Adjunct 1

Approximate calculation of Sub-area level additional CVs based on revised abundance estimates for conditioning of *ISTs*

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Sub-area level CVs are calculated based on the method in SC/58/Rep1. CVs based on sampling errors were calculated by Tables 2 and 3 (Case 2) of Kitakado *et al.* (2005). For example, the sampling CV for block F, $CV_S(N_F)$, is

$$CV_S(N_F) = \frac{\sqrt{(N_{F,\text{closing}}/R)^2\{CV_S^2(N_{F,\text{closing}}) + CV^2(R)\} + N_{F,\text{passing}}^2 CV_S^2(N_{F,\text{passing}})}}{N_{F,\text{closing}}/R + N_{F,\text{passing}}}.$$

where R = 0.727 ($CV(R)$ = 36.4%) (SC/58/Rep1, annex H). We ignored a correlation for simplicity.

Then, $\text{var}_S(N_F) = \{CV_S(N_F)\exp(\mu_F + \sigma_F^2/2)\}^2$ where μ_F and σ_F are extracted from table 1 of SC/58/Rep1, annex H.

Total $CV_T(N_F) = \sqrt{CV_S^2(N_F) + \sigma_A^2}$ for each block, and $\text{var}_T(N_F) = \{CV_T(N_F)\exp(\mu_F + \sigma_F^2/2)\}^2$.

For Sub-area 1W = F+G+H, the Sub-area level CVs are calculated as follows:

$$CV_S(N_{FGH}) = \frac{\sqrt{\text{var}_S(N_F) + \text{var}_S(N_G) + \text{var}_S(N_H)}}{N_{FGH}},$$

$$CV_T(N_{FGH}) = \frac{\sqrt{\text{var}_T(N_F) + \text{var}_T(N_G) + \text{var}_T(N_H)}}{N_{FGH}},$$

$$CV_{Add}(N_{FGH}) = \sqrt{CV_T^2(N_{FGH}) - CV_S^2(N_{FGH})}.$$

Table 1

Summary of the sub-area CVs.

	Sub-area 1W (blocks FGH)	Sub-area 1E (blocks IJK)	Sub-area 2 (blocks LM)
N	8,152	10,814	2,860
$CV_{(\text{sampling})}$ %	25.43	24.45	32.80
σ_p=0.673			
$CV_{(\text{Total})}$ %	46.68	51.59	58.29
$CV_{(\text{add})}$ %	39.15	45.42	48.19
σ_p=0.9			
$CV_{(\text{Total})}$ %	58.20	65.48	72.31
$CV_{(\text{add})}$ %	52.36	60.75	64.44

REFERENCE

Kitakado, T., Shimada, H., Okamura, H. and Miyashita, T. 2005. Update of additional variance estimate for the western North Pacific stock of Bryde's whales. Paper SC/O05/BWI6 presented at the Bryde's whale *Implementation* workshop, Tokyo, 25-29 October 2005. 16pp. [Paper available at the Office of this Journal].

Adjunct 2

Estimation of age-at-maturity for female Bryde's whales

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Four models were fitted to the data on the maturity-at-age for female Bryde's whales sampled during JARPN II (table 1 of Bando *et al.*, 2005). The four models are special cases of the following general model:

$$P_a = \left[\frac{\alpha}{1 + \exp[-(a - a_{50})/\delta]}\right]^{\beta} \quad (1)$$

where

- P_a is the proportion of animals of age a which are mature;
- a_{50} is the age-at-50%-maturity (if α=1 and β=1);
- δ is the parameter that determines the width of the maturity ogive;
- α is asymptotic fraction of animals which are mature; and
- β is a shape parameter.

The model is fitted using a binomial likelihood under the assumption that age and maturity determination are exact (i.e. no measurement error).

Table 1 lists the values for the parameters of Equation (1) for each of the four models and the true age-at-50%-maturity (the age at which a proportion of α/2 animals are mature). Fig. 1 shows the fit of the four models to the available data.

Although the model in which α (but not β) is treated as an estimable parameter provides the most parsimonious representation of the data, the age-at-50%-maturity is robustly estimated to be 6 years. The age-at-first-parturition corresponding to this age-at-maturity is 7 years.

a_{50}	δ	α	β	No. of parameters	$-\ell nL$	Age-at-50%-maturity
5.93	2.07	1	1	2	21.042	5.93 (0.89)
6.21	0.915	0.978	1	3	15.662	6.21 (0.55)
-23.40	2.33	1	212031	3	19.640	5.99 (N/A)
-7.42	1.25	0.999	30066	4	15.619	5.90 (0.51)