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Short communication

New Zealand fur seals (*Arctocephalus forsteri*)
at the Snares Islands: a stabilised population?

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Abstract The abundance and distribution of New Zealand fur seals (*Arctocephalus forsteri*) on the Snares Islands were investigated in February 1984 and in March 1997. In 1984, a total of 1683 adult fur seals were counted in a census that included all islands in the Snares group. Twenty-five per cent of these were found on the hitherto uncounted islets of the Western Chain. In 1997, 1324 adults were counted on North East and Broughton Islands. In 1984, 164 pups were counted in the entire archipelago, whereas 171 pups were seen on North East and Broughton Islands in 1997. Sixteen breeding sites were identified including six sites that were new in 1984, and one new in 1997. It is suggested that the fur seal population on the Snares is now spatially limited and may have stabilised after a period of relatively rapid growth in the 1950s and 1960s.

Keywords New Zealand fur seal; *Arctocephalus forsteri*; Snares Islands; population status; subantarctic islands

INTRODUCTION

New Zealand fur seals (*Arctocephalus forsteri*) have been hunted extensively and intensively in New Zealand since the arrival of humans in this region. Before human immigration and subsequent exploitation, fur seals were thought to number

between 1.5 and 2 million animals (Richards 1994) and were found throughout New Zealand including the Kermadec Islands and all of the subantarctic islands (Wilson 1981). Breeding colonies were found as far north as northern Northland (Smith 1985). The species is also found in southern Australia (King 1969). Heavy hunting pressure, first by Maori settlers and then by commercial European and American sealing ships, resulted in a huge reduction in the distribution and abundance of this species (Crawley & Wilson 1976). However, population estimates in this century indicate that numbers are increasing throughout the extant range (e.g., Australia, Shaughnessy et al. 1995; New Zealand, Wilson 1981; northern South Island, Taylor et al. 1995; Otago Peninsula, Lalas & Harcourt 1995; Bounty Islands, Taylor 1982), and that the range itself is expanding with the re-colonisation of areas where fur seals were exterminated (e.g., Wilson 1981; Dix 1993; Taylor et al. 1995). Most congeners show this same pattern of heavy exploitation followed by recent increases in population (Wickens & York 1997). New Zealand fur seals are presently concentrated on South Island, New Zealand, with smaller populations on North Island, in South and Western Australia, and on the subantarctic islands within the New Zealand region.

The subantarctic islands sustained exceptionally heavy commercial harvesting pressure with the discovery of each island group and the populations there were reduced from tens of thousands to levels so low that few seals could be found, despite much effort (Simpson 1952). Fur seal populations in the subantarctic have varied in their resilience to hunting pressure, with some island groups showing a strong recovery (Bounty Islands, Taylor 1982) and others remaining at low levels (Antipodes Islands, Taylor 1992).

At the Snares Islands, commercial sealing began shortly after their discovery in 1791 and continued there until c. 1810, when the species was

commercially extinct (Simpson 1952). By the end of the 19th Century, only one or two seals were reported at the Snares (Chapman 1890). Since then, the population at the Snares has increased significantly with c. 200 animals seen in 1948 (Richdale, no date), and 1021 counted in 1970 (Crawley 1972). Crawley also reported that breeding colonies were limited to the western side of North East Island, with non-breeding haul outs on the east coast.

This study presents the results of seal counts at the Snares in 1984 and in 1997. The 1984 census is the first systematic seal count at the Snares to include all of the islands in the archipelago.

STUDY AREA

The Snares Islands (48°01'S 166°36'E) are a northern subantarctic island group in the New Zealand sector. North East (Main) Island is the largest with an area of c. 280 ha. Broughton Island (48 ha) is the only other of significant area and terrestrial habitat, but there are several other islets and stacks that fur seals inhabit. About 5 km southwest of North East Island is the Western Chain, a string of five granite islets that rise almost vertically from the sea and which support large populations of sea birds.

The coast is rocky in its entirety. On the western side, cliffs up to 110 m make up the shoreline with small tumbledown boulder beaches in only a few places. Access to these beaches and to the sea is very difficult. The eastern side is more moderate of slope and the sea can be safely reached in many places. For a full description of the geography of the Snares, see Fleming et al. (1953).

METHODS

Fur seals were counted as weather and other expedition scheduling allowed. At North East Island counts were made on 8 and 9 February 1984, and on 5, 9, 12, and 14 March 1997. At Broughton Island, counts were made on 15 January 1984 and on 2 March 1997. The time ashore on Broughton Island in 1997 did not allow for a census of the whole island. Seals on all the islets of the Western Chain were counted from a dinghy on 11 February 1984, and during landings on Toru (12 February 1984) and Rua and Tahī (19 February 1984). Topography on Rima made a count from shore there impractical, and no landing was made on Wha.

