NEW ZEALAND JOURNAL OF ECOLOGY

RESEARCH

Introduction, rescue, and subsequent history of Auckland Islands livestock

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Published online: 28 November 2022

Abstract: Farm livestock and other animals were introduced onto the Auckland Islands during the 19th century. Most were eradicated by the late 20th century, but before then, some goats (*Capra aegagrus hircus*), rabbits (*Oryctolagus cuniculus*), cattle (*Bos taurus*) and pigs (*Sus scrofa*) that were considered to have unique genetic characteristics were taken to mainland New Zealand with a view to studying and maintaining their particular breeds. Goats were liberated on the Auckland Islands on several occasions but those that survived to the late 20th century probably came from a group left on Auckland Island in 1865. In 1986 and 1987 some of these goats were taken to the South Island of New Zealand but were not maintained. Those goats left on Auckland Island were eradicated by 1992. Enderby Island rabbits came from a group of silver-greys that were released there in 1865. Forty-nine of them were captured and taken to Wellington in 1992, the rest were eradicated the following year. Breeding groups representing these rabbits are maintained in New Zealand today, but their numbers remain below the threshold required to ensure survival of the breed. Cattle were taken to the Auckland Islands in 1850 but appear not to have survived. A later introduction onto Enderby Island in 1896 fared better, though their numbers were never great. Semen was taken from 16 bulls at the time of their culling in 1991 and preserved, but oocyte removal from 11 cows at the same time was unsuccessful. A single surviving cow ('Lady') and her calf were rescued in 1993, but the calf later died. A number of Lady's descendants have subsequently been produced in New Zealand through cloning, embryo transfer and natural mating. Pigs had been left on Enderby Island in 1807 and were reported to be on Auckland Island in 1840. Seventeen from Auckland Island were captured in 1999 and brought back to New Zealand where the breed has proved to be a valuable source of medical products.

Keywords: Auckland Islands, cattle, Enderby Island, eradication, evacuation, goats, livestock, pigs, rabbits

Introduction

Archaeological evidence indicates that Polynesian voyagers first visited the Auckland Islands during the late 13th to early 14th centuries (Anderson 2009). They probably came from New Zealand and they brought one or more dogs with them, but the impact of their sojourn was minimal. The limited amount of archaeological evidence available indicates that they had a brief period of settlement on Enderby Island during at least summer and autumn. Animal remains in their middens included bones of sea-lions (*Phocarctos hookeri*), fur seals (*Arctocephalus forsteri*), sea-birds such as white-chinned petrels (*Procellaria aequinoctialis*), sooty shearwaters (*Puffinus griseus*), Auckland Island shags (*Leucocarbo colensoi*), southern royal albatrosses (*Diomedea epomophora*) and yellow-eyed penguins (*Megadyptes antipodes*), as well as black cod (*Paranotothenia microlepidota*) and conger eels (probably *Conger verreauxi*). Shellfish remains were mostly the shells of southern blue mussel (*Mytilus edulis galloprovincialis*) and ribbed mussel (*Aulacomya atra maoriana*) as well as some limpets (probably *Cellana strigilis strigilis*; Anderson 2009). They burnt the woody vegetation – mostly *Dracophyllum* spp. and southern rata (*Metrosideros umbellata*), plus some *Coprosma* spp. and *Veronica* spp. (Wallace 2009) – for cooking food and doubtless for warmth. Their utilisation of these species is unlikely to have had any long-lasting effects.

Later visitors and settlers, following the islands' rediscovery by Europeans early in the 19th century, had a much greater effect on the environment. First came sealers, then there were brief visits by ships from different countries on exploring expeditions, and then scientists came to study the plant and animal life (Dingwall & Jones 2009a; Dingwall et al. 2009). A group of Māori and Moriori people from the Chatham Islands arrived in 1843 and stayed for about 13 years (Fotheringham 1995, p. 36, 60, 102, 115). In 1850 the Enderby Settlement was established on Auckland and Enderby Islands though it lasted less than 3 years (Dingwall & Jones 2009b). Vegetation was cleared, sea mammals were harvested, different plant species were introduced and livestock of several species was brought in, either as a food resource for castaways or for farming purposes. The settlers' impact upon the indigenous animals and vegetation has been discussed by numerous

DOI: https://doi.org/10.20417/nzjecol.46.3487

writers (e.g. Turbott 2002; Russell et al. 2020) and need not be repeated here. In the latter half of the 20th century most of the surviving introduced livestock was exterminated with a view to restoring an earlier environment, though not without raising the contentious question of whether one selected element of biological diversity should be sacrificed in order to protect another (Alderson 2020, p. 68–69).

This paper discusses the goats (*Capra aegagrus hircus*) and pigs (*Sus scrofa*) from Auckland Island, and the rabbits (*Oryctolagus cuniculus*) and cattle (*Bos taurus*) from Enderby Island, that were rescued from the islands and taken to mainland New Zealand for study and conservation. Small breeding groups of these pigs, rabbits, and cattle are currently being maintained in New Zealand, where their distinctive characteristics define them as unique breeds. The fates of the other mammals that were introduced into the Auckland Islands group have been dealt with elsewhere (particularly Russell et al. 2020). Today, pigs, cats and mice remain (Russell et al. 2022).

The Rare Breeds Conservation Society of New Zealand was formed in 1988 with the intent of providing a focus for the growing interest throughout the country in conserving rare and minority breeds of farm livestock, both for the particular qualities such breeds may have and for the general desire to preserve biodiversity. The Society was marginally involved with the Auckland Island goats and directly involved in the capture and evacuation of the rabbits and cattle from Enderby Island and the pigs from Auckland Island.

Auckland Island goats

Goats are reported to have been liberated by various organisations and government authorities in at least ten places on the Auckland Island group during the second half of the 19th century as food for castaways, and although details of their introduction and demise are not beyond question it is reasonably certain that by the middle of the 20th century there was only one living population remaining in the northern part of the main island (Russell et al. 2020).

At the end of 1840, a scientific expedition led by Captain James Clark Ross, which spent the best part of a month at the Auckland Islands, observed that apart from birds and some cats and mice there were "no species of land animal, with the exception of the domestic pig, introduced several years ago, and now in a wild state" (Ross 1847, p. 148). They left some sheep, pigs, poultry and rabbits on Auckland Island and some rabbits on Enderby Island, but no goats (Ross 1847, p. 151–152).

