Eradication of Norway rats (*Rattus norvegicus*) and house mouse (*Mus musculus*) from Browns Island (Motukorea), Hauraki Gulf, New Zealand

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Abstract Browns Island (60 ha) is located within the Waitemata Harbour, Auckland, New Zealand. Mice (*Mus musculus*) were on this island for an unknown period. Norway rats (*Rattus norvegicus*) were first recorded in the late 1980s when their burrows were observed to be damaging archaeological sites. An eradication operation was organised using donated materials and helicopter services. A single application of Wanganui No. 7 bait loaded with bromadiolone at 20ppm was applied by helicopter at a nominal rate of 10 kg/ha in September 1995. One mouse was trapped 19 days after the poison drop but there has been no sign of rodents since. Bait stations placed to intercept possible new arrivals are also used for ongoing monitoring.

Keywords Bromadiolone, historic sites.

INTRODUCTION

Browns Island, 60 ha, is located within the Waitemata Harbour, Auckland, New Zealand, and is separated from the mainland, which has rats, and rat infested islands, by distances of greater than 600 metres at low tide. It is a Recreation Reserve owned by Auckland City Council but managed by the Department of Conservation.

This island has a long history of human occupation with Maori and other historic sites covering much of the land area. This is a highly-ranked site for the conservation of these historic values.

The vegetation today is mainly introduced grasses. A canopy of pohutukawa (*Metrosideros excelsa*) over mainly introduced shrubs exists in limited coastal cliff areas around the north-eastern quarter (Fig. 1) and comprises less than 1% of the island area. There is a lesser area of *Cupressus macrocarpa* and scattered trees of other introduced species. Apart from fenced off coastal cliffs the island has been grazed for nearly 150 years. This is a lowly-ranked site for the conservation of flora and fauna apart from the population of New Zealand dotterel (*Charadrius obscurus*) which utilise the beaches.

The date of mouse (*Mus musculus*) introduction is not known. Rabbits (*Oryctolagus cuniculus*) were introduced in about 1975 and were eradicated between 1985 and 1991 (Veitch 1995). Mustelid sign, probably stoat (*Mustela erminea*), was observed in August 1995. Norway rats (*Rattus norvegicus*) were first recorded in the late 1980s when their burrows were observed to be damaging archaeological sites (Robert Brassey pers. comm.).

The possible impact of this operation on non-target species was considered but no populations were identified as possibly at risk. No action was considered for management of the mustelids as this island is well within their swimming range from the mainland.

The objective of this operation was to remove rodents from Browns Island and thus stop the damage they were causing on archaeological sites.

METHODS

The eradication operation was organised using donated materials and helicopter services. On 13 September 1995, the eradication was initiated with bait loaded into a helicopter bait spreader bucket at North Head (Fig. 1). Wanganui No 7, a 2 gram green dyed pollard pellet containing 20 ppm bromadiolone, was applied at a nominal

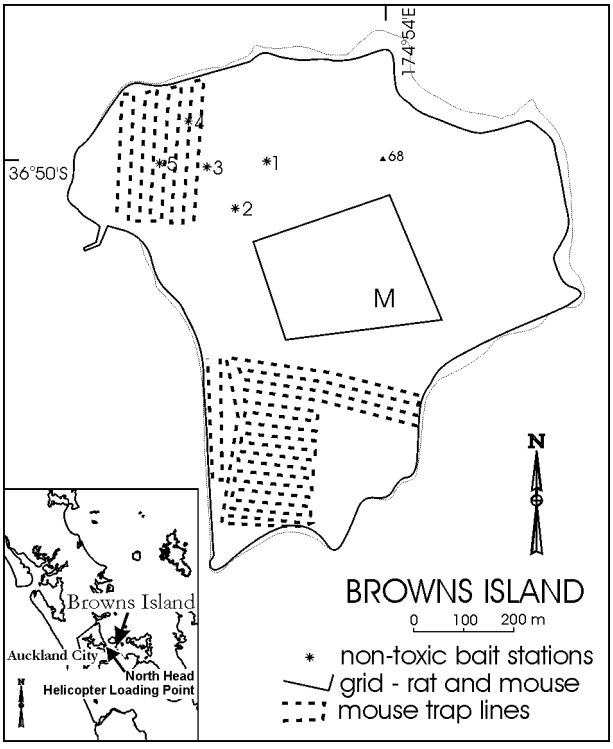

Fig. 1 Browns Island showing post-drop monitoring trap lines and bait stations.

