

## Adjusted Anchovy Assessment with Implications for OMP-08

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### Changes to the Anchovy Assessment

Certain errors in the anchovy catch numbers in Tables 1 and 2 of Cunningham *et al.* (2007) have recently been discovered. The anchovy assessment has accordingly needed to be recalculated with the corrected catch data.

This corrected assessment fits the survey data better. Unlike for the previous assessment which used incorrect catch data, there now appears to be no compelling reason to change the juvenile natural mortality from the  $0.9 \text{ yr}^{-1}$  used for the 2004 assessment and in testing OMP-04, particularly since estimates of the ratios of biases for the acoustic survey abundances  $k_r^A/k_N^A = 0.78 \in [0.5, 1.0]$  and for the proportion of fish of age 1 in the November survey  $k_{prop}^A = 0.934$  now return to lie within ranges previously deemed acceptable. The stock-recruitment curve (Figure 1) and the standard deviation of the residuals about this curve at the posterior mode remain similar for the 2004 and 2007 assessments. However the median maximum recruitment in the hockey stick stock recruitment curve has increased from 213 billion for the OMP-04 tests to 248 billion for the adjusted input to OMP-08 tests, while the median standard deviation of the residuals has decreased slightly from 0.883 to 0.861, both of which contribute towards the improved prognoses below for anchovy compared to that under OMP-04.

### Impact on OMP-08

Hardly any changes are required in the OMP-08 formulae and simulation testing framework. However, the input used to test the OMP from the anchovy assessment has now been adjusted to correspond to the corrected assessment.

The same method of adopting a risk threshold for anchovy as used for the earlier versions of OMP-08 has been adopted. This involves securing a leftward movement of the biomass distribution compared to the zero catch case similar to that for OMP-04. Tables 1 and 2 give the ratio of percentiles of these distributions for sardine and anchovy for the adjusted OMP-08 compared to the previous version of OMP-08 and OMP-04.

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The sardine risk threshold was kept unchanged, and the anchovy risk threshold adjusted until the adjusted OMP-08 distribution at the corner point of the trade-off curve corresponded as closely as possible to that for OMP-04.

The average and median TAC/Bs and average and median catches/bycatches for the corner points of the trade-off curves for the previous and the adjusted OMP-08 are given in Table 3. Note that median bycatches are much less than means because the distribution of bycatch is highly skewed, including a small proportion of high bycatch when the sardine biomass is very large; in these circumstances high juvenile sardine bycatches would be necessary to allow a reasonable catch of anchovy, and do not put the sardine resource at risk because of its high level. Table 4 gives the constraints and control parameters for these same two corner points.

### **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. MCM Document MCM/2007/SEP/SWG-PEL/03. 28pp.
- Cunningham, C.L., and Butterworth, D.S. 2008. Proposed Final OMP-08. MCM Document MCM/2008/SWG-PEL/09. 42pp.

**Table 1.** The ratio of the percentiles of the distribution of *sardine* biomass in 2027 under OMP-08 to a no-catch scenario at the corner points of the trade-off curves under the proposed previous OMP-08 presented in Cunningham and Butterworth (2008) and under the adjusted OMP-08 of this document. Shaded cells represent cases for which the predicted ratio (depletion) is more pessimistic than that used for OMP-04.

	OMP-04/No-catch	OMP-08/No-catch (Corner Point)	
		Previous	Adjusted
10%ile	0.59	0.51	0.49
20%ile	0.68	0.69	0.68
30%ile	0.69	0.74	0.72
40%ile	0.71	0.75	0.73
Median	0.72	0.74	0.72

**Table 2.** The ratio of the percentiles of the distribution of *anchovy* biomass in 2027 under OMP-08 to a no-catch scenario at the corner points of the trade-off curves under the proposed previous OMP-08 presented in Cunningham and Butterworth (2008) and under the adjusted OMP-08 of this document. Shaded cells represent cases for which the predicted ratio (depletion) is more pessimistic than that used for OMP-04.