The earliest confirmed reports of goats being introduced

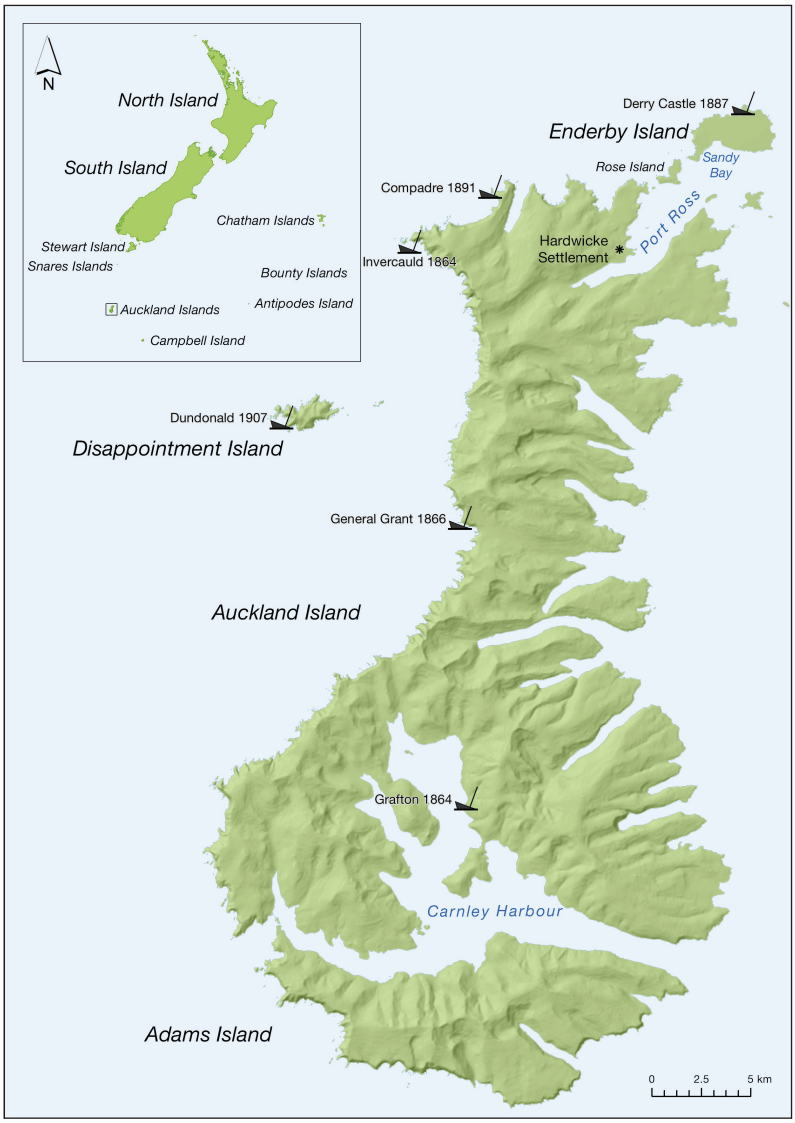

Figure 1. Map of the Auckland Islands showing place names and shipwreck locations referred to in the text.

onto Auckland Island was in 1865 by the HMCS *Victoria* from Australia (Nelson Examiner 1865; Norman & Musgrave 1866, p. 12, 30) and a lesser-known introduction by the *Southland* from New Zealand shortly afterwards (Otago Daily Times 1865; McLaren 1948, p. 83). It has been suggested that descendants of these 1865 goats survived on Auckland Island to the late 20th century (McIvor & Sherley 1988).

Goats were definitely present on the main island in 1891 when the crew of the wrecked *Compadre* caught three but "sufficient were left to renew the stock" (Southland Times 1891, p. 3; see Fig. 1 for shipwreck locations).

Rudge and Campbell (1977) have suggested possible introductions were also made in the 1890s, referring to Bollons in Thomson (1921). However, this claim cannot be taken as positively applying to the main island because Captain Bollons of the Government supply ship *Hinemoa* did not specifically mention which island, but had simply written in a letter to scientist George Thomson that "Goats have been sent down from time to time to the Auckland Islands since 1890, most of which have either died or been killed off as food for castaways" (Thomson 1921, p. 95).

An important field study of the Auckland Island goats was made during the summer of 1972–1973 by M. R. Rudge and D. J. Campbell of the Ecology Division of the Department of Scientific and Industrial Research (DSIR) in Lower Hutt. About 100 goats were then living on the north-west side of Port Ross, which is one of the driest and warmest parts of the island (Fig. 2). Their distribution appears to have been limited by the occurrence of suitable food sources, and by weather conditions on higher ground. They spent most of their time feeding and no other activities or inactive rest were observed. Most of them were in groups of five or fewer and they moved around meeting other groups then parting from them. They preferred open scrub and fine grass country to forest, tussocks or dense scrub. Due to the soft peaty soil conditions, the goats' hooves had become overgrown and split, which affected their running. Three-quarters of them were mostly white or grey in colour, and five goats that were measured were predominantly larger than the mean sizes of mainland feral goats. Rudge and Campbell (1977) considered that the Auckland Island flora or fauna were not being endangered by the goat population, and they could see no merit in exterminating the population as there were many signs that the goats were unlikely to survive much longer on the island's vegetation. They concluded that the goats could safely be left alone, having the distinction of being the world's most southerly population of feral goats (Rudge & Campbell 1977).

This conclusion was strongly contested by some botanists from the Botany Division of the DSIR at Lincoln the following year, who wrote that "if they are indeed dying out slowly, the opportunity should be taken of shooting them now, rather than risking an increase or spread through unforeseen circumstances. The conservation value of the native biota far transcends the limited scientific interest that the goats present" (Wardle et al. 1978, p. 291). A few years later, Campbell and Rudge (1984) had changed their views, largely on the strength of revisiting sites they had marked out 10 years earlier, and they now recommended the extermination of goats (and pigs) on the island. The goats had not increased in numbers – although they might have increased their range.

Subsequent observations by Rudge in 1986, made during a Department of Lands and Survey expedition to Auckland Island to capture some goats and take them to a property at Eyrewell in North Canterbury (Fig. 3), indicated that the Auckland Island goats were among the largest recorded in New Zealand. Eleven goats were collected at this time (Rudge 1986; McIvor & Sherley 1988).

A preliminary report on these goats by the Animal Science Group (1986) at Lincoln College noted that they ranged in colour from black to white-grey (although some pure white

Figure 2. Goats at Port Ross, Auckland Island, 1976 (Photo: John Gardiner, Department of Conservation).

Figure 3. Auckland Island bucks at Eyrewell, North Canterbury, 1986 (Photo: Aldous MacIvor).

had been seen on the island). Blood typing showed a marked difference in terms of serum albumen and transferrins from the feral and Anglo-Nubian goats held at Lincoln. Their plasma protein characteristics were similar to Spanish Serrara Andaluza and Hungarian Saanen goats. The Lincoln Animal Science Group report concluded: "It is clear that in spite of an inhospitable climate individual goats appear to be well adapted for survival on the Auckland Islands although the population as a whole may be limited by neo-natal mortality. Those goats which survive to maturity are large framed animals which appear to be genetically different from New Zealand feral goats. It is possible that under intensive farming conditions these goats may produce offspring of exceptional size, and good nutrition and selection could be expected to increase Cashmere [fine undercoat] production. We feel that these goats warrant further study, both as a source of new genetic material and as a physiologically adapted population that have evolved over 100 years in a harsh climate. It would be unwise to eliminate this population completely since it is difficult to have the foresight to know what characteristics may be required of farm animals in the future" (Animal Science Group 1986, p. 4).

