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Appendix A. Detailed description of archipelago-wide census methods and count error and southern sea lion (*Otaria flavescens*) breeding colonies at the Falkland Islands.

A1: Archipelago-wide census methods and count error.

Southern sea lion breeding colonies were identified by surveying the coast line from a boat. Where possible, observers walked the coast line and interior of each island to ensure all breeding groups were found. Most breeding colonies (80 %) were direct counted from land. Direct counts from the boat (or zodiac) were the preferred method for seven breeding colonies (Table A1). We were unable to land at seven breeding colonies because access was not granted (Table A1). One breeding colony (Beauchêne Island) ($n = 3$ pups) was counted in 2011 by Falklands Conservation (unpublished data), but not in 2014 due to logistical constraints. Five small breeding colonies reported in 2003 (≤ 30 pups) did not exist in 2014. However, we found six new breeding colonies (Table A1).

Several potential sources of count error exist. These are (1) pups were born after visiting breeding colonies, (2) pups died prior to counting and the carcass was not detected and (3) live pups at some breeding colonies may have been hidden by tussac grass (*i.e.*, had moved away from the main breeding beach) (Hamilton 1939, Thompson et al. 2005).

We cannot account for the first two sources of error, although previous studies suggest they are less than 5 % (Hamilton 1939, Thompson et al. 2005). To explore potential count error associated with pups hidden by tussac grass, we used the average number of pups counted in tussac grass as a proxy for potential error. In 1995, the number of pups counted in tussac was 4 % (based on breeding colonies counted after 31 January 1995) (Thompson et al. 2005). In 2014, all pups remained on breeding beaches until the 24 January. After the 24 January, pups at 14 breeding colonies were found in tussac grass on the periphery of breeding beaches (Table A1). Based on these 14 breeding colonies, the number of pups in tussac grass was, on average, $14 \pm \text{SD } 12$ % of the total count. We estimated the potential count error for all breeding colonies counted after 24 January. Count error was derived by drawing a fractional error from a uniform distribution, assuming the uncertainty of the original count was between 4 % and 14 %. A value (count) was then randomly drawn from a sampling distribution based on the error. The procedure was repeated 10,000 times and the resulting 10,000 possible estimates generated for each breeding colony were summed. The 2.5 and 97.5 percentiles calculated as the lower and upper band of the 95 % confidence interval.

One known breeding colony (Port Louis) was not counted in 2014 because of issues associated with site access. In 2003, 64 pups were counted at Port Louis. To estimate the number of pups at Port Louis in 2014, we used the same bootstrap approach detailed above, but with an error range that was based on the population change between 2003 and 2014 for colonies of a similar size (>60 pups). The lower and upper error used was 17 % and 94 %, respectively.

For 36 breeding colonies counted on or after 24 January 2014, the total number of pups estimated using a count error of between 4 % and 14 % to account for pups that could have moved from the beach into surrounding tussac grass, ranged between 2,923 and 2,951 (lower and upper 95 % CI). Therefore, the total number of pups born in 2014 could be as high as 4,591 or a 66 % increase in the number of pups since 2003, using upper 95 % confidence intervals for breeding colonies counted before (1,513) and after (2,951) 24 January and Port Louis.

Table A1. Breeding colonies of southern sea lions at the Falkland Islands counted in 2014, 2003, 1995, 1965 and the 1930s. Dead pups are included in the total column, and reported as the value within parenthesis. D = direct count. DB = preferred method, direct count from boat.

Date	Location	Sea lion pups					Latitude	Longitude	Pups in tussock	Count method
		2014	2003	1995	1965	1930s				
		4,443	2,765	2,042	5,506	80,555				
01-Mar-11	Beauchêne Island	3					-52.91	-59.19	0	D
16-Jan-14	Bills Islet	125 (1)	94 (2)				-51.35	-59.82	0	D
16-Jan-14	North West Island	74	48	37		838	-51.58	-59.21	0	D
16-Jan-14	Penguin Point	42	27	27		350	-51.35	-59.44	0	D
16-Jan-14	Penguin Point (rocks)	44	22				-51.35	-59.44	0	D
16-Jan-14	Rabbit Island	101	113	52		161	-51.31	-59.73	0	D
17-Jan-14	Dry Island	1					-51.37	-59.89	0	DB
17-Jan-14	Government Island	22	10	12			-51.22	-59.9	0	D
17-Jan-14	Monday Islet	11					-51.37	-59.91	0	D
17-Jan-14	Port Egmont Cays	65 (2)	29	25		1859	-51.18	-60.04	0	D
17-Jan-14	Sedge Island	6	7			2782	-51.15	-60.38	0	D
17-Jan-14	Skip Rock	12	23	10			-51.44	-60.14	0	DB
17-Jan-14	Wreck Island	66 (1)	35 (1)	34		1941	-51.16	-60.25	0	D
18-Jan-14	Dunbar Island	36	51	38		768	-51.37	-60.37	0	D

