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**THE FERAL GOATS OF AUCKLAND ISLANDS
NATIONAL RESERVE: SOME OBSERVATIONS
FROM A FIELD TRIP IN JANUARY 1987**

by

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ABSTRACT

This report details the results of a field investigation into Auckland Island goats and describes the live-captured goats. The goats most favoured habitat occupies about 0.5% of Auckland Island. Sightings indicated the preferred habitat of the goats was coastal margins. Auckland Island goats appear to be larger than mainland feral stock and some domestic breeds. About 42 goats remained after the two live-capture expeditions, with the majority of goats captured in 1987. Reproductivity of Auckland Island does is low, with weaning of kids soon after birth.

1.0 BACKGROUND

The management plan for the Reserve (Lands and Survey 1987) provides for the removal of feral goats from Auckland Island by 1990. Until 1990 Landcorp and other organisations have the option to live capture goats and study them *in situ*.

In 1986 thirteen goats were shipped to a mainland Landcorp farm at Eyrewell, South Canterbury to be investigated as a potential commercial breed. The aims of the 1987 expedition were to gather as much information as possible about the feral herd and to live capture 30-50 goats for shipment back to the mainland.

This report details the results of the field investigation into Auckland Island goats and describes the live-captured goats.

2.0 ORGANISATION

Mr Aldous (Dept Lands and Survey now Landcorp) organised and managed the trip while (Field Officer, Landcorp) organised the live capture. Bob Willis (now a Conservation Officer) and the author left Stewart Island on 28 January 1987 on "Calypso". While filming the Auckland Islands for their documentaries on New Zealand, Captain Cousteau and his crew generously gave help by landing us ashore, conducting an aerial survey of Auckland Island and providing hospitality aboard "Calypso".

On 30 January "Calypso" departed from Auckland Islands and AM, BW and GS were left on the island to survey the goats and plan their live-capture. HMNZS Canterbury with a capture party consisting of three shepherds and their dogs, Allan Kinness and three "Calypso" crew who filmed the live capture. The Navy's helicopter was used to transport men and goats.

Finally, on 20 February the "Canterbury" left with everyone except Allan Kinness, of the shepherds and the goats. The latter were picked up by the Fisheries Research Division's (MAF) research vessel "James Cook" on 22 February and delivered to Dunedin. The goats were transferred initially to an Eyrewell (South Canterbury) and later to Landcorp farms at Ahaura (North Westland) and Te Anau.

3.0 OBSERVATIONS ON FREE-RANGING GOATS

3.1 Distribution of the goats

During the course of movements around the island, signs of browsing were recorded and all observations of goats were located on an aerial photograph of the northern sector of the island.

The area covered included all country NNE of a line from the end of North Harbour to the head of Laurie Harbour at the mouth of Grey Duck Creek (Figure 1). The country was walked and searched with binoculars at every opportunity from strategic points. All the country (except North Harbour) from which goats have been reported in recent years was thoroughly searched on foot.

3.1.1 "Calypso" search:

The pilot of the 'Calypso's" helicopter (J R Braunbeck) searched Auckland Island during the course of moving film crews and generally assessing the potential of the island for their documentary. His flying time around Auckland, Adams, Disappointment and Enderby Islands was 14 hrs 20 minutes. Braunbeck systematically recorded his flight paths over Auckland Island (Figure 1). No goats were seen on the Hooker Hills from the helicopter or by ground parties. However, Braunbeck saw pigs distributed throughout the island.

3.1.2 Habitat description:

Within the survey area we identified six major habitat types differentiated more by the vegetation's physiognomy than by its species composition. Areas of these habitats were estimated from an aerial photograph from the NZ Mapping Service (scale 1:2400) of the northern sector of the island. The boundaries of the various habitats were drawn observations from Deas Head, aerial photographs and observations from the air. The areas were then calculated using a digital planimeter.

The differences between two sets of habitats corresponded to two altitude contours, one at 60 m a.s.l. and the other at 200 m a.s.l. (Figure 2). For a more detailed vegetation map see Rudge and Campbell (1977, page 230). The following habitat categories were identified.

1. High altitude tussock (above 200 m a.s.l., area = 590 ha), consisting mainly of tussock (*Chionochloa antarctica*), scattered *Oreobolus* sward, and low *Dracophyllum longifolium*. This habitat occurred mainly on the Hooker Hills.
2. High peat (374 ha mainly between 200 m and 60 m a.s.l.), bordered each side by scrub areas (see below). The habitat consisted of areas of dense *Myrsine divaricata* shrubs and scattered low (<1.5m) *Dracophyllum longifolium* and *C. antarctica* occurred throughout. This habitat differed from the Hooker Hills in the greater frequency of occurrence of shrub species, their larger size and the presence of *Myrsine divaricata*.