In 1987, a major recovery project was undertaken by the Department of Lands & Survey, the New Zealand Navy, Jacques Cousteau and the crew of his research vessel *Calypso*, and the Ministry of Agriculture and Forestry's Fisheries Research vessel *James Cook*. A survey made during this expedition supported the earlier conclusion that the number of goats on the island would remain the same or steadily decline. Fifty-six animals were captured (leaving about 42 on the island), and although 13 of those collected subsequently died, the remainder were grazed on two Landcorp properties in the South Island. All the females and half the males were run on a property at Ahaura in Westland, and the remaining males at Snowdon farm near Te Anau. At that time there were extensive plans for the breeding and studying of the goats (Southland Times 1988).

John van Buren, who was one of the three shepherds employed with their dogs to capture the goats in 1987, later gave a detailed personal account of how the capture was done. The capture team was assisted by navy volunteers and the idea was to form a large approximate semicircle in the rata bush where the main population of goats lived, keeping in contact with handheld radios, and to drive them out into open tussock country where they could be surrounded and caught. When captured they were immobilised by tying their legs with leather dog collars, and then taken by helicopter to a bush camp that the scientists had set up (though some had to be carried manually through the bush when the helicopter was unavailable). At the camp they were held for later collection and transport on the *James Cook* back to the mainland and thence to Eyrewell in North Canterbury (Van Buren 2014, p. 385–394, 398).

Landcorp scientists Aldous McIvor and Greg Sherley (who had made a field study of the goats during the 1987 expedition) produced a comprehensive report in 1988, summarising the history of the Auckland Island goats and the studies that had been made of them (McIvor & Sherley 1988). Their report gave details of the goats' physical characteristics, behaviour and food eaten, as well as the area occupied and the vegetation on the island. They noted that the flock had not expanded its observed regular habitat range, which they stated to be about 327 ha of the island's 51 000 ha (currently given as 45 891 ha), and consequently had not significantly damaged indigenous flora and fauna (though a greater habitat range has been suggested elsewhere; Brown et al. 2022). They concluded that the remnant flock on Auckland Island was sufficiently important to warrant protection, and that the safest plan was to preserve the resource on Auckland Island, with its own natural random mating and response to an environment free from human influence. They wrote: "The most practical management option that will retain the historical and scientific values of this flock is to retain the remnant flock on Auckland Island, where it can be studied and monitored. Failing this, the remaining animals should be captured and joined with the other captured animals in Westland. This however is not the preferred option. The remnant flock should not be destroyed" (McIvor & Sherley 1988, p. 37).

McIvor and Sherley (1988) finished their report with a direct request to the Department of Conservation to send their recommendations to the Minister of Conservation with a view to

obtaining approval for the goats to remain on Auckland Island, where they should continue to be studied and monitored, and if necessary, confined to their present range. Alternatively, if protection was not granted, eradication should be deferred to enable Landcorp to capture the remaining animals. However, the Minister of Conservation, Helen Clark, decided to eradicate any goats remaining on Auckland Island (Press Association 1988), and this was carried out between 1989 and 1991 (Brown et al. 2022).

At its first committee meeting in January 1989, the Rare Breeds Conservation Society of New Zealand had noted with concern the intention to kill out the Auckland Island goats, to be followed by cattle and pigs (Rare Breeds 1989). However, no action was taken by the Society until 1992, largely because initially the Society was not much involved with feral breeds. Then the president, Professor Hugh Blair of Massey University, contacted Landcorp only to learn that their herd was down to 15 does with no bucks having been kept for several years. The does were being run with unrelated feral goats and there was no attempt to control matings. Blair unsuccessfully suggested to Landcorp that the Rare Breeds Society would find a home for them (Blair 1993). By March 1994 Landcorp was reported to have only six does left (Rare Breeds 1994a) but soon afterwards none could be located (Rare Breeds 1994b; Rudge 1994). A final search for them was made in 1999 without success (Fraser 2004). It is possible that some genetics from escaped or abandoned Auckland Island goats remain in surviving feral goats.

Enderby Island rabbits

In 1840 James Clark Ross's expedition with the *Erebus* and *Terror* landed some domestic rabbits, along with sheep, pigs, and poultry on Auckland Island (Ross 1847, p. 151), and rabbits on Enderby Island (Ross 1847, p. 152). Because subsequent visitors to the Auckland Islands did not mention the rabbits (e.g. Malone 1854), they are assumed to have died out soon afterwards. Other transitory introductions into the Auckland Islands have been reported but details of numbers and locations are lacking (e.g. Richards & Evans 1875, p. 316; Russell et al. 2020).

In 1863 the Acclimatisation Society of Victoria in Melbourne obtained four domestic silver-grey rabbits that had been privately imported to a nearby Victorian property. The Society's annual report noted that "The skin of this animal is far more valuable than that of the common rabbit, and the Council would beg to call the attention of gentlemen desirous of forming warrens to the desirability of starting with this animal" (Acclimatisation Society of Victoria 1863, p. 7–8). Two years later the Society recorded that goats, pigs, rabbits (breed not specified), and fowls had been set free on the "Auckland, Campbell, and other Islands of the Antarctic group" by Commander Norman of HMCS *Victoria*, in the hope "that they will increase and prove of value to persons who may be shipwrecked upon the islands" (Acclimatisation Society of Victoria 1866, p. 10). The release of animals including rabbits on Enderby Island was confirmed by Commander Norman himself who reported that he sent ashore ten goats and 12 rabbits (Norman & Musgrave 1866, p. 13, 21, 35). By 1894 the island was reported as being "literally alive with rabbits" (Gordon 1894b, p. 3). The rabbits from this introduction appear to have continued breeding there until they were exterminated in 1993 (Torr 2002). As no other varieties of rabbits (or hares) are listed in the Acclimatisation Society's holdings at this time it can be fairly certain that it was silver-grey rabbits that were liberated. More details of this liberation and the rabbits' subsequent history have been given by Whitman (2003).

Figure 4. Feral rabbits on Enderby Island, 1973 (Photo: HA Best, Department of Conservation).

By the 1970s, only the rabbit populations on Enderby Island (Fig. 4) and nearby Rose Island had survived (Torr 2002; Russell et al. 2020), and in 1991 the Department of Conservation decided to eradicate them as part of an overall programme to remove all introduced mammals from the islands. They had carried out poison bait trials on Enderby Island in 1991 and 1992, and planned their eradication programme for the following year (see Torr 2002).

At this time the Enderby rabbits were thought to be of a rare French domestic breed known as Argenté de Champagne, which look very similar to the silver-grey breed. Silver-greys had been distributed in New Zealand by acclimatisation societies during the 1860s (e.g. Nelson Evening Mail 1867) and had probably been brought into the country even earlier (McIntosh 1940, p. 278–279). Running wild they soon increased enough to become a pest, but the silver-grey characteristics later became overwhelmed by the common grey brown variety of wild rabbit. Those on Rose Island appeared to be the grey brown variety (probably descended from some released there by Charles Enderby in the 1850s; Richards & Evans 1875).

A proposal to relocate a breeding group of rabbits from Enderby Island to the New Zealand mainland was initially formulated by Dr Mike Rudge who not only had undertaken research on the Auckland Islands, but was also a prominent member of the Rare Breeds Conservation Society, becoming chairman in 1993. He approached MW, and asked if he would be prepared to lead a team down to Enderby Island, with a view to capturing and relocating a breeding group of rabbits.

