Eradicating mammal pests from Pomona and Rona Islands in Lake Manapouri, New Zealand: a focus on rodents

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Abstract Pomona and Rona Islands are situated in Lake Manapouri, Fiordland National Park New Zealand. Since 2006 a community-driven initiative, led by the Pomona Island Charitable Trust, has been removing the introduced pests from the two islands. Rona Island had stoats (Mustela erminea) and mice (Mus musculus) present, Pomona Island had five pest species to be removed: stoats, red deer (Cervus elaphus), possums (Trichosurus vulpecula), ship rats (Rattus rattus) and mice. Pomona and Rona Islands are 500m and 600m respectively from the mainland. Having removed the stoats from Rona Island and the stoats, deer and over 430 possums from Pomona Island, the Trust undertook an aerial operation to eradicate the rodents from both islands. Following best practice, the aerial operation involved two aerial drops of the pesticide brodifacoum conducted 40 days apart. The paper provides an overview of the eradication techniques for each pest species on the islands, planning for the rodent eradication operation, community consultation, logistics of the aerial operation and post-eradication monitoring to confirm the success of the operation. Biosecurity measures put in place post-rodent eradication are discussed and their effectiveness assessed.

Keywords: Eradication, rats, Rattus rattus, mice, Mus musculus, brodifacoum, community conservation

INTRODUCTION

Pomona and Rona Islands are located in Lake Manapouri, Fiordland National Park, New Zealand (Fig. 1). Pomona Island, 262 hectares, is the largest island in a lake in New Zealand. Rising 340 m above Lake Manapouri, it is a round-topped granite hill with steep sides separated from the mainland by the 500m wide Hurricane Passage. The island is almost completely forested and has some impressive bluffs. Pomona Island has a variety of habitat types and a rich flora for its size. Introduced predators and browsers have had an impact on the island’s biodiversity, particularly native birds. Five mammal pests have been recorded on Pomona: stoats (Mustela erminea), ship rats (Rattus rattus), possums (Trichosurus vulpecula), mice (Mus musculus) and red deer (Cervus elaphus).

Rona Island (60ha) is the second largest island in Lake Manapouri and is just over 600 m from the mainland. Two pest mammal species have been found there: stoats and mice.

The Pomona Island Charitable Trust (a community-led organisation) was established in 2005 with the vision of restoring Pomona and Rona Islands to a pest-free state and maintaining them as island sanctuaries. The key aims of the Trust are to eradicate all introduced pest species from the islands, to re-introduce, through natural and assisted means, birdlife native to Fiordland and the Southwest New Zealand World Heritage Area, to ensure community involvement in the island restoration project and to provide an accessible location for people to see, hear and learn about the flora and fauna native to Fiordland. The Trust has a management agreement with the Department of Conservation (DOC) to manage the restoration project on the two islands.

MAMMAL ERADICATIONS

Eradication of Stoats, Possums and Deer

A formal pest management plan was commissioned to guide the eradication of pests from the two islands (Brown 2006). The work described in this paper follows this plan with modifications as noted.

Stoats were the first pest to be targeted. A 9.2km network of tracks was cut by volunteers on Pomona Island to service 37 stoat trap sites. Each stoat box contained a double-set Mark IV Fenn trap which was baited with an egg and a piece of meat (Fig. 2). The traps were first set in August 2006 and, up to November 2007, 18 stoats were trapped. In September 2008 the double-set Fenn traps were replaced with single DOC 150 traps and in September 2009 an additional 10 single-set DOC 200 traps were placed along the Hurricane Passage side of the island, the part of the island most vulnerable to re-invasion.

In January 2007 four double-set Mark IV Fenn traps were set out around the coast of Rona Island. Three stoats were caught in these traps, the last one caught in January 2008. In October 2009 a further 14 double-set DOC 150 traps (Fig. 3) were installed across the island and no stoats were caught up to February 2010.

