**Expected Improvements in Precision when Integrating Opportunistic Close-Kin Mark-Recapture Data into Fisheries Stock Assessments**

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Abstract

Close-Kin Mark-Recapture (CKMR) sampling, by providing additional information on abundance and survival rates (among other things), offers a promising new data source for fisheries stock assessments. To date and to my knowledge, most applications have focused on fitting a CKMR model outside of the stock assessment model and then either comparing the estimates those from the assessment or providing the abundance estimate and uncertainty to the assessment as data. Fewer studies have directly integrated the CKMR data into the stock assessment model. Sample design in order to achieve a desired precision is somewhat straightforward in standard CKMR models however when integrated within a full stock assessment model with many other data sources, the value of the data (in terms of a reduction in uncertainty of model estimates) is less clear. Herein I demonstrate, using self-test simulations, the expected improvements in precision of derived quantities and estimated parameters within statistical catch-at-age models when opportunistic CKMR sampling is conducted and the data integrated within the assessment. By opportunistic CKMR sampling I mean to describe the genomic sampling of individuals that comprise the age composition data, such that increases in CKMR sampling would also increase the age composition samples. I examine the expected improvements (conditional on model being correct representation of the system) across three life history types (Cod-like, Sardine-like, Flatfish-like) and different amounts of data available to the assessment, including the precision of the abundance index data, and the number and time series length of CKMR and age composition samples.

Introduction

Close-Kin Mark-Recapture (CKMR) theory () and

Conceptually it is simple. The more related your random samples from a population, the smaller your population is.

Here I simply show what one should expect in terms of improvements in model performance if close-kin mark-recapture (CKMR) data is collected and integrated within the stock assessment.

The precision of the normal CKMR estimator is reasonably standard, however the information it provides to fisheries assessment is a little more complicated given all of the different data sources.

We know it will depend on N.

Methods

I do not distinguish “juveniles” and “adults” as I am modeling an age structured population with proportional maturity at age. Thus any individual whose age difference with another (backdated to year of birth) places them in a potentially mature age (at the year of birth of younger individual) has the potential to be a parent of the individual. I make comparisons between “younger” and “older” individuals in reference to both potential POPs and HSPs (rather than say, juveniles and adults). Although this will be moot given the probability should be zero if a potential parent is not mature at year of youngers birth.

Simulator

Here show how the data were simulated

Estimator

Here the CKMR equations in the assessment model.

Acknowledgements

References