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Review of IOTC-2011-WPTmT03-15 – standardization of albacore CPUE by Japanese longline fishery in the Indian Ocean, by Takayuki Matsumoto and Koji Uosaki.

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This paper standardized Japanese longline catch and effort data aggregated into strata at 5x5 degrees, month, and HPB category for 1975-2010. Two approaches were used: lognormal error structure and negative binomial error structure.

The models used were :

$$\ln(CPUE + 0.3) = \mu + Y_i + Q_j + A_k + G_l + Q{*}A_{jk} + Q{*}G_{jl} + e_{ijkl}$$

$$Catch = H.\exp(\mu + Y_i + Q_j + A_k + G_l + Q{*}A_{jk} + Q{*}G_{jl} + e_{ijkl})$$

The paper notes that drastic changes have occurred in targeting, but the data are not separated into target types. Without this separation the CPUE time trend is likely to be driven largely by target strategy changes, and contain little information about abundance trends. The CPUE decline 1960-1975 is no doubt largely due to target change. The increase 1990-2010 may also be due to target change. The best way to identify what is really happening is to examine the operational data and explore methods for separating out the effort types using cluster analyses or regression trees (e.g. He et al 1997; Bigelow and Hoyle 2009; Hoyle and Okamoto 2011).

This target problem may be the most important for the indices. There are some other issues that apply generally, to analyses of either aggregated or operational data.

Each model includes the entire spatial extent, which assumes the same error distributions apply across the whole spatial and temporal domain. This differs from the approach used for WCPO and EPO analyses (e.g. Hoyle 2010) – we find that analyzing each subarea independently gives more consistent results. See Chang et al (2011) for a comparison of the two approaches. Error distributions are likely to vary in space, particularly between areas with very different albacore catch rates and targeting practices. Gear effects are also likely to vary spatially, but this is not included in the model. The paper IOTC–2011–WPTmT03–13 (Matsumoto and Uosaki 2011a) shows that targeting practices change differently through time among different areas.

None of the models examine 5 degree square as an explanatory factor, but when included 5 degree square is often one of the most important explanatory variables. This applies in albacore CPUE standardization (e.g. Bigelow and Hoyle 2008, 2009) as well as for other species (e.g. Hoyle 2010, Kiyofuji et al 2011). Including 5 degree square can significantly change the year effect. Examination of CPUE patterns by eye suggests large differences within subareas which could be accounted for in models by using 5x5 squares (Matsumoto and Uosaki 2011a).

An issue that is specific to aggregated data analyses is the additive constant used to avoid taking the log of zero catch rates. In this case the additive constant used was used 10% of the mean CPUE. The choice of the added value can affect the result. It is useful to follow a rule of thumb (reference for this method not given in the paper), but various rules of thumb are available (see Maunder and Punt 2004 for several) and it seems likely that analyses of different datasets will perform best with different rules – objective methods for choosing the best value are available. However, a better approach may be to avoid this choice altogether by using an alternative statistical method such as a delta lognormal model (e.g. Lo et al 1992).

Choice of the lognormal model seems reasonable given that the data are aggregated across a mixture of different distributions and targeting methods. Negative binomial may perform better with operational level data.

The primary issue with modelling CPUE data is to understand and model the processes that drive the observed catch rates. The operational catch and effort data held by Japan represent a key resource that will permit understanding of these processes. Without this understanding it will be difficult to estimate the abundance trends needed for stock assessment.

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