

Analysis of simulated Antarctic minke surveys (“2008” scenarios) using the “standard” and the “direct duplicate” method

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Simulated survey data (Palka and Smith 2004, 2005) were analyzed for new scenarios sc39 through sc56, with 100 iterations each of alternating IO and closing mode data. The same methods used to analyse scenarios sc1–sc38 were used here (Branch 2005a,b; 2006a). The only change in the input data is that sightings with confirmed school sizes are now delineated by an additional column containing a “1” in the sightings file, whereas before all sightings were simulated as having confirmed school sizes (Palka 2007). This does not affect the analyses because the simulated data assume that all sightings within 3.0 nmi of the trackline have confirmed school sizes, either because they were within 0.3 nmi of the trackline or because the vessel closed on them. Therefore only confirmed sightings in closing mode are used to estimate school size, as in the standard method (Branch and Butterworth 2001, Branch 2006b). For each survey iteration, a mean value was calculated for the quantities of interest. Tables 1–4 present the mean and CVs of these mean values calculated over all 100 iterations.

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Table 1. Summary statistics (mean and CV of the iterations) for the “standard” method (Branch and Butterworth 2001, Branch 2006). Columns are effective strip half-width, esw , estimated mean school size, $E[s]$, and density of whales, D_w . Note that esw is from IO mode, $E[s]$ is from confirmed sightings in closing mode only, and D_w is the inverse-variance weighted estimate obtained by finding the ratio R between IO and closing mode estimates, multiplying closing mode estimates by R to obtain pseudo-IO mode estimates, and then inverse-variance weighting the IO and pseudo-IO estimates of D_w .

Scenario	esw (m)	CV	$E[s]$	CV	D_w (no. per km ²)	CV
sc39	1829	0.093	3.60	0.103	0.100	0.155
sc40	1518	0.106	3.60	0.135	0.145	0.231
sc41	1600	0.099	2.74	0.089	0.075	0.108
sc42	1573	0.121	3.08	0.114	0.100	0.161
sc43	1212	0.082	2.65	0.085	0.058	0.111
sc44	1171	0.098	2.80	0.130	0.074	0.175
sc45	1224	0.109	2.50	0.070	0.044	0.094
sc46	1071	0.106	2.50	0.090	0.059	0.134
sc47	1059	0.093	2.53	0.076	0.059	0.123
sc48	1249	0.099	2.49	0.062	0.045	0.087
sc49	1166	0.109	2.74	0.107	0.071	0.146
sc50	1220	0.097	2.67	0.091	0.060	0.108
sc51	1554	0.114	3.18	0.129	0.105	0.183
sc52	1591	0.110	2.75	0.074	0.075	0.106
sc53	1483	0.105	3.57	0.149	0.145	0.231
sc54	1803	0.081	3.58	0.121	0.101	0.181

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Table 2. Component estimates used in estimating density by the direct duplicate method; estimated search half-width (esw, in m) from IO mode, separately for each platform; and mean school size ($E[s]$) from confirmed sightings from all platforms in closing mode.

Scenario	IO platform		Topman platform		IO + topman platform		All platforms closing mode only	
	esw	CV	esw	CV	esw	CV	$E[s]$	CV
sc39	1357	0.117	1727	0.109	1103	0.141	3.65	0.123
sc40	1187	0.132	1486	0.105	1032	0.141	3.70	0.203
sc41	1222	0.122	1566	0.116	1077	0.146	2.74	0.088
sc42	1260	0.141	1618	0.129	1112	0.170	3.08	0.114
sc43	934	0.139	1210	0.118	805	0.150	2.65	0.085
sc44	919	0.117	1205	0.114	778	0.151	2.81	0.137
sc45	960	0.149	1253	0.123	813	0.194	2.50	0.070
sc46	854	0.135	1127	0.134	783	0.189	2.50	0.090
sc47	846	0.142	1133	0.109	795	0.169	2.53	0.076
sc48	964	0.150	1282	0.112	833	0.190	2.49	0.062
sc49	903	0.136	1190	0.123	748	0.181	2.75	0.119
sc50	908	0.144	1219	0.103	804	0.155	2.67	0.092
sc51	1262	0.134	1590	0.129	1099	0.159	3.18	0.130
sc52	1208	0.140	1577	0.122	1084	0.144	2.75	0.073
sc53	1158	0.155	1470	0.118	996	0.161	3.66	0.200
sc54	1326	0.119	1709	0.095	1076	0.123	3.64	0.153

Table 3. Estimated density of whales (D_w , in no. per km²) for the direct duplicate method (final column). Estimates are given separately based on sightings from the topman platform (x_1), from the IO platform (x_2), and from both topman and IO platforms (x_3). The direct duplicate estimate of density is given by $x_1 * x_2 / x_3$. Densities of schools are estimated from the IO mode data, which is then multiplied by mean school size estimates from closing mode to obtain densities of whales.

Scenario	IO platform		Topman platform		IO + topman platform		Direct duplicate est.	
	D_w	CV	D_w	CV	D_w	CV	D_w	CV
sc39	0.087	0.177	0.075	0.207	0.063	0.227	0.105	0.191
sc40	0.114	0.196	0.095	0.269	0.061	0.260	0.179	0.233
sc41	0.063	0.135	0.053	0.194	0.040	0.192	0.085	0.177
sc42	0.075	0.150	0.063	0.200	0.039	0.216	0.122	0.182
sc43	0.046	0.144	0.037	0.212	0.025	0.191	0.067	0.201
sc44	0.054	0.168	0.044	0.241	0.026	0.217	0.093	0.237
sc45	0.034	0.137	0.027	0.180	0.019	0.220	0.049	0.157
sc46	0.042	0.141	0.034	0.204	0.018	0.224	0.080	0.191
sc47	0.041	0.148	0.033	0.207	0.017	0.228	0.081	0.192
sc48	0.034	0.139	0.028	0.167	0.019	0.222	0.050	0.172
sc49	0.052	0.170	0.043	0.216	0.026	0.248	0.087	0.207
sc50	0.047	0.183	0.040	0.176	0.027	0.230	0.070	0.200
sc51	0.079	0.174	0.065	0.245	0.041	0.243	0.128	0.227
sc52	0.062	0.155	0.053	0.182	0.039	0.185	0.085	0.178
sc53	0.114	0.232	0.098	0.285	0.064	0.312	0.177	0.234
sc54	0.088	0.198	0.077	0.227	0.064	0.242	0.105	0.201