Final Anchovy and Sardine TACs and TABs for 2015, Using OMP-14

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Following the recent 2015 recruit survey, the revised 2015 South African anchovy and sardine TACs and TABs are to be recommended. The following data have been used:

1) November 2014 survey estimate of sardine 1+ biomass: 444 500 tonnes.
2) November 2014 survey estimate of anchovy 1+ biomass: 2 970 760 tonnes.
3) May 2015 survey estimate of anchovy recruitment: 262.698 billion.
4) May 2015 survey estimate of sardine recruitment: 9.237 billion.
5) Time after 1 May that the survey commenced: 0.677 months (survey commenced on 22nd May)
6) Anchovy recruit catch from 1st November to 21st May, using monthly cut-off lengths from de Moor *et al*. 2012 and assuming recruit cut-off lengths of 9.5cm for April and 10.5cm for May: 11.457 billion
7) Anchovy adult catch from 1st November to 21st May, using monthly cut-off lengths from de Moor *et al*. 2012 and assuming cut-off lengths of 9.5cm for April and 10.5cm for May: 8.044 billion
8) Juvenile sardine : anchovy ratio (by mass) observed in the May recruitment survey: 0.228
9) Juvenile sardine : anchovy ratio (by mass) observed in the May commercial catches: 0.0672
10) Directed >14cm sardine TAC for 2014: 90 000 tonnes.
11) Directed anchovy TAC for 2014: 450 000 tonnes.

Using the above data, the final 2015 TAC and TAB recommendations are calculated by OMP-14 (de Moor and Butterworth 2014) to be:

Final directed >14cm sardine TAC:	83 470 tonnes
Final ≤14cm sardine TAB with directed >14cm sardine fishing:	5 843 tonnes
Final anchovy TAC:	450 000 tonnes
Final ≤14cm sardine TAB with directed anchovy fishing:	66 375 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.

Comments on the TACs

As the November survey estimate of sardine abundance was less than 600 000t, the "buffer rule" was implemented for the first time resulting in an initial directed >14cm sardine TAC being recommended at

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the beginning of the year. The final directed >14cm sardine TAC is dependent on the May survey estimate of 9.24 billion sardine recruits, which was less than the historical average of 13.74 billion. This historical average is the threshold at which the final directed >14cm sardine TAC would equal the "original TAC" of 90 000t. The final directed >14cm sardine TAC is thus calculated as 83 470t.

The proportion of the directed >14cm sardine TAC to be caught west of Cape Agulhas in 2015, is unchanged from that recommended at the beginning of the year, i.e. to be between 0.502 and 0.702.

The ≤14cm sardine TAB associated with this directed sardine TAC is also revised, given its dependence on the directed >14cm sardine TAC.

The final anchovy TAC was constrained by the maximum TAC of 450 000t. Exceptional Circumstances do not apply.

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References

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Appendix: Summary of final anchovy and sardine TAC and TAB equations of OMP-14 (from de Moor and Butterworth 2014).

The revised sardine TAC is initially calculated as:

$$TAC^{S}_{final,2015} = TAC^{S}_{2015,init} + \left(\frac{N^{obs,S}_{2015,r}}{R_{avg}}\right)^{1.5} \times \left(TAC^{S}_{2015} - TAC^{S}_{2051,init}\right)$$

This results in $TAC^{S}_{final,2015} = 83\,470\text{t}$. The constraint:

$$TAC^{S}_{final,2015} \leq \left(1.1 + 0.1 \times \frac{\left(\frac{B^{obs,S}_{2014,N}}{B^{S}_{ec}}\right)^{-1.66099} - 1}{1 - 2^{-1.66099}}\right) \times TAC^{S}_{2015}$$

does not alter the revised sardine TAC. In the above equations we have:

$N^{obs.S}_{y,r}$ - the estimate of recruitment of sardine from the hydroacoustic recruit survey in May of year y.

$R_{avg} = 13.74$ - the level of sardine recruitment required in order to achieve the original HCR calculated sardine TAC.

$B^{obs,S}_{y,Nov}$ - the estimate of sardine 1+ abundance (in thousands of tonnes) from the hydroacoustic survey in November of year y.

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

The revised ≤14cm sardine bycatch with directed sardine fishing, is calculated as follows:

$$TAB^{S}_{2015,small} = \omega TAC^{S}_{2015}$$

where

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

The revised anchovy TAC is initially calculated as:

$$TAC^{2,A}_{2015} = \alpha_{ns}\; q\left(p\frac{N^{A}_{2014,rec0}}{\overline{N}^{A}_{rec0}} + (1-p)\frac{B^{obs,A}_{2014,N}}{\overline{B}^{A}_{Nov}}\right)$$

This results in $TAC^{2,A}_{2015} = 630\,190\text{t}$. As the normal season anchovy TAC in 2014 was above the 2-tier threshold of 330 000t, this TAC is subject to the following constraints:

$$\max\left\{TAC^{1,A}_{2015} ; \left(1 - c^{A}_{mxdn}\right)c^{A}_{tier}\right\} \leq TAC^{2,A}_{2015} \leq c^{A}_{mxtac}$$

which results in $TAC^{2,A}_{2015} = 450\,000\text{t}$. The anchovy biomass projected for November 2015 is above the Exceptional Circumstances threshold and thus no Exceptional Circumstances provisions were invoked. In addition the projected November 2015 biomass is above 700 000t, and thus no smoothing is applied. In the above equations we have:

$B^{A}_{2014,Nov}$ - the estimate of anchovy abundance (in thousands of tons) from the hydroacoustic spawner biomass survey in November 2014.

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

$N^{A}_{2014,rec0} = (N^{obs,A}_{2015,r} e^{t^{A}_{20154} \times 1.2/12} + C^{A}_{2015,0bs})\, e^{6\times 1.2/12} = 533.071$

- the simulated estimate of anchovy recruitment from the recruitment survey in 2015, $N^{obs,A}_{2015,r}$, back-calculated to 1 November 2014 by taking natural and fishing mortality into account.

$\overline{N}^{A}_{rec0} = 217.3$ - the average 1985 to 1999 observed anchovy recruitment (in billions) in May, back-calculated to November of the previous year.

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

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

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

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

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

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

$C^{A}_{2015,0bs} = 14.657$ - the observed juvenile anchovy landed by number (in billions) from the 1st of November 2014 to the day before the recruit survey commenced in 2015.

$t^{A}_{2015} = 0.228$ - the timing of the anchovy recruit survey in 2014 (number of months) relative to the 1st of May.

The revised <14cm sardine TAB with anchovy is calculated using:

$$TAB^{2,S}_{2015,anch} = \lambda_{2015}\ TAC^{1,A}_{2015} + r_{2015}\ (TAC^{2,A}_{2015} - TAC^{1,A}_{2015})$$

This gives $TAB^{2,S}_{2015} = 66\,375\text{t}$, where $\lambda_{2015} = \max\{\gamma_{2015}, r_{2015}\} = 0.1475$.

In the above equations we have:

$\gamma_{2015} = 0.102$ - a conservative allowance for the ratio of juvenile sardine to juvenile anchovy in subsequent catches.

$r_{2015} = \frac{1}{2}(r_{2015,sur} + r_{2015,com}) = 0.1475$

- the ratio of juvenile sardine to anchovy "in the sea" during May 2015, calculated from the recruit survey and the sardine bycatch to anchovy ratio in the commercial catches[1] during May.

[1] Only commercial catches comprising at least 50% anchovy with sardine bycatch are considered.