**Efficient Estimation (and Modelling) of Electrofishing Capture Efficiency for Juvenile Salmon over Large Spatial and Temporal Scales.**

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# Abstract

The use of juvenille salmon abundance estimates based on electrofishing for management and conservation is widespread. For practical reasons single pass electrofishing is often favoured over multipass electrofishing. It is well known that reliable estimates of abundance from electrofishing rely on reliable estimates of capture efficiency, which requires multiple electrofishing passes. Typically hierarchical Bayesian models have been used to model capture probability (and jointly fish density) but these approaches do not scale well to large datasets and so are not, currently, suitable for analyses of national scale datasets. We present an approach based on classical conditional likelihood methods which allow capture probability to be modelled in terms of linear and non-linear (non-parametric) relationships. The use of conditional likelihood provides a simple way to investigate complex covariate relationships. We present a set of best approximating capture probability models for Scotland over the years 1996 to 2014 utilising GIS based covariates which will allow the prediction of capture probability to any new site or to sites on which only single pass electrofishing has taken place. Sampling protocol was the most important covariate, followed by Fish age class (fry, parr) and species (salmon, trout) and day of year, other factors such as width, gradient affected capture probability to a lesser extent. The simplifications introduced over HBMs allowed a full model selection procedure (potentially even model averaging) to be conducted. A simulation study was conducted to show the effect of these simplifying assumptions as well as the overall impact of modelling capture probability.

Keywords: Atlantic Salmon, Fry, Parr, Capture Efficiency / Probability, Electrofishing.

# Introduction

* Estimating density is important for fishery management and conservation
* To estimate density from electrofishing data you need to estimate capture probability
* Capture probability estimation requires multipass fishing
* Often single pass is used for practical reasons
* Recently the trend is to use HBMs to model capture probability, but these become unwieldy in terms of model selection and fitting when faced with large scale datasets
* Conditional likelihood approaches are a simplification over HBMs but provide huge savings in efficiency and allow for complex models to be applied relatively easily using standard tools in R.
* We present an analysis of capture probability for xxxx sites covering Scotland for the years 1996 to 2014.
* A simulation study is used to support the conclusions and to investigate the impications of simplifying the modelling assumptions

Refs:

# Materials and Methods

# Results

# Discussion

# References