Possums were introduced to Pomona Island in the 1970s by a hunter who wanted his own personal supply of possum fur. The number of possums present on the island was unknown, but estimates from possum hunters were around 200 animals. Possums are known to eat the bait that was to be used for the rodent eradication, so it was deemed important to remove as many as possible from the island prior to the aerial application of brodifacoum. In May 2007 a contractor was employed and used a mix of leg-hold traps and Feratox poison to kill more than 430 possums. There was a concern that, with so many dead possums on Pomona Island, the carcasses might provide an alternative food supply for the rodents. For this reason the contractor and volunteers removed as many carcasses as possible. Where it was not practical to remove them from the island, the contractors created piles of possums

Fig. 1 Location of Pomona and Rona Islands.

References

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in identified locations along the track. To ensure that all possums had been eradicated a second possum operation was conducted in June 2008, but no evidence of possums was found.

Deer: Pomona Island is well within the swimming range of red deer. In the past, local hunters have sporadically hunted deer on the island and a pen to trap deer had been constructed there during the 1970s. Given that the deer on the island had been subject to some hunting pressure, it was felt that a professional contractor with dogs would be the best option to remove them. A condition of the resource consent for the aerial poison operation targeting rodents was that all practicable steps be taken to remove deer from the island prior to the rodent eradication programme. During May 2007 a total of five deer were shot on the island and the deer pen was repaired and re-activated. Since then no further evidence of deer has been found on the island.

Eradication of Rodents

Choice of Method

An aerial poison operation using brodifacoum-laced bait was selected as the best method for eradicating rats and mice from Pomona Island and mice from Rona Island. The reasons for this were that the cost of ground-based control would be very high and the steep nature of the terrain, especially on Pomona Island, would mean that complete coverage could not be guaranteed. As a charitable organisation, the Trust had limited funds and would not have had the ability, financially or in terms of volunteer resource available, to conduct on-going ground control work. A one-off aerial operation, therefore, represented the most cost effective approach to rodent eradication. Brodifacoum has been used to successfully eradicate rodents from a number of islands and at the time of the operation the proposed method was also the ‘best practice’ for eradication of rats and mice from islands (e.g., Clapperton 2006; Clout and Russell 2006; Torr 2002; Veitch 2002a; Veitch 2002b; Veitch 2002c; Empson and Miskelly 1999).

Operational Planning

The pest management plan (Brown 2006) prescribed two aerial applications of bait, spaced a minimum of seven days apart. It recommended sowing bait at a nominal rate of 8kg/hectare with two extra swaths along the entire coastline of both islands for the first application and a second application sown at a nominal rate of 4.5kg/hectare with two additional coastal swaths. A review by the Department of Conservation’s Island Eradication Advisory Group (IEAG) recommended increasing the sowing rate to 8kg/hectare for both drops, with two additional coastal runs and increasing the minimum time between the drops to 10 days. Following an inspection of the islands by the Chief Pilot for the operation, Peter Garden, he recommended additional bait be sown on the steeper flanks of Pomona to ensure good coverage. Therefore, in addition to the two coastal runs, some of the bluffs on the island received as many as six additional coastal runs.

The aerial spread of poison required a resource consent from Environment Southland. An Assessment of Environmental Effects provided an overview of the proposed operation, a description of the treatment area, a discussion of alternative rodent eradication options available, the environmental effects of using brodifacoum and a set of proposed consent conditions (Willans 2007). Resource consent was received in May 2007. A total of 7.1 tonnes of Pestoff 20R cereal bait containing 20ppm (0.02g/kg) of brodifacoum was ordered. This included a 10% contingency amount to allow for any unforeseen mishaps with the bait applications or the need to re-treat any gaps in bait spread.
The poison drops were planned for the winter of 2007. Winter was judged as the most appropriate time for the operation, as food supplies for the rodents would be at their lowest thus increasing the chance they would eat the bait. It was also judged desirable to ensure that as many of the possums and deer on the islands as possible had been eliminated prior to the first drop so that the competition for the bait would be reduced. Following each aerial operation, volunteers laid additional bait by hand around the piles of possum carcasses on Pomona.

