Sardine TAC and Initial Anchovy TAC and Sardine TAB for 2006, using Re-Revised OMP-04

S.J. Johnston and D.S. Butterworth

MARAM
Department of Mathematics and Applied Mathematics
University of Cape Town
Rondebosch, 7701

Following the recent 2005 spawner biomass survey, the initial 2006 TACs for the South African sardine and initial sardine TAB are to be set. The following data have been used:

1. November 2005 survey sardine spawner biomass: 962 289 tonnes (November 2004 = 2 607 064 tonnes).
2. November 2005 survey anchovy spawner biomass: 3 062 710 tonnes (November 2004 = 2 035 827 tonnes).
3. Directed sardine TAC for 2005: 382 119 tonnes.
4. Anchovy normal season TAC for 2005: 215 000 tonnes[1].

Using the above data, the initial 2006 TACs and TAB are calculated by the Re-revised OMP-04 (Cunningham and Butterworth 2005a) to be:

Directed sardine TAC: **204 000 tonnes** (eqn (A.1, A.2))
Initial normal season anchovy TAC: **212 251 tonnes** (eqn (A.3, A.4))
Initial normal season sardine TAB: **32 711 tonnes** (eqn (A.6))

Comments

The Directed sardine TAC for 2006 shows a 47% decrease from the 2005 value. The reason for the large decrease in sardine TAC is the substantial drop in the spawner biomass estimate from the November survey compared to 2004 (see Table 1 and Figure 1). An appreciable decrease was anticipated following poor results from sardine recruit surveys in both May 2004 and May 2005. Cunningham and Butterworth (2005b) in August this year predicted a (reduced) November 2005 biomass survey estimate of 1.76 million tonnes, with an associated TAC of 267 thousand tonnes, using an assessment model that put high weight on fitting these recruit survey results. Their estimate did not, however, include evaluation of the range about this estimate associated with imprecision of the assessment and sampling error for the November 2005 survey biomass estimate.

[1] For 2005, the initial normal season anchovy TAC was 215 000 tonnes (adjusted upwards from 204 750 tonnes to meet preliminary allocation commitments), the final normal season TAC was also 215 000 tonnes, and the final seasons-combined TAC 315 648 tonnes. Note, however, that the first two figures corresponded to the Revised OMP, and the last to the Re-Revised OMP, where these revisions were in response to court judgements.

Acknowledgements
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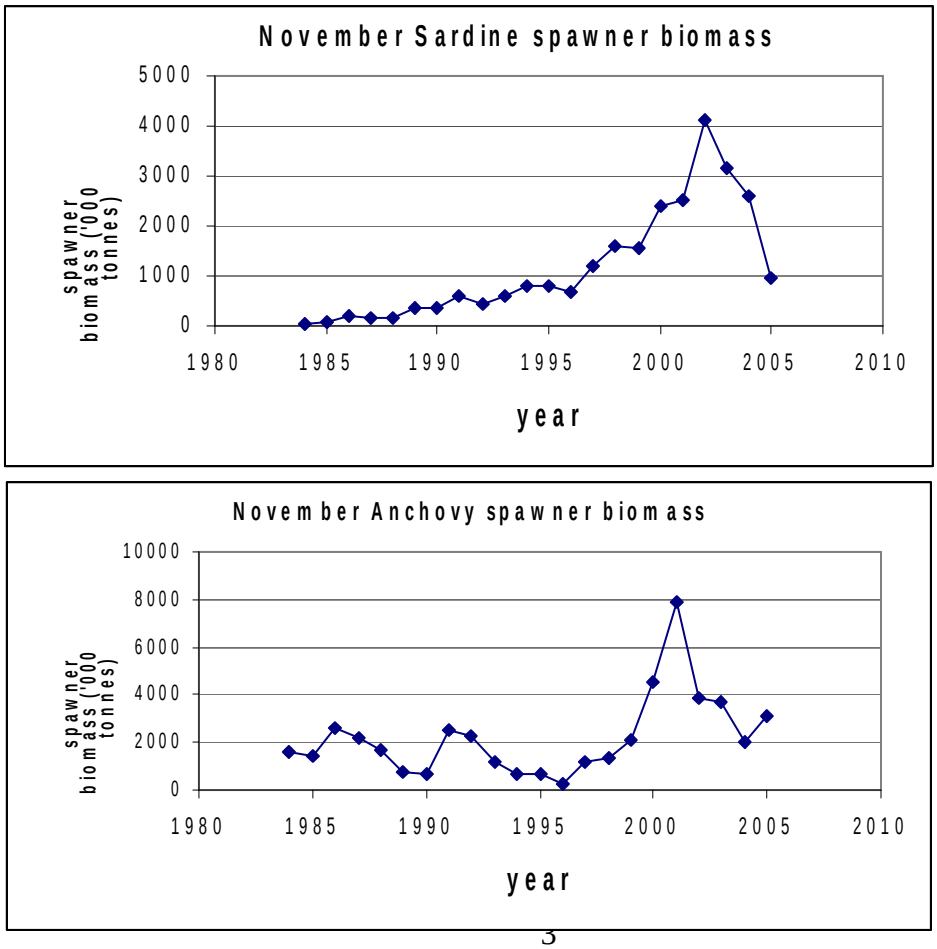
References
Cunningham, C.L. and D.S. Butterworth. 2005a. Re-Revised OMP-04. MCM document, SWG/DEC05/PEL/05.

