

Southern sea lion research at the Falkland Islands 2014

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Picture: Rachael Orben

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Summary

- Completed the fifth archipelago-wide sea lion census. A total of 4,443 pups were counted, representing a 60% increase in the number of pups between 2003 and 2014.
- Tracked 10 adult male and 10 adult female sea lions (this is the first time adult males have been tracked at the Falkland Islands).
- Completed a dive physiology study on adult females.
- Collected skin samples from southern sea lions for fine-scale population genetic study.
- Collected skin samples from South American fur seals for a genetic taxonomy study.

Introduction

Southern sea lions (*Otaria flavescens*) breeding at the Falkland Islands have declined by 97%, from the largest population in the world in the 1930's (pup production of ca. 80,000) to now the smallest population (less than 3000 pups) (Hamilton 1939, Thompson et al. 2005). Despite this dramatic decline and failure to recover, their ecology remains virtually unstudied. For example, foraging location data is currently limited to one adult female satellite tracked during the 1992 austral summer (Thompson et al. 1998). However, four archipelago-wide censuses have been undertaken (1934-1936, 1965, 1995, 2003) and consequently population data for the Falkland Islands is more comprehensive than some other southern sea lion breeding locations (these being Peru, Chile, Argentina and Uruguay).

At the Falkland Islands, sea lions breed at 68 sites. The most recent Falkland Islands sea lion census revealed that while most of the 68 breeding colonies had increased, some declined or remained stable in the period between the 1995 and 2003 censuses (Thompson et al. 2005).

To assess the current conservation status of sea lions, we undertook the fifth Falkland Islands archipelago-wide sea lion census. In addition, to better understand sea lion ecology and potential impediments to population recovery, we (1) deployed 10 satellite tags on adult male southern sea lions (2) deployed 10 GPS tags on adult female sea lions and undertook a dive physiology study (the latter was in collaboration with Dr Dan Costa, UCSC) (3) collected skin samples from sea lions around the Falkland Islands for a fine-scale population genetics study (a masters project to commence in 2014 and supervised by Dr Joseph Hoffman, University of Bielefeld). We also collected skin samples from South American fur seals (*Arctocephalus australis*) for a taxonomic review of the Falklands subspecies (collaboration with Dr Robert Brownell Jr, NOAA). However, this report reviews only two aspects of the 2014 field season. These are the 2014 archipelago-wide sea lion census and the at-sea movements of adult male sea lions.

Methods

(1) Sea lion census

Between 16 January and 12 February 2014 we visited all known southern sea lion breeding colonies *via* a charter boat. The timing of the 2014 census was consistent with the recommended census period first established in the 1930's (Hamilton 1939) and subsequently used in the 1995 and 2003 censuses (Thompson et al. 2005). Specifically, most southern sea lion pups at the Falkland Islands are born by mid January, while mid February is before females and pups disperse from breeding beaches (Hamilton 1939; Thompson et al. 2005).

Consistent with the 1995 and 2003 census, the numbers of pups at breeding colonies were counted by two observers either (1) ashore, from one or more vantage points overlooking the breeding colony (2) direct counted from the charter boat (or zodiac) but from several

vantage points along the shoreline or (3) counted from photographs taken from the top of the boat mast.

Counts were complete (*i.e.*, we did not average counts because breeding colonies were typically small, enabling each count to be repeated until a single value was obtained). Therefore, the number of pups counted represents the minimum number of pups born. However, several potential sources of 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 sites may have been hidden by tussock 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 have suggested these sources of error to be less than 5% (Hamilton 1939; Thompson et al. 2005). To explore potential count error associated with pups hidden by tussock, we used the average number of pups counted in tussock as a proxy for potential error. In 1995, the number of pups counted in the tussock was 4 % (based sites 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 tussock grass on the periphery of breeding beaches. Based on these 14 sites, the number of pups in tussock grass was on average 14 ± 12 % of the total count. We estimated the potential count error for all sites 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 and 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. 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.

(2) Deployment of satellite tags

In February 2014 we attached satellite tags (Sirtrack® Kiwisat 202's) to the guard hairs of adult male sea lions using a flexible 2-part epoxy (Devcon® 5-minute epoxy). All males were captured at Big Shag Island by remote injection, using the anesthetic drug Zoletil (c.a. 1.5 mg/kg of estimated weight). Zoletil was delivered using Pneu-Dart darts (Type P, 3.0 ml, ½ inch, gelatin collar) dispensed from a CO₂ powered Dan-Inject JM standard tranquilizer gun. Please refer to Baylis et al. (2014) for a detailed overview of darting procedures.

