The hake predation model: future developments and research

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Table 1 of MARAM/IWS/DEC16/Hake/P2 lists future work items that are outstanding from past panel recommendations and/or have been identified in the thesis as future developments. The highest priorities are listed below, and any comments, suggestions or recommendations that the panel have regarding these would be appreciated.

1. Any advice on how to deal with the "switching"? This a feature of the model whereby it switches between fitting one set of data more closely to fitting another. The same set of starting parameter values can end with two relatively different sets of final estimates for these parameters, but with virtually identical likelihood values.

2. Punt (1994) introduced a competition term in order to prevent excessive cannibalism (and consequently oscillations and generally unstable behaviour of the model) resulting from large predator cohorts increasing with age over time. We mimicked this concept by placing an upper bound on the predation mortality. Various values for this bound were tested, with rate of 0.06 per month (equating to an annual mortality rate of $0.72y^{-1}$) chosen for the base case bound. With a fixed basal mortality rate of $0.2y^{-1}$, this effectively puts an upper bound of 0.92 on the natural mortality rate. Are there other approaches that could be explored for limiting predation resulting from large predator cohorts? Or alternatively, are there any recommendations for determining realistic bounds on the annual natural mortality rate?

3. Exploring sensitivity to basal mortality rate assumptions – what are appropriate variants? (Note experience suggests that single factor variations are inappropriate, as any alternative base case requires subtle changes across a number of assumptions/parameter values for realism and acceptable fits to data).

4. Model-simplification /how best to address potential over-parameterisation

5. Segregating the model by coast.
    a. Explore differences in diet on WC and SC
    b. The past panel recommendation was to use either a movement model or treat predation on the WC and the SC as separate fleets. Any further comment/recommendations for implementing this segregation?

6. Developing methods for incorporating preference information by length, rather than by age.

7. Incorporating an "other predator" component, such as seals.

8. Running the model with coarser time-steps to increase computational efficiency.

9. Any items from Table 1 of Hake/P2 that need to be accorded higher priority?