Final Anchovy TAC and Sardine TAB for 2009, Using OMP-08

Carryn L de Moor[∗] and Douglas S Butterworth[∗]

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

Following the recent 2009 recruit survey, the revised and final 2009 TAC for South African anchovy fishery and sardine TAB are to be recommended. The following data have been used:

1) November 2008 survey sardine 1+ biomass: 384 080 t.

2) November 2008 survey anchovy 1+ biomass: 3 705 893 t.

3) May 2009 survey anchovy recruitment: 363.387 billion.

4) Time after 1 May that the survey commenced: 0.452 (survey commenced on 15th May)

5) Anchovy recruit catch from 1st November to 14th May, using monthly cut-off lengths from Cunningham *et al*. 2007: 7.010623 billion

6) Anchovy adult catch from 1st November to 14th May, using monthly cut-off lengths from Cunningham *et al*. 2007: 4.39966 billion

7) Juvenile sardine : anchovy ratio (by mass) observed in the May recruitment survey: 0.048

8) Juvenile sardine : anchovy ratio (by mass) observed in the May commercial catches: 0.002233

9) Directed sardine TAC for 2008: 90 776 t.

10) Directed anchovy normal season TAC for 2008: 397 500 t[1].

Using the above data, the final 2009 TACs and TAB recommendations are calculated by OMP-08 to be:

Directed sardine TAC:	90 000t
Initial normal season anchovy TAC:	299 437t
Revised normal season anchovy TAC:	449 437t
Additional season anchovy TAC:	120 000t
Total anchovy TAC:	569 437t
Initial normal season sardine TAB:	33 961.6t
Revised normal season sardine TAB:	37 729.1t
Additional season sardine TAB:	2 000.0t
Total sardine TAB:	39 729.1t

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

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

[1] The total anchovy TAC for 2008 was 517 500t, comprising of 397 500t for the normal season and 120 000t for the additional season.

Comments on the TACs

As no Exceptional Circumstances were declared for sardine in December 2008, there is no update to the directed sardine TAC. The revised normal season anchovy TAC has increased by the maximum of 150 000t and the additional season anchovy TAC was constrained by the maximum of 120 000t.

References

Cunningham, C.L., van der Westhuizen, J.J., Durholtz D. and Coetzee, J. 2007. A Record of the Generation of Data Used in the Sardine and Anchovy Assessments. Unpublished MCM Document MCM/2007/SEPT/SWG-PEL/03. 28pp.

de Moor, C.L. and D.S. Butterworth. 2008. OMP-08. MCM document, MCM/2008/SWG-PEL/23. 15pp.

Appendix: Summary of Revised and Final anchovy TAC and sardine TAB Equations of OMP-08 (from de Moor and Butterworth 2008).

<u>Revised TAC / TAB</u>

The revised anchovy TAC is initially calculated as:

$$TAC_{2009}^{2,A} = \alpha_{ns} \; q \left(p \frac{N_{2008,rec0}^{A}}{\overline{N}_{rec0}^{A}} + (1-p) \frac{B_{2008,N}^{obs,A}}{\overline{B}_{Nov}^{A}} \right)$$

This results in $TAC_{2009}^{2,A} = 732\,657\text{t}$. As the normal season anchovy TAC in 2008 was above the 2-tier threshold of 330 000t, this TAC is subject to the following constraints:

$$\max\left\{ TAC_{2009}^{1,A}; \left(1-c_{mxdn}^{A}\right)c_{tier}^{A} \right\} \le TAC_{2009}^{2,A} \le \min\left\{ c_{mxtac}^{A}; TAC_{2009}^{1,A} + c_{mxinc}^{ns,A} \right\}$$

which results in $TAC_{2009}^{2,A} = 449\,437\text{t}$. The anchovy biomass projected for November 2009 is above the Exceptional Circumstances threshold and thus no Exceptional Circumstances provisions were invoked. In the above equations we have:

$B_{2008,Nov}^{A}$ - the estimate of anchovy abundance (in thousands of tons) from the hydroacoustic spawner biomass survey in November 2008.

