A case for a higher critical biomass threshold in the anchovy-only OMP-18rev than in OMP-18

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Reasons are given in support of an increase in B^A_{crit} and a decrease in α for an anchovy only OMP-18rev, compared to that used in OMP-18.

Keywords: anchovy, critical biomass threshold, OMP-18rev, risk

Background

de Moor (2021a,b) has provided a number of results for alternative candidate Management Procedures for an anchovy-only OMP-18rev. The SWG-PEL TTG has suggested that the shape of the anchovy HCR should remain the same as that for OMP-18 (de Moor 2018a) and only the control parameters α and B^A_{crit} should be adjusted. This document provides some reasons for the author promoting an increase in the critical biomass threshold and a decrease in α from that selected for OMP-18.

Risk

- The anchovy risk threshold for OMP-18rev (as for OMP-18) is the 1996 level of spawner biomass, which is the lowest historical level. "Risk" is the average probability of the anchovy spawner biomass being below this risk threshold over the 20-year projection period (de Moor 2018a, 2021a,b).
- There is a 3% probability of the anchovy spawner biomass dropping below the lowest historical level (1996) under a no future catch scenario – i.e. $Risk_A = 0.03$ (de Moor 2021a).
- In developed countries, fisheries management advice is frequently set ensuring that the probability that spawner biomass is below SSB_{lim} is <5% (regardless of what the 'risk' is under a no catch scenario[1]) (e.g. ICES 2016, 2020). In Australia the maximum probability is 10% (Dichmont *et al*. 2016).
- To allow for situations of greater uncertainty and non-zero risk under a no catch scenario – which is common for small pelagics - I think it is more reasonable to set fisheries management advice such that the risk is 5% MORE than that which is calculated under a no catch scenario.
- Risk under OMP-18 was 7.1% more than that under the no future catch scenario at that time (de Moor 2018a).
- Risk over the 20 year projection period under OMP-14 (but tested against a different threshold; see de Moor 2021b) was 3.9% more than that under the no future catch scenario at that time (de Moor 2014).
- However, given the agreed shape of the HCR it is not possible to select a combination of values for α and B^A_{crit} (within a range of 600 – 800 thousand tons) which restricts the risk to 5% more than that of a no catch scenario (i.e. 8% in total). This is because the HCR allows for a quadratic decrease in the anchovy TAC below B^A_{crit}, regardless of the value of α, and a minimum of a 'stable TAC' of 120 000t above B^A_{crit}, regardless of the value of α. The lowest possible risk for OMP-18rev is 8.7% for $B^A_{crit} = 800$ and 10.1% for $B^A_{crit} = 600$ (Figure 5 of de Moor 2021b).

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[1] ICES do make some provision for possible catches of small pelagics if risk under the no catch scenario is >5% (ICES 2016).

Some of the reasons for the increased risk under the new OM, compared to that used during the development of OMP-18, and thus reasons for requiring a more conservative OMP (i.e. higher B^A_{crit} and/or lower α) include, but are not limited to:
- the resource being estimated to be less productive than previously thought (Figure 3 of de Moor 2021b);
- the projections are not influenced by high incoming recruitment informed by recent survey estimates only (the 2017 survey estimate of recruitment was used in projections (de Moor 2018b), but was subsequently found to be a substantial over-estimate of recruitment if natural mortality is time-invariant; see e.g. Figure 3 of de Moor (2020a)); and
- an updated estimate of survey bias indicating less bias than previously estimated together with a corrected maturity ogive and thus a lower absolute total biomass from which an absolute level of catch biomass is to be taken (Figure 1 of de Moor 2021b).