The inaccessibility of most fur seal locations meant that most counts were made with binoculars from the cliff tops overlooking colonies. This also had the advantage of not disturbing the seals. At least two counts were made from each vantage point to ensure as complete a count as possible. Because some seals were obscured by rocks, additional counts were also made, wherever possible, from different vantage points to minimise the number of "hidden" seals. The maximum number seen at each site are presented here. The availability of a dinghy in 1984 allowed for counts to be done from sea level on the east coast of North East Island and along the Western Chain in that year.

When ashore, fur seals require space on rocks that is accessible from the sea and protected from large waves (Crawley & Wilson 1976). Aerial photographs of the islands were studied and all coastline was surveyed for suitable fur seal habitat. In all instances where fur seals were present, they were recorded as either "adults" or "pups" since from the cliff tops it was not possible to distinguish between some subadult classes. One of the difficulties with counting marine mammals while they are ashore is that the portion of the population presently at sea is unknown. An attempt was made to understand daily fluctuations in the number of seals ashore so as to correct for those at sea. However, the results showed no clear trend and varied greatly between different sites so that no practical correction factor could be produced that would apply to all sites. The data presented below are actual numbers of seals counted at each site.

RESULTS

In 1984, a total of 1683 adult fur seals were counted in the entire archipelago (Table 1). North East Island accounted for 59% (989 adults) of the total, whereas the Western Chain supported 25% (422 adults) of the population. In 1997, a total of 1324 adult fur seals was counted, but the Western Chain was not surveyed. On North East Island, there were 989 adults in 1984, and 1131 in 1997 (Table 1). Broughton Island is also a major seal locality with 253 in 1984 and at least 182 in 1997.

In 1984, 164 pups were counted in the entire archipelago, and 125 of these (76%) were in colonies on North East Island (Table 1). In 1997, 155 pups were seen on the main island and at least 16 were counted on Broughton. Counts of pups increased at eight colonies and decreased at four.

The breeding range of fur seals on the Snares has expanded since 1970. Sixteen physically discrete breeding sites were identified on North East Island, with most located on the Southwest Promontory and the western side of the main body of the island (Fig. 1). However, breeding also occurred at four sites on the east coast of North

East and Broughton Islands, and on Toru Islet. The topography at the Toru Islet colony is very different from the others in the Snares, as it is located on an open shelf of granite with high walls on three sides creating an amphitheatre shape. It is located c. 20 m above sea level and access to the sea is via a rough, steeply-sloping rock face. The area inhabited by pups can not be seen from a dinghy. The breeding sites on the east coast of North East Island are situated in shallow clefts in the coast on small rock piles and backed by steep terrain. Neither is larger than 40 m wide. On Broughton Island, the main breeding colony is located on the northeast side of the island over the "tunnel gut" area. The rocks here are relatively open with small ridges and hollows, but without the protective jumble of boulders generally favoured as pupping habitat.

Coastal surveys and studies of aerial photographs failed to show any substantial areas of seal habitat on the Snares that are not presently occupied. There are numerous small ledges that could be used by a few seals for hauling out, but no vacant areas were found that could support a new breeding colony.

Table 1 Numbers of fur seals (*Arctocephalus forsteri*) at sites on the Snares Islands. See Fig. 1 for location of each site. (NC = not counted.)

North East I. location (Fig.1)	1984 adults	1997 adults	1984 pups	1997 pups
a	17	72	0	0
b	2	1	0	0
c	10	19	4	4
d	48	67	5	5
e	56	57	5	13
f	173	138	48	29
g	32	63	13	6
h†	19	87	11	16
i†	4	18	1	0
j	7	10	0	0
k†	23	57	3	13
l	6	0	0	0
m	3	16	0	0
n†	20	35	1	5
o	5	8	1	1
p	19	54	6	16
q	20	34	1	7
r	50	47	17	30
s‡	13	25	0	2
t	15	17	0	0
u	29	11	0	0
v	81	67	0	0
w	53	37	0	0
x	32	23	0	0
y	52	34	0	0
z†	18	6	5	0
aa†	26	18	4	8
bb	6	2	0	0
cc	59	26	0	0
dd	25	7	0	0
ee	64	79	0	0
ff	11	6	0	0
gg	8	0	0	0
hh	4	1	0	0
Broughton I.	253	182§	24	33§
Rima	93	NC	0	NC
Wha	60	NC	0	NC
Toru	50	NC	15	NC
Rua	203	NC	0	NC
Tahi	26	NC	0	NC
Totals	1683	1324	179	188

†New breeding record in 1984.