	OMP-04/No-Catch	OMP-08/No-catch (Corner Point)	
		Previous	Adjusted
10%ile	0.25	0.28	0.31
20%ile	0.37	0.33	0.38
30%ile	0.45	0.42	0.42
40%ile	0.56	0.44	0.44
Median	0.58	0.47	0.51

**Table 3.** Risk and average and median projected TAC/TAB and catch/bycatch (rounded to nearest '000t) for the proposed previous OMP-08 presented in Cunningham and Butterworth (2008) and under the adjusted OMP-08 of this document. Results are given corresponding to the control parameters for the corner points of the trade-off curves for each case.

	$\beta$	$\alpha_{ns}$	$\alpha_{ads}$	risks	risk <sub>A</sub>	Average directed sardine TAC	Average total anchovy TAC	Average sardine TAB	Average directed sardine catch	Average anchovy catch	Average sardine bycatch	Median directed sardine TAC	Median total anchovy TAC	Median sardine TAB	Median directed sardine catch	Median anchovy catch	Median sardine bycatch
Previous OMP-08	0.094	0.445	0.6675	0.179	0.279	188	299	93	188	269	71	152	448	49	152	400	33
Adjusted OMP-08	0.097	0.78	1.17	0.178	0.097	190	420	100	190	381	79	152	448	49	152	400	33

**Table 4. Parameters and constraints in OMP-02, re-revised OMP-04, for the proposed previous OMP-08 presented in Cunningham and Butterworth (2008) and for the adjusted OMP-08 of this document.**

Control Parameter	OMP-02	Re-Revised OMP-04	Previous OMP-08	Adjusted OMP-08
$\beta$	0.14657	0.14387	0.094	0.097
$\alpha_{ns}$	0.73752	0.72858	0.445	0.78
$\alpha_{ads}$	1.47504	1.45716	0.6675	1.17
<b>Constraints</b>				
$TAB_{rh}^S$	10 000t	10 000t	3 500t	3 500t
$C_{mxdn}^S$	0.15	0.15	0.20	0.20
$C_{mxdn}^A$	0.25	0.25	0.25	0.25
$C_{mntac}^S$	90 000t	90 000t	90 000t	90 000t
$C_{mntac}^A$	150 000t	150 000t	120 000t	120 000t
$C_{mxnac}^S$	500 000t	500 000t	500 000t	500 000t
$C_{mxnac}^A$	600 000t	600 000t	600 000t	600 000t
$C_{tier}^S$	240 000t	240 000t	255 000t	255 000t
$C_{tier}^A$	330 000t	330 000t	330 000t	330 000t
$C_{mxnac}^{ns,A}$	200 000t	200 000t	150 000t	150 000t
$C_{mxnac}^{ads,A}$	150 000t	150 000t	120 000t	120 000t
$TAB_{ads}^S$	2 000t	2 000t	2 000t	2 000t

Table 4 (continued).

Constraints		OMP-02	Re-Revised OMP-04	Previous OMP-08	Adjusted OMP-08
$B_{smooth}^S$	threshold at which directed sardine TAC is linearly decreased	N/A	800 000t	800 000t	800 000t
$B_{ec}^S$	threshold at which exceptional circumstances are invoked for sardine	250 000t	250 000t	300 000t	300 000t
$B_{ec}^A$	threshold at which exceptional circumstances are invoked for anchovy	400 000t	400 000t	400 000t	400 000t
$B_1$	threshold above which the anchovy additional sub-season TAC can increase more rapidly	N/A	N/A	1 000 000t	1 000 000t
$B_2$	threshold above which the anchovy additional sub-season TAC reaches a maximum	N/A	N/A	1 500 000t	1 500 000t
$x^S$	the proportion of the exceptional circumstances threshold below which sardine TAC is zero.	0	0	0.25	0.25
$x^A$	the proportion of the exceptional circumstances threshold below which anchovy TAC is zero.	0	0.25	0.25	0.25
$R_{crit}$	sardine recruitment threshold above which the maximum possible mid-year increase in sardine TAC under exceptional circumstances is achieved	N/A	N/A	17.38	17.38
$\Delta^A$	threshold above $B_{ec}^A$ at which linear smoothing is introduced before anchovy exceptional circumstances are declared (to ensure continuity)	N/A	N/A	100 000t	100 000t
Fixed Controls					
$\delta$	'scale-down' factor on initial anchovy TAC	0.85	0.85	0.85	0.85
$p$	weighting given to recruit survey in anchovy TAC	0.7	0.7	0.7	0.7
$q$	relates to average TAC under OMP99	300	300	300	300
$\gamma_y$	conservative initial estimate of juvenile sardine : anchovy ratio	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2