Control Parameters for OMP-18rev

- If the same method is 'blindly' followed to tune α so that the risk under OMP-18rev is the same as that under OMP-14 (which is how α was selected for OMP-18), then CMPg has a risk of 19.3% with $\alpha = 0.979$ and $B^A_{crit} = 600$ (Table 3 of de Moor 2021b).
- Increasing B^A_{crit} to 800 provides *some* 'saftey net' at the mid-lower range of anchovy biomass, without impacting TACs at mid-higher levels of anchovy biomass. The risk for CMPi is 15.5%, which is 12.5% more than the no catch scenario (Table 3 of de Moor 2021b), so still substantially higher than could be argued to be 'ideal', but is an improvement from the risk of 19.3% under CMPg. An increase in B^A_{crit} to 900 would reduce the risk further to 14.0%, but we were previously advised that $B^A_{crit} = 900$ would be too great a change for industry and thus agree to consider the 600 to 800 range only.
- The same risk of 15.5% under CMPi could be attained by keeping $B^A_{crit} = 600$ and decreasing α to about 0.7 (Figure 5 of de Moor 2021b).
- If I could only choose one of the two above options, I would prefer an increase in B^A_{crit} to 800 as that reduces risk by decreasing the TAC over the mid-lower range of anchovy biomass. In contrast, maintaining $B^A_{crit} = 600$ and reducing α reduces risk by decreasing the TAC above B^A_{crit} only. I'd choose to be more cautious over the mid-lower range of anchovy biomass and allow for maximum TACs when the biomass and/or recruitment is high. As an example, if $B^A_{crit} = 800$ and $\alpha = 0.979$, the initial anchovy TAC reaches the maximum of 350 000t at a survey estimate of biomass of around 3250 000t, and the average annual catch is estimated to be 273 000t, while if $B^A_{crit} = 600$ and $\alpha = 0.7$, the initial anchovy TAC only reaches 350 000t at a survey estimate of biomass of around 5850 000t, and the average annual catch is estimated to be 262 000t.
- **My recommendation, however, is a combination of both an increase in B^A_{crit} to 800 and some decrease in α**. If $\alpha = 0.9$, risk is 0.150 with average annual catch being 271 000t, while if $\alpha = 0.85$, risk is 0.146 with average annual catch being 269 000t (Table 4 of de Moor 2021b).

Further considerations

- All the above risk comments pertain to the baseline OM only. One of the reasons we landed with Exceptional Circumstances for anchovy was because OMP-18 was not selected to be robust to uncertainty (i.e. to satisfy key robustness tests, such as, lower incoming recruitment). It is crucial that we consider the robustness of our selected OMP-18rev to plausible alternative OMs, some of which have a higher risk than that of the baseline OM (Tables 2 and 3 of de Moor 2021a).
- It is likely that, were the recommended histological method for ageing used instead of macroscopic ageing, the absolute anchovy biomass would be lower than assumed in testing OMP-18rev (de Moor 2021c), and thus risk would likely be higher.

- The arguments for economic loss by Bergh and SAPFIA (2021) are based on a survey estimate of 600 000t. However, the November survey estimate of anchovy has been less than 600 000t only once in 37 years (in 1996), with other relatively "low" biomasses in 1995 and 1994. They argue that "the biological benefits are quite small and the economic impacts can in certain circumstances be very large". However, history shows these "certain circumstances" would occur with a small probability, but it is these very circumstances when we should be concerned and manage carefully – waiting to see whether incoming recruitment can support a higher TAC - to ensure a viable long-term fishery for all Right Holders, now and in the future.
- Bergh and SAPFIA (2021, Section 3) note a difference in the 1-year 'risk' between CMPg, CMPh and CMPi to be 0% in 2021. This is because the initial anchovy TAC in 2021 was 299 700t for all CMPs (de Moor 2020d). The differences in 1-year 'risk' between alternative B^A_{crit}'s are only meaningful in future years.
- The Appendix contains responses to Bergh's (2020) 'mitigating factors' for firstly arguing the HCRs and associated control parameters for setting anchovy TACs be unchanged from OMP-18 and secondly preferring a decrease in α to an increase in B^A_{crit} (de Moor 2020b).

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APPENDIX: Some Comments on FISHERIES/2020/DEC/SWG-PEL/129

de Moor (2020b) is repeated here as both Bergh (2020) and de Moor (2020b) have not yet been presented to the SWG-PEL.

Some comments are provided to the 'mitigating factors' given by Bergh (2020) (repeated here, in red).

1. The 'no catch' risk under the revised OM has increased to 3%, from a level of 1.8% in late 2018. The increased risk of OMP-18 under the new OM needs to be viewed in this context.

   The 'no catch' risk has increased by 1.2% (from 1.8% to 3.0%). In contrast, risk under OMP-18 increases by 12.9% (from 8.9% to 21.8%).

2. The OMP under consideration will be applied for the 2021 and 2022 seasons only. The 2021 and 2022 risks are generally less than $Risk_A$ by between 3% and 4%.

3. In general, reconsideration of the risks in an OMP in mid-session will show greater risks if these risks are evaluated shortly after some negative trends in a resource. This is particularly the case for highly variable pelagic resources. Doing so as a general practice defeats the purpose of the OMP philosophy which requires disciplined application of a formula over a period of 4 or so years. This context should be considered when considering the risks that are assessed now following the technical EC status that has occurred in the last two years.

   Bergh is correct that an OMP should ideally be implemented unchanged for a number of consecutive years. However, Exceptional Circumstances have been declared for both sardine and anchovy as the populations were found to be outside the range to which OMP-18 was simulation tested and OMP-18 was thus set aside and not used to set sardine and anchovy TAC/Bs. If short-term ad-hoc advice is to be avoided, a new OMP is required.

