

Initial Directed Sardine and Anchovy TACs and TABs for 2017, Using OMP-14

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Following the recent 2016 November biomass survey, the initial 2017 TACs and TABs for South African sardine and anchovy are to be recommended. The following data have been used:

- 1) November 2016 survey sardine biomass: 258 575 tonnes.
- 2) November 2016 survey anchovy biomass: 1 733 040 tonnes.
- 3) Directed >14cm sardine TAC for 2016: 64 928 tonnes.
- 4) Directed anchovy TAC for 2016: 354 326 tonnes.

Using the above data, the initial 2017 TAC and TAB recommendations are calculated by OMP-14 to be:

Initial directed >14cm sardine TAC:	29 955 ¹ tonnes
Initial ≤14cm sardine TAB with directed >14cm sardine fishing:	2 097 ¹ tonnes
Initial anchovy TAC:	247 500 tonnes
Initial ≤14cm sardine TAB with directed anchovy fishing:	25 064 tonnes
>14cm sardine TAB with directed round herring and anchovy fishing:	7 000 tonnes
≤14cm sardine TAB with directed round herring fishing:	1 000 tonnes
Anchovy TAB for sardine only right holders:	500 tonnes

The equations used to calculate these TAC/Bs are given in the Appendix.

The recommended spatial restriction is that not more than 21 400t of the initial directed >14cm sardine TAC be caught west of Cape Agulhas. This value is to be considered a maximum, and is not subject to further allowance under OMP-14.

In addition, a precautionary adjustment to the initial TAC for sardine is recommended for 2017 only, which gives:

Initial directed >14cm sardine TAC:	23 964 tonnes
Initial ≤14cm sardine TAB with directed >14cm sardine fishing:	1 677 tonnes

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¹ This is revised downwards by 20% below.

Comments on the OMP-14 recommended TACs

The anchovy initial TAC was subject to the constraint of a maximum decrease from the “two-tier threshold”, as the TAC in 2016 was above this threshold of 330 000t. This is a threshold above which high TACs can be awarded during years of high survey estimates of abundance and recruitment, with the provision that the TAC in the following year will be restricted by a 25% reduction from this threshold rather than a 25% reduction from the relatively high TAC.

The sardine biomass was below the Exceptional Circumstances threshold of 300 000t. This is a threshold below which the TAC is rapidly lowered with decreasing survey estimates of biomass in order to maintain the sustainability of the resource. The Exceptional Circumstances rule goes hand-in-hand with the ‘minimum’ TAC; a level at which TACs are maintained for as long as possible, despite decreasing biomass.

Under Exceptional Circumstances only half of the OMP calculated directed sardine TAC is recommended at the start of the year. This initial TAC will be revised mid-year once the results of the May survey are available. The ≤ 14 cm sardine TAB associated with this directed sardine TAC is thus also an initial recommendation and its revision mid-year will depend on any revision to the directed >14 cm sardine TAC.

Under OMP-14, the final directed >14 cm sardine TAC for 2017 would depend on the survey estimate of sardine recruitment in May/June 2017, and would range from this initial TAC of 29 955t to a maximum of 65 902t. However, it is expected that a new OMP (OMP-17) will be adopted before the final small pelagic TACs and TABs for 2017 are recommended.

The >14 cm sardine TAB with directed round herring and anchovy fishing, the ≤ 14 cm sardine TAB with directed round herring fishing and the anchovy TAB for sardine only right holders are final for the year.

Split of Sardine TAC

At the SWG-PEL meeting on 7th December, a new method of calculating the recommended catch west of Cape Agulhas was agreed. This involved projecting the sardine population forward from November 2015 to November 2017, taking into account surveys and catch already observed (de Moor and Butterworth 2016). According to the method agreed, the catch west of Cape Agulhas should be restricted to not more than 21 370 – 21 380t (Table 1).

Precautionary Adjustment for Initial Sardine TAC for 2017 Only

The SWG-PEL agreed on 7th December to restrict the initial directed sardine TAC to 80% of that recommended by OMP-14. As the ≤ 14 cm sardine bycatch with directed >14 cm sardine is proportional to the directed >14 cm TAC, this associated bycatch limit is also reduced. It is expected that a new OMP (OMP-17) will be adopted prior to the final small pelagic TACs and TABs for 2017 being calculated. Any

final TAC/Bs calculated under OMP-17 will be constrained to be a minimum of that recommended initially for 2017.

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References

de Moor, C.L. and D.S. Butterworth. 2014. OMP-14. DAFF Branch Fisheries Report No. FISHERIES/2014/DEC/SWG-PEL/60.

de Moor, C.L. and D.S. Butterworth. 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 Report No. FISHERIES/2016/DEC/SWG-PEL/74rev.

Table 1. The probability of the November 2017 2⁺ biomass being below the inflection point of the hockey-stick stock recruitment curve, $p(B_{j=w,2017}^{2+} < b)$, for a range of west coast catches during 2017, $C_{j,2017}$, and assuming west to south movement in November 2016 is the average of the past 6 years.

$C_{j,2017}$	$move_{2016,1} = 0.37$
0t	0.272
10 000t	0.295
20 000t	0.322
21 000t	0.330
21 200t	0.330
21 300t	0.331
21 370t	0.331
21 380t	0.333 ²
21 400t	0.333
21 500t	0.333
22 000t	0.333
25 000t	0.351

² The SWG-PEL agreed to consider an additive increase of 6% from the probability under a zero catch scenario. A catch of 21 370t – 21 380t matches this increase from 0.272 to 0.332.