AUCKLAND ISLANDS

FIGURE 1: Flight path of Calypso helicopter over Auckland Island

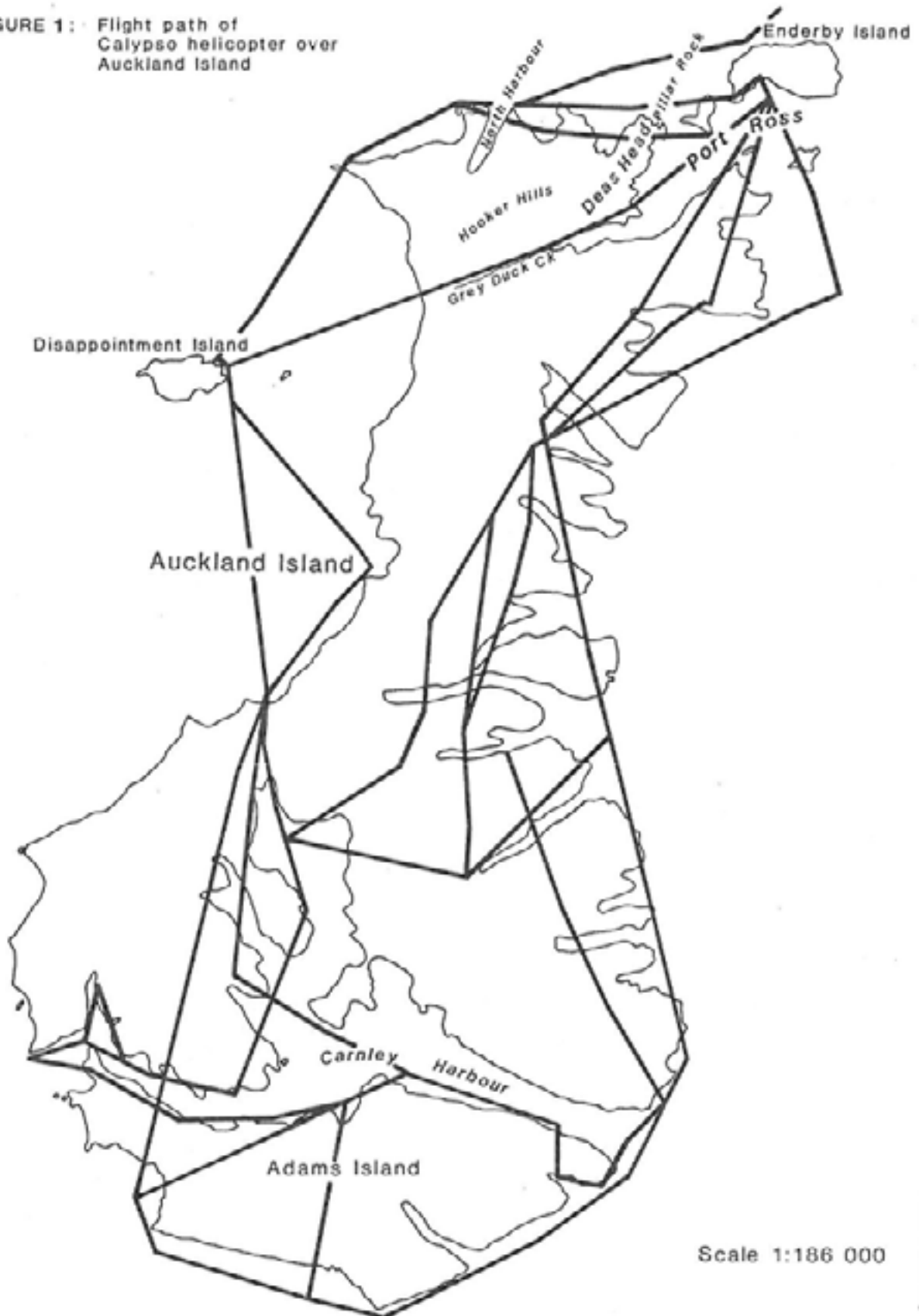
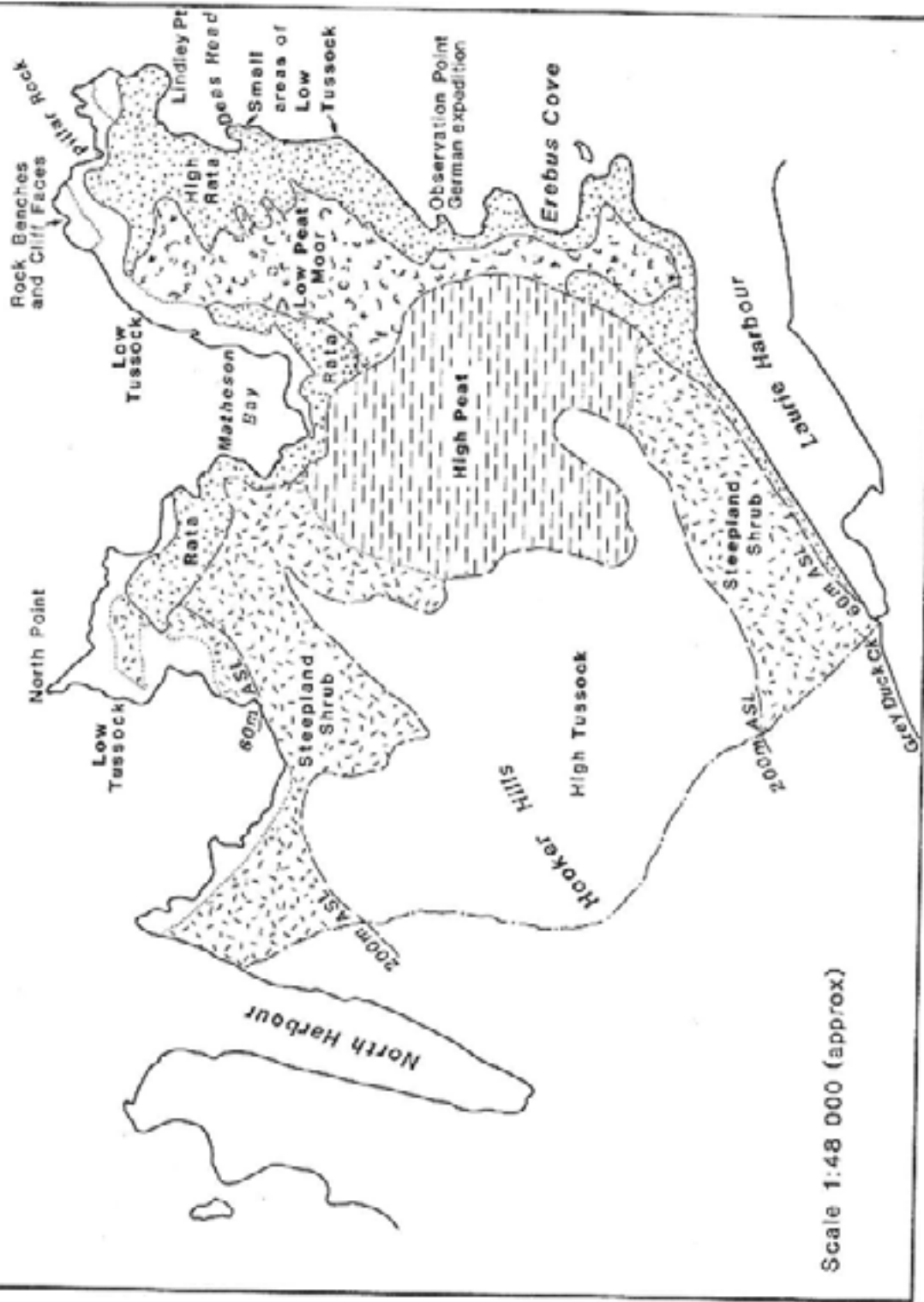