   The 'context' is explicitly considered when developing RSA small pelagic OMPs by making comparisons between CMPs and the no future catch scenario, which have identical OMs (i.e. identically positive or negative trends in the resource). Given recent data, risk to the resource has increased by 1.2% under a no catch scenario. To be 'equal in context', risk under a new OMP should also increase by 1.2% (to 0.10). In contrast CMP3 (with $B_{crit}^{A} = 600$), CMP5 (with $B_{crit}^{A} = 800$) and CMP6 (with $B_{crit}^{A} = 700$) have risks which have increased by 9.2%, 6.4% and 7.8% respectively!

4. The risks that have been calculated for CMP3 use an OM which has ignored the mid-2020 recruit survey results. Inclusion of these results causes a lower value of $Risk_A$ by about 4.8%.

   The June 2020 survey estimates of recruitment have not been completely 'ignored'. The survey observations are within the range which is simulated for mid-May 2020. (During implementation, this would be a check that the OMP is 'good for use'). The SWG-PEL TG agreed to set aside the previous weighting method because it resulted in too much weight being given to the most recent survey estimate. Following that method could result in Exceptional Circumstances being declared once again for anchovy if the recruit survey observations suggest recruitment is higher than that subsequently realised in the population. Rather, an OMP needs to be robust to a range of uncertainties (including incoming recruitment) and not one that "believes" the June 2020 survey exactly.

   The 'upper recruitment extreme' option – an alternative lending more weight to the most recent recruit survey than the inverse variance weighting method the SWG-PEL TG agreed to set aside - was a 'rough' run to test the sensitivity of the α control parameter to the inclusion of the June 2020 survey estimate, and (considering the 'context' of lower risks under both no catch and catch scenarios) it shows α is relatively robust.

5. The risks that have been calculated for CMP3 ignore the fact that the anchovy TAC is generally under-caught. Inclusion of this consideration results in a lower value of $Risk_A$ than has been reported so far for CMP3, by about 2%.

If industry is confident that the anchovy TAC will continue to be undercaught, then three alternative options could be considered:

i) A lower maximum TAC (e.g. Table 3 of de Moor 2020).

ii) A lower maximum catch (results would be identical to Table 3 of de Moor 2020 for a maximum TAC of 350 000t, but a maximum catch of 275 000t). If this option were selected, then although individual quotas of the anchovy TAC would sum to 350 000t, the fishery would be closed once the maximum catch of 275 000t is taken. This could result in a 'race to fish' and some right holders would be unable to catch their allocated quota.

iii) The simulated anchovy catch is modelled to be a proportion of the TAC based on historical data. This could be a possibility for OMP-22 once an updated timeseries of catch data becomes available, but is not feasible for OMP-18rev. The implementation of such an OMP would thus need to be checked to remain within the bounds of that simulation tested (similar to what has been done for sardine bycatch in the past).

However, one cannot suggest that the risks associated with a CMP with a lower maximum TAC can be used to justify the choice of a CMP with a higher maximum TAC without one of the above associated 'costs'.

6. The socio-economic impact of increasing the value of B_{crit} can be considerable. The impact that this has is to decrease both the initial TAC and the final TAC. This can cause a loss of potential catch prior to the mid-season revision of the TAC, which cannot be made-up thereafter, regardless of how attractive the final TAC is. This is likely to cause the final TAC to be undercaught by a greater % than has been the case in the past.

See below.

7. The risk reduction that can be achieved by large increases in Bcrit of 50% are relatively small, about 2%. This benefit seems incommensurate with the scale of the socio-economic impact. This is about 10% of the **final TAC** or in the order of 30 000 MT per annum, based on running the OMP formula retrospectively on the actual historical survey results. The impact on the **initial TAC** is much larger, just under 60 000 MT per annum on average, based on the same historical survey results. The net loss that results from this is complex but likely very considerable. A possible scenario is that the initial TAC is much reduced, Status Quo versus Proposal B, but the final TAC is not – there would be a substantial loss **which would not show up when only considering final TACs**. Another example (see 'Equation OMP.18' below) is what the negative socio-economic impact would have been this year had there been application of formula OMP.18 with 'Proposal B modification', viz. a loss of 64 000 MT.

While the one-season socio-economic impact may be great, the above two points fail to consider the multi-year socio-economic impact: that greater risk to the resource this year could result in lower catches and greater socio-economic cost the following year.

Rather than increasing the risk to the resource, the best solution is for the recruit survey to be undertaken timeously during May, so as not to delay the final TAC recommendation.