Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
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IOTC–2012–WPTmT04–INF04

Received: 20 August, 2012

To: Working Part on Temperate Tuna
From: Dr. Rishi Sharma, IOTC Stock Assessment Scientist
Date: 18th August, 2012.
Re: CPUE Standardizations for Japan for the Albacore Assessment

Japan appears to have revised some of their methods from the previous presentation in 2011. However, they still haven't addressed some key issues that probably need to be addressed before using this dataset in an assessment. The following are the key issues that should probably be addressed:

1) While operation data appears to be used in the new analysis presented by Japan (instead of the 5 degree grid). It still doesn't expand on whether the species declines/increases in the periods 1960-1975/1990-2010 were due to species target changes.
2) While the log-transform appears to be the best, it is still not entirely clear what proportion of the sets came from 0 observations. A Delta model could also be applied in this case if there are a large number of zeros.
3) Figure 3 in the paper shows the QQplot to indicate leptokurtic behavior (too much in the tails), and the model seems to over-predict smaller values and under-predict the larger values. While corrections in the MSE term in the standardized form may cancel this out to some extent, it may still appear to be problematic when using it for an index of abundance.
4) Even though almost all terms and interactions in the model are significant (Table 1), the Standardized CPUE uses only the main effect of Year and the MSE/2 as a correction. Maybe using all the terms in the model to test for spatial interactions and hook effect would be useful.
5) To that last term, the hook effect, I am not sure how the period 1966-1974 was decided to be a 4-7 HPB. It seems fairly arbitrary and more thought on this and its overall effect on the decline should be examined. Would using this as a continuous variable change the effects?
6) As these models are quite complicated, and are most probably of an unbalanced design, how did you deal with the order and interaction terms in the final model? Please present the results along with parameter estimates as we can see the effect of time, area, etc.

As suggestions I would examine the full model and then standardize the signal obtained from the full model. In addition, I would examine the effect of using the delta distribution. The use of Delta distribution (delta lognormal model, Pennington et. al. 2002, Lo et. al. 1992) can lead to more efficient estimators of mean and variance because non-zeros are assumed to follow a log normal distribution and zeros are treated separately. Examining this as a Poisson model treating each observation as counts and using effort as a covariate may be another alternative. In addition, using things such as the Box-Cox transformation to justify application of the log-normal as the appropriate response may the best way to go (See Figure 1 indicating that the log-transform is appropriate for the second case, and a square-root transform for the 1st case on some data analyzed on growth).

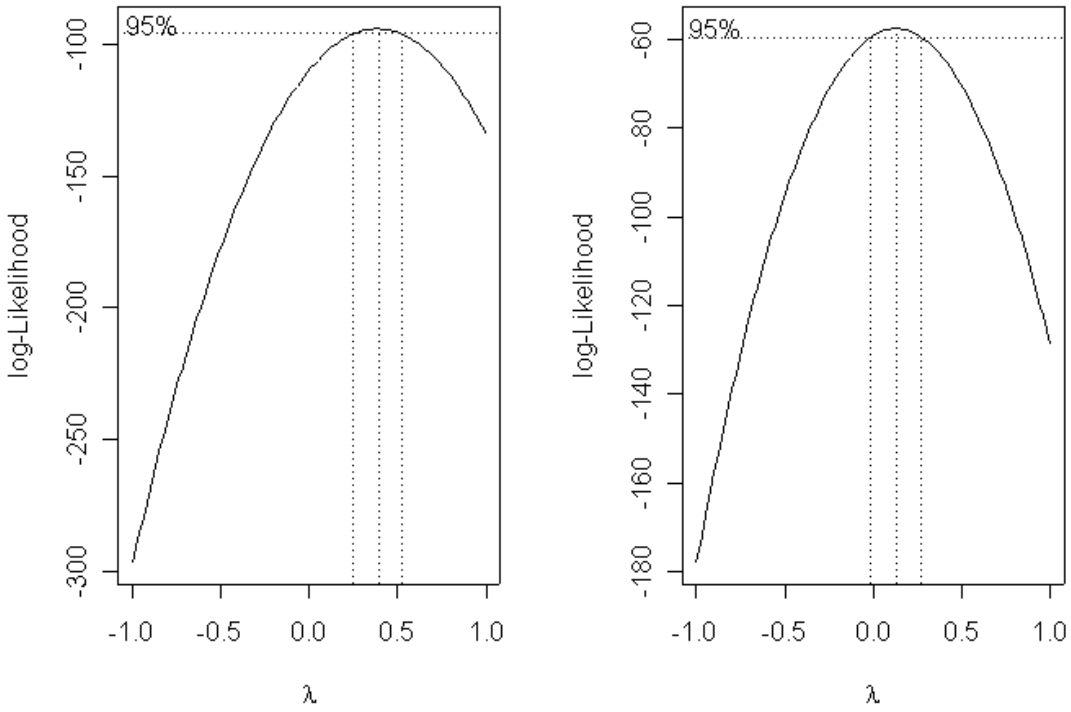

Figure 1: Box-Cox transformations on the derived data with the corresponding profile likelihood values for lambda (used in the power transformation). The left panel indicates a lambda of 0.5 so a square root transform is more appropriate than the right hand panel where a log-transform is more appropriate).

Finally, examining a sub-set of the log-book data may be more informative then using all the data especially when other species were being targeted if that information is available. As far as possible, you want to have a data-set that is invariant to these external factors that determine the CPUE. If this can be examined, along with some continuous covariates (in a richer dataset if available, if depth, vessel type, etc. was available) then the analysis may give a very different picture (Maunder and Punt 2004). Finally, how you weigh this data in a final assessment will eventually determine the outcome of the stock assessment (Schnute and Richards 2001).

References:

Pennington, M. , L. Burmeister, and V. Hjellvik. 2002. Assessing the precision of frequency distributions estimated from trawl-survey samples Fish. Bull. 100:74-80.

Lo, N.C., Jacobson, L.D., Squire, J.L., 1992. Indices of relative abundance for fish spotter data based on delta-lognormal models. Can. J. Fish. Aquat. Sci. 49, 2515–2526.

Maunder, M.N and A.E. Punt. 2004. Standardizing catch and effort data: a review of recent approaches'. Fisheries Research 70: 141–159.

Schnute, J. T. and L. J. Richards, 2001. Use and abuse of fishery models. Can. J. Fish. Aquat. Sci. **58:** 10–17.