FIGURE 2: Goat range and its major vegetation zones on Auckland Island



Scale 1:48 000 (approx)

3. Steepland scrub (411 ha between 200 m a.s.l. contour and the coast). Principle species was southern rata (*Metrosideros umbellata*), usually about 2 m tall. The other dominant shrub was *Dracophyllum longifolium* about the same height. Minor species (but important to goats as browse (Campbell and Rudge 1984)) included the small shrubs *Coprosma foetidissima* and *Pseudopanax simplex*. Large *P. simplex* were scattered throughout, but foliage on these was out of reach of browsing goats.
4. Low peat moor ("Lanes" habitat sensu Preliminary reports of expeditions to the Auckland Islands Nature Reserve 1973-1984) (134 ha below 60 m a.s.l. bordered by mature rata forest and coastal *Poa* grassland). Short *Oreobolus* sward with sparse *Chionochloa antarctica* separated "islands" of woody vegetation, especially copses of rata with some *Dracophyllum longifolium*. The tended to string together, giving the intervening *Oreobolus* sward the appearance of lanes.
5. Coastal rata forest (197 ha, all below 60 m a.s.l. and bordering the scrub, high peat and low peat "lanes" areas). The main species was rata (*Metrosideros umbellata*). For me this habitat characterises views of Auckland Island from the water, especially when the rata are in flower. The trees are mainly large mature individuals, self-seeded or reproducing vegetatively. In an area around Erebus Cove and the eastern margins of Port Ross some of the forest is regenerating from the aftermath of settler clearing. There is sparse ground under the forest cover. Other species which occurred in good light conditions included *Coprosma foetidissima* and *Pseudopanax simplex*.
6. Coastal low altitude tussock (71 ha on the coast verge interfaced with the coastal rata forest). The principal species was *Poa litterosa*, existing mainly as mature clumps with some young growth. Occasional megaherbs (e.g. *Anisotome latifolia*, *Pleurophyllum* sp. and *Stilbocarpa polaris*) occurred in inaccessible cracks and crannies about the cliffs. *Chionochloa antarctica* and other grass species persisted into the forest edge. The latter area was apparently important because much of the younger, less rank grass growth probably favoured by goats occurred there.

The coastal grassed areas also corresponded with shelter and sunning areas for goats. Goats often moved from these places down to the high water line to browse on large seaweed clumps (e.g. bull kelp). The cliffs were included in this area and were divided by shelves or benches which provided foraging areas for grass and shelter.

3.1.3 Habitat preference and range area estimates

Auckland Island goats moved frequently between different habitat categories (Rudge and Campbell 1977, pers. obs.). However, approximate habitat preferences were indicated by maps of the location of each goat and goat group sighted. During the time we were on Auckland Island the location of the sightings indicated that the goats mostly were using the coastal margins, grassed areas and coastal rata. The former was grazed/browsed and the latter used for shelter and whatever browsing was afforded from shrubs. The rata forest as well as the two peat "lanes" were used for access between preferred grassed areas.

My observations indicate that range of the Auckland Island goat population is 1835 ha, or 3.6% of the area of Auckland Island (51,000 ha). Of this 1835 ha, 1508 ha is made up of high tussock, high peat moor, low peat moor lanes, and scrub with very few palatable species. Therefore the most favoured habitats are probably restricted to about 327 ha, or 0.5% of the area of Auckland Island. These preferred areas are coastal rata forest, coastal grassland/forest ecotone and a complicated mixture of coastal vegetation communities (grassland, *Myrsine divaricata*/grassland) present on cliff tops, benches between cliffs, and immediately above the high tide mark.

3.2 Population size, appearance and weight

We made the following counts of individually identifiable goats: North Point - 40 goats, Matheson Bay -30; Pillar Point -20; lowland peat lanes (below 200 m asl) - 4; and the high peat moor (between 60 m and 200 m asl) -2.

Table 1 shows the number of goats captured at different times and the number of goats seen alive after the last capture in February 1987.

Table 1 Remaining goats on Auckland Island in February 1987.

Goats captured in 1986	11
Goats captured in 1987	56
Goats died in 1987	2
Goats seen alive in Auckland Is after February 1987	42
Goats known to be present before live captures started in 1986	111

Capture data in 1987 suggest that my estimate of the number of goats on Auckland Island before the start of live capture was similar to Campbell and Rudge's (1986) estimate made after their visit in 1972. Hence their conclusion that "the number (of goats) would stay the same, that is, round about 100 or decline steadily" has been supported by our survey results.

I identified three broad types of coat colour: (1) grey/whites: uniform grey or white coats, or grey and white with no distinct patterns; (2) wild type (*sensu* Asher 1979): animals with distinctive white facial stripes from nose to horn, or black with dark forequarters from the rib-cage forward; white lower legs with a thin black stripe down the front of each foreleg; white bellies and a white ventral blaze around base of the tail; variable colour combinations except for the colour of the facial stripes: (3) polychromatics of two or more colours with none of the symmetrical patterns which existed with the other two coat types.

