Eradication of Norway rats (Rattus norvegicus) and house mouse (Mus musculus) from Motuihe Island, New Zealand

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Abstract Motuihe Island is located within the Waitemata Harbour, Auckland, New Zealand. Mice (Mus musculus) and Norway rats (Rattus norvegicus) were introduced to this island at an unknown date. Rabbits (Oryctolagus cuniculus) and feral house cats (Felis catus) are present. Most of the island is a pastoral farm. Past anecdotal records of rats and mice suggest that there have been significant changes in their abundance from year to year. Two aerial applications of Talon 7-20, a cereal-based anticoagulant rodenticide containing brodifacoum, were made in 1997 with the intention of eradicating both the rats and the mice. Trapping for rats and mice in 1999 and 2000 failed to detect the presence of either species and the project is deemed to have achieved eradication.

Keywords Brodifacoum.

INTRODUCTION

Motuihe Island, 179 ha, is located within the Waitemata Harbour, Auckland, New Zealand (Fig. 1), and is separated from the mainland and rodent infested islands by distances of greater than 1.05 km at low tide. This island has a long history of human use, including numerous Maori sites. Since about 1840 it has been a pastoral farm. It has also been used as a quarantine station, prisoner-of-war camp, and naval training base. It is now a Recreation Reserve managed by the Department of Conservation with about 80% of the land area grazed by sheep and cattle (DOC 1995).

Most of the shoreline is sandy beach with much of it backed by vertical cliffs up to 30 m high. The farmed land is rolling and reaches a maximum altitude of 63 m. The 20% of the island that is not grazed pasture has stands of native and non-native trees and is heavily grazed by rabbits (Oryctolagus cuniculus).

The holders of a concession to operate the small shop, manage camping and day visitor facilities, farm the land and let one house, live on the island. Visitor numbers are not recorded but on a good summer day 600 boats, varying in size from kayaks to 20 m in length, may be hauled ashore or anchored nearby.

There is no definite information on when the mice (Mus musculus), Norway rats (Rattus norvegicus), cats (Felis catus) or rabbits arrived on the island and there are no records of rodent abundance prior to the 1995 study by Stubbs (1996). Cats were recorded as being eradicated in 1981 (Veitch and Bell 1990) but have since returned. Mustelids have never been recorded.

Rats were abundant from time to time prior to 1987, but mice were not seen (John Allen pers. comm.; Chris Roberts pers. comm.). Poisoning operations for rabbits in 1988 may have eradicated Norway rats (Dowding et al. 1999). Between March and December 1995, Stubbs (1996) set rat and mouse traps at six-weekly intervals for a total of 1260 trap nights and caught 212 mice, but no rats. The capture rate varied from four to 45 mice/100 trap nights. In February 1997, I operated 30 Ezetset rat traps and 30 Ezetset mouse traps for three nights and caught one Norway rat.

Secondary objectives of this bait drop, not part of this paper, were the reduction of rabbit numbers prior to their eventual eradication and the assessment of toxin transfer from rat baits to cats, by consumption of prey that had eaten toxic baits (Dowding et al. 1999), prior to their eventual eradication using other methods. This work was not completed due to a withdrawal of funding.
The possible impact of this operation on non-target species was considered, based on reported and personal experience of previous rodent eradication operations, but, while individuals were expected to be affected, no populations were identified as possibly at risk.

METHODS

Using a helicopter, two aerial applications of Talon 7-20, 2 gram baits, were made with the intention of eradicating both the rats and the mice. Talon 7-20 is a cereal-based bait containing brodifacoum at a rate of 20ppm and dyed green to reduce visual attraction to birds. This was used because it was the only bait registered for aerial application on offshore islands. After the operation was completed it was found that this bait also contained bitrex, a bittering agent added to the toxin to reduce the possibility of humans eating the bait. Bitrex has been shown to reduce bait consumption by rats (Kaukeinen and Buckle 1992; Veitch 2002b).

The bait was spread from a dedicated underslung bait bucket which spread the bait over a 120m wide swath. The helicopter was fitted with a Differential Global Positioning System (DGPS). For both drops the DGPS was set so that the helicopter pilot would follow a line spacing of 120 metres.

In previous rodent eradication operations bait had been applied at or about 10 kg/ha and successfully eradicated the target species (e.g. Brown 1997; Veitch 2002a. 2002c). For this operation two rodent species were present, so two bait spreads were considered desirable, with an eight day interval between drops. As two drops were to be made, a lower bait application rate was possible for each drop, with the total bait applied being slightly more than for a single-species operation.

The first drop of bait was carried out on 25 July 1997 with 1450 kg of Talon 7-20 being spread at a nominal rate of 8 kg/ha. The second drop of bait was applied on 4 August, used 800 kg of bait and the bait bucket was set to spread at 4kg/ha. A printout from the DGPS (Fig. 2) was checked for gaps between flight lines after each bait application.