Preliminary results and Discussion

(1) Sea lion census

In total, 4,443 pups were counted at 70 breeding colonies that were distributed around > 800 km of coastline. The number of pups counted in 2014 increased by at least 60% when compared to 2003 (2,765 pups, including dead pups), but is still less than 5% of the 1930's estimate (Fig 1). One known breeding site (Port Louis) was not counted but was estimated to be 64 ± 105 pups in 2014 (22 and 127 pups estimated to be the lower and upper 95% CI). Including this site, the total number of pups estimated in 2014 is therefore between 4,465 and 4,570.

Most breeding colonies were direct counted from land (80 %). Direct counting from the boat was the preferred method for six sites (Appendix Table 1). We did not land at eight breeding sites because access was not granted (Appendix Table 1). One breeding colony (Beauchêne Island) was counted in 2011 but not in 2014 due to logistical constraints. We were unable to locate two breeding colonies that were counted in 2003, despite extensive searching of the coastline.

For 36 sites counted on or after 24 January 2014, the total number of pups estimated using a count error of between 4% and 14% ranged between 2,923 - 2,951 (these values correspond to the 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 (1,513 + 2,951 + 127 pups, or (sites counted before 24 Jan) + (sites counted after 24 Jan) + (Port Louis)).

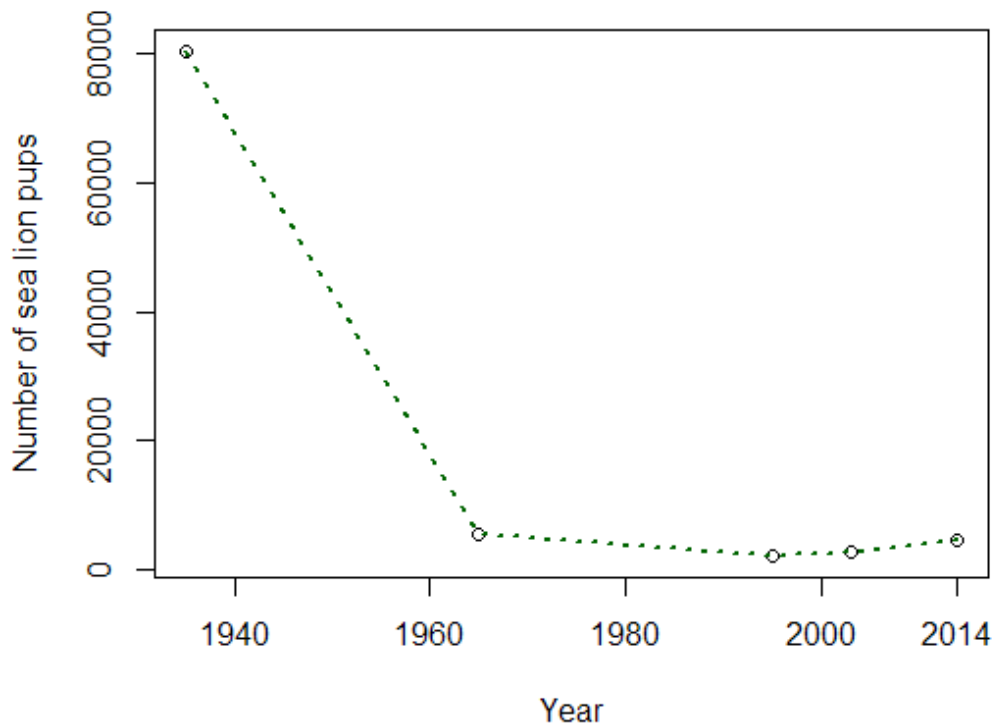


Fig 1. Estimated number of southern sea lion pups born at the Falkland Islands in 1934-1936, 1965, 1995, 2003 and 2014.

(2) Adult male at-sea movements

In total 10 satellite tags were deployed on adult males (we did not weigh adult males, but average length was 222 ± 9 cm). Deployment duration lasted 22 ± 8.3 days, with the shortest and longest deployment period for adult males being 7 and 37 days, respectively. Males typically foraged less than 150 km to the north of Big Shag Island, in the same area frequented by adult females (Fig 2). However, males also moved between breeding colonies, venturing to Seal Bay (Port Louis; to the east of Big Shag Island), and Cape Dolphin (to the west of Big Shag Island). We had anticipated deployment duration would last until June, when adult males moult. We suspect the tags malfunctioned.