Most goats were grey/white (Table 2), which agrees with Rudge and Campbell (1977) who found that 63% of 89 goats were white or off-white. Rudge and Campbell (1977) noted 12% had "additional smoky patches on the neck and shoulder", and the remaining 25% had combinations of "white, brown and black to uniformly black" which probably included our polychromatic group. They did not mention the "wild type" coat pattern which I found so distinctive.

Table 2 The frequency of coat types on Auckland Island goats in late summer 1987

	Grey/white	Wild type	Polychromatic	Total
N	40	11	14	65
%	61	17	22	100

Horn shapes of the captured animals varied widely. Most horns of bucks (about 70%) were shaped like parallel scimitars with an outward twist. Two other shapes were far less common, but quite exceptional. One (about 30%) was the parallel scimitar without any twist whatsoever and with the horns lying flat along the contour of the neck. The other shape was seen in a few does. The horns were only 5 cm or so long, and blunt and thin as if they were "degenerate".

Ear shape was recorded as either dropped ears or prick ears. There was no correlation with sex between the two categories, the larger of which (98% of 45) had dropped ears.

The body weights of the live-captured goats was much heavier than those of mainland feral goats (Table 3, Appendix 1).

Table 3 Live weight (kg) of Auckland Island goats (two teeth and older). Data from 1987 summer capture (Average, SD, N) compared with mainland feral goats.

	Bucks	Does	Combined
Auckland Is	36.8 (6.8, 18)	28.9 (5.2, 15)	29.6 (6.1, 36)
Mainland	No data	21.6 (3.5, 37) ¹	20.0 (no data) ²
% Difference	-	34	48
T Test	-	P<0.05	-

Note: 1 = Kirton and Paterson (1976)
2 = Sheppard and O'Donnell (1979)

Gel-electrophoretic studies by the Animal Sciences Unit, Lincoln College, of blood proteins from the 1986 live captured goats also showed differences between these animals and mainland ferals, Saanans, and Anglo Nubians. Auckland Island goats appear to be genetically distinct from New Zealand mainland breeds (Aldous McIvor, Landcorp; pers.comm.).

3.3 Age and sex composition

3.3.1 Free ranging goats

Details of age, sex and group size of goats were recorded from field observations (210 man-hours by three men). The coat markings of individuals usually enabled reliable identifications of each goat seen. From our observations (N = 65) adult sex ratio was about unity and productivity appeared low (Table 4).

Table 4 Sex ratio and productivity of Auckland Island goats observed in the field in 1987

Bucks	Does	Yearlings ¹	Kids ¹	Total
23	25	7	10	65

Productivity to weaning (kids/does), summer 1986/87 = 40% (cf >100% mainland ferals²)

Recruitment (yearlings/does), summer 1986/87 = 28% (cf 100% mainland ferals³).

1 The yearling/kid ratio was determined from live-capture data, i.e. the 17 young animals seen in the field were converted to kids and yearlings by applying the 7.4 ratio of kids and yearlings caught. Note: kid = current season's offspring.

2 Rudge (1969).

3 Kirton *et al.* (1976).

3.3.2 Live captured goats

Goats were caught on an opportunistic basis throughout their range, except North Harbour and the "lanes" area. Three were caught at the German Transit of Venus Observation Point near Erebus Cove, and one was caught near Pillar Rock. Although another eight were caught along the cliff tops west of Pillar Rock these had been "moved up" from Matheson Bay. The remaining 44 were caught in the North Point area, including the associated plateau.

The age distribution determined by dentition was weighted towards older animals (Table 5).

Table 5 Age of Auckland Island goats caught in 1987 determined from tooth eruption. (T = tooth).

	Gummy	8T	6T	4T	2T	Kid	Broken mouth	Total
Females	1	8	8	1	2	3	1	24
Males	0	5	11	2	7	3	2	30
Total	1	13	19	3	9	6	3	54

It is apparent that the age structure of the Auckland Island population is skewed towards older animals. However McIver and Sherley (1988) consider that the usual correlation between age and tooth eruption may not apply to these animals.

3.4 Social behaviour of free-ranging goats

Seventeen different groups of goats were seen. Two comprised bucks only, 6 contained does with a kid

at hoof, 4 contained bucks and one doe with a kid at hoof, and 5 consisted of bucks and does only. The average group size including kids was 3.2 (n = 17). Kids may not remain with their does for the usual length of time (c. 12 weeks) because I observed two does disallowing suckling despite the very young age of their kids. One young kid with a full set of milk teeth was completely weaned and did not even attempt to suckle.