Transport down to Enderby Island was by the Navy dive vessel HMNZS *Manawanui*, which left from Port Chalmers in September 1992. MW took Dr Dave Matheson, a veterinarian with also wide experience outdoors, and they were accompanied by Wayne Costello and Trevor Tidy of the Department of Conservation plus a large quantity of expeditionary equipment.

As with any such venture, a considerable amount of research and preparation was required. The transport of wild rabbits can be fraught with difficulty, and in some cases 100 percent losses have been experienced, mostly due to a low tolerance of stress. To eliminate the emotional tension, they took a cocktail of sedatory drugs, along with travelling

Figure 5. Silver-grey Enderby Island rabbits in Canterbury, 2008 (Photo: MT).

containers they hoped the rabbits could relax in with reduced environmental disturbance. The travelling containers were prefabricated from 300 mm round discs of 12 mm plywood, half of which had a hinged door cut into them, and 25 mm square mesh netting, which was wrapped around and stapled onto the wooden ends, making a tubular cage 300 mm wide and 900 mm long. Simple doors could be cut in the top for additional access. Wood, wool and shredded paper were used for the rabbits to tunnel into and for bedding. The cages could be stacked on top of each other, and were very stable.

As much advice as possible was sought from experienced people and organisations such as Lincoln University who were researching trapping methods for a variety of animals, and a number of methods were used on the island. Poaching snares were left pegged outside burrows, wing nets were used to drive rabbits into soft-jawed leg hold traps, and cage traps, hand nets and spotlights were all used, along with a variety of improvised materials.

The rabbits were present in reasonable numbers, but were also wary and used to being preyed upon by birds such as skuas. In Sandy Bay they had dug large conventional burrows in the sand, but in other places where there was little sand and only peat, they had dug holes amongst the roots and under the trunks of the rata forest encircling the island. There was limited food and they readily took to carrot pieces that were scattered in order to attract them into an area to facilitate capture. The permit allowed the capture of up to 50 rabbits, but the first few days were met with limited success. Then spotlighting at night was tried, and this became the preferred method of capture – one person would hold the animal in the beam, while the other crept around and came up behind it with a capture net. Weather was sometimes an issue. Within half an hour the conditions could go from being a benign starlit sky, to a howling gale with heavy snow.

Slowly the numbers built up and cleaning and finding food for the captive group became quite a large job. The day before departure the 50th rabbit was caught – 15 does and 35 bucks. All were the standard silver-grey colour, except for one that was creamy white. He was one of only three cream rabbits that were seen on the Island. Rabbits were collected from different areas of the island to get as much genetic diversity as possible. Each animal was tagged with a small numbered metal ear tag and records kept of where they came from. Each area or warren was given a name – Base Warren (7 rabbits), Rata Warren (8), Stella Warren (2), and the Enderby Warren (32).

One male rabbit damaged its back before departure and had to be euthanised, so only 49 rabbits were carried through the surf by black-suited frogmen onto the *Manawanui*, and started the voyage to the Somes Island quarantine station in Wellington Harbour. They arrived in good health and were run loose together in a large concrete building with sawdust on the floor and cardboard boxes to sleep in. This arrangement was practical, but not ideal, and there was much fighting with resulting torn ears amongst the bucks, and harassing of the females, all of which led to a loss of overall condition. Apart from that, the quarantine was uneventful, and three kits were born during it, which led to 52 rabbits being released. They were then loaded back into their crates and shipped across the harbour and taken to Staglands Wildlife Park for distribution to caregivers.

The eradication programme on Enderby Island took place from February to May 1993, with a team of four people and a specially trained rabbit tracking dog. The rabbits were killed with a green dyed cereal pellet containing brodifacoum, which was spread using a helicopter (flying direct from New Zealand) in two applications 18 days apart. The last rabbit on Enderby Island was caught and destroyed on 12 April 1993 ending a 127 year period of natural selection (Torr 2002; Whitman 2003).

Back in New Zealand the rescued rabbits were tattooed with identification numbers, separated into their different warrens, and divided amongst selected volunteers who had a commitment to the breed. Breeding successes proved to be very limited, though there is no definite reason for why. There was doubtless some inbreeding depression, but there is little evidence of any genetic faults. Climate may play a part, as excessive heat will prevent males from breeding, as will excessive cold, which causes their testicles to shrink. Seasonality may be a factor but as most are kept in hutch systems, that has not been apparent.

The one crème male that was caught was used to cover several females, and within a short period of time several crème young were produced. These were sought after to a degree, because of their unusual colouration. While not really unexpected, it did little to help genetic variation.

Temperamentally, the Enderby Island rabbits being bred in New Zealand today are still comparatively wild and easily stressed. Those that have been run relatively free range have in some instances done better. Following this finding there was a thought of keeping them in a large open enclosure, and such a one was trialled on a Canterbury farm owned by Roger Beattie, but the animals proved easy prey for harrier hawks, and the concept was abandoned.

There has never been any financial gain in keeping these rabbits so the people who took up the mantle deserve huge recognition for their input. Gwen Blake, from New Plymouth in Taranaki, was one of the first people to become closely involved, keep records and communicate between breeders. Lyn Anderson from Auckland was a prominent breeder and co-ordinator in that region. Catreona Kelly in Christchurch devoted several years of her time looking after the animals that were based around Willowbank Wildlife Reserve, and also keeping records. Sitereh Schouten has firmly become the mainstay of the project, and has devoted years to tracing and recording animals, and helping to encourage breeders to keep them. Through her efforts in April 2002, the Enderby Island rabbits, which had developed different characteristics from the original silver-greys during 127 years in isolation, were given Breed Status by the Rabbit Council of New Zealand. Without such people the breed would have been completely lost (Fig. 5).

In March 2003, ten Enderby Island rabbits were exported to Bob Whitman in Texas, requiring a 12 day quarantine period. In May 2005, another 24 rabbits were exported to Whitman. Of these, 12 were carrying the crème gene. Two pairs of these rabbits were later moved to a breeder in Carolina. Whitman appears to have had limited success in breeding them, possibly because of the high temperatures within that region. More recently contact has been made by the American Livestock Conservancy, who are aware of nine Enderby Island rabbits going to Canada from New Mexico, but have yet to authenticate their purity.

With the limited breeding taking place, it became difficult and impractical to keep the different warrens separated. There are some that can apparently still trace their direct lineage back to the Base Warren, and at least two animals back to the Enderby Warren. The rest are now a mixture of different warren lines. By 2019 the total number in New Zealand had risen to only 163 and there were nine (unconfirmed) in North America (Schouten 2019).

In spite of the effort being put into these rabbits and their co-ordinated management, there is little to suggest that there will be much change. The numbers are well below the threshold required to maintain a breed, and it sits on a knife edge, depending on the continued enthusiasm of a few breeders scattered throughout New Zealand. Should they die out, they will take with them a link to the subantarctic, part of a chain that may even have gone back to Sir Walter Raleigh, who is reputed to have introduced the silver-greys into Yorkshire from Portugal. A remarkable little rabbit, whose past history and future, has been dictated by the vagaries of mankind.

