Comments on FISHERIES/2020/AUG/SWG-PEL/75 and FISHERIES/2020/AUG/SWG-PEL/76

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A perspective on some of the comments in FISHERIES/2020/AUG/SWG-PEL/75 is given.

This document contains comments on FISHERIES/2020/AUG/SWG-PEL/75 and FISHERIES/2020/AUG/SWG-PEL/76 which would ordinarily be raised during the course of a SWG-PEL meeting discussion, but are now required in writing given the change to the SWG-PEL Aide Memoires. For ease of reference, I have pasted a copy of some of the text from FISHERIES/2020/AUG/SWG-PEL/75 and FISHERIES/2020/AUG/SWG-PEL/76 below before responding.

2. *Is that additional information from the survey sufficient to justify such reconsideration this year?* Yes: expressed broadly (FISHERIES/2020/AUG/SWG-PEL/73), the recruitment estimate (for the preceding November) assumed for decisions made before the survey took place changes from 9 to 11-13, which is not an insubstantial increase. Following the revised survey result, this range changes to 12-16.

2. Doc A reports, method dependent, a range in November 2019 recruitment from the initial working up of the survey data (Doc A) of between 11-13, and from the revised working up of the survey data (Doc B), of 12-16. The calculations below use a value of either 11.5 or 14.14 which fall in the middle of the range of values. These choices were also motivated by the fact that Table 5a,b of FISHERIES/2020/AUG/SWG-PEL/70 provides consequence values at these two recruitment levels (11.5 or 14.14).

- The ranges quoted here assume acceptance and equal weighting of all three methods in FISHERIES/2020/AUG/SWG-PEL/73. "Method 1" has previously been reported to the SWG-PEL, and "Method 2" is a continuous version of that. "Method 3" is different and assumes a constant "stock-recruitment relationship". It is, however, likely that spawner biomass levels over the most recent 5 years have straddled a Hockey-Stick stock recruitment hinge point, or been around the lower downward slope of a Beverton-Holt stock recruitment relationship, suggesting a constant stock-recruitment relationship cannot be assumed.

- Methods 1 and 2 of FISHERIES/2020/AUG/SWG-PEL/73 indicate an increase from 9 to 11.1 – 11.8 billion (median 11.2) for the original survey estimate and to **11.9 – 13.9 (median 12.6)** for the revised survey estimate.

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9. Our suggestion was originally for a 2-3 kt increase on both coasts, though the exact correspondence thereof to the indications from the additive change in B measure is serendipitous. This suggestion was driven more by broader overview considerations, including:

- Being conservative (pending November 2019 recruitment strength being further informed by the results from the November 2020 survey) – this in the sense that the results in Table 1 overall could be taken to support a greater increase than we suggested.

- Giving somewhat greater weight to allocating an increase in estimated surplus production (given the 2020 survey result) towards further resource growth than an immediate catch increase; particularly important given the present low biomass of the western component.

- Being not greatly concerned about "literally" seeing a slight decrease in the value of the Relative multiplicative effSSB measure. A drop of 1% there is minimal, especially for a measure whose baseline value (for 34.05 kt) is already very high and above the 0.88 value used as a basis for recommendations in 2019.

- While FISHERIES/2020/AUG/SWG-PEL/74 attempts to methodically and quantitatively revisit the sardine TAC recommendation of April 2020, the above reasoning is more qualitative and serendipitous.

- The results given in Table 1a of FISHERIES/2020/AUG/SWG-PEL/75 only correspond to a σ estimated from 2005 onwards, whereas if the higher variability estimated in more recent years (e.g. 2010 onwards) is considered then the recommended revision according to Table 1a, for the June 2020 survey estimate of 11.78 billion, would be 0.4 – 4kt lower (FISHERIES/2020/AUG/SWG-PEL/72add).

- The proposal for a 5kt increase on both coasts does not give a greater weight to allocating an increase in estimated surplus west component production towards further resource growth (and subsequent catch) than immediate catch. The revision to the November 2019 recruitment results in a greater chance of an increase in west biomass from 2019 to 2020 under a no catch scenario (from 69 – 75%). While the 5kt proposal for both coasts also results in a greater chance of an increase in west biomass from 2019, this is now only 76% of that under a no catch scenario compared to 81% in April, and 79% with the 3kt proposal (Table 2). There is no "surplus" west component at the 20%ile – the biomass is predicted to decrease. An increase is predicted at the median, and for the median this proposal allocates 76% of the surplus biomass to the fishery, compared to the 65% selected in April 2020 (Table 5a of FISHERIES/2020/AUG/SWG-PEL/70 and Table 2). This appears to be contrary to 'important'ly considering the 'present low biomass of the western component'?

