

Clustered or dispersed: testing the effect of sampling strategy to census burrow-nesting petrels with varied distributions at sub-Antarctic Marion Island

Supporting Online Information

Table S1. Descriptions of geological and vegetation classes on sub-Antarctic Marion Island used in models to predict the abundance and distribution of burrow-nesting petrels in 2015 (adapted from Boelhouwers *et al.* 2008). Geological classes relate to the two colour maps (Figs. 2 & 3).

Geological classes	
Black lava types 1-4	extensive areas of rocky broken black lava flows classed by age:
Type 1	- oldest flows which are now vegetated lava hummocks
Types 2 & 3	- partly vegetated lava hummocks
Type 4	- youngest raw black lava
Recent lava flows (post-1980)	e.g. at Kaalkop on west coast
Eastern and Western successions	grey lava successions radiating from the centre of the island
Holocene scoria cones	resulting from several volcanic eruptions subsequent to glaciations
Wind-blown volcanic ash	ash from volcanic eruptions subsequent to glaciations
Vegetation classes	
Cinder Cones	largely unvegetated occasional patches of <i>Acaena magellanica</i> creeper and isolated cushion plants <i>Azorella selago</i>
Coastal Vegetation	coastal slopes and flat areas with two main habitats: - salt spray areas - dominated by extensive low herbfields of <i>Cotula plumosa</i> , <i>Crassula moschata</i> & sprawling <i>A. selago</i> - biotic areas - fertilised by seal and seabird colonies dominated by tussock grass <i>Poa cookii</i> & sedge <i>Uncinia compacta</i>
Fellfield	- loose broken black lava dominated by mosses <i>Sphagnum</i> species cushion plants <i>A. selago</i> & <i>Agrostis</i> grasses - steep slopes at lower altitudes dominated by <i>Blechnum penna-marina</i> ferns and <i>A. magellanica</i> creepers
Mire-Slope Vegetation	- mires: wet relatively flat boggy areas on black lava coastal plains & on grey lava ridges with <i>Sphagnum</i> mosses & <i>Agrostis</i> grasses - steep vegetated slopes: well-drained soils on grey lava ridges dominated by creeping stems of <i>B. penna-marina</i> ferns & <i>A. magellanica</i> creeper which form large soft mats of vegetation
Polar Desert	at elevations >650 m shallow or no soil cover lichens & mosses

Table S2. The estimated number of great-winged white chinned and blue petrel burrows on Marion Island in 2015 using burrow densities estimated from 52 random transects (25 m wide, total 144 km). Burrow densities and five associated habitat attributes (G, V, S, A, E) were grouped across multiple combinations in 32 models to generate island estimates. Best-fitting models following AIC-based model selection are in bold.

Model	Great-winged petrel	White chinned petrel	Blue petrel
Null	35 336	56 391	116 305
Geology (G)	33 710	50 034	121 156
Vegetation (V)	33 192	50 660	111 962
Slope (S)	35 231	53 189	113 384
Aspect (A)	34 449	51 794	112 638
Elevation (E)	33 557	48 612	116 104
GV	32 417	49 862	119 297
GE	33 659	46 794	130 326
GA	35 012	52 189	122 525
GS	36 545	52 642	131 250
VE	35 559	52 264	112 523
VA	33 287	50 015	111 276
VS	34 587	51 555	117 362
EA	33 293	47 209	111 130
ES	34 579	48 961	113 787
AS	36 836	55 417	111 122
GVE	32 386	48 517	129 844
GVA	33 528	49 314	122 724
GVS	32 559	47 473	127 281
GEA	33 596	44 806	112 747
GES	33 502	46 718	138 968
GAS	34 983	48 715	120 405
VEA	33 348	47 111	102 510
VES	36 047	52 335	143 230
VAS	35 473	52 444	107 484
EAS	32 318	46 273	112 196
GVEA	33 472	47 482	124 101
GVES	29 910	44 825	152 825
GVAS	32 198	45 154	121 860
GEAS	28 721	41 017	115 955
VEAS	33 254	49 063	106 170
GVEAS	28 515	40 237	113 952
Average	33 596	49 033	119 512
SD	1 936	3 637	10 977
Minimum	28 515	40 237	102 510
Maximum	36 836	56 391	152 825
Median	33 543	49 012	116 205

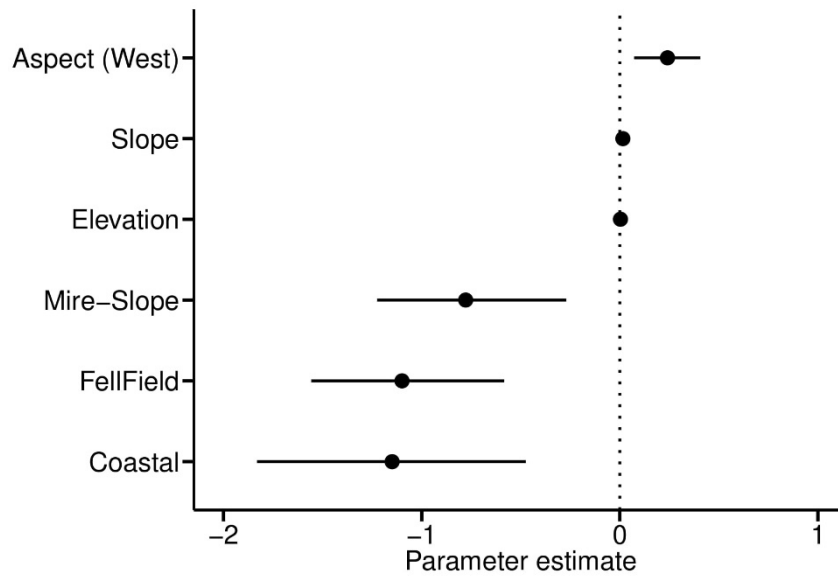


Fig. S1 Parameter estimates of the top model describing the relationship between burrow abundance and habitat attributes for great-winged petrel. Reference categories were: aspect, east; and vegetation, Cinder.

