Population changes of sympatric Subantarctic and Antarctic fur seals at Marion Island

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Conclusions

- 50% Reduction in pup production of Subantarctic fur seals (*Arctocephalus tropicalis*) was highest at the high-density rookeries. These rookeries are all situated along the W and NW coast of Marion Island.
- Coastline orientation is a major driver for the colony-level preferred foraging areas in fur seals.
- Therefore, we suggest this decline is potentially a result of density-dependent, intra-specific competition for food resources. However, a population over-shoot cannot be ruled out.
- Antarctic fur seals (*A. gazella*) continue to increase, although the rate of increase has slowed. This is possibly due to saturation at the main breeding rookery – Watertunnel Beach.

Introduction

After the cessation of sealing on Marion Island in 1931, only a small population of Subantarctic fur seals (SAFS) remained. Regular population censuses from 1951, showed the SAFS population exhibited initial slow population growth (1950's to 1970's) followed by exponential increase (1980's) and a final maturity phase of slowed population growth (1990's). The last census in 2004 indicated a further reduction in growth at original high-density breeding rookeries on the western side of the island and an increase at newly formed rookeries around rest of the island. Antarctic fur seals (AFS) were still increasing exponentially in 2004.

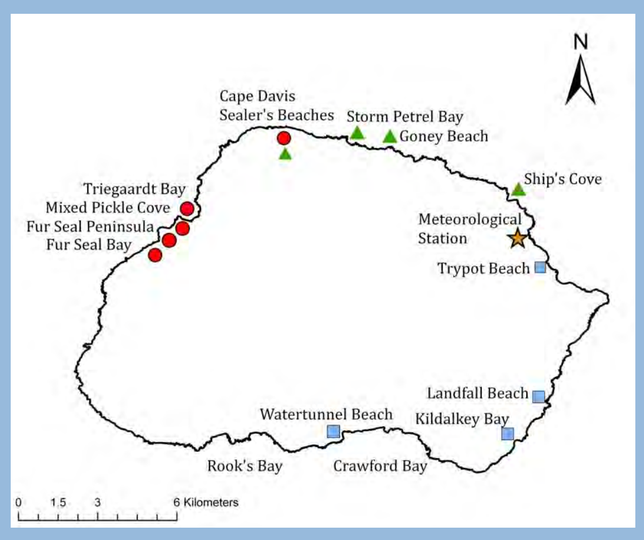

Figure 1: Three different counts were performed:

- **SAFS Total Island Count:**
  A once-off total island count of SAFS pups was conducted between 18 January – 12 February 2013. The 5 highest-density rookeries are indicated by red circles.
- **SAFS Annual Counts:**
  Starting in the summer of 2006/07, SAFS pups were counted annually at Cape Davis and several smaller beaches between Storm Petrel Bay and Goney Beach and from Ship's Cove to the Meteorological Station (the beach at the end of each stretch represented by green triangles).
- **AFS Triennial Count:**
  Triennial total island counts of AFS pups were conducted in 2007, 2010 & 2013. The four largest AFS rookeries are shown in blue squares.

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Methods

Direct Counts:

- All counts were done by a single observer travelling on foot between beaches.
- Beaches with >100 pups were counted 2-4 times.
- All AFS pups were counted directly.
- Intrinsic rate of population change (r) was calculated as:

$$N_t = N_o e^{rt}$$

- This was converted to a mean annual percentage change:

$$\textit{Annual \% change} = (e^r - 1) \times 100$$

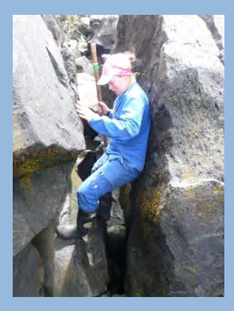
The high density of seals at Fur Seal Peninsula precluded a direct count (5554 pups in 2004). A CMR study was used to estimate the number of pups. 735 Pups were marked over 2 days & 12 transects (marked by white poles) were performed 3 times to count marked & unmarked pups.

Capture-Mark-Recapture Experiment (CMR):

- The Petersen Estimate, with Bailey's Correction for direct sampling, was used to determine the total number of pups.

Direct count undercount estimate (2007 – 2013):

- To correct for direct undercount a CMR was performed annually on Cape Davis main beach:
  100 – 200 Pups were marked and 7 – 9 transects performed 3 times.
- Hereafter 3 direct counts of live pups were conducted and an observer-specific % undercount was calculated.



Jumbled rocky beaches and pups that hide result in undercounting. Therefore an undercount estimate was applied to all direct counts.