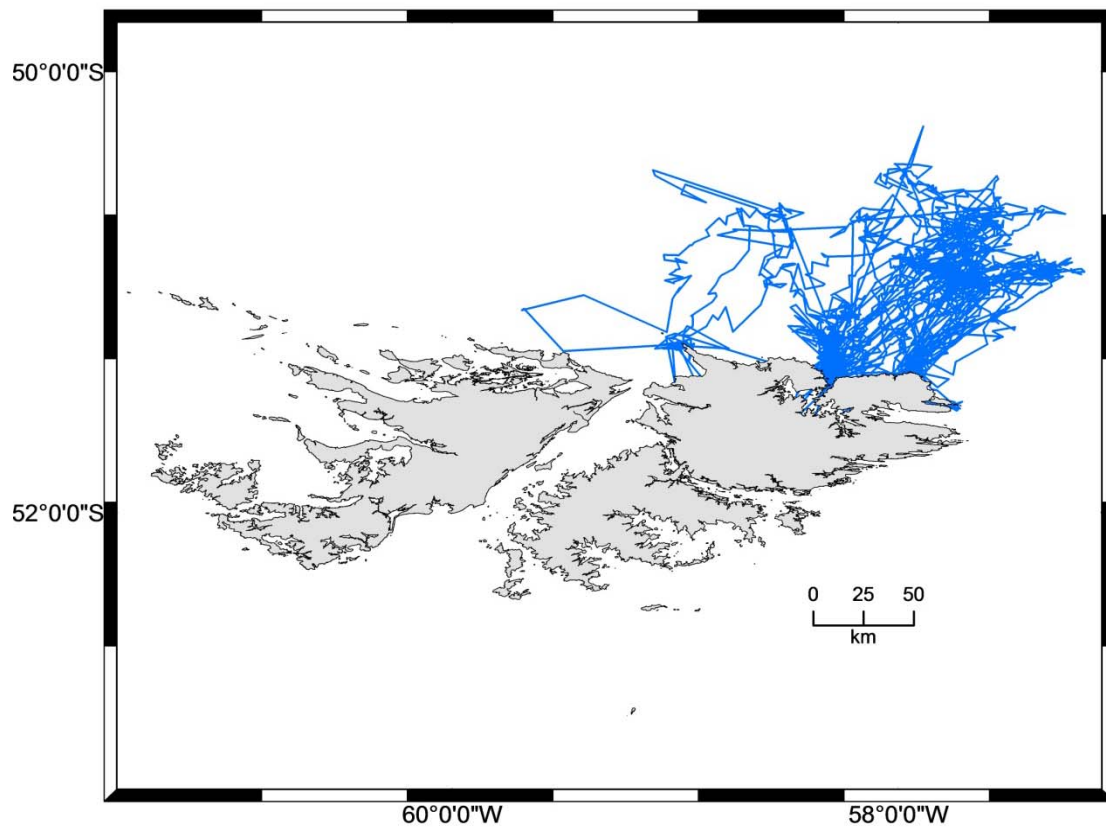


Fig 2: Preliminary results representing the at-sea movements of adult male southern sea lions at the Falkland Islands, during March 2014. The figure summarises the foraging trips of 10 adult males captured at Big Shag Island, East Falkland.

Time line

Date 2014	Activity
Jan 11	Arrive Falkland Islands
Jan 12 – 14	Preparations Stanley
Jan 15	Drive to New Haven, first night on charter boat
Jan 16 – Feb 6	Census via charter boat, genetic sampling
Feb 7	Return to Stanley
Feb 8	Volunteer Rocks (fur seals)
Feb 9 – Feb 11	Resupply for deployments
Feb 12	Stanley to Big Shag Island, undertake census
Feb 13	Deploy GPS tags on females
Feb 14	Return to Stanley
Feb 15	MPA for LAN flight (change-over field crew)
Feb 16	Stanley to Big Shag Island

Feb 17 – 25	Adult male deploy, adult female deploy (and recapture), genetic sampling
Feb 26	Return to Stanley
Feb 27	Volunteer Point (day off)
Feb 28	Stanley, prepare samples for export, packing equipment
March 1	MPA (field crew depart on LAN flight)
March 2	Stanley to Big Shag, final genetic sampling, return to Stanley
March 3	Clean and pack equipment
March 4-6	Jane Cameron National Archives (sea lion harvest data)
March 7	Final packing, store equipment
March 8	Depart Falkland Islands

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Appendix Table 1: A total of 4,443 southern sea lion pups were counted during the 2014 Falkland Islands archipelago-wide census.

