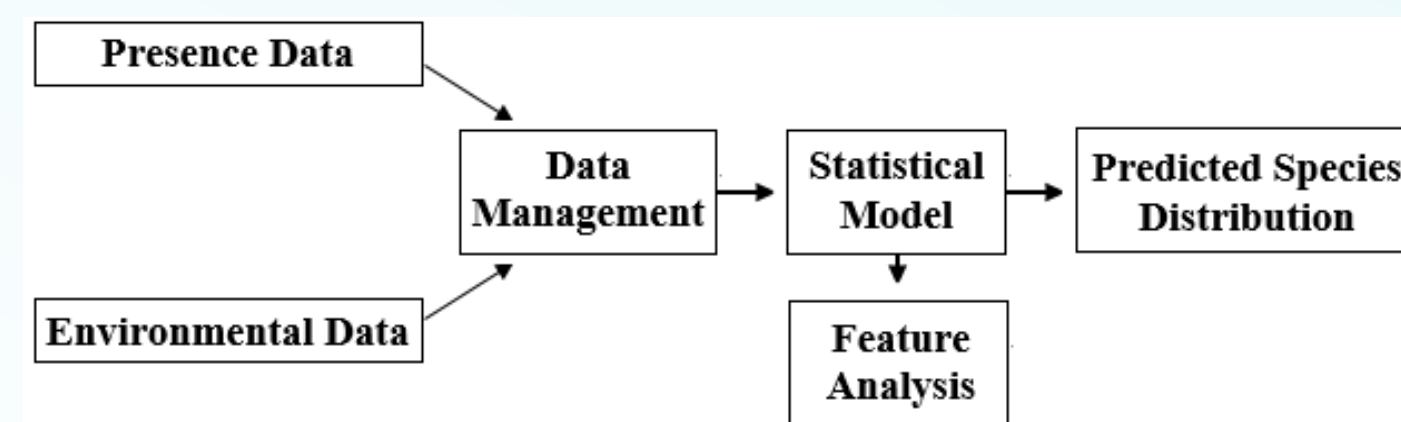


Figure 1. Outline of species distribution modelling using MaxENT

Results

All models had good fit (Figure 2), with MaxEnt identifying suitable habitat for *Lutra lutra* across the UK. Distribution models performed well across validation metrics (AUC > 0.70, and low omission rates).

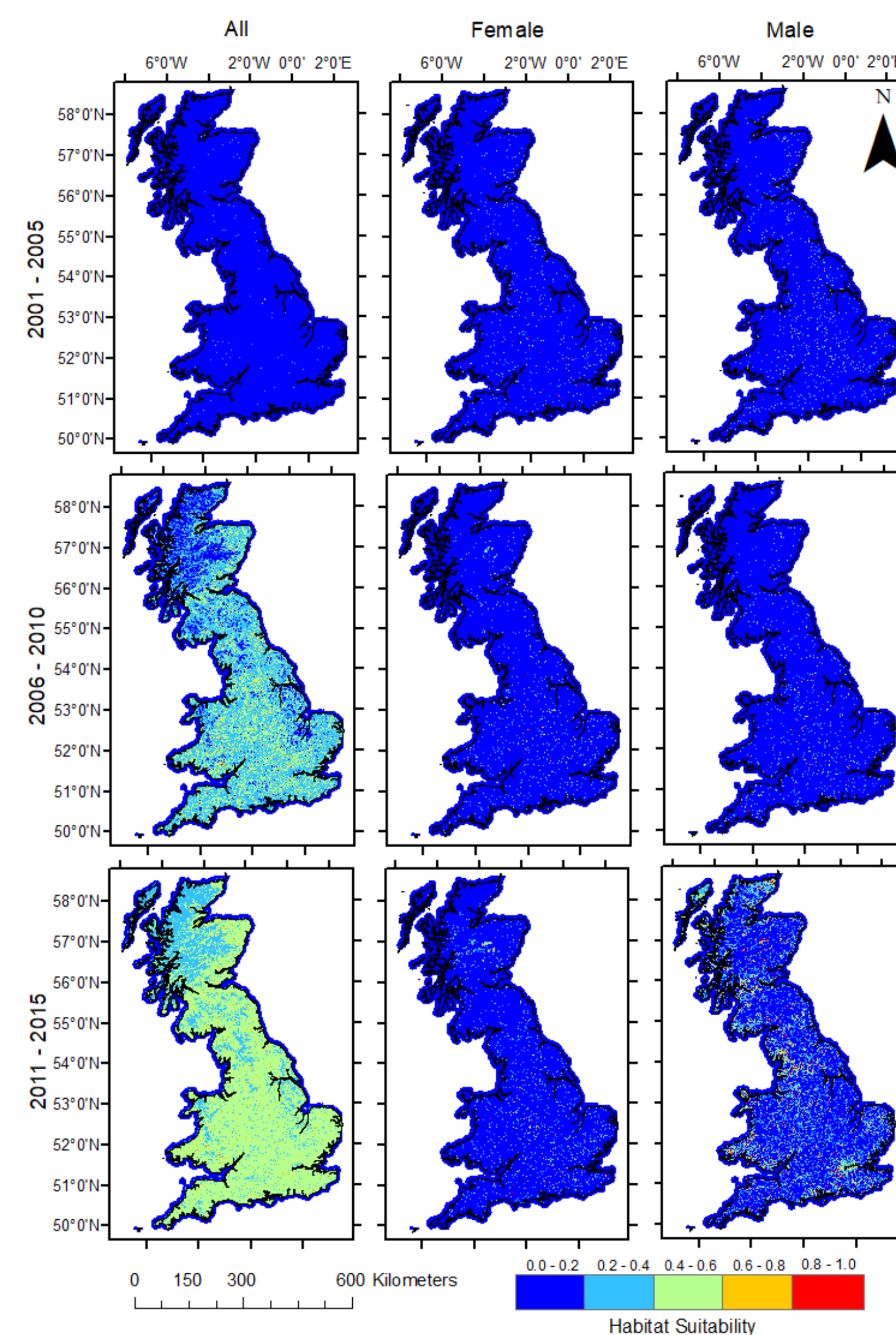


Figure 2. Pointwise mean *Lutra lutra* potential distribution (habitat suitability) across the UK using MaxENT.

Results cont.

Jack-knife analysis of variable contribution showed that for both *L. lutra* and sex-specific analysis the highest contributions to habitat suitability were from elevation, improved grassland and arable landscape. Test AUC scores for single variable models reinforced that these were the top predictor variables regardless of co-variation.

Pearson's analysis found no correlation between gender (r , male to female, 2001-2005 = 0.50, 2006-2010 = 0.52, 2011-2015 = 0.29, 2001-2015 = 0.46).

Conclusion

This study provides a baseline for future research efforts. Areas of research concentration pointed out by this study include, intraspecific spatial variation, effects of human disturbance and population analysis. With the models indicating areas of high probability of *L. lutra* suitability for directing future research efforts.

This study has provided a baseline of *L. lutra* habitation probability across the UK and denoting areas for future conservation and research efforts.