SAFS Results

Table 1: SAFS pups counted at the five highest density rookeries and the remainder of the island over the last 38 years. Value in brackets is annual % change in pup numbers for that beach between 2004 and 2013.

Year	1974/75	1981/82	1988/89	1994/95	2003/04	2012/13
Cape Davis	91	193	597	662	927	487 *(-6. 9%)*
Triegaardt Bay	79	461	589	879	911	478 *(-6.9%)*
Mixed Pickle	158	339	876	1190	1129	853 *(-3.1%)*
Fur Seal Peninsula	967	2301	5139	4161	5554	2134 *(-10.1%)*
Fur Seal Bay	168	276	1035	1096	1187	750 *(-4.97%)*
Remainder	34	135	294	1600	4231	3621 *(-3.3%)*
Total:	***1497***	***3705***	***8530***	***9588***	***13939***	***8323***

SAFS Results

- 8323 pups were counted during the total island count in 2013 .
- The CMR study at Fur Seal Peninsula yielded an estimate of 2134 ± 67.5 pups.
- Population decrease was highest at the high-density rookeries (Table 1).

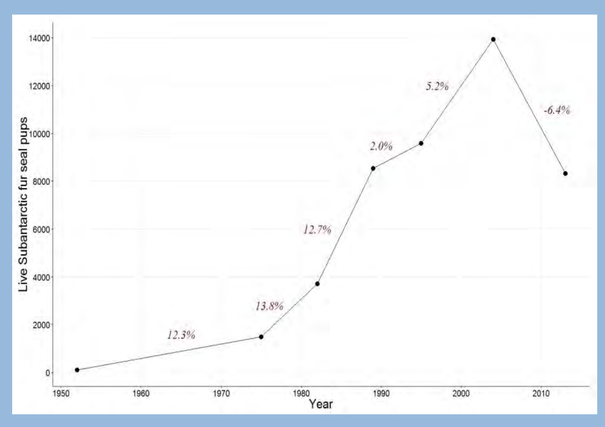


Figure 2: Total SAFS pups counted over the last 61 years. Red, italicised numbers are the mean annual percentage change between censuses.

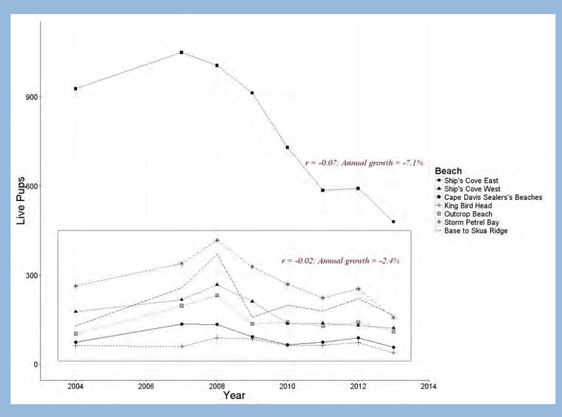


Figure 3: Annual counts of SAFS pups at Cape Davis Sealer's Beaches and the smaller north-east coast rookeries also indicated a steady decrease in pup production.

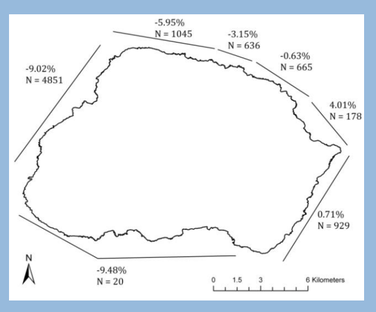


Figure 4: Total number of SAFS pups (*N*) and mean annual % change in pup production between 2004 and 2013 on the different stretches of coastline.

AFS Results

- The AFS population continued to increase but population growth has slowed down (Fig. 5).
- Slowed growth is mainly attributed to Watertunnel beach (WT), which supports most of the population.

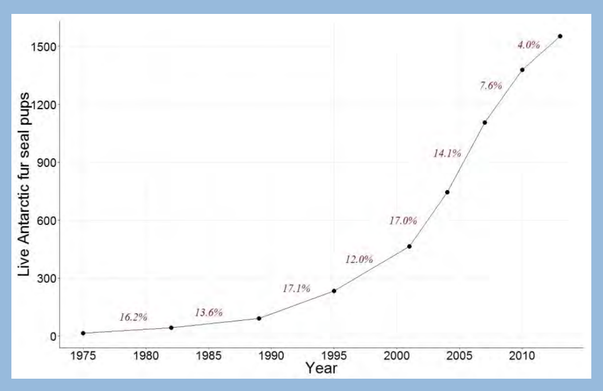


Figure 5: Continued increase of AFS pups born on Marion Island.