

# The simulated short term impact of using OMP-14 to set the initial directed sardine TAC

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## Background

OMP-14 was tuned, assuming a single homogeneously distributed sardine stock, such that the probability of the total sardine biomass falling below the average biomass from 1991 to 1994 at least once during the 20 year projection period was less than 0.21. de Moor (2017a) showed that continuing to use OMP-14 for the next 20 years would result in a very high (close to 1) probability of being below this threshold, and the continued use of OMP-14 for recommending directed sardine TACs for 2018 may result in an unacceptably high risk to the sardine resource. This document considers only the simulated short-term (one year) impact of using OMP-14 to recommend the directed sardine TAC for 2018.

## **Short-Term Projections**

These analyses simply consider the projected sardine spawner biomass in November 2018 under a single year of no directed sardine fishing, compared to fishing under OMP-14 with an underlying spatial split of catches between the two components (de Moor and Coetzee 2017). The sardine Operating Model used for these simulations is the two component hypothesis with 20% of south coast spawner biomass forming part of the west coast effective spawner biomass and the baseline random west to south movement hypothesis, *MoveR*. The projections have been updated from that in de Moor (2017b) to allow for an increase in the directed sardine catch in 2017 from 27 757t to 45 560t, and a down-sizing<sup>1</sup> of the south component numbers-at-ages 1+ on the south coast to closer match the realised survey estimate of abundance during November 2016 (Figure 1).

## Results

Figure 2 shows the projected sardine spawner biomass levels under no catch scenarios and under OMP-14. The distributions of west component spawner biomass in recent years and projected to November 2018 assuming no directed sardine fishing, or fishing under OMP-14 during 2018 are shown in Figure 3. While the median simulated survey estimate of biomass in November 2016 is higher than that observed, the observations are within the 95% probability intervals of the simulated distributions (Figure 4). These simulations result in a median November 2017 survey estimate of biomass of 478 000t, with 238 000t on the west coast (Figure 4).

Tables 1 and 2 consider the possible one year impact to the west component spawning stock of fishing under OMP-14. The risk to the resource naturally increases from a no directed fishing scenario. However, given an absolute risk level is yet to be determined, these can only be compared qualitatively for now.

Figure 5 shows the distribution of directed sardine catches simulated under OMP-14 for 2018.

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<sup>&</sup>lt;sup>1</sup> South component numbers-at-ages 1+ were divided by 5.

Figures 6 and 7 and Tables 3 and 4 indicate sensitivity to these results if the May 2017 survey estimate of sardine recruitment west of Cape Infanta was an overestimate, and recruitment was 1.156 billion instead of 7.156 billion.

#### Summary

The OMP Task Team thus recommends that OMP-14 be used to recommend the *initial* directed sardine TAC for 2018. Once OMP-18 is adopted, should the Harvest Control Rule recommend a higher directed sardine TAC for 2018, the directed sardine TAC will be increased. The increase may be subject to different spatial restrictions from the initial TAC. As always, the TAC will never decrease mid-year, even if OMP-18 recommends a lower TAC than that already awarded as an initial TAC.

#### References

de Moor CL. 2017. Should OMP-14 be used to set South African sardine and anchovy catch limits for 2018? DAFF: Fisheries Branch Document FISHERIES/2017/OCT/SWG-PEL/25.

de Moor CL and Coetzee JC. 2017. Simulating single area management on two sardine components. MARAM International Fisheries Stock Assessment Workshop, 27 November – 1 December 2017, Cape Town. Document MARAM/IWS/2017/Sardine/P4.

**Table 1.** The lower percentiles of west component spawner biomass in recent years (see Figure 3) relative to the west component spawner biomass in 2036 assuming no future directed sardine fishing. The decrease in the last column compared to the second last column indicates the impact of directed sardine fishing.

