

Potential Process for using Estimates of Biomass Directly in Management

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Introduction

The Panel that conducted the 2018 review of the acoustic-trawl methodology (ATM) surveys did not support use of the ATM biomass estimates as absolute estimates of biomass ($Q=1$) in assessments. However, the Panel agreed that some of the estimates (see Table 3 of the review report) can be used as relative indices in assessments and directly in management (i.e. related to absolute biomass, but via an unknown proportionality). The Panel also recognized that specifying harvest control rules that directly use ATM biomass estimates is complicated because it did not support use of estimates of biomass as absolute in assessments. At present, age-based stock assessments exist only for Pacific sardine and Pacific mackerel (although ATM data have only been used to date in the assessment for Pacific sardine), making inclusion of ATM data in assessments for anchovy unlikely in the short- to medium-term owing to needing to first collect sufficient data to warrant development of an age-based assessment. In principle, biomass indices could be used directly in management, as is the case, for example, for South African sardine and anchovy. However, the South African management strategies, which have been tested using Management Strategy Evaluation, assume that the absolute abundance biomass estimates from acoustic methods are unbiased, even though it is known there is some bias associated with those estimates.

The report of the ATM review notes that Management Strategy Evaluation, MSE, could be used to develop harvest control rules that rely on ATM biomass estimates. The Pacific Fishery Management Council (Council) is familiar with the use of MSE and the process of developing and evaluating an MSE, but the case of CPS adds extra complexity owing to the facts that: (a) there is no assessment for several CPS stocks, and (b) the ATM review did not support use of the ATM biomass indices as absolute.

Potential approaches

Lack of assessments / constructing operating models

A lack of existing assessments is not uncommon when conducting MSEs for ‘data poor’ situations, and approaches such as the Data Limited Methods Toolkit (DLMTTool) have been developed specifically for such cases. For CPS, the approach for developing an operating model would necessarily involve a broad range of scenarios to ensure that (to the extent possible) the full range of uncertainty is covered. This may involve assuming that the current ATM estimates are unbiased, but examining sensitivity to other options (e.g. different target strength relationships, corrections for the proportion of the population inshore of the survey areas). The aim would not be to obtain “best estimates” but rather to cover the likely range. Similarly, scenarios regarding productivity (e.g. natural mortality, growth etc.) may need to be based on studies for similar species (as is already the case for the target strength relationships). This will necessarily lead to more scenarios than was the case for the MSE for Pacific sardine, but this reflects the additional uncertainty associated with stocks with little data and no assessment.

Alternative control rules

The Council is familiar with control rules of the “threshold” type in which a catch limit (aka OFL) is a function of biomass, and the strategies for Pacific sardine and Pacific mackerel are

of this type. However, those strategies rely on the assumption that the estimate of biomass is “close to unbiased”. Whether such an approach is appropriate for PFMC CPS finfish other than Pacific sardine for which Q is estimated to be 1.1, is yet to be established, but could be tested using MSE, as was the case for South African sardine and anchovy.

Other forms of harvest control rule have been adopted in cases in which the index of abundance is relative rather than absolute. These control rules adjust catch limits (or fishing effort) based on trends in the estimates of biomass or changes in such estimates. Examples of these control rules are given by Johnston and Butterworth (2005), Plaganyi *et al.* (2007), and Little *et al.* (2011). Some of these harvest control rules involve using multiple relative abundance indices (e.g. Johnston and Butterworth, 2005), which in the context of CPS could involve using ATM indices of biomass as well as DEPM/CalCOFI data. In general, the harvest control rules change the catch limit annually. However, harvest control rules that set multi-year catch limits (e.g. the ABC given a fixed OFL) could be considered as well as harvest control rules that assign the stock to harvest rate categories based on the values of indices and only change the ABS/OFL if a category change occurs (e.g. McGarvey *et al.*, 2016 for southern rock lobster).

Tentative timeline considerations

The time to develop an MSE for northern anchovy should take into consideration:

- The Council’s objectives for any harvest control rule and, in particular, whether account would need to be taken of dependent species in the modelling, rather than simply indirectly by maintaining high biomass relative to that expected were there to be no fishing.
- The uncertainties and how they would be represented in the operating models to be considered. This would ideally be accomplished using a workshop of relevant experts, including SSC and other advisory body participation.
- Candidate harvest control rules to evaluate. This step could be accomplished during Council meetings. However, given the types of control rules may differ from those considered previously for CPS, appropriate time for discussion may be needed.
- Coding and testing of the operating model, although the work already conducted for Pacific sardine may provide a good starting point for this step.
- Running simulations and discussing options for additional analyses.

Conclusion

In principle, MSE can be used to help the Council select a way to use ATM results directly in management. The MSE will require the usual types of input from advisory bodies and the public, but if the SSC agrees with the conclusion of the ATM review that the estimates of biomass should not be used as absolute, the MSE will be more complex than might have been the case.

References

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