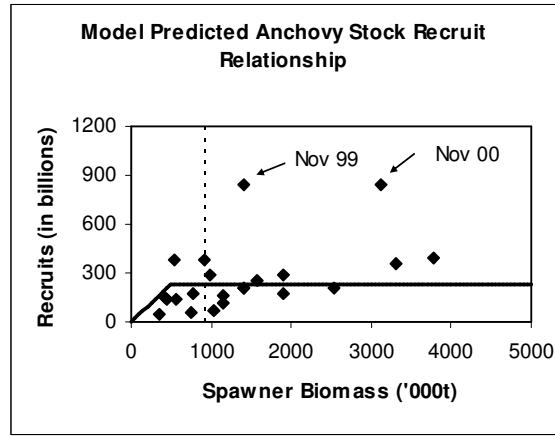


Figure 1. The stock recruit relationship for the adjusted base case anchovy assessment with  $M_j^A = M_{ad}^A = 0.9$ .

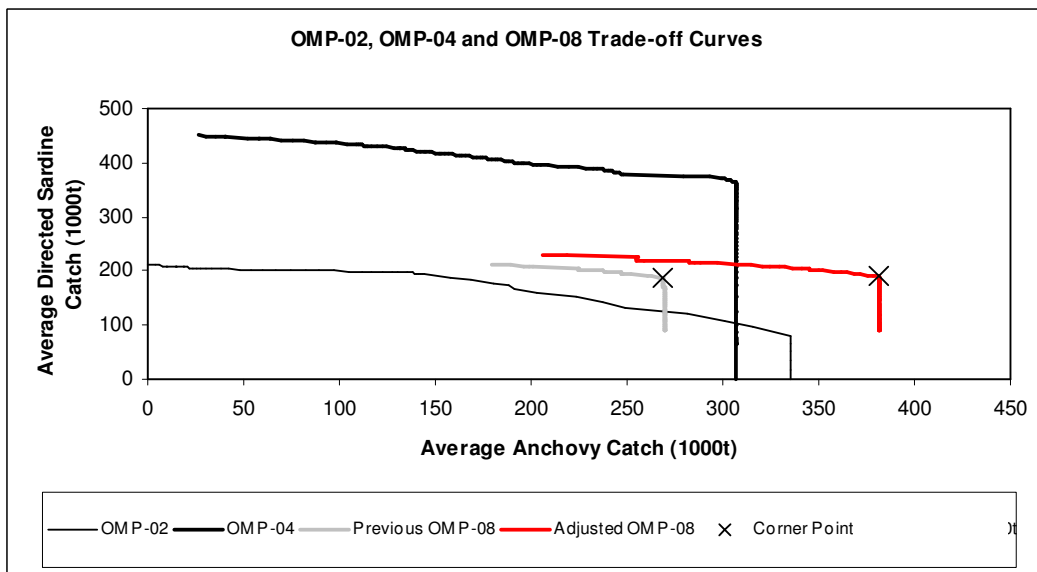


Figure 2. The trade-off curves for OMP-02, OMP-04 the previous proposed OMP-08 (see Cunningham and Butterworth 2008) and the adjusted OMP-08 of this document.