Community Involvement

A Social Impact Assessment (see Cossllett et al. 2004) for the operation was undertaken to identify key interested parties in the local community and to ascertain their views on the Trust’s planned restoration of Pomona and Rona Islands and, in particular, the planned method of rodent eradication (Shaw 2006). Members of the community were overwhelmingly positive to the Trust’s plans to restore Pomona Island. The vast majority of respondents thought that this was a great project which would benefit the local communities of Manapouri and Te Anau. Strong support was found for the Trust’s plans to eradicate all pests from the island and re-introduce native bird species. There was widespread support for the community-driven initiative with high numbers of individuals volunteering their time to the project. Support for the project from the Department of Conservation was considered by members of the community to be important. A strong relationship with the Department has developed as the restoration project has progressed.

The main concern raised at a public meeting related to the poison that the Trust planned to use. When informed that brodifacoum (the active ingredient in the product Talon which is freely available for household use in New Zealand) was the poison recommended in the pest management plan, concerns seemed to be allayed. A small number of individuals raised the issue of alternatives to an aerial poison drop and questioned whether it was possible to eradicate the rodents using hand-laid bait. Research evidence suggests that the spacing of bait would have to be very close. The manufacturer’s recommendation for Talon for mouse control is that bait should be no more than 3 m apart (Clapperton 2006). The cost of adopting such an approach would be high and would be impractical due to the nature of the terrain on both islands. Once this was explained, the individuals expressing their concern seemed to accept the rationale for an aerial poison drop.

The Trust kept the local community informed about the operation. Public meetings were held and an information sheet prepared, distributed and put on the Trust’s website. Objection to the operation from deer hunters resulted in a condition placed on the Trust to take all practical steps to eliminate deer from Pomona Island prior to the aerial operation.

As a community-led restoration project there was strong volunteer involvement in the actual rodent eradication programme. The Project Manager, Operations Manager and the Chief Pilot all donated their time and volunteers, under the supervision of Department of Conservation staff, loaded the bait into the spreader bucket sling beneath the helicopter. Volunteers did all the post-operation ground checks for bait coverage and the condition of bait on the ground. Funding for the aerial operation came from community sources, with NZ$40,000 being donated by an anonymous benefactor and the remaining NZ$14,195 coming from the Community Trust of Southland. Weather forecasting for the operation was also provided by a local contractor to the Trust at no charge.

Aerial Operation

Bait was sown using a Bell Jet Ranger helicopter with an under-slung spreader bucket with an effective swath width of 80 m. A Differential Global Positioning System (DGPS) with a fixed base station was used to guide the helicopter whilst sowing bait. Bait was sown at 4kg/ha with a 50% overlap of swaths giving the target coverage of 8kg/ha.

The first aerial operation took place on 8 July 2007. The DGPS base station was installed on the mainland adjacent to the islands. Volunteer bait loaders and the bulk bait were flown to the loading site on the mainland adjacent to the islands (Fig. 1) where the bait was loaded into the spreader bucket. An experienced GIS expert from the Department of Conservation, capable of downloading and interpreting the logged flight data from the helicopter’s DGPS, joined the crew at the loading site. Bait was spread first on Rona Island and a printout from the DGPS unit assessed to ensure coverage was complete. Bait was then spread on Pomona Island. Data was downloaded from the DGPS and coverage assessed before all of the equipment and volunteers packed up for the day. The loading site was cleared to ensure that no pellets remained on the ground. Poison warning signs were put in place by volunteers on the islands and at all boat launch sites on Lake Manapouri.

The weather for the first drop was perfect, with freezing conditions on the ground. There was no significant rainfall for 16 days following the first drop. An inspection of the bait on the ground a week after the aerial operation showed good coverage had been achieved and the cold, crisp conditions meant that the bait was still in almost pristine condition. The second aerial operation was therefore delayed until 18 August 2007. The second operation was conducted in an identical fashion to the first. There was no significant rainfall for eight days following the second drop and a ground inspection found good coverage on both Pomona and Rona Islands. Bait was still visible on the islands three months after the second aerial operation.