d) *It seems that penguins in the west rely heavily on sardine (Robinson et al., 2015), so that EAF considerations would indicate not to increase the west directed sardine catch.* Calculations at the 20%ile had indicated that the previous agreed TAC would have increased the drop in biomass of 8 kt in the absence of a catch to a drop of 20 kt. Under the directed catch increase proposal made here, this drop is now slightly less at 19 kt. The magnitude of any of these catches would in any case have rather little impact on penguin adult natural mortality in terms of its relationship (see Figure 1) with west sardine biomass estimated in that paper. Note that the relationship suggests that such negative impacts commence once the west component biomass drops below about 350 kt. The 2019 biomass of this component is estimated at 90 kt (FISHERIES/2020/APR/SWG-PEL/30), and the magnitude of the slope of the relationship is falling for biomasses around this level. For the decrease of 20 kt sardine biomass (12 kt more than were no catch taken) which was originally projected for the existing agreed TAC, the adult natural mortality would be estimated to increase by 0.01 from about 0.55 to 0.56 (with about half of that a consequence of the fishery). For the 10 kt directed catch increase we now propose, with 5 kt of that on the west coast, that 0.01 would be estimated to decrease, but by a negligible 0.0005.

- As mentioned above, the decrease in biomass at the 20%ile considered in April 2020 was 8kt under a no catch scenario and 20kt under the recommended catch level. While the authors mention above that the decrease in biomass at the 20%ile under the revised recruitment scenario is 19kt under their recommended catch level, they don't mention that this would be 4kt under a no catch scenario. So their proposal results in a greater reduction in biomass from a no catch scenario than that accepted in April 2020.

- The relationship referred to in Robinson *et al*. (2015) is based on survey estimated biomass west of Cape Agulhas, not model estimated biomass (which has nevertheless changed substantially from that estimated in 2012).

- Robinson *et al.*'s (2015) relationship showed a negative impact on adult annual mortality once the index dropped below 25% of the maximum. In November 2019, the index was only 3.2% of the maximum (43 600t, Figures 1 and 2).

- FISHERIES/2020/AUG/SWG-PEL/75 argue that 5 000t additional catch has minimal impact on the adult annual mortality at very low biomass levels due to the shape of the relationship fitted, which assumes asymptotes at either extreme. Firstly the catch tonnage is not directly comparable with the survey biomass given survey bias. Secondly, it would be interesting to see if the adult annual mortality still asymptotes to just above 0.6 or just below 0.7 if this relationship (or one with less constraining asymptotes) were refit with the additional 7 years of data now available. Assuming this relationship, however, an index of 0.032 corresponds to an adult annual mortality of 0.613 based on values at the posterior mode and 0.665 based on values at the posterior median (Figure 2). Decreasing this biomass by 15 400t (0.77x20 000t) down to an index of 0.021 results in an increase in adult mortality to 0.617 (mode) or 0.675 (median). On the other hand, were the population able to increase by 15 400t, the adult mortality would decrease to 0.608 (mode) or 0.650 (median).

e) *Increasing the directed sardine catch in the west would involve excessive resource conservation risk.* This is addressed in part in 9 above. But risk needs also to be seen in a wider context than small pelagic species only, and set more broadly against the "norm" for other SA fisheries together with the indications being given for some of those by decision makers in the current circumstances of extreme socio-economic pressures requiring a greater focus on jobs and wealth creation. For example, for sardine a much larger proportion of surplus production has been recommended by the PWG to be allocated to resource growth than to fishery catch, based also on a low percentile of the distribution concerned to be precautionary. In contrast in the case of the yet more heavily depleted west coast rock lobster resource, the DEFF decision on allocation has been quite the reverse with a much greater proportion allocated to the fishery than to resource growth (following the WCRL SWG recommended a 50:50 split), linked to calculations reported for the less precautionary median values of the distributions concerned. Quite clearly therefore, the acceptable resource conservation risk levels underpinning recommendations for sardine in the PWG have recently been set much higher than those accepted by DEFF for the west coast rock lobster.[1] For DEFF to have a broadly defensible position across species, the risk bar being set by the SWG-PEL in its recent decisions regarding sardine needs to be reconsidered. Further discussion on this amongst the various DEFF scientific working groups and managers would clearly be beneficial.

