Update regarding the calibration factors for the two hake species between the two gear types used on the *Africana*

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January 2009

In June 2003, the trawl gear on the *Africana* was changed and a species-dependent multiplicative bias factor q is taken to apply to the surveys conducted with the new gear. Calibration experiments have been conducted between the *Africana* with the old gear (hereafter referred to as the "old *Africana*") and the *Nansen*, and between the *Africana* with the new gear ("new *Africana*") and the *Nansen*, in order to provide a basis to relate the multiplicative biases of the *Africana* with the two types of gear (q_{old} and q_{new}). A GLM analysis assuming negative binomial distributions for the catches made (Brandão *et al*., 2004) provided the following estimates:

$\Delta\ell nq^{capensis} = -0.494$ with $\sigma_{\Delta\ell nq^{capensis}} = 0.141$ i.e. $\left(q^{new}/q^{old}\right)^{capensis} = 0.610$ and

$\Delta\ell nq^{paradoxus} = -0.053$ with $\sigma_{\Delta\ell nq^{paradoxus}} = 0.117$ i.e. $\left(q^{new}/q^{old}\right)^{paradoxus} = 0.948$

where

$$\ell nq^{s}_{new} = \ell nq^{s}_{old} + \Delta\ell nq^{s} \quad \text{with } s = \textit{capensis} \text{ or } \textit{paradoxus} \qquad (1)$$

No plausible explanation has yet been found for the particularly large extent to which catch efficiency for *M. capensis* was estimated to have decreased for the new research survey trawl net. It was therefore recommended (BENEFIT, 2004) that the ratio of the catchability of the new to the previous *Africana* net be below 1, but not as low as the ratio estimated from the calibration experiments. $\Delta\ell nq^{capensis}$ has therefore been taken to be -0.223, i.e. $\left(q^{new}/q^{old}\right)^{capensis} = 0.8$.

Eleven surveys have now been conducted using the new gear on the *Africana*. As noted above, the calibration factor priors (serving as penalty functions in a frequentist context) input to assessments have medians of 0.95 for *M. paradoxus* and 0.8 for *M. capensis*. The estimates (posterior mode equivalents) output from the New Baseline Assessment (NBA, Rademeyer and Butterworth, 2008) are 0.947 (CV=0.026) and 0.787 (CV=0.036) for *M. paradoxus* and *M. capensis* respectively (Table 1).

With the relatively tight CVs on the priors (0.141 and 0.117 for *M. capensis* and *M. paradoxus* respectively) the estimates output for the calibration factors are dominated by the priors. With no priors, the estimates output (which reflect only the data from the subsequent surveys, ignoring the original calibration experiment) are 1.155 (CV=0.422) and 1.167 (CV=0.298) for *M. paradoxus* and *M. capensis* respectively (Table 1). Thus the subsequent surveys suggest that the new gear is slightly more efficient than the old, the reverse of what the original experiment indicated, but it should be noted that the estimates based on the subsequent surveys alone are very imprecise. The very high precision of the calibration factor estimates indicated in Table 1 when both sources of information is surprising, but the Hessian-based estimates there have been compared to likelihood-profile results which suggest similar magnitudes. However this investigation provided indications of multi-modality in the likelihood function in relation to these calibration factors, suggesting (though not conclusively) that there are incompatibilities between the two sources of information – this in turn would invalidate the methods used to evaluate precision.

Note nevertheless that although the point estimates of the calibration factors differ substantially depending on whether or not the information from the calibration experiment is taken into account, the estimates of management quantities differ little (Table 2).

REFERENCES

BENEFIT (2004) Formal report: BENEFIT/NRF stock assessment workshop, Cape Town, 12-17 January 2004.

Brandão A Rademeyer RA and Butterworth DS (2004). First attempt to obtain a multiplicative bias calibration factor between the *Africana* with the old and the new gear. Unpublished report, Marine and Coastal Management, South Africa WG/11/04/D:H:26. 2pp

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Table 1: Survey calibration factor estimates with Hessian-based CV's in parentheses.

	Prior		Posterior		Data	
M. paradoxus	0.948	(0.117)	0.931	(0.023)	1.155	(0.422)
M. capensis	0.800	(0.141)	0.787	(0.036)	1.167	(0.298)

Table 2: Estimates of management quantities for the New Baseline Assessment (with priors on the survey calibration factors) and the assessment without any such priors. Note that because the New Baseline Assessment includes the priors (as penalty functions), the resultant likelihood values reported below are not comparable.

			New Baseline Assessment	Assessment without any prior on the calibration factors
	-lnL total		-53.5	-56.7
M. paradoxus	K^{sp}		1408	1341
	h		0.89	0.88
	MSY		109	109
	Bsp_{2008}/Ksp		227	227
	B^{sp}_{2008}/K^{sp}		0.16	0.17
	$B^{sp}_{2008}/MSYL^{sp}$		0.79	0.80
	$MSYL^{sp}$		0.20	0.21
	M	0	0.90	0.91
		1	0.90	0.91
		2	0.90	0.91
		3	0.62	0.63
		4	0.46	0.47
		5+	0.35	0.36
M. capensis	K^{sp}		667	656
	h		0.95	0.95
	MSY		85	84
	B^{sp}_{2008}		406	400
	B^{sp}_{2008}/K^{sp}		0.61	0.61
	$B^{sp}_{2008}/MSYL^{sp}$		1.74	1.74
	$MSYL^{sp}$		0.35	0.35
	M	0	1.00	1.00
		1	1.00	1.00
		2	1.00	1.00
		3	0.75	0.75
		4	0.60	0.60
		5	0.50	0.50
		6	0.50	0.50
		7+	0.50	0.50
	2008 species ratio	B^{sp}	1.79	1.76
	(*paradoxus/capensis*)	B^{2+}	1.50	1.46