Cunningham, C.L. and D.S. Butterworth. 2005b. Update regarding Potential Directed Sardine TAC for 2006. MCM document, SWG/AUG05/PEL/05.

Table 1: November survey spawner biomass estimates for sardine and anchovy.

	Sardine	Anchovy
1984	42.10099	1586.014
1985	71.04541	1449.263
1986	210.5049	2596.782
1987	167.4153	2164.863
1988	143.0608	1640.715
1989	371.4128	797.2474
1990	344.4175	697.1326
1991	580.488	2500.349
1992	429.0016	2230.894
1993	610.5354	1189.18
1994	780.638	708.2039
1995	814.0049	642.7951
1996	663.4074	212.634
1997	1180.688	1190.899
1998	1612.106	1318.069
1999	1564.311	2099.735
2000	2386.953	4505.615
2001	2500.338	7925.531
2002	4138.252	3858.376
2003	3175.604	3668.638
2004	2607.064	2035.827
2005	962.2887	3062 710

Figure 1: Plot of the time series of November survey sardine and anchovy spawner biomass estimates.



Appendix: Summary of Initial TAC and TAB Equations of Re-revised OMP-04 and their Application for 2006

(1) Directed Sardine TAC

In an initial calculation, the directed sardine TAC is set in proportion to the 2005 November spawner biomass index of abundance:

$$TAC_y^S = \beta\, B_{y-1,Nov}^S \tag{A.1}$$

thus $TAC_{2006}^S = 0.14657 * 962 = 141$ thousand tonnes

However, the TAC is also subject to the constraints of a minimum and a maximum value and a maximum drop to the 'two-tier' threshold:

$$\begin{array}{lll} \max\left\{\left(1-c_{mxdn}^S\right)TAC_{y-1}^S\,;\,c_{mntac}^S\right\} \le TAC_y^S \le c_{mxtac}^S & & TAC_{y-1}^S \le c_{tier}^S \\ \left(1-c_{mxdn}^S\right)c_{tier}^S \le TAC_y^S \le c_{mxtac}^S & & TAC_{y-1}^S > c_{tier}^S \end{array} \tag{A.2}$$

where c_{tier}^S =240 thousand tonnes.

Since $TAC_{y-1}^S = 382$ thousand tonnes for 2004 which is greater than c_{tier}^S,

$TAC_{2006}^S = (1-c_{mxdn}^S)c_{tier}^S = 0.85 * 240$ = **204 thousand tonnes.**

$\beta = 0.14657$ - a control parameter reflecting the proportion of the previous year's November spawner biomass index of abundance that is used to make the initial calculation for the directed sardine TAC.

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

$c_{mxdn}^S = 0.15$ - the maximum proportional amount by which the directed sardine TAC can be reduced from one year to the next if the TAC is below c_{tier}^S (which is set at 240 thousand tonnes for sardine).

$c_{mntac}^S = 90\,000$ t - the minimum directed TAC that may be set for sardine.

$c_{mxtac}^S = 500\,000$ t - the maximum directed TAC that may be set for sardine.

