Details of the jack-knife approach implemented for the results presented in Table 1 of MARAM/IWS/DEC16/Peng Clos/P3

A. Ross-Gillespie and D.S. Butterworth

Data

Table 1 lists the chick condition data used in this analysis. There are in total 7 years' data, with Robben data only for the year 2004, and Dassen and Robben data for the years 2008-2013.

Jack-knife approach

Take *i* in {1,2,..,7} where each *i* corresponds to one of the years in the dataset, so that year is being treated as the sampling unit. Exclude the data corresponding to that year (i.e. exclude data, where available, from both Dassen and Robben Island), run the GLM-bias procedure (i.e. simulate 1000 data sets for the historical years and re-apply the EM to evaluate the GLM-bias; see Step 4 of Table 2 of MARAM/IWS/DEC16/Peng Clos/P1a). For each *i*, record the GLM-bias-adjusted estimate for (catch model) or δ (closure model). The jack-knife estimate of variance is given by:

$$\sqrt{\frac{n-1}{n}\sum_{i=1}^{n}(x_i-\bar{x})^2} \qquad (1)$$

where *n* is the total number of unique years (7), x_i is the estimate of λ or δ when the i^{th} data set is removed, and $\bar{x}$ is the GLM estimate based on the entire data set (i.e. the grey cells in Table 2).

Results

Table 2 lists the GLM-bias adjusted estimates (mu*_EM) for each run where a consecutive year's data have been omitted. The grey cells show the results for when the EM is applied to the entire dataset. Table 3 reports the jack-knife estimates calculated from the values in Table 2, according to Equation (1).

Table 1: The chick condition data. This Table is a replicate of Table 6 of MARAM/IWS/DEC15/PengD/BG1, and showing values for 2013 which are no longer confidential.

Year	Robben	Robben n	Robben SE	Dassen	Dassen n	Dassen SE
2004	0.51	1168	0.009			
2008	0.27	762	0.013	0.32	393	0.023
2009	0.30	1176	0.011	0.28	947	0.014
2010	0.32	397	0.021	0.31	583	0.018
2011	0.24	464	0.018	0.27	717	0.015
2012	0.50	772	0.015	0.30	673	0.016
2013	0.46	754	0.016	0.24	430	0.020

Table 2: The GLM-bias adjusted estimates for λ (catch only model) or δ (closure only model) when one year's data are removed from the series at a time. The grey cells show the estimates for when the entire series is included.

			Catch only EM		Closure only EM	
Index	Island	Year excluded	mu*_EM	sd_EM	mu*_EM	sd_EM
ALL	Dassen	NA	0.01	0.18	-0.07	0.22
1	Dassen	2004	0.01	0.16	-0.08	0.19
2	Dassen	2008	0.04	0.21	-0.03	0.31
3	Dassen	2009	0.00	0.23	-0.16	0.32
4	Dassen	2010	-0.01	0.20	-0.11	0.27
5	Dassen	2011	0.01	0.12	-0.13	0.13
6	Dassen	2012	-0.11	0.40	-0.11	0.24
7	Dassen	2013	-0.19	0.17	-0.08	0.25
ALL	Robben	NA	-0.21	0.15	-0.11	0.20
1	Robben	2004	-0.19	0.13	-0.26	0.18
2	Robben	2008	-0.14	0.24	-0.05	0.22
3	Robben	2009	-0.17	0.19	-0.07	0.23
4	Robben	2010	-0.19	0.17	-0.10	0.24
5	Robben	2011	-0.34	0.11	-0.46	0.13
6	Robben	2012	-0.13	0.17	0.02	0.23
7	Robben	2013	-0.09	0.15	-0.04	0.23

Table 3: The jack-knife estimate of variance, followed by the GLM estimates repeated from Table 2.

Jackknife se		
	Catch only	Closure only
Dassen	0.21	0.11
Robben	0.20	0.38
GLM se		
	Catch only	Closure only
Dassen	0.18	0.22
Robben	0.15	0.20