Appendix: Summary of Initial TAC and TAB Equations of OMP-14 (from de Moor and Butterworth 2014).

The directed >14cm sardine TAC is initially calculated in proportion to the 2016 November 1+ biomass estimate:

$$TAC_{2017}^S = \beta B_{2016,Nov}^{obs,S} \quad (A.1)$$

This results in $TAC_{2017}^S = 22\,470t$. As the TAC in 2016 was below the 2-tier threshold, the following constraint applies:

$$\max\{(1 - c_{mxdn}^S)TAC_{2016}^S; c_{mntac}^S\} \leq TAC_{2017}^S \leq c_{mxtac}^S \quad (A.2)$$

The above constraints result in $TAC_{2017}^{S_before} = 90\,000t$. However, as $0.25 < \frac{B_{2016,Nov}^{obs,S}}{B_{ec}^S} < 1$, exceptional circumstances are calculated as follows:

$$TAC_{2017,init}^S = 0.5 \times TAC_{2017}^{S_before} \left(\frac{\frac{B_{2016,Nov}^{obs,S}}{B_{ec}^S} x^S}{1 - x^S} \right)^2 \quad (A.3)$$

This results in an initial TAC of $TAC_{2017}^S = 29\,955t$.

In the above equations we have:

$\beta = 0.0869$ - a control parameter reflecting the proportion of the previous year's November biomass index of abundance that is used to set the directed sardine TAC.

$B_{y,Nov}^{obs,S}$ - the estimate of sardine abundance (in thousands of tonnes) from the hydroacoustic survey in November of year y .

$c_{mxdn}^S = 0.20$ - the maximum proportional amount by which the directed sardine TAC can be reduced from one year to the next, above the buffer zone.

$c_{mntac}^S = 90$ - the minimum directed TAC (in thousands of tonnes) that may be set for sardine.

$c_{mxtac}^S = 500$ - the maximum directed TAC (in thousands of tonnes) that may be set for sardine.

$c_{tier}^S = 255$ - 2-tier threshold for directed sardine TAC

$B_{ec}^S = 300$ - the biomass threshold (in thousands of tonnes) below which Exceptional Circumstances apply for sardine.

As the directed >14cm sardine TAC is an initial TAC for 2017, the $\leq 14cm$ sardine bycatch with directed sardine fishing is also an initial TAB, and is calculated as follows:

$$TAB_{2017,small}^S = \omega TAC_{2017}^S \quad (A.4)$$

where

$\omega = 0.07$ - an estimate of the maximum percentage of $\leq 14cm$ sardine bycatch in the >14cm sardine catch

The directed anchovy initial TAC is based on how the 2016 November biomass survey estimate of abundance relates to the historical (pre-2000) average.

$$TAC_{2017}^{1,A} = \alpha_{ns} \delta q \left(p + (1-p) \frac{B_{2016,Nov}^{obs,A}}{\bar{B}_{Nov}^A} \right) \quad (A.5)$$

This results in $TAC_{2017}^{1,A} = 244\,076t$. As the TAC in 2016 was above the 2-tier threshold, the following constraint applies:

$$\max\{(1 - c_{mxdn}^A) c_{tier}^A; c_{mntac}^A\} \leq TAC_{2017}^{2,A} \leq c_{mxtac}^A \quad (A.6)$$

This results in $TAC_{2017}^{1,A} = 247\,500t$. The anchovy biomass estimated by the November survey is above the Exceptional Circumstances threshold and thus no Exceptional Circumstances provisions were invoked.

In the above equations we have:

$B_{y,Nov}^{obs,A}$ - the estimate of anchovy abundance (in thousands of tonnes) from the hydroacoustic spawner biomass survey in November of year y .

\bar{B}_{Nov}^A - the historical average index of anchovy abundance from the biomass surveys from November 1984 to November 1999, of 1 380.28 thousand tonnes.

$\alpha_{ns} = 0.889$ - a control parameter which scales the anchovy TAC to meet target risk levels for sardine and anchovy.

$\delta = 0.85$ - a 'scale-down' factor used to lower the initial anchovy TAC to provide a buffer against possible poor recruitment.

$p = 0.7$ - the weight given to the recruit survey component compared to the biomass survey component in setting the anchovy TAC.

$q = 300$ - reflects the average annual TAC expected under OMP99 under average conditions if $\alpha_{ns} = 1$.

$c_{mxdn}^A = 0.25$ - the maximum proportional amount by which the directed anchovy TAC can be reduced from one year to the next.

$c_{mntac}^A = 120$ - the minimum directed TAC (in thousands of tonnes) that may be set for anchovy.

$c_{mxtac}^A = 450$ - the maximum directed TAC (in thousands of tonnes) that may be set for anchovy.

$c_{tier}^A = 330$ - 2-tier threshold for directed anchovy TAC

The initial $\leq 14cm$ sardine TAB with anchovy directed fishing is calculated using:

$$TAB_{2017,anch}^{1,S} = \gamma_{2017} TAC_{2017}^{1,A} \quad (A.7)$$

where:
$$\gamma_{2017} = 0.1 + \frac{0.1}{1 = \exp\left(-\ln(19) \frac{(B_{2016,Nov}^S - B_{50})}{(B_{ec} - B_{50})}\right)} = 0.101$$

In the above equations we have:

γ_y - a conservative allowance for the ratio of juvenile sardine to juvenile anchovy in subsequent catches in year y .

$B_{50} = 2000$ - biomass where the logistic curve for γ_y reaches 50%.

$B_{95} = 3177.8$ - biomass where the logistic curve for γ_y reaches 95%.