‡New breeding record in 1997.

§Incomplete because part of island was not counted.

DISCUSSION

Fur seals on the Snares have now been counted 3 times in the past 27 years and the population appears to show only a slight increase over that time. The 1683 adult seals seen in 1984 make it the highest count for the Snares, and the only complete survey of the entire group of islands. Counts in 1970 (Crawley 1972) and 1997 were complete only for North East Island, so inter-year comparisons are feasible for this locality only.

There are several reasons why caution is required when comparing the different counts from the Snares. The censuses were made in different months (December 1970, February 1984, and March 1997) and the activities and onshore distribution of New Zealand fur seals are known to vary with the season (Crawley & Wilson 1976). Although no figures are available from the Snares, the coefficient of variation of 23 counts of adults ashore in March and February at a non-breeding colony on Otago Peninsula was 35% (Bradshaw unpubl. data 1997). This is greater than the difference between the counts from separate years. Also, the data available from the Snares are not suitable for detecting population trends because they are single counts with no coefficient of

166° 35'E

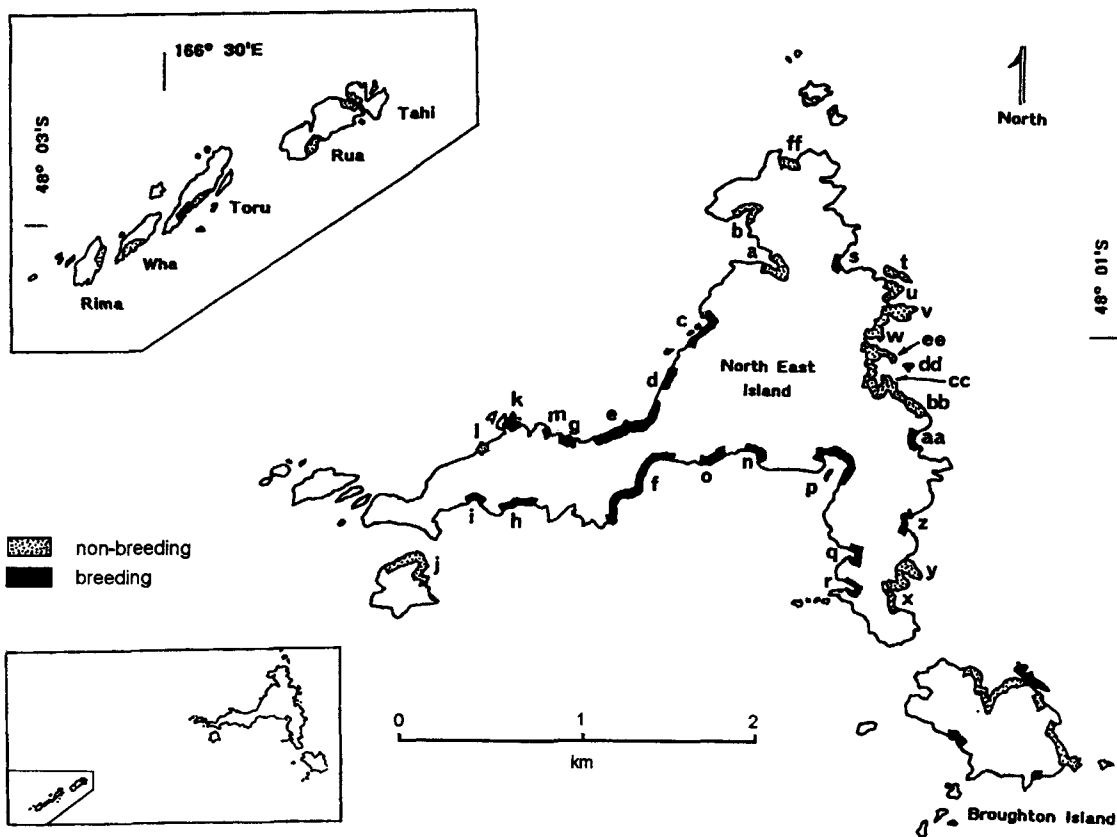


Fig. 1 Distribution of breeding colonies and non-breeding haul-outs on the Snares Islands. See Table 1 for the abundance of seals at the localities marked.

variation (Harris 1986). Again, the number of seals counted in different years is relatively similar and so it is not possible to differentiate between real changes and sampling error.