There was no ground verification to monitor the thoroughness of bait coverage over the island. The spread rate was monitored immediately after the first drop by randomly casting a metre-square wire frame to left and right of a casual line of about 600 m walked over grazed pasture between the summit and the woolshed. The baits within each metre square where the frame fell were counted. This test was repeated 50 times.

Between 28 June and 2 July 1999, two trap-lines each with 30 Ezeset rat traps under tin and wire mesh covers and 30 Ezeset mouse traps under wire mesh covers were operated for a total of 480 trap nights (Fig. 1). These traps were set at 30 metre intervals in the order: rat trap under tin cover; mouse trap under mesh cover; rat trap under mesh cover; mouse trap under mesh cover; and so on. The traps were set in rough vegetation under fences or just into the scrub edge beyond the farm stock browse line.

Between 12 and 16 June 2000 two trap-lines of alternating rat and mouse traps set in the same order and similar locations as in 1999, but at 50 m intervals, were operated for a total of 380 trap nights (Fig. 1).

There was no organised or regular searching for non-target species, but birds found dead and suspected of being poisoned were collected for analysis.

Fig. 2 Upper: The DGPS printout following the first bait drop on 25 July 1997. The line indicating the island outline is not the surveyed outline but is the helicopter track when logging the outline. Lower: The DGPS printout following the second bait drop on 4 August 1997.
RESULTS

The DGPS printout for the first drop (Fig. 2) showed a thorough flight coverage of the island. The weather on Motuihe remained dry over the next three nights. The DGPS data shows that the 1450 kg of bait was spread over 235 hectares (6.18 kg/ha) but there are some areas of overlap and some flight lines extend beyond the island boundary. The test of bait spread using a metre-square frame found a bait spread equal to 7.96 kg/ha.

Analysis of the DGPS data shows that the second drop of bait achieved a spread rate of 3.5 kg/ha over the logged application area. A strong south-east wind was blowing at the time and this shows up in the relative flight speeds of the up-wind and down-wind tracks shown on the DGPS printout (Fig. 2). One day after this drop an absence of bait was noticed on the north-western headland (John Dowding pers. comm.), and a subsequent search failed to find any bait on this headland. This part of the island was the end of the helicopter flight and these observations suggest that the bait bucket was empty before the helicopter reached this point. No bait was available to remedy this problem.

Twenty-nine individuals of 10 bird species found dead following the operation were collected: paradise shelduck (Tadorna variegata), mallard (Anas platyrhynchos), grey duck (A. superciliosa), Australasian harrier (Circus approximans), pukeko (Porphyrio p. melanotus), southern black-backed gull (Larus dominicanus), blackbird (Turdus merula), chaffinch (Fringilla coelebs), common myna (Acridotheres tristis) and Australian magpie (Gymnorhina tibicen). Analysis of the livers of these birds showed that all contained brodifacoum (Dowding et al. 1999). House sparrows (Passer domesticus) and goldfinches (Carduelis carduelis) were observed eating bait but none were found dead. Three groups of pukeko that were counted before and after the operation were observed to decline by 49%, but have since increased again, and a paradise shelduck flock declined by 60% (Dowding et al 1999). Both pukeko and paradise shelduck have now returned to their pre-bait drop abundance.

Trapping for rats and mice in 1999 and 2000 failed to detect the presence of either rodent species. There has been no other sign which might indicate the presence of rodents. Rats and mice have probably been eradicated.

DISCUSSION

The DGPS data presented here suggests that there are considerable discrepancies between the intended rate of bait spread and the actual rate of bait spread. However, the one ground check recorded a bait spread similar to the intended spread. The helicopter pilot needs to operate two switches at the beginning and end of each flight line: one to switch the bait flow on or off and the other to start or stop the DGPS track. There will be a time lapse between these two actions and this is accentuated when operating on small islands with short bait spreading runs. In this instance if the time lapse averaged one second then the recorded bait spread rate differs from the actual bait spread rate by 8%. On this island, unlike forest covered islands, ground checks of bait spread were possible and more checking should have been done.

The high variability of rodent density, both anecdotal and from the trapping data recorded in this paper, may be due to a number of factors either singly or in combination:

- The rabbit population has frequently been at high levels and their browsing is likely to reduce the food source for rodents.
- There has been intermittent action by island managers to control rabbits using a wide variety of methods which also kill rodents (J. Allan pers. comm., Dowding et al. 1999).
- Cats are present and they may slow the rate of increase of a reduced rodent population (Fitzgerald 1990).

This variation in rodent abundance, combined with the low trapping success in February 1997, means that the failure to catch rodents in 1999 and 2000 may not be confirmation that rodents are absent. Their continuing absence from buildings, the compost heap, and rubbish containers suggests that eradication was successful. If a mouse or Norway rat appears again after these five years of absence there is no way of knowing whether the eradication operation failed or it is a new arrival from one of the many boats that visit the island.

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REFERENCES