Pages 350-352 In Veitch, C. R. and Clout, M. N. (eds.). *Turning the tide: the eradication of invasive species*. IUCN SSC Invasive Species Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Table 1 Some published LD_{50} values (mg/kg) for brodifacoum and bromadiolone (shown with levels of accuracy and ranges as published). Where the rat or mouse was identified to species level these were chosen over generic groups. Where "wild" was specified this was chosen over captive or unspecified strains.

Brodifacoum		Bromadiolone		
Mouse	Rat	Mouse	Rat	Reference
0.40 (0.30-0.63)	0.22	0.86 - 1.75	0.57-0.65	Hone & Mulligan 1982
0.4	0.27	0.99	0.65	Haydock & Eason 1997
0.4	0.24	1.75	1.125	Eason 1991

rate of 10 kg/ha. This was used subject to an experimental use permit.

The helicopter was not fitted with a Differential Global Positioning System (DGPS) to aid the accuracy of bait placement. Instead, a colour aerial photograph was marked with flight lines spaced to ensure adequate overlap of bait spread. The small size of the island and presence of suitable landmarks such as trees, stone walls and fence lines made this a reasonable practice.

No attempt was made on the ground to check for gaps in the bait spread as the dense grass sward made it impractical to do so. A period of more than three days fine weather followed the bait drop. Random searches to assess the quantity of bait remaining were made from 26 September to 5 October and on 10 October.

From 26 September to 5 October 121 Ezeset mouse snap traps were set for 968 trap nights and 25 Ezeset rat snap traps were set for 200 trap nights on a grid (Fig. 1). Five stations with 3 cm cubes of cheese fixed on wires under tin covers were also set out for this period. This non-toxic bait trial was chosen following bait preference trials on this island earlier in the year (Weihong *et al.* 1999). From 30 October to 9 November, 386 mouse snap traps were operated along lines for 3860 trap nights (Fig. 1).

For ongoing protection of the island, and as a monitoring mechanism, 50 Rentokil bait stations containing Rid Rat wax block baits were placed around the island. The bait in these stations is replaced at six-monthly intervals and checked periodically for rodent sign.

RESULTS

One mouse was trapped on the grid 19 days after the poison drop (shown as 'M' on Fig. 1). Mouse sign in the form of chewed baits was observed at two of the five bait stations over the latter part of the period they were set out; up to 21 days after the bait drop. No rats or mice were caught on the mouse trap-lines. There has been no sign of rats or mice since 5 October 1995.

The random searches for remaining bait which began 13 days after the drop revealed only a few small pieces of bait, each less than 0.25 g.

DISCUSSION

Bromadiolone at 20 ppm in a single aerial drop of 2 g pellets was successful in the eradication of rats and mice from Browns Island.

Brodifacoum has been the toxin of choice for rodent eradications (e.g. Brown 1993, Taylor and Thomas 1993), as it is very highly toxic to rodents, and when compared with other less toxic rodenticides, less active ingredient is required to kill the target species. We used bromadiolone because it was donated, thus reducing our costs.

The LD_{50} data for brodifacoum and bromadiolone and the two rodent species involved in this operation vary between studies (Table 1). If worst case scenario data are used then both rats and mice may need to eat more than four times the quantity of bromadiolone loaded bait compared to brodifacoum loaded bait (Table 2). In the Browns Is-

Table 2 A comparison of the quantities of brodifacoum and bromadiolone that may need to be consumed by mice and Norway rats to meet the LD_{50} level. The highest LD_{50} levels from Table 1 have been used. Rodent weights are from King (1990).

	Brodifacoum	Bromadiolone
Mouse LD_{50} (mg/kg)	0.40	1.75
Norway rat LD_{50}	0.27	1.13
mg of toxin to meet LD_{50} level		
Mouse if 24 g	0.01	0.04
Norway rat if 260 g	0.07	0.29
Grams of bait loaded at 20 ppm		
Mouse if 24 g	0.48	2.10
Norway rat if 260 g	3.51	14.69
Number of feeding days bait loaded at 20 ppm		
Mouse[1]	0.16	0.70
Norway rat[2]	0.14	0.56

[1] Crowcroft (1996) – a mouse consumes 3-4g of food daily – 3g level used here.
[2] Leslie and Ranson (1954) – Norway rats eat about 10% of their body weight daily = 26g/day.

land situation it appears that the Norway rats rapidly cached the baits which was then available to the mice after the rats had died. Some individual rodents may need to ingest three times the LD_{50} level to obtain a lethal dose. Thus a Norway rat on Browns Island may have needed to eat only bait for 1½ days and a mouse may have needed to eat only bait for more than two days to receive lethal doses.

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