The presence of breeding colonies and non-breeding haul-out beaches in such close proximity to one another is a feature of the Snares and some other subantarctic islands (e.g., Bounty Islands, Taylor 1982). Although dispersing juveniles may spend much of their time at sea (Taylor 1992), New Zealand fur seals are not known to have a pelagic phase to their annual cycle (Crawley & Wilson 1976). Hence, populations on remote islands with good local food supplies might be expected to be year-round residents. If the Snares is a relatively discrete population (see below), then an accurate census is possible if all the islands in the archipelago

are surveyed. Although logistical difficulties make counts unlikely at all but North East Island, the outlying islands are very important as seal habitat because 25% of the adults in the 1984 census were found on the Western Chain, and a further 15% on Broughton Island.

Because the seals on the Snares have not been marked and the Western Chain is seldom visited, the degree of movement by seals between the Western Chain and the main islands is unknown. Since most of the seals at the Western Chain are at non-breeding haul-outs, it may be that numbers increase there outside the breeding season if individuals move over from the breeding grounds on North East Island. If this is true, the present population on the Snares is likely to be much higher than the 1324 individuals counted on North East

Island in 1997. Future seal counts at the Snares should make every effort to include the Western Chain.

The population of New Zealand fur seals is increasing throughout its range. At Kangaroo Island in South Australia an exponential increase has been reported by Shaughnessy et al. (1995), whereas in the northern part of South Island, New Zealand, the population has increased 7-fold since 1973 and pup production has increased at a mean annual rate of 23% (Taylor et al. 1995). On the Otago Peninsula, pup production increased from c. 30 in 1983 to 673 in 1994 (Lalas & Harcourt 1995). At the subantarctic Bounty Islands, Taylor (1982) estimated the annual population increase to be 4.9%, and even at Macquarie and Antipodes Islands (two of the sites seemingly most resistant to population recovery) seal numbers have increased at rates of 6 and 4% per year, respectively (Shaughnessy & Fletcher 1987; Taylor 1992). In contrast, the fur seal population at the Snares has not increased detectably in the past 27 years. This may indicate a saturation of available habitat at the Snares. This lack of noticeable recent change may also indicate a population that has recovered from exploitation and stabilised earlier this century, before accurate counts were made. Richdale (no date) counted "not more than 200" seals there in January and February 1948 and 22 years later Crawley (1972) found the population to be c. 5 times greater. This increase is similar to what has been documented elsewhere in New Zealand in the 1980s and 1990s (e.g., Lalas & Harcourt 1995; Taylor et al. 1995). It may be that the absence of disturbance on the Snares allowed the seal population there to recover earlier than those on the mainland. A similar population stabilisation has been reported for *A. tropicalis* on Marion Island (Hofmeyr et al. 1997). It may also be that the inaccessibility of some Snares beaches left a higher relict population.

In 1997, all suitable habitat on the Snares was occupied by fur seals. The breeding range within the islands has expanded since 1970 with six new rookeries found on North East Island in 1984, and one new breeding site recorded in 1997. Three of these seven sites are located on the east side of the island, in areas that were previously occupied only by non-breeding seals. This suggests that haul-outs can evolve into breeding colonies and that the population may be able to grow, at a very low rate, even in areas with limited space. Under such conditions the breeding population may also be able to grow through increased density in the rookeries.

Although no significant change was found in the number of females/territory at South Bay (Site f, Fig. 1) in 1970 (Crawley 1972) and in 1984 (Carey unpubl. data), continued monitoring of this density may be helpful in understanding future population trends.

The Snares are only c. 100 km from Stewart Island so it might be expected that there is some interchange between colonies from each island, or with those further away. Since 1991, seals have been marked at some mainland colonies but so far only one tagged individual, a male from Cape Foulwind or Wekakura Point (west coast of South I.) (H. Best pers. comm.) has been seen on the Snares (Carey pers. obs.). On South Island, male seals in particular are known to move between colonies as the seasons change (Crawley & Wilson 1976), and the predominantly non-breeding populations at Macquarie and Antipodes Islands fluctuate with temporary immigration and emigration (Csordas & Ingham 1965; Taylor 1992). The amount of movement into and out of the Snares by fur seals is unknown, but recent genetic evidence hints that there may be very little exchange between Snares seals and those elsewhere in New Zealand. From analysis of variations in the mitochondrial cytochrome b gene, Lento et al. (1997) found that the seals sampled on the Snares were so different from *A. forsteri* sampled elsewhere, that the distinction approached that of a separate species. Continued sampling is required at the Snares and other subantarctic islands to further explore this difference, but the relatively static population growth at the Snares concurrent with the rapid increase at many other colonies, suggests that it may be a separate population.

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