18-Jan-14	Low Island	23	42 (2)	43	3316	-51.34	-60.46	0	D
18-Jan-14	Low Island rocks	59				-51.34	-60.48	0	D
18-Jan-14	Twins South	68	44 (1)	13	1495	-51.25	-60.64	0	D
19-Jan-14	Gibraltar Rock	28	14	7		-51.32	-60.76	0	DB
19-Jan-14	Twins North	49 (1)	15	15		-51.25	-60.64	0	D
20-Jan-14	Elephant Jason	20	26	23	684	-51.17	-60.85	0	D
20-Jan-14	North Fur Island	39	34 (1)		8158	-51.13	-60.74	0	D
20-Jan-14	South Fur Island	3	5 (1)	7	5010	-51.26	-60.84	0	D
20-Jan-14	South Jason	13	5	4	17	-51.2	-60.84	0	D
21-Jan-14	Flat Jason	51	17	23	6041	-51.09	-60.9	0	D
21-Jan-14	The Fridays	68	29	25	25641	-51.06	-60.97	0	D
21-Jan-14	Steeple Jason Islet	132	46	61 (1)	414	-51.06	-61.15	0	D
22-Jan-14	3rd Passage Island3	45	30		7777	-51.57	-60.83	0	Photo
22-Jan-14	Cliff Island	86	85	36	400*	-51.48	-60.56	0	DB
22-Jan-14	Sea Lion Island	50	43	38		-52.44	-59.09	0	D
22-Jan-14	Split Island	21	31 (2)	13	3325	-51.47	-60.72	0	D
23-Jan-14	Gibbs Island	22	30 (1)	53		-51.65	-60.3	0	D
23-Jan-14	Rabbit Island	10				-51.55	-60.49	0	DB
23-Jan-14	Shallow Harbour Islet	100	68 (1)	66		-51.79	-60.51	0	D
23-Jan-14	Town Point Rocks	14				-51.66	-60.25	0	DB
24-Jan-14	Circum Island	71	37 (1)	36 (2)	1247	-51.93	-60.87	0	D
24-Jan-14	Outer Island	45	45	25 (1)	1938	-51.86	-60.53	0	D
24-Jan-14	West Double Creek	34	18	2		-51.97	-60.59	2	D
25-Jan-14	Hill Islet3	48	24	27		-51.8	-61.08	0	DB
25-Jan-14	Hill Main3	27	19 (1)	22		-51.8	-61.08	0	DB
25-Jan-14	Weddell Island	45	15	11	2061	-51.78	-61.03	0	D
26-Jan-14	Stinker Island	135	20			-51.83	-61.19	65	D
26-Jan-14	Stuck in the mud	95	84 (1)	98 (2)		-51.85	-61.17	0	D
27-Jan-14	Tussack Island	71	37	26	1217	-52.02	-60.95	13	D
29-Jan-14	Bare Island	39	29	1		-52.2	-60.68	0	D
29-Jan-14	Peat Island	39	31	16	246	-52.18	-60.48	4	D
30-Jan-14	Calista Island3	24	20	21	2073	-52.02	-59.86	0	DB
30-Jan-14	North Wedge Island3	39	24	26	201	-52	-59.8	0	DB

