Review of ICESJMS-2015-625

A general catch comparison method for multi-gear trials: application to a quad-rig trawling fishery for Nephrops by Daragh Browne, Cóilín Minto, Ronan Cosgrove, Brian Burke, Daniel McDonald, Rickard Officer, Michael Keatinge

This is a really interesting methodological paper which develops a multinomial mixed model framework for investigating catch comparison data from multiple codends. The methods are sound, the availability of code means that they are likely to be used, and the paper should certainly be published. However, work is still needed to improve the model development. Also, multinomial models can be really difficult to interpret and, if the method is to be used properly by others, it is incumbent on the authors to describe and interpret their own results more fully. Finally, I would like to see more discussion of how further work might incorporate the data structures that often arise in catch comparison trials.

Model development

1. p6, l1-6. It took me ages to get my head around the notation, and the problem is simply that the matrix Y isn't well described. What is an observation? I eventually worked out that it is a combination of length class and haul, and n is the total number of length-haul combinations. But my natural inclination was to think of the haul as the observation, and I was looking for an h subscript on the Y matrices.
2. p7, l4-9. Didn't understand the modelling of catch weights at all. What is W_i? Is it the total catch weight for haul h_i across all four cod-ends? Why would this have a common effect on all four cod-ends? Much more explanation needed.
3. eqns 2, 3, 4, 7. Should turn subscripts round on the πs to make them consistent with the subscripts on Y.

Model interpretation

4. I get the feeling that some interpretational issues have been ducked. For example, there is a strong catch weight effect. Looking at Table 2, it is arguably the most important individual term. Yet the results only describe how AIC changes with catch weight and the discussion (p13, l11-15) only reiterates that catch weight was significant and affects selection. What was the sign of γ, and what does that mean for the relative catch rates of the four nets? I worry about models where the inclusion of terms is rather 'black-box'.
5. There are strong correlations in the random effects. Does this mean that the 80, 90 and 100 mm cod-ends are behaving similarly and, in particular, differently to the (reference) 70 mm cod-end? Why would that be? I presume the correlation matrix would look rather different if the 100 mm cod-end was used as the reference.
6. Do all the four cod-ends differ from each other? Do e.g. the 90 and 100 mm cod-ends have similar catch rates? Some plots of the differences between the fitted proportions, or reporting the results of adjusted pairwise comparisons would help.
7. It wasn't until I looked at Table 2 that I realised that the net-configuration term was an 'interaction'. I initially thought it was a 'main effect' with four levels (inner and outer port and inner and outer starboard). But the results (p10, l1) do suggest such a main effect ('inner port position typically fishing worst, and the other starboard or port fishing better'), so why not fit one and then add the interaction and see how important it is. Indeed, with more days fishing, you might treat this interaction as a higher-level random effect.

Model adequacy and structure

8. The random effects are clearly important, but how do you know that they are adequate? In selection and catch comparison studies it is common for both the intercept and the slope to vary between hauls. Here, for example, the carapace effects might vary between hauls. I don't think the paper needs to try to fit such a correlation structure – it has progressed things plenty as it is – but I think there should be some more discussion about how correlation structures more complex than an 'additive' haul effect are often required and how they might be incorporated.
9. The proportions might be expected to converge to 25% at large lengths. I know the quadratic terms in length did not improve the model fit (at least based on AIC), but one of the problems of linear length relationships is that they can be driven by the proportions retained at smaller and intermediate lengths

(where there are usually more individuals) with the fitted values at larger lengths then constrained to follow the linear relationships wherever they may lead. I have often found when fitting loess smoothers to catch comparison data that the relative catch rates asymptote to 50% for large lengths, even though the smoothers are not a ‘significant’ improvement on a linear model (just not enough power in the data). So there is a need to be award of the dangers of over-interpreting the fits at large lengths. One possibility might be to put some constraints on the length relationships (e.g. so that the proportions are all equal to 25% above some ‘large’ length) and see how that compares to the unconstrained model.

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