Enderby Island cattle

Cattle were first taken to the Auckland Islands in 1850 for the short-lived Enderby Settlement, though it is not entirely clear how many were introduced. Taylor (1971, p. 231), probably quoting McLaren (1948, p. 56), referred to "forty-five horned cattle", while Fotheringham (1995, p. 48, 102) and Dingwall (2009, p. 105) both stated that 80 were landed on Enderby Island at that time. One account said that the cattle had been put over the side of the *Artemisia* where they swam ashore and immediately disappeared into the thick bush and were lost (Evening Post 1932). When the Enderby Settlement was abandoned in 1852, cattle, along with other introduced animals, were left behind. However, Malone (1854, p. 76) intimated that they might be killed by the Māori settlers, who had been resident since 1843.

Malone (1854) was at the Auckland Islands from May to August 1852 during the winding up of the Enderby Settlement and he referred to cows, calves and bullocks being present. If his use of the word 'bullocks' was the normal one it could be that no entire male animals were left, in which case the cattle left there would not have comprised a breeding population. Whatever the reason for their demise, when the HMCS Victoria visited the islands in 1865 no cattle were found there (Norman & Musgrave 1866); it was over 30 years before any more were brought in.

Cockayne (1904) stated that cattle (and sheep) were brought to Enderby Island by the *Hinemoa* in 1894 and that some cattle had also been placed on Rose Island. Although the *Hinemoa* was certainly at the Auckland Islands at this time (Evening Star 1894; Gordon 1894a, b, c), it is possible that Cockayne was inadvertently referring to the landing of nine cattle and 20 sheep on Enderby Island 2 years later on 4 May 1896 for the Moffatt family (Colonist 1896; Lukins 1896). Interestingly, McLaren (1948, p. 93) gave the number of cattle taken by the *Hinemoa* as three and the date 1895. A contemporary account of the cattle shipped to the Auckland Islands for the Moffatts gave the breeds as Shorthorn and Polled Angus including a purebred Shorthorn bull and heifers of 'good strains' (Otago Witness 1896). However, the Enderby cattle do not look like either Shorthorn or Angus, and most closely resemble those of the Shetland Islands. No documentation of this breed being brought to New Zealand has been found, though there are unconfirmed anecdotal reports of cattle coming here with immigrants from the Shetland Islands in the late 19th century. Hyndman et al. (2001) found the highest coefficient of co-ancestry between Enderby and Shetland cattle (although in error interpreted the lowest coefficient as indicating co-ancestry with Jersey cattle). Although the Moffatt venture ended in failure (Dingwall 2009, p. 114), the cattle on Enderby Island survived and were reported on at various times over the next few decades (Fig. 6).

Shipwrecked survivors of the *Dundonald* found "plenty of cattle on Enderby and Rose Islands" in 1907 (Otago Daily Times 1907). In April 1910 a visitor to Enderby Island reported that "About 100 head of fine, upstanding cattle were contentedly browsing there" (Waikato Independent 1910) but a few months later in November 1910 another visitor described them as "a good number of cattle—over 100 head—but they were poor looking mongrel beasts" (Southland Times 1910), and in 1916 an editorial paragraph on the Otago Daily Times (1916) was devoted to the "shocking state of affairs among the cattle on Enderby Island" which were in a weak emaciated state. Varying reports followed, but by 1931 the cattle were described as being in good condition (Otago Daily Times 1931). During World War Two there were two coast watching stations on the Auckland Islands, and wild cattle on Enderby Island were slaughtered to provide fresh meat for them (Press 1945; Turbott 2002).

Figure 6. Feral cattle at Sandy Bay, Enderby Island, 1972 (Photo: HA Best, Department of Conservation).

Figure 7. Capturing Enderby cow, Lady, and her calf on Enderby Island, 1993 (Photo: MW).

Figure 8. Enderby cow Lady in the background, with two of her clones on the left plus their purebred offspring, Matheson property, 2007 (Photo: MT).

In 1990 the Rare Breeds Conservation Society learned that the remaining Enderby Island cattle were to be exterminated (see Brown & Cox 2022), but not having resources to collect live animals decided to restrict a salvage operation to the collections of sperm and oocytes from the shot animals for artificial fertilisation. Early in 1991 a Rare Breeds team comprising Dr Jim Catt of the Biotechnical Division of the DSIR with Rare Breeds members Craig Ferguson and Lyle Miller accompanied the Department of Conservation party to Enderby Island on the naval vessel *Monowai*, when a total of 47 animals were shot; 25 cows and 22 bulls. Sperm was removed from 16 of the bulls and successfully frozen, and although ovaries were removed from 11 cows the oocytes failed to mature. Catt had aimed to make test-tube embryos on the island but was unsuccessful, probably due to the low ambient temperature and lack of a reliable power supply (Chamberlain 1991). Because the Enderby Island cattle were understood to be a unique feral population of early Shorthorn type, details of age, body measurements and colours of all the shot animals were recorded so that they could be compared with other more developed breeds (Catt 1991).

A year later, when MW and Dave Matheson were on Enderby Island in September 1992 rescuing rabbits, they saw the hoof imprints of a cow and a calf on a peat flat on the southern coast of Enderby Island, and the decision was made to try to rescue these last survivors (Willis 2019, p. 177).

> "In September 1992 … We were walking along a peat flat on the Southern Coast, when to our astonishment we saw clearly the imprints of a cow's hoof. Not only that, but alongside them were the imprints of a calf. We followed them, and they went unerringly to a bleached pile of bones, all that remained of a cattle beast with a tell-tale hole in the forehead. The foot prints went around the skeleton, and headed off with us following. They led to another pile of bones and then on to yet another. I had a mental image of this lonely cow still searching for the company of her friends, for without doubt this was the sole survivor of the Enderby Herd, and I promised I would go back and collect her" (MW).

Back in New Zealand MW looked at various options for their capture and transport. He decided that the ideal method of capture would be by helicopter using a netgun such as was used for the capture of live deer, and preliminary talks were held with Richard [Hannibal] Hayes (later Sir Richard) who had a helicopter rated for offshore use, with long-range fuel tanks, that could fly from Stewart Island to Enderby Island. The Department of Conservation also approached Hayes, to see if he could spread poison baits for the Enderby Island rabbit eradication project. Subsequent talks with the Department of Conservation showed a great deal of support and co-operation for the cattle recovery, without which the mission would not have been possible. An opportunity came in February 1993.

Transport for the capture team – and return with animals if captured – was on the coastal supply vessel *Marine Countess*. Only two berths were available for the party, one of whom had to be a veterinarian in order to certify the animals' health documents for entry into New Zealand, and Dr Peter Trolove made himself available for this position. In the event of the capture by netgun not being possible, MW had a tranquilising rifle and pistol, both of which he had used extensively before. A supply of ropes, straps and collars for immobilisation was also taken, as well as a portable steel crate that could be erected in the hold, together with hay, camping gear and supplies for all conditions.