31-Jan-14	Clump Island	2	15 (1)	21	720	-52.03	-59.75	0	DB
31-Jan-14	Mike's Island	57	28	2		-52.1	-59.75	0	D
31-Jan-14	Sandy Tyssen	56	13	24	291	-51.88	-59.63	0	D
31-Jan-14	West Tyssen	126	81	60	647	-51.89	-59.67	0	D
01-Feb-14	Cape Dolphin	172	74 (1)	82	3393	-58.95	-51.25	30	D
01-Feb-14	Blind Island	159 (3)	86	70	274	-52.27	-59.54	20	D
01-Feb-14	East Cay ³	30	29	24	2569	-52.16	-59.84	6	Photo
01-Feb-14	Sandy Elephant Cay	130 (1)	64	57	150*	-52.13	-59.84	0	D
01-Feb-14	Speedwell Islet	70	30		37	-52.3	-59.74	0	D
01-Feb-14	Speedwell Pass Point	77	92	88		-52.31	-59.74	0	D
02-Feb-14	Cattle Point Island	5 (1)				-52.2	-59.26	0	D
02-Feb-14	Fanny Island	61	55	34		-52.25	-59.33	0	D
02-Feb-14	Tussock Point Island	64	10			-52.34	-59.4	2	D
03-Feb-14	Motley Island	18	32	17		-52.15	-58.6	0	D
03-Feb-14	Outer Triste Island	91	46	53		-52.15	-58.71	0	D
03-Feb-14	Sisters	60	36	30		-52.19	-58.99	0	D
03-Feb-14	Turn Island	51	41	34		-52.12	-58.92	5	D
04-Feb-14	Green Island	181	125	93 (1)		-51.96	-58.51	35	D
04-Feb-14	North East Island	48	3			-52.01	-58.36	2	D
04-Feb-14	Sal Island	83	47	51		-52.06	-58.53	1	D
05-Feb-14	Kelp Island	260 (3)	166 (1)	138		-51.85	-58.19	21	D
06-Feb-14	Port Harriet	93				-51.74	-57.85	0	D
12-Feb-14	Big Shag Island	328 (3)	125	73		-51.39	-58.32	60	D
Not visited	Port Louis ³	-	64	32 (1)	350	-51.39	-58.17	-	-

Breeding colony reported in 1995 or 2003, but not in 2014

26-Jan-14	Letterbox		24	24		-51.83	-61.15		
24-Jan-14	North Harbour Is		1	3		-51.87	-60.88		
08-Feb-14	Diamond Cove		30	19		-51.54	-57.92		
29-Jan-14	Kelp Lagoon		15			-52.24	-60.62		
16-Jan-14	Bullock Is		7			-51.35	-59.61		
02-Feb-14	Bull Point			2		-52.357	-59.373		
29-Jan-14	North Arch Is			2	19	-52.219	-60.451		

1-Feb-14	Elephant NW Cay	1	-52.13	-59.87
	Eroded tussock island ²	27	?	?

Breeding colony reported in 1934–1937, but not in 1995, 2003, or 2014

22-Jan-14	Fourth Passage Is		5779	-51.56	-60.87
26-Jan-14	Pitt Is		4087	-51.81	-61.06
31-Jan-14	Tyssen Islet		1494	-51.875	-59.648
26-Jan-14	unnamed off Weddell		951	-51.79	-61.04
Not visited	Jason West Cay		500*	-50.999	-61.45
Not visited	Pebble Islet		302	-51.239	-59.892
Not visited	Pebble West Islet		272	-51.217	-59.906
Not visited	Jason East Cay		250*	-51	-61.307
25-Jan-14	Quaker Is		248	-51.77	-61.04
Not visited	Carcass reef		226	-51.31	-60.579
22-Jan-14	Second Passage Is		200*	-51.57	-60.77
1-Feb-14	South East Elephant Cay		200*	-52.164	-59.829
1-Feb-14	South Elephant Cay		150*	-52.157	-59.84
26-Jan-14	Bald Is		130	-51.778	-60.966
16-Jan-14	White Is		108	-51.23	-59.776
29-Jan-14	Cape Meredith		85	-52.222	-60.667
Not visited	West Is		77	-51.975	-59.838
Not visited	Channel Is		75*	-51.806	-61.196
Not visited	New Island seal rocks		35	-51.778	-61.298
Not visited	New Is		19	-51.7	-61.31
Not visited	Stop Is		12	-51.983	-60.965
Not visited	Barren Is		12	-52.362	-59.709
Not visited	North Is		4	-51.65	-61.23
29-Jan-14	Saddle Is		4	-51.67	-61.24
29-Jan-14	Arch Is		2	-52.231	-60.478

1 Includes 750 pups 'estimated' rather than direct counted

2 Location unknown. Description rather than name of island.

3 Access not granted.

*Counts were 'estimates' rather than direct counted

Literature Cited

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