

## Brief update on progress of the hake cannibalism/predation model

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An update to the hake cannibalism model (MARAM/IWS/DEC14/Hake/P8) was presented to the panel of experts at the MARAM/DAFF International Stock Assessment Workshop, December 2014 (IWS 2014). On the whole, the panel were impressed with the progress that had been made and noted that while fits to trend data were not as good as the Rademeyer fits, they were by no means bad fits in terms of fisheries standards.

The panel made several recommendations for further work, including:

- Considering alternative formulations of stock-recruit models for hake that incorporate cannibalism, both directly as a covariate and indirectly in how spawning stock biomass is defined.
- Explicitly accounting for spatial structure, either using movement model, or as treating predation on the west and south coast as separate ‘fleets’.
- Disaggregating the model by sex to better fit, for example, the longline catch-at-age data (although it should be noted that it is possible to disaggregate the diet data by predator sex but not by prey sex).
- Including other predators.
- Exploring data-poor methods for estimating diet composition in the absence of substantial amounts of stomach contents data.

The above points have been noted, but will likely be beyond the scope of the current PhD project and will need to be explored post-PhD. Recommendations that I am attempting to incorporate into the current PhD project, time permitting, are:

- Ignoring the spatial availability matrix to assess whether this feature of the model is needed to allow the model to mimic the observed diet compositions by age.
- Exploring alternate approaches to estimating or evaluating daily ration.
- Considering alternative models for how predation rates change with predator age.
- Examining the role and range of “other prey” more thoroughly, perhaps as in a sensitivity analysis to better reconcile how much food hake need to eat with what specific prey they eat.
- Exploring and contextually informing the topic of hake cannibalism using a literature survey.
- Examining the residual patterns for the fits to the diet data by year and consider the inclusion of random effects if these patterns are indicative of major model mis-specification.
- Implementing different values for basal mortality.

Progress since IWS 2014 has been primarily in updating the model to incorporate the latest available data. The latest catch-size data are available as catch-at-length matrices, and as such adjustments had to be made to the model to convert model-predicted catch-at-age estimates to catch-at-length estimates in a similar fashion to the current Rademeyer model. Since hake diet data are given by predator and prey lengths, these data can now also be used directly in the model fit without needing to convert to diet-by-age information first. Progress has also been made in reviewing literature relevant to the topic.

Work over the next few months will focus on refining the model, testing sensitivities, filling in gaps in the literature review and thesis writing. I will also need to verify that the diet data that I have are correct and up-to-date, in particular with reference to concerns expressed at IWS 2014 that the proportion of hake in the diet of *M. paradoxus* predators indicated by the data was higher than expected.

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