- While discussion amongst DEFF scientific working groups and managers regarding resource risk would be welcome, making an *ad hoc* mid-season increase to sardine risk based on the above arguments is unwise.
- It is more important to remain consistent within a working group than between working groups. The proposal of de Moor (2020) is consistent with the same procedure as was followed for anchovy. This was, in fact, what was originally requested of the TG (a re-visitation of the April 2020 sardine TAC recommendation in the light of the recruit survey estimate as was done for anchovy).
- Any such risk should not only be considered in a South African context (where west coast rock lobster is unfortunately far from our 'ideal' resource), but also in an international context. In some settings, e.g. US, this fishery would currently be closed. In other settings, the risk of the resource falling below the lowest historical level (previously set at 2007, and exceeded in the most recent 2 years) must be <5%.
- FISHERIES/2020/AUG/SWG-PEL/75 is mistaken in their comments regarding "…a much larger proportion of surplus production has been recommended by the PWG to be allocated to resource growth than to fishery catch…". Firstly, at the lower percentiles of 5 and 20%ile there is NO surplus production. Instead, the west component biomass is predicted to decrease. If one considers the less precautionary median values, however, some surplus production is estimated. The proposal for an increase in 5000t of catch on both coasts advocates for 76% of this median surplus production to be allocated to the fishery and only 24% to population growth, contrary to the statement in FISHERIES/2020/AUG/SWG-PEL/75. The proposal for an increase in 3000t of catch on both coasts advocates for 2 thirds of this median surplus production to be allocated to the fishery and one third to population growth, similar to that of the April 2020 recommendation (Table 2).

- It is therefore NOT "quite clearly" the case that the acceptable resource conservation risk levels underpinning recommendations for sardine in the PWG have been set much higher than those accepted for west coast rock lobster.

With this modification, the results (i) – (iv) are as follows, (v) – (viii):

v)   WC consequences A-D only, equally weighted: 51.01 (*62.93*) thousand MT
vi)   WC + SC consequences A-H, equally weighted: 46.93 (*57.39*) thousand MT
vii)   WC consequences A-D only, weighted 0.25, 0.25, 0.5, 1.00: 44.60 (*52.24*) thousand MT
viii)   WC + SC consequences A-H, weighted 0.25, 0.25, 0.5, 1.00: 42.85 (*50.17*) thousand MT

- The above weightings assign three times the weight to statistics based on effective spawner biomass compared to that based on total biomass. In addition, as explained in FISHERIES/2020/AUG/SWG-PEL/74, one of these statistics is derived directly from the other and should not be 'double-counted'. Table 1 indicates the sensitivity of these results to the weightings selected, giving an example where the effective spawner biomass statistics are given double or equal the weight of that for total biomass. Further alternatives can be produced during the meeting should participants wish.

Table 1a. The "TAC CALCS" from FISHERIES/2020/AUG/SWG-PEL/76 for alternative weightings, using the results corresponding to $N^S_{w,0,2014,0} = 11.5$ billion from Table 5a of FISHERIES/2020/AUG/SWG-PEL/70.

|	Multiplicative Δ in effSSB	Additive Δ in effSSB	Additive Δ in B	Relative Multiplicative Δ	Resultant TAC
Slope	-0.004	-0.101	-0.340	-0.003	
Intercept	1.670	18.218	-6.438	1.000	
April 2020	1.43	12	-20	0.90	
Revision	63.22	61.42	39.87	37.53	
Weight (a)	1	1	1	1	50.55
Weight (b)	0.25	0.25	0.5	1	44.32
Weight (c)	0.005	0.005	0.5	0.99	38.48
Weight (d)	0.005	0.005	1	0.99	38.83

Table 1b. The "TAC CALCS" from FISHERIES/2020/AUG/SWG-PEL/76 for alternative weightings, using the results corresponding to $N^S_{w,0,2018,0} = 14.14$ billion from Table 5a of FISHERIES/2020/AUG/SWG-PEL/70.

|	Multiplicative Δ in effSSB	Additive Δ in effSSB	Additive Δ in B	Relative Multiplicative Δ	Resultant TAC
Slope	-0.004	-0.100	-0.341	-0.002	
Intercept	1.757	20.513	-4.236	1.000	
April 2020	1.43	12	-20	0.90	
Revision	87.63	85.27	46.28	40.44	
Weight (a)	1	1	1	1	64.90
Weight (b)	0.25	0.25	0.5	1	53.40
Weight (c)	0.005	0.005	0.5	0.99	46.69
Weight (d)	0.005	0.005	1	0.99	43.59

Table 2. A summary of some of the statistics and implications for the alternative TAC increase options.