The team sailed from Bluff and arrived in Sandy Bay off Enderby Island where they had to wait for suitable weather before the helicopter could fly down, and during that time MW located the cow and calf. She had learnt from her past experience with humans, and was extremely wary.

A weather window opened, and the helicopter made the long flight down. It first transferred the poison baits from the supply vessel's hold onto the island, and then was available for the cattle recovery. The cow and her heifer calf were difficult to locate at first, as they were hiding on the edge of the bush, but once found, the helicopter, piloted by Alan Bond, could herd them out into the open where a netgun could be used. The gun was successfully fired by Hayes, and he and MW jumped down from the helicopter onto the animals and secured their legs (Fig. 7). They were sedated and one by one lifted back to camp, and then onto the boat where they were dropped down using a strop into the crate erected in the hold.

Several days then passed with other members of the crew doing other work around Auckland Island, moving south to Carnley Harbour, and the animals started to lose condition. They were being supplied with fresh water and hay that had been taken for that purpose. However, it transpired that they would not eat the hay, probably because they were primarily browsers of woody species on Enderby Island as there was little or no grassland. Because they started to lose condition, a decision was made by the Department of Conservation officer in charge (Willie Shaw, a botanist/ecologist), to allow the Rare Breeds team to collect the foliage of potentially palatable common woody species and to see if the animals would eat these plants. This was done, under direct supervision, on the margin of Carnley Harbour, with only limited foliage collected from each affected common woody plant, such as karamū (*Coprosma robusta*). The foliage was eaten and the animals regained condition, and they arrived at Bluff in good health. However, without this feed it is likely that there would have been quite a different outcome. Then followed a land and sea journey, being checked by the Government authorities in Christchurch, across the strait to Wellington, and then to the quarantine station on Somes Island. The Dairy Unit at Massey University expressed an interest in working with the recovered cattle, using semen taken post mortem during the cull on the Island, to try and obtain offspring. About 18 months passed and nothing happened, until it was learned that the young heifer had died. Dave Matheson and MW took a truck up and collected 'Lady', the remaining cow, to be looked after on Matheson's property. The heifer had died 'of the scours', and Lady herself was in poor condition. It took several months of care to bring her back to good health. Dialogue was established with a specialist veterinarian, and Lady was then moved up into a breeding centre at Waikari, North Canterbury, where again efforts were made to fertilise her or create an embryo, with no success, and she was returned to the farm.

In the meantime, the Ruakura Research Centre in Hamilton had heard of the project, and offered an assisted reproduction programme under the direction of Dr William Vivanco, and so Lady was taken back north. However, success eluded everyone. Some 60 oocyte collections were made from her, and using sperm collected from the shot bulls 18 embryos suitable for implantation were obtained, but only two of them developed. One died but the other held, and a bull named Derby was born. It now looked as if that was going to be the end of the project as Lady's oocytes were obviously very poor; probably a factor of many different things such as age, lack of genetic variability, past history and environment.

Just when it seemed that the project would fail, the scientist in charge, Dr David Wells, mentioned that they were quietly embarking on a cloning programme, and Lady might be a suitable donor for that. And so began a long process of attempting to create one of the first cattle clones in the world. Firstly, somatic cells were cryo-banked and ovary granulosa cells extracted. Separately egg cells from unrelated cows were collected, the genetic material removed, and the two fused. From these repackaged cells, attempts were made to create embryos. Initially 22 embryos were made, two of which developed into calves, but only one survived and was named 'Elsie', from L.C. for 'Lady's Clone' (see Wells et al. 1998).

Elsie was the first cow in the world to be cloned in this manner, just after Dolly the sheep. There was huge international interest in the achievement, and there was a detailed article in the Washington Post (Weiss 1998). Elsie and her mother were put on display at the Auckland Easter Show, but as genetic modification was a contentious issue and there had been a suggestion of harm being done to them, they were provided with their own security guards for the duration.

Ruakura scientists continued to refine their techniques, and managed to create three more cloned heifers before Elsie died, and they drew an end to the programme. The Rare Breeds Society wished to return Lady together with her clones to Matheson's farm in Canterbury, and twice sent a truck to collect them. Each time the truck was turned away, and told that they could not be released because they were genetically modified organisms. Fortunately, there was a change in attitude, and in 2003 they arrived back in Canterbury. In 2004 the herd totalled seven animals made up of Lady, her three clones, two heifer calves and Derby the bull.

Without doubt Matheson, along with his wife Judy, have been key figures in maintaining these animals on their farm and helping to co-ordinate some of the breeding. Equally the staff at Ruakura provided an opportunity that would otherwise not have been available. The Lotteries Commission provided some of the initial funds for the work at Ruakura, and the Auckland Easter Show were sponsors for the animals. At this time approximately $120 000 was spent on securing the future of these animals. Maintaining them has not been a simple task. They have retained a feral nature, which makes their husbandry difficult. Things like loading and sending surplus to the 'works' can pose problems. As yet they have not illustrated any commercially valuable traits, but others like methane emissions are yet to be explored.

In 2005 Dr Graham Kay of Lincoln University examined samples of the semen collected from the shot bulls on Enderby Island and found that it ranged in quality from good to poor. He identified which bulls' semen could be used with confidence and recommended a programme of superovulation and embryo transfer to provide greater genetic diversity. With the aid of a grant from MT and Beverley McCulloch this programme was carried out by Dr Martin Hamer in Kaiapoi. Fertilised embryos were placed in Angus-cross and Devon-cross recipient cows and six purebred Enderby calves were born – three heifers and three bulls – giving renewed hope for the survival of this breed (Fig. 8). Since then Matheson has funded some work through Xcell Breeding Services to try and get some embryos frozen down in the Rare Breeds Society's Gene Bank. The last attempt was in 2020 but only one embryo was recovered.

Currently there are three small herds, one in the South Island and two in the North Island, making a total of around 30 animals. The Seaweed Eating Cattle of Enderby are still critically endangered, with little recognition from the Government or mainstream agriculture. Lawrence Alderson in his 2020 book, *The Quest to Conserve Rare Breeds*, wrote "The survival of Enderby cattle … is one of the most dramatic and remarkable in the history of rare breeds" (Alderson 2020, p. 168).

Auckland Island pigs

Captain Abraham Bristow, who had discovered the Auckland Islands without landing in 1806, returned in the *Sarah* a year later and stayed there for 2 months (Taylor 2006). Following his return to England he wrote to Lord Auckland in 1810 to inform him that he had named the islands 'Lord Aucklands Group' (Bristow 1810a), and in a subsequent letter said that for the benefit of future navigators he had "left a breed of hogs (the only quadrupeds I had on board) on Enderby Island" (Bristow 1810b). In neither letter did he mention leaving any on Auckland Island itself, and his log-book is no longer available (Jones 1970, p. 369).