Date	Island	Falklands	Alive	Dead	Total
16.01.2014	North West Island	West	74	0	74
16.01.2014	Penguin Point (east; Tamar Is Bare)	West	42	0	42
16.01.2014	Penguin Point (main; Tamar Is Rocks)	West	44	0	44
16.01.2014	Rabbit Island	West	101	0	101
16.01.2014	Bills Islet	West	124	1	125
17.01.2014	Monday Islet	West	11	0	11
17.01.2014	Dry Island	West	1	0	1
17.01.2014	Skip Rock	West	12	0	12
17.01.2014	Government Island	West	22	0	22
17.01.2014	Port Egmont Cays	West	63	2	65
17.01.2014	Wreck Island	West	65	1	66
17.01.2014	Sedge Island	West	6	0	6
18.01.2014	Dunbar Island	West	36	0	36
18.01.2014	Low Island	West	23	0	23
18.01.2014	Low Islands rocks	West	59	0	59
18.01.2014	Twins South	West	68	0	68
19.01.2014	Twins North	West	48	1	49
19.01.2014	Gibraltar Rock ¹	West	28	0	28
20.01.2014	South Fur Island	West	3	0	3
20.01.2014	South Jason	West	13	0	13
20.01.2014	North Fur Island	West	39	0	39
20.01.2014	Elephant Jason	West	19	1	20
21.01.2014	Flat Jason	West	51	0	51
21.01.2014	The Fridays (south)	West	66	2	68
21.04.2014	Steeple Jason Islet	West	129	3	132
22.01.2014	3rd Passage Island ²	West	45	0	45
22.01.2014	Split Island	West	21	0	21
22.01.2014	Cliff Island ¹	West	85	1	86
22.01.2014	Sea Lion Island	East	48	2	50
23.01.2014	Rabbit Island ¹	West	10	0	10
23.01.2014	Gibbs Island	West	22	0	22
23.01.2014	Town Point Rocks ¹	West	14	0	14
23.01.2014	Shallow Harbour Islet	West	100	0	100
24.01.2014	Outer Island	West	45	0	45
24.01.2014	West Double Creek	West	34	0	34
24.01.2014	Circum Island	West	69	2	71
25.01.2014	Hill Main ²	West	27	0	27
25.01.2014	Hill Islet ²	West	48	0	48
25.01.2014	Weddell Is (Quaker Pass)	West	44	1	45

26.01.2014	Stinker Island	West	134	1	135
26.01.2014	Stuck in the mud	West	94	1	95
27.01.2014	Tussack Islands (most north)	West	71	0	71
29.01.2014	Bare Is (East of cross)	West	38	1	39
29.01.2014	Peat Island	West	38	1	39
30.01.2014	Calista Island ²	West	24	0	24
30.01.2014	North Wedge Island ²	West	39	0	39
31.01.2014	Sandy Tyssen	East	56	0	56
31.01.2014	West Tyssen	East	126	0	126
31.01.2014	Clump Island ¹	East	2	0	2
31.01.2014	Mike's Island	East	56	1	57
1.02.2014	Sandy Elephant Cay	East	129	1	130
1.02.2014	East Cay ²	East	30	0	30
1.02.2014	Speedwell Islet	East	70	0	70
1.02.2014	Speedwell Pass Point (George Island)	East	77	0	77
1.02.2014	Blind Island	East	156	3	159
2.02.2014	Tussock Point Island North (Bull Point)	East	64	0	64
2.02.2014	Fanny Island (south)	East	61	0	61
2.02.2014	Cattle Point Island	East	4	1	5
3.02.2014	Sisters ¹	East	60	0	60
3.02.2014	Turn Island	East	50	1	51
3.02.2014	Outer Triste Island	East	89	2	91
3.02.2014	Motley Island	East	18	0	18
4.02.2014	Sal Islands	East	83	0	83
4.02.2014	Green Island	East	178	3	181
4.02.2014	North East Island	East	48	0	48
5.02.2014	Kelp Islands (north)	East	257	3	260
6.02.2014	Port Harriet (seal point)	East	93	0	93
Feb-14	Cape Dolphin	East	172	0	172
12.02.2014	Big Shag Island	East	325	3	328
16.03.2011	Beauchêne Island	East	3	0	3
NA	Port Louis	East	?	?	?
Total			4404	39	4443

¹Preferred method was to count pups from the boat

²Limited to counting pups from boat