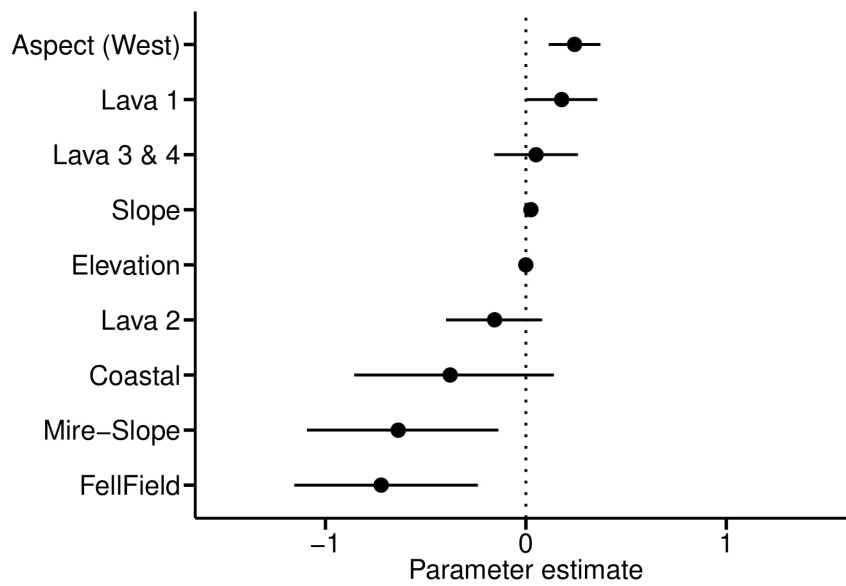


Fig. S2 Parameter estimates of the top model describing the relationship between burrow abundance and habitat attributes for white-chinned petrel. Reference categories were: aspect, east; geology, eastern succession; and vegetation, Cinder.

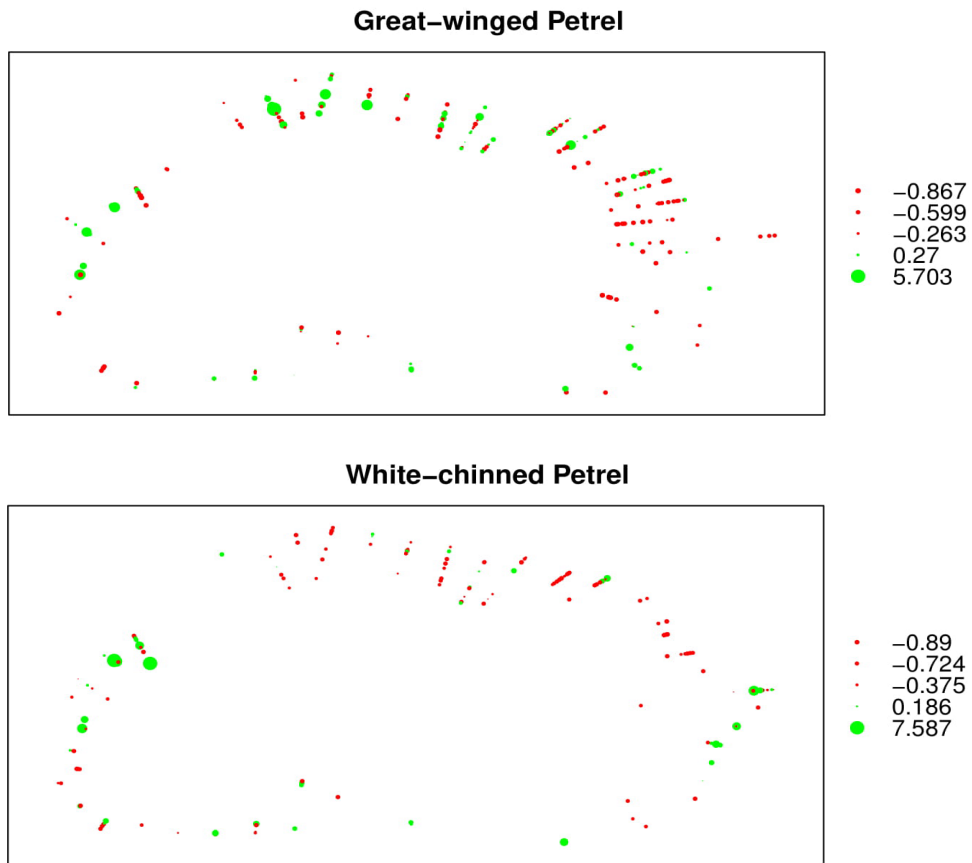


Fig. S3 Bubble plots showing the distribution and magnitude of model residuals across Marion Island for two petrel species.