In March 1840, the United States Exploring Expedition under Commander Charles Wilkes spent several days in the northern part of Auckland Island without seeing any pigs (Wilkes 1849, p. 353). Yet when James Clark Ross visited the islands in November–December of the same year during the *Erebus* and *Terror* expedition to Antarctica, he found numerous pigs running wild on the main island. He nevertheless left more pigs there (Ross 1847, p. 150–151), which had possibly come from Tasmania. Ross assumed that the pigs already there were descendants of those left by Bristow, though he had not been able to refer to the log-book of the *Sarah* (Ross 1847, p. 138), and the possibility that they had swum there from Enderby Island cannot be discounted.

Whether the Māori settlers with their Moriori slaves from the Chatham Islands who arrived in 1843 brought their own pigs with them is uncertain. Although the free-roaming pigs on Auckland Island have been cited as among the "ample food resources" that attracted the Chatham Islanders to the Auckland Islands (King 1989, p. 78), a report by Montgomery Martin (1856, p. 373) stated that they brought about 50 pigs with them (see also McLaren 1948, p. 53), but the source of this information is unclear. Interestingly, Alexander Shand's well-regarded account of the settlement, which lists other available foodstuffs, does not mention pigs, either wild or domesticated, though an editors' note attributed to Dr Hocken of Dunedin relates that they "possessed many hogs" (Shand 1893, p. 84, note 3) – these could of course have come from the earlier liberations.

The participants of the short-lived Enderby settlement (Fotheringham 1995) are unlikely to have brought any pigs with them from 1849–1850. Edmund Malone reported wild pigs in 1852 (Malone 1854, p. 66), and Charles Enderby, who left the settlement in 1853, later reported having seen "a vast number of pigs" on both Enderby and Auckland Islands (Richards & Evans 1875, p. 315).

The crew of the *Grafton*, which was wrecked in Carnley Harbour in the southern part of Auckland Island on 3 January 1864, lived there for 19 months but did not come across any pigs (Raynal 1874) though they did see some footprints similar to those made by pigs (Musgrave 1866, p. 28, 128). Survivors of the *Invercauld*, which was wrecked on the northwest coast of the island on 10 May 1864, trekked overland to Port Ross, saw and caught some pigs (Smith 1865).

When the *General Grant* was wrecked on the western side

of Auckland Island on 14 May 1866, survivors, who had two boats, ended up on Enderby Island. They caught some pigs on the northern part of Auckland Island, largely through the use of home-made hooks, and took them to Enderby Island where they made pens for them (Guardian 1868; Southland Times 1868). When they were rescued after 18 months they released the remaining pigs on Enderby Island "for the benefit of others" (Teer 1868, p. 2), but these pigs had been killed or died out by 1887 when castaways from the *Derry Castle* were there for 3 months (Otago Daily Times 1887).

As the above summary indicates there is uncertainty as to when pigs were introduced onto Auckland Island, but it would appear that they first appeared in the northern part of the island, and that although their numbers have fluctuated, they have been on Auckland Island since the early part of 19th century. As part of the Department of Conservation's management plan for the Auckland Islands, the pigs were considered to be detrimental to the environment, and needed to be removed. Before doing so it was decided that it would be desirable to remove a live population representing the island pigs to mainland New Zealand.

The Rare Breeds Conservation Society obtained a grant of $30 000 from the Lotteries Commission, and sourced a suitable ship, *Sea Surveyor* with a skipper rated for the subantarctic with the cost difference being made up by members of the Rare Breeds' recovery team. A property in Invercargill was found and set up as a quarantine station. Six dogs under the control of two handlers were certified by the Department of Conservation as being highly trained, and rated for working in such a fragile environment. The team was made up of a veterinarian, a nurse, the two dog handlers, two small boat handlers, a Department of Conservation Officer, and six others to help capture and care for the needs of the animals when caught. After a mayoral reception in Invercargill, the ship left Bluff harbour on 12 January 1999 for the Auckland Islands.

Figure 9. Rescuing an Auckland Island pig, 1999 – Bob Page and dog Red (Photo: MW).

The expedition took enough netting to create wing fences and enough steel mesh to make traps. On Auckland Island meat and carrots were initially left out to see if they would attract any animals, but this did not prove to be of any value. The main plan was to use the dogs to locate and hold the animals for capture. Each dog team was highly experienced in pig hunting, and two or three other members of the recovery team were allocated to each team. From previous experience of the island it was known that the pigs would be close to the shore, and a system was soon developed of walking about a 100 m inland following the coast, and sending a dog out each side to work back and forth. When a dog smelt a pig, there was generally one sharp bark, enough to know the direction, and send additional dogs for support. Usually when a dog gets on to a wild pig, there is a lot of squealing and noise as they bail up, but with the Auckland Island pigs, there was very little noise. Usually crashing in the undergrowth or a yip from the dogs would indicate where the pig was, and the human hunters would set off as fast as the terrain would allow to join the melee.

The bush was tightly twisted rata forest with undergrowth that hindered all progress but eventually the hunters would arrive at the spot where the dogs were holding the pig at bay. While the dogs distracted the front end, the technique was to grab a hind leg and throw the pig off balance and onto its side. It would be held down with pressure on the neck, and the jaws taped together with duct tape, along with the legs. Once immobilised, it would be carried on shoulders to the shore (Fig. 9), and a boat called up by radio. Each capture was a bit different, and some ended up in the sea, but gradually the numbers caught increased.

There was surprisingly little damage to the pigs using this method, and back at camp they were examined, antibiotics administered as a precaution against infection, and put into individual mesh crates with a shredded paper bed. Within a day or two they were generally reasonably relaxed and virtually eating out of the handler's hand. Experienced pig hunters noted that their temperament was noticeably different from that of wild Captain Cooker type pigs, possibly because of generations of breeding on an island with no hunting or predator pressure. There was one exception. A ginger and black boar, who was noticeably higher and narrower at the shoulder but tapering off behind, was named Boris, and had the respect of everyone. A trace back to his ancestors would have been interesting. Boris apart, they were all still formidable animals when put under stress, as one of the hunters found out to his cost with a tusk through his leg. Stitches were put in place, and the capture programme continued.

The weather was unseasonably kind for most of the duration of the trip, and because of that it was possible to cover virtually the whole length of Auckland Island, in order to collect as much genetic diversity as possible. Most of the pigs collected were black in colour, with approximately 15% ginger and black.

Besides their calm temperament, which was often remarked upon, there were some small physical traits that differentiated them from wild pigs on mainland New Zealand. Their tails generally seemed to be normal, but had a tassel at the end like a donkey's tail and hung low. Their hair was

Figure 10. Auckland Island sow with piglets at Staglands Wildlife Reserve, 2007 (Photo: Gail Simons).

longer than usual, and several had almost woolly ears, all of which could be considered to be advantageous in the cold and harsh environment that they had been deposited into, and had to adapt to.

Having hunted the length of Auckland Island, including in places that few if any people had been before, the pigs were loaded aboard and the expedition headed back to Bluff Harbour.

The quarantine was managed by Ross Fraser from Invercargill, who was part of the capture expedition, and now took the responsibility to manage this component of the project. The Southland Heirloom Trust had been formed, and volunteers from that also came forward to assist. What should have been a simple matter of a short period of quarantine became mired in bureaucracy: the resettlement programme encountered a belligerent attitude right from the start. Government authorities demanded to know why the required dose of antibiotics had been exceeded when administered on the Island. It had to be explained to them that it was neither safe nor practical to inject a wild pig in the buttocks several times on the hour, when there was one opportunity to give it one good shot. Then the Pig Breeders Association objected to their release on the grounds that they may pose a health and safety risk to domestic pigs in New Zealand. Instead of a few weeks, it developed into more than a year.