Our observations showed that groupings continually changed composition and their location. This prevented calculating densities in habitats or recording group locations. However, on various occasions we observed 41 animals in North Point, 14-25 in Matheson Bay and 10-14 around Lindley Point (Figure 1). Individual mature bucks ranged widely and joined up with doe groups for 2-3 days then left. One of these bucks was seen in preliminary copulatory behaviour with one of the does. On two occasions two of these mature bucks were seen confronting and butting younger (smaller) bucks. My interpretation of this behaviour is that a small number of dominant bucks normally rove around the goats' range checking the does' stage of oestrus and establishing dominance over other bucks. The coat patterns of these mature bucks corresponded with the three coat patterns in the population. The distribution of browsing sign and goat droppings was more extensive than our sightings of goats themselves. No goats were seen beyond the Transit of Venus Observation Point near Erebus Cove (Figure 1), nor above the 60 m contour (Fig 2).

3.5 Foraging behaviour of free-ranging goats

Information on foraging behaviour was drawn from direct observations and by noting browsed plants. The food preferences of Auckland Island goats have been described by Campbell and Rudge (1986), Rudge and Campbell (1977). Their quantitative observations agree with my qualitative assessment that two main categories of plants are eaten: grasses and shrubs (Table 6).

Table 6 Plants observed eaten by Auckland Island goats

1. Grasses

Poa litterosa
Chionochloa antarctica

2. Shrubs/trees

Pseudopanax simplex
Coprosma foetidissima
*Dracophyllum longifolium**

3. Algae - *Durvillea* sp. (bull kelp)

* rarely noticed browsed

Other palatable species which occurred in the goat range included the megaherbs *Pleurophyllum* and *Anisotome*. These species are now restricted to cliff crevices and so are inaccessible to goats.

3.6 Reproductive condition of captured does

Young at hoof were either the current season's kids or hoggets from the previous season. The smallest kid captured (3.5 kg) had been weaned for some time, and its stunted size and harsh coat suggested that weaning had taken place soon after birth.

None of the January 1986 live-captured females were pregnant, and it was not until late April 1986 that oestrous cycles began. Further, a 12 kg female hogget cut her first two adult teeth in late summer. This hogget did not come into oestrus, unlike a companion 2-tooth (20.5 kg) which mated in mid-June. However, in the 1987 group 50% of the surviving females (n=18) were pregnant and began kidding on 28 June 1987. Kid weights were 1.5-1.7 kg.

Does in both capture groups showed a lack of udder development, which suggests that the does had produced only small quantities of milk or ceased lactating some time before capture. Also, 16 of the 19 does up to 6-tooth age from the 1987 capture were dry and had not produced milk in the 1986/87 breeding season (Charlie O'Conner, Farm Manager, Ahaura, pers. comm.). Some of these does did not appear to have ever lactated. By contrast, 5 of the 6-tooth and broken-mouth does had lactated in the 1986 or the 1987 season. The other one appeared to be barren.

The breeding condition of the captured does compared with the gestation period (6 months) indicates that mating on Auckland Island occurs between early June with kidding from July to early December. The low weights of the kids, together with the lack of udder development, suggests that kids are weaned or substantially substitute browse or grass for milk as early as 2-3 weeks of age. Alternatively, the lack of udder development may have meant kids were born and weaned earlier in the year so that the udders had regressed by the time of our visit.

4.0 SUMMARY

1. Auckland Island goats appear to be larger and genetically different from mainland feral stock and some domestic breeds.
2. About 42 goats remained after the two live-capture expeditions.
3. The reproductive ability of Auckland Island does is low.
4. Goats regularly occupy about 0.5% of the area of Auckland Island.
5. On Auckland Island goats preferred coastal vegetation communities.
6. Most goats were grey-white coloured.
7. The age distribution of the Auckland goat population was weighted towards older animals.
8. In their wild state Auckland Island goats probably mate between early February and June and kid from July to early December.

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APPENDIX 1: Capture weights (February 1987) of Auckland Island goats

Note: not all captured animals were weighed; weight in kg

	Males	Females
Broken mouth	44.9	32.2
Eight tooth	37.2, 36.3, 37.6	34.0, 33.1, 27.0, 30.8, 25.4
Six tooth	35.4, 35.6, 42.2, 46.3, 41.7, 30.4, 39.5, 28.1, 41.7	29.5, 31.7, 28.6, 33.6, 31.3, 34.7
Four tooth	41.3, 25.2	22.7
Two tooth	26.3, 27.7	18.1, 20.4
Yearling	17.0, 17.7, 17.2	-
Kid	9.1	-