	2015	2016	2017	2018 (F=0)	2018 (OMP-14)
10%ile	0.31	0.16	0.18	0.20	0.17
20%ile	0.49	0.25	0.27	0.35	0.29
30%ile	0.60	0.33	0.37	0.49	0.42
40%ile	0.78	0.42	0.47	0.63	0.54
median	0.96	0.54	0.60	0.80	0.69

**Table 2.** The probability of the west component spawner biomass being below the risk threshold of the 2007 west component spawner biomass during 2016 - 2018.

2016	0.25
2017	0.22
2018 (F=0)	0.14
2018 (OMP14)	0.19

0.38

0.50

cruitment of 1.156 instead of 7.156 billion sardine.								
2015	2016	2017	2018 (F=0)	2018 (OMP-14)				
0.31	0.17	0.14	0.14	0.12	_			
0.49	0.25	0.20	0.26	0.21				
0.61	0.33	0.28	0.35	0.29				
	2015 0.31 0.49 0.61	2015 2016   0.31 0.17   0.49 0.25   0.61 0.33	$\begin{array}{c ccccc} 2015 & 2016 & 2017 \\ \hline 0.31 & 0.17 & 0.14 \\ 0.49 & 0.25 & 0.20 \\ 0.61 & 0.33 & 0.28 \\ \end{array}$	2015 $2016$ $2017$ $2018$ (F=0) $0.31$ $0.17$ $0.14$ $0.14$ $0.49$ $0.25$ $0.20$ $0.26$ $0.61$ $0.33$ $0.28$ $0.35$	2015 2016 2017 2018 (F=0) 2018 (OMP-14)   0.31 0.17 0.14 0.14 0.12   0.49 0.25 0.20 0.26 0.21   0.61 0.33 0.28 0.35 0.29			

0.37

0.47

0.45

0.58

**Table 3.** A repeat of Table 1, but for the sensitivity test that assumed a May 2017 survey estimate of recruitment of 1.156 instead of 7.156 billion sardine.

**Table 4.** A repeat of Table 2, but for the sensitivity test that assumed a May 2017 survey estimate of recruitment of 1.156 instead of 7.156 billion sardine.

0.42

0.54

2016	0.25	
2017	0.31	
2018 (F=0)	0.24	
2018 (OMP14)	0.30	

0.79

0.96

40%ile

median



**Figure 1.** The median model estimated (2014-2015) and predicted (2016-2017) survey estimates of abundance (triangles) for sardine a) west and b) east of Cape Agulhas, together with 95% probability intervals (dotted lines). The actual survey estimates of abundance with their 95% confidence intervals are shown in red.



**Figure 2.** The median and 95% probability intervals of a) west and b) south component spawner biomass under a no future (2018-2036) catch scenario (green), a no future directed sardine catch (grey) and OMP-14 (black). The red lines denote the median and 95% probability intervals of the 2007 west component spawner biomass which will be used as a risk threshold during OMP-18 development. The right hand plots are a repeat of the left hand plots, but over a smaller range for the vertical axis.



**Figure 3.** Simulated future distributions of west component spawner biomass. The distributions differ only from 2018 onwards as no catch scenarios still include the catches known or assumed to have occurred during 2016 and 2017.

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**Figure 4.** Simulated survey estimates of sardine biomass (top) west of Cape Agulhas, (middle) east of Cape Agulhas, and (bottom) whole survey area for Novembers 2016 and 2017. The median and 95% probability intervals of these distributions (in '000t) are given on the plots together with the actual observation in November 2016.



Figure 5. The simulated distribution of 2018 directed sardine catch under OMP-14.

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**Figure 6.** Simulated survey estimates of sardine biomass (top) west of Cape Agulhas, and (bottom) east of Cape Agulhas for Novembers 2016 and 2017, **for the sensitivity test that assumes a May 2017 survey estimate of recruitment of 1.156 instead of 7.156 billion sardine**. The median and 95% probability intervals of these distributions (in '000t) are given on the plots together with the actual observation in November 2016.



**Figure 7.** The simulated distribution of 2018 directed sardine catch under OMP-14, for the sensitivity test that assumed a May 2017 survey estimate of recruitment of 1.156 instead of 7.156 billion sardine.