The Agreed Method to Determine the Maximum Sardine Catch West of Cape Agulhas During 2017

C.L. de Moor*

Correspondence email: *carryn.demoor@uct.ac.za*

This document details the method agreed at the Small Pelagic Scientific Working Group meeting on 27th June 2017 to be used to inform the maximum directed >14cm sardine catch to be recommended to be caught west of Cape Agulhas during 2017. The agreement involves setting the maximum directed >14cm sardine catch west of Cape Agulhas for 2017 to the average of the maximum catch calculated from two different methods. Note that this maximum may also not be more than the total directed >14cm sardine TAC for 2017 as calculated by OMP-14.

Method 1

The first method is the upper bound of the "Gentleman's Agreement" (de Moor and Butterworth 2014, DAFF 2014), where the recommended proportion of catch west of Cape Agulhas during year *y* is calculated as follows:

$$p_y = 0.5\left(\frac{B^{obs}_{y-1,w}}{B^{obs}_{y-1,w}+B^{obs}_{y-1,s}} + \frac{B^{obs}_{y-2,w}}{B^{obs}_{y-2,w}+B^{obs}_{y-2,s}}\right)$$

and the maximum is $p_y + 0.1$. Under this method the maximum catch west of Cape Agulhas during 2017 would be calculated as p_{2017} multiplied by the total allowable directed >14cm sardine catch for 2017, as calculated by OMP-14, where $p_{2017} = 0.5(0.709 + 0.271) = 0.490$.

The catch resulting from this calculation is subject to a minimum of 21 400t given this is the amount that has already been awarded for 2017.

Method 2

The second method is based on the analysis of de Moor (2017) which considered the impact of a range of 2017 catch tonnages west of Cape Agulhas on the west component sardine spawner biomass in November 2017. For the purpose of these analyses, the SWG-PEL agreed to use a spawner biomass risk threshold corresponding to recruitment at 75% of the end point of the general parametric stock recruitment relationship (see Table 1). The analyses of de Moor (2017) will be updated following the 2017 recruit survey to include survey estimates of recruitment, actual catches prior to the survey and observed sardine:anchovy ratios which were modelled with assumptions by de Moor (2017). Thus the probabilities in Table 1 will all adjust given these observed data.

* MARAM (Marine Resource Assessment and Management Group), Department of Mathematics and Applied Mathematics, University of Cape Town, Rondebosch, 7701, South Africa.

As 21 400t has already been awarded as a maximum catch west of Cape Agulhas during 2017 (DAFF 2016), the SWG-PEL agreed to consider the probability corresponding to 21 400t. While the 21 400t recommendation for 2017 was calculated under an analysis that made no assumption about the forthcoming 2017 recruitment (de Moor 2016), in the absence of further information the SWG-PEL agreed to consider the probability corresponding to average recent recruitment of 7.3[1] billion. The maximum catch west of Cape Agulhas will then be calculated as that which corresponds to the same probability given the 2017 survey estimate of recruitment west of Cape Infanta, subject to shrinkage to the mean (see Table 2). This means the maximum catch will be greater than 21 400t only for survey estimates above 7.3 billion recruits. The catch resulting from this calculation is subject to a minimum of 21 400t given it has already been awarded.

The survey estimate of recruitment used in this analysis is the inverse variance weighted recruitment between that observed in 2017 and the average recent recruitment:

$$N_{2017}^{ToUse} = \frac{\frac{N_{2017}^{obs}}{\left(N_{2017}^{obs} \times CV_{2017}^{obs}\right)^2} + \frac{0.2\sum_{y=2011}^{2015} N_y^{obs}}{(0.2)^2 \sum_{y=2011}^{2015}\left(N_y^{obs} \times CV_y^{obs}\right)^2}}{\frac{1}{\left(N_{2017}^{obs} \times CV_{2017}^{obs}\right)^2} + \frac{1}{(0.2)^2 \sum_{y=2011}^{2015}\left(N_y^{obs} \times CV_y^{obs}\right)^2}}$$

References

DAFF 2014. Initial recommendation of the small pelagic scientific working group for the sustainable management of small pelagic resources for the season 2015. DAFF: Branch Fisheries Document FISHERIES/2014/DEC/SWG-PEL/65.

DAFF 2016. Initial recommendation of the small pelagic scientific working group for the sustainable management of small pelagic resources for the season 2017. DAFF: Branch Fisheries Document FISHERIES/2016/DEC/SWG-PEL/81.

de Moor CL. 2016. A proposal for determining the initial desirable maximum catch of directed sardine west of Cape Agulhas during 2017, with suggestions on how this might be achieved. DAFF: Branch Fisheries Document FISHERIES/2016/JUN/SWG-PEL/74rev.

de Moor CL. 2017. A proposal for determining the final desirable maximum catch of directed sardine west of Cape Agulhas during 2017. DAFF: Branch Fisheries Document FISHERIES/2017/JUN/SWG-PEL/18.

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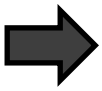
[1] Average 2011-2015 survey estimated sardine recruitment west of Cape Infanta.

Table 1. The probability of the November 2017 spawner biomass being below the spawner biomass threshold corresponding to 75% of the end point of the general parametric stock recruitment curve for a range of west coast catches during 2017 and a range of the survey estimated sardine recruitment during May 2017.

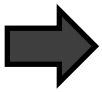
	May 2017 survey estimate of sardine recruitment (billions)					
	1	3	5	7.3	10	13
0t	0.600	0.559	0.518	0.482	0.453	0.424
10 000t	0.613	0.573	0.537	0.509	0.465	0.449
20 000t	0.624	0.581	0.543	0.516	0.474	0.450
21 400t	0.625	0.584	0.543	0.516	0.474	0.452
30 000t	0.632	0.587	0.554	0.524	0.485	0.454
40 000t	0.639	0.595	0.564	0.534	0.501	0.458
50 000t	0.649	0.603	0.573	0.540	0.510	0.470

Table 2. A diagram indicating how the maximum catch west of Cape Agulhas will be calculated using Method 2. The probability, *p*, will be calculated in the same way as in Table 1, assuming a catch of 21 400t and an average recent sardine recruitment, but with updated observed data excluding the June 2017 survey estimate of recruitment. The catch corresponding to this probability, p, will then be calculated given the survey estimate of June 2017 recruitment, after inverse variance weighting with the recent average recruitment.

	Average 2011-2015 recruit survey estimate of sardine recruitment (7.3 billion)
21 400t	p



	N_{2017}^{ToUse}
C_{2017}	p



$C_{2017} \geq 21400t$