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

$N_{2008,rec0}^{A} = (N_{2009,r}^{obs,A} e^{0.5(6+t_{2009}^{A})0.9/12} + C_{2009,0bs}^{A}) \; e^{[0.5(6+t_{2009}^{A})]0.9/12}$

     - the simulated estimate of anchovy recruitment from the recruitment survey in 2009, $N_{2009,r}^{obs,A}$, back-calculated to 1 November 2008 by taking natural and fishing mortality into account.

$\overline{N}_{rec0}^{A} = 197.96$ - the average 1985 to 1999 observed anchovy recruitment (in billions) in May, back-calculated to November of the previous year.

$\alpha_{ns} = 0.78$ - 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 $\alpha_{ns} = 1$.

$c_{mxdn}^{A} = 0.25$ - the maximum proportional amount by which the normal season directed anchovy TAC can be reduced from one year to the next (note that the additional season anchovy TAC is not taken into consideration in this constraint).

$c_{mxtac}^{A} = 600$ - the maximum directed TAC that may be set for anchovy (in thousands tons).

3

$c_{mxinc}^{ns,A} = 150$ - the maximum amount by which the anchovy TAC is allowed to be increased within the normal season (in thousand tons).

$C_{2009,0bs}^{A} = 7.01$ - the observed anchovy landed by number (in billions) from the 1st of November 2008 to the day before the recruit survey commences in 2009.

$t_{2009}^{A} = 0.452$ - the timing of the anchovy recruit survey in 2009 (number of months) relative to the 1st of May.

The revised sardine TAB is calculated using:

$$TAB_{2009}^{2,S} = \lambda\, TAC_{2009}^{1,A} + r_{2009}\,(TAC_{2009}^{2,A} - TAC_{2009}^{1,A}) + TAB_{rh}^{S}$$

This gives $TAB_{2009}^{2,S} = 37\,729.1\text{t}$, where $\lambda = \max\{\gamma_{2009}, r_{2009}\} = 0.102$.

In the above equations we have:

$TAB_{rh}^{S} = 3500\,\text{t}$ - the fixed tonnage of adult sardine bycatch set aside for the round herring fishery each year.

$\gamma_{2009} = 0.102$ - a conservative allowance for the ratio of juvenile sardine to juvenile anchovy in subsequent catches.

$r_{2009} = \frac{1}{2}(r_{2009,sur} + r_{2009,com}) = 0.025$

     - the ratio of juvenile sardine to anchovy "in the sea" during May 2009, calculated from the recruit survey and the sardine bycatch to anchovy ratio in the commercial catches[2] during May.

Final TAC / TAB (the anchovy additional sub-season from 1st September)

The final anchovy TAC is initially calculated as:

$$TAC_{2009}^{3,A} = \alpha_{ads}\; q\left(p\,\frac{N_{2008,rec0}^{A}}{\overline{\overline{N}}_{rec0}^{A}} + (1-p)\,\frac{B_{2008,N}^{obs,A}}{\overline{B}_{Nov}^{A}} \right)$$

This gives $TAC_{2009}^{3,A} = 1098\,990\text{t}$. The constraints:

$$\max\left\{TAC_{2009}^{2,A}; c_{mntac}^{A}\right\} \le TAC_{2009}^{3,A} \le \min\left\{c_{mxtac}^{A}; TAC_{2009}^{2,A} + c_{mxinc}^{ads,A}\right\}$$

result in $TAC_{2009}^{3,A} = 569\,437\text{t}$. The anchovy biomass projected for November 2009 is above the Exceptional Circumstances threshold and thus no Exceptional Circumstances provisions were invoked. In the above equations we have:

$\alpha_{ads} = 1.17$ - a control parameter which scales the anchovy TAC to meet target risk levels for sardine and anchovy.

$c_{mxinc}^{ads,A} = 120$ - the maximum amount by which the anchovy TAC is allowed to be increased within the additional sub-season (in thousands tons).

---

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

The final sardine TAB is calculated as:

$$TAB_{2009}^{3,S} = TAB_{2009}^{2,S} + \min\left\{ TAB_{ads}^{S} \; ; \gamma_{2009}\,(TAC_{2009}^{3,A} - TAC_{2009}^{2,A}) \right\}$$

which gives $TAB_{2009}^{3,S} = 39\,729.1\text{t}$. Here:

$TAB_{ads}^{S} = 2$ - the maximum fixed tonnage of juvenile sardine bycatch set aside for the anchovy additional sub-season each year (in thousand tons).