(2) Initial Directed Anchovy TAC

The initial directed anchovy initial TAC is based on how the 2005 November spawner biomass survey estimate of abundance related to the historic (pre-2005) average.

$$TAC_y^{1,A} = \alpha_{ns}\ \delta\ q\left(\ p + (1-p)\frac{B_{y-1,Nov}^A}{\overline{B}_{Nov}^A}\right) \tag{A.3}$$

Application of this formula results in:

$$TAC_{2006}^{1,A} = 0.73752 * 0.85 * 300 * [0.7 + 0.3 * \frac{3063}{2144}]$$

= 212 251 thousand tonnes.

This anchovy TAC is subject to similar constraints as apply for sardine:

$$\begin{array}{ll} \max\left\{\left(1-c_{mxdn}^A\right)TAC_{y-1}^{2,A}\ ;\ c_{mntac}^A\right\} \le\ TAC_y^{1,A}\ \le\ c_{mxtac}^A & TAC_{y-1}^{2,A} \le c_{tier}^A \\ \left(1-c_{mxdn}^A\right)c_{tier}^A\ \le\ TAC_y^{1,A}\ \le\ c_{mxtac}^A & TAC_{y-1}^{2,A} > c_{tier}^A \end{array} \tag{A.4}$$

where $c_{tier}^A = 330$ thousand tonnes.

Since $TAC_{y-1}^{2,A}$=215 thousand tonnes for 2005, which is smaller than c_{tier}^A, and $\left(1-c_{mxdn}^A\right)TAC_{y-1}^{2,A} = 0.75 \times 215\ 000 = 161\ 250$, the anchovy TAC for 2006 remains **212 251 tonnes**.

In the above equations we have:

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

$\overline{B}_{Nov}^A$ - the historic average index of anchovy abundance from the spawner biomass surveys from November 1984 to November 2004, of 2143.75 thousand tonnes.

$\alpha_{ns} = 0.73752$ - 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 spawner biomass survey component in setting the anchovy TAC in the midyear revision.

$q = 300$ - 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 (note that the additional season anchovy TAC is not taken into consideration in this constraint).

$c^{A}_{mntac} = 150\,000t$ - the minimum directed TAC that may be set for anchovy.

$c^{A}_{mxtac} = 600\,000t$ - the maximum directed TAC that may be set for anchovy.

Note that for the mid-year revision, the normal season TAC will be given by:

Revised anchovy TAC: $$TAC^{2,A}_{y} = \alpha_{ns}\, q\left(p\frac{N^{A}_{y-1,rec0}}{\overline{N}^{A}_{y-1,rec0}} + (1-p)\frac{B^{A}_{y-1,Nov}}{\overline{B}^{A}_{Nov}} \right) \quad \text{(A.5)}$$

where

$N^{A}_{y-1,rec0}$ - the simulated estimate of anchovy recruitment from the recruitment survey in year y, back-calculated to 1 November $y-1$ by taking natural and fishing mortality into account, and

$\overline{N}^{A}_{y-1,rec0}$ - the average simulated estimate of anchovy recruitment at the beginning of November from 1984 to $y-2$.

and subject to other constraints detailed in SWG/DEC2005/PEL/05.

(3) Initial sardine TAB

The initial sardine TAB is calculated using:

$$TAB^{1,S}_{y} = \gamma_{y}\, TAC^{1,A}_{y} + TAB^{S}_{rh} \quad \text{(A.6)}$$

where: $$\gamma_{y} = 0.1 + \frac{0.1}{1+\exp\left(-\frac{1}{0.1}0.00025\left(B^{S}_{y-1,Nov} - 2000\right)\right)} = 0.107$$

thus, given $B^{S}_{2005,Nov}$ =962 thousand tonnes:

$TAB^{1,S}_{2006} = 0.107 * 212\,251 + 10\,000$ = **32 711 tonnes.**

In the above equations we have:

$TAB^{S}_{rh} = 10\,000$ t- the fixed tonnage of adult sardine bycatch set aside for the round herring fishery each year.

γ_{y} - a conservative allowance for the ratio of juvenile sardine to juvenile anchovy in subsequent catches.

(4) Exceptional circumstances

Since the observed November 2005 survey sardine spawner biomass estimate is above 250 000t, no sardine exceptional circumstances are invoked. Similarly, since the November 2005 survey anchovy spawner biomass estimate is above 400 000t, no anchovy exceptional circumstances are invoked.