	April 2020 (2014-8 recruitment)		August 2020 (2018 recruitment)					
Total TAC/TAB	0t	34 050t	0t	35 050t	41 050t	43 050t	45 050t	50 050t
Increase in directed TAC for each coast	-	-	-	+0kt	+ 3kt	+ 4kt	+ 5kt	+ 7.5kt
20%ile of Rel Mult Δ effB_{west}	1.00	0.90	1.00	0.91	0.90	0.89	0.89	0.88
20%ile of Add Δ B_{west}	-8	-20	-4	-17	-18	-19	-19	-21
P("Bonus[1]" in Add Δ B) to fishery at 20%ile	-	-	-	25%	50%	75%	75%	125%
No surplus production at 5%ile or 20%ile : biomass is predicted to decrease								
Surplus production at 50%ile to fishery	-	11	-	13	14	15	16	17
P(Surplus production) to fishery at 50%ile	-	65%	-	62%	67%	71%	76%	81%
P(B_{west} increase)	69%	56%	75%	60%	59%	58%	57%	55%
Multiplicative difference		81%		80%	79%	77%	76%	73%
Economic value for 2020					R 97.9 M		R163.1 M	R244.7 M
5%ile of Add Δ B_{west}	-35	-46 / -47	-29	-41	-43	-43	-44	-45
P("Bonus" in Add Δ B) to fishery at 5%ile	-	-	-	0%	33%	33%	50%	67%
50%ile of Add Δ B_{west}	17	6	21	8	7	6	5	4
P("Bonus" in Add Δ B) to fishery at 50%ile	-	-	-	50%	75%	100%	125%	150%

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[1] Given the revised understanding of this year's recruitment, the west component biomass is expected to decrease by 4 000t less at the 20%ile under a no catch scenario. Some of this 4 000t "bonus" is allocated to the fishery and some to resource recovery.
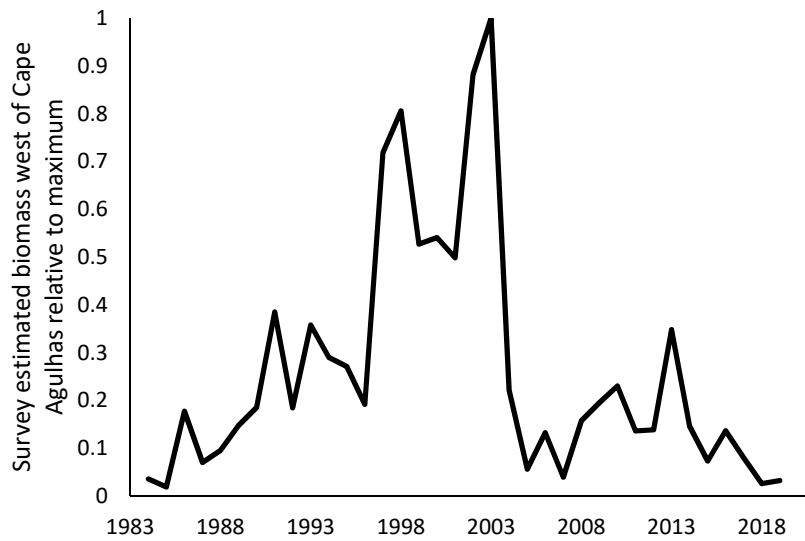
Figure 1. The survey estimated biomass west of Cape Agulhas (from FISHERIES/2019/DEC/SWG-PEL/41Rev) relative to the 2003 maximum.
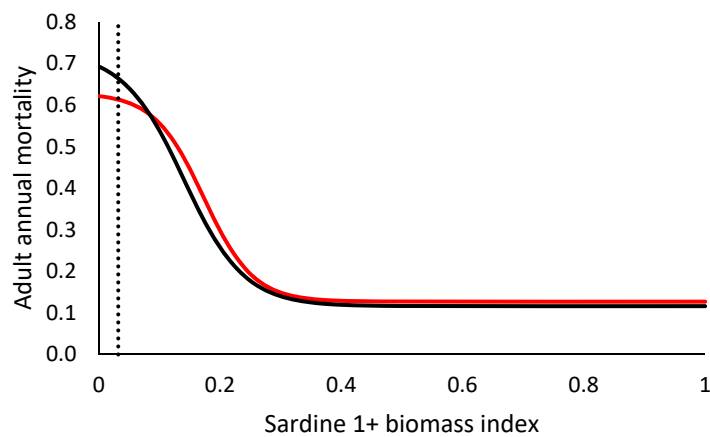
Figure 2. The relationship from Figure 4 of Robinson *et al*. (2015) using values at the posterior mode (Tables 1 and 2 of the main text, red line) and at the posterior median (Table S8 of the supplementary material, black line). The dashed line indicates the November 2019 index of 0.032.