There was no money to buy food for the animals, and this put an enormous strain on the volunteers and their families. The Invercargill Mayor, Tim Shadbolt, in his own inimitable way, solved the problem. He had seen the expedition leave Bluff, and had welcomed it back in Port. He now used some of his Mayoral funds to buy food for the pigs. He got away with this approach for a while, and then questions began to be asked.

Fortunately at the same time, Professor Bob Elliott – later to become Sir Bob – of Auckland University realised that these pigs might have a huge future because of their long-term natural isolation on Auckland Island. Transgenic porcine/human implants had virtually been stopped because all the other known pigs in the world had a virus in their makeup that could possibly mutate if transplanted into humans. Samples from the Auckland Island pigs were sent to laboratories around the world, and the answer came uniformly back: they were clear of any such viruses (Carr 2016). It then became a race to build a new sophisticated quarantine facility in order to protect the pigs' unique status. The result was a high security quarantine building, elevating the pigs up to being the most expensive in the world. Some media put their value at $350 000 an animal (e.g. 3 News 2008) or even higher.

Their value was seen initially in a cure for diabetes. Pancreatic cells taken from the pigs and coated with a seaweed extract could be implanted into a diabetic patient, following which the pancreatic cells would continue to

develop and produce insulin naturally. Early trials were extremely successful; a Japanese pharmaceutical company became involved and the whole operation was shifted offshore. However, Bob Elliot continued to realise the further potential of the pigs, and rebuilt the facility in Invercargill and continued to work on other avenues of their potential such as for kidney implants and even treatment of Parkinson's Disease, amongst others. Elliot died in September 2020, but what became known as the Ross Fraser facility continues with his work.

On mainland New Zealand there are two distinct populations of Auckland Island pigs. Some are in the highly bio-secure facility in Invercargill, and the rest are located generally around the country, where they have lost their status of being free from any contamination. Either population is unlikely to exceed 30 mature animals. Outside of the quarantine facility, Willowbank Wildlife Reserve in Christchurch maintains a small display group, as well as supporting a satellite breeding group. Staglands in Upper Hutt maintains a small display group (Fig. 10). Progeny of both these groups have been sold on, but have not been kept or bred from to any extent. So the Auckland Island pigs on mainland New Zealand could be considered critically endangered – there is no overall breeding programme and they are extremely in-bred. While there is no discernible evidence of inbreeding depression, it is a long term concern.

As might be expected from the known historical evidence, DNA studies of the Auckland Island pigs have confirmed that they constitute a distinct breed, related most closely to European breeds (Gongora et al. 2002, 2004; Robins et al. 2003; Fan et al. 2005). Using samples from two of the adults taken from the island, and from 19 first generation animals born in captivity, Fan et al. (2005, p. 279, 284) calculated that the Auckland Island pigs have a low level of genetic variability compared with other pigs, and that this could create problems for *ex situ* conservation.

On Auckland Island, the Department of Conservation has a mandate to exterminate the remaining pigs. The size of the island, the location, and the terrain, are all obstacles in achieving this, but much work is being done to determine the feasibility of total elimination (Anderson et al. 2022; Cox et al. 2022). The eradication is an unfortunate proposal that polarises many people. There is no doubt that the pigs cause some environmental damage, but their human value could be of huge global benefit and it would be useful to get more live pigs from Auckland Island. At the very least, genetic material should be being preserved in its pure state, so that future opportunities are not lost from a single focus approach.

Discussion

New Zealand is by no means unique in having to address the issues of feral livestock that has been introduced into island territories (e.g. Headland 2012). Balanced against the often high ecological value of the Auckland Islands' flora and fauna, it is well established that feral livestock breeds are a unique source of genetic material, whose variation is obtained through the founder animals, and developed by natural selection and mutation over a number of generations. The resulting animals can be given a range of values – scientific, historical, heritage, commercial and even aesthetic. Recognition that feral livestock in New Zealand could have potential values, as well as there being conflicting interests in regard to their preservation, was first discussed at a seminar convened by the Department of Lands and Survey in 1976 (Whitaker & Rudge 1976).

International examples of islands with similar issues include the Chirikof and Aleutian Islands off the Alaskan Coast, and the French subantarctic islands (Chapuis et al. 1994). Unfortunately, little can be drawn from other islands' experiences, as the tensions between preservation of a valuable non-native breed while restoring native species on islands have never been resolved anywhere. In all cases there are opposing views on how to balance and manage the needs of the livestock and landscape. A halt was recently called to the culling and removal of the Chirikof Island cattle (Rosen 2016) until the issues were better understood, while the French on Kerguelen Island (Patel 1995) vacillate around complete removal, total protection, farming and management, and/or tourism and trophy hunting.

In many ways New Zealand leads the world in our ability to manage the removal of pest species from island reserves, but native species are affected by multiple threats. For instance, pigs are blamed for the historical reduction in numbers of albatross on the Auckland Islands, but the current decline in bird numbers is also attributable to long-line fishing. Eradicating pigs may not be the most urgent action to save albatross, and pigs should not be used as scapegoats for other damage caused by human actions.

Changes in attitude lead to conflicting reactions. Only a couple of decades ago, all of the early huts and shelters on the Auckland Islands were abandoned, and Government policy was to let them decay. Now they are considered heritage items to be restored. This change in policy values is what continues to throw doubt on the wisdom of pursuing only one complete option, especially when it is irreversible. Good management plans are essential, and such plans should always consider the establishment of reserves, translocation, and other means of achieving a mutually agreeable goal.

New Zealand is a signatory to the Rio Convention, which urges all countries to protect their biodiversity. The extermination of non-native breeds of livestock from the Auckland Islands without understanding or recognition of their value, or taking responsibility for their future, is hardly in accordance with this principle. The Food and Agriculture Organization strongly defends the retention of rare genetic lineages and the preservation of the breeds carrying them, all of which adds to the unique qualities of the subantarctic islands, their history, their potential values, and our difficulty in fully appreciating the secrets and treasures that they continue to reveal.

Author contributions

MT conducted the historical research; MW provided information on the capture and recovery of rabbits, cattle and pigs.

Acknowledgements

Our thanks to Aldous MacIvor, Lyle Millar, William Brockelsby, James Russell, Colin Miskelly, Rowley Taylor, Gail Simons, Dave Matheson, Sitereh Schouten and the Invercargill Library and Archives for providing information and photographs, and to James Russell and Willie Shaw for assistance with the manuscript. Earlier research was assisted by the help of Ross Fraser, Kingsley Timpson, Pete McClelland, Ian Hill, Greg

Sherley, and Jaime Gongora. Thanks also to Carolyn King and an anonymous reviewer for helpful comments on a draft of this paper.

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Editorial board member: James Russell
Received 25 January 2021; accepted 6 April 2021