Addendum to Updated Anchovy Assessment

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There was an error in the calculation of the loss to natural mortality reported in Table 2 of de Moor and Butterworth (2009). The correct annual losses to predation as estimated by the base case assessment are given below and the formulae used are listed in Appendix B.

References

de Moor, C.L., and Butterworth, D.S. 2009. Updated Anchovy Assessment. MCM Document MCM/2009/SWG-PEL/31. 10pp

Table 2. *The annual estimated loss to predation (in '000t) compared to the annual catch (in '000t).*

Year	Loss to *M*	Catch	Catch: Loss to *M*
1984	1466.712	268.900	0.18
1985	1164.249	277.000	0.24
1986	1593.319	303.800	0.19
1987	1643.539	600.380	0.37
1988	1378.440	572.745	0.42
1989	824.564	294.420	0.36
1990	658.923	151.559	0.23
1991	1262.925	151.044	0.12
1992	1456.315	349.044	0.24
1993	1006.929	235.867	0.23
1994	641.334	155.941	0.24
1995	493.751	178.430	0.36
1996	432.600	40.881	0.09
1997	729.642	60.386	0.08
1998	1014.694	107.867	0.11
1999	1448.241	179.892	0.12
2000	2851.358	267.291	0.09
2001	3852.166	287.512	0.07
2002	3688.174	213.446	0.06
2003	3048.211	258.876	0.08
2004	2316.551	190.092	0.08
2005	2122.426	282.727	0.13
2006	1781.871	134.184	0.08
2007	1922.152	253.092	0.13
2008	2602.063	265.823	0.10
2009	3265.687	168.370	0.05

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Appendix B: Calculation of Loss to Predation

The assessment model assumes catch is taken in a pulse mid-way through the year. The loss in numbers of age a in year y is calculated by:

$$P^N_{y,a} = N^A_{y-1,a-1}\left(1-e^{-M^A_{a-1}/2}\right)+\left(N^A_{y-1,a-1}e^{-M^A_{a-1}/2}-\hat{C}^A_{y,a-1}\right)\left(1-e^{-M^A_{a-1}/2}\right), \qquad a=1,2$$

$$= N^A_{y-1,a-1}\left(1-e^{-M^A_{a-1}}\right)-\hat{C}^A_{y,a-1}\left(1-e^{-M^A_{a-1}/2}\right)$$

$$P^N_{y,3} = N^A_{y-1,2}\left(1-e^{-M^A_2}\right)$$

$$P^N_{y,4} = N^A_{y-1,3}\left(1-e^{-M^A_3}\right)+N^A_{y-1,4}\left(1-e^{-M^A_4}\right)$$

The loss in biomass of fish of age *a* to predation in year *y* is therefore given by:

$$P_{y,a} = \left(N^A_{y-1,a-1}\left(1-e^{-M^A_{a-1}/2}\right)+\left(N^A_{y-1,a-1}e^{-M^A_{a-1}/2}-\hat{C}^A_{y,a-1}\right)\left(1-e^{-M^A_{a-1}/2}\right)\right)\frac{1}{2}\left(w_{y-1,a-1}+w_{y,a}\right), \qquad a=1,2$$

$$= \left(N^A_{y-1,a-1}\left(1-e^{-M^A_{a-1}}\right)-\hat{C}^A_{y,a-1}\left(1-e^{-M^A_{a-1}/2}\right)\right)\frac{1}{2}\left(w_{y-1,a-1}+w_{y,a}\right)$$

$$P_{y,3} = N^A_{y-1,2}\left(1-e^{-M^A_2}\right)\frac{1}{2}\left(w_{y-1,2}+w_{y,3}\right)$$

$$P_{y,4} = N^A_{y-1,3}\left(1-e^{-M^A_3}\right)\frac{1}{2}\left(w_{y-1,3}+w_{y,4}\right)+N^A_{y-1,4}\left(1-e^{-M^A_4}\right)\frac{1}{2}\left(w_{y-1,4}+w_{y,4}\right)$$

The assumption is made that $w_{1983,a} = w_{1984,a}$, $a = 1,\ldots,4+$.

The total loss in anchovy biomass to predation in year *y* is then given by:

$$P_y = \sum_{a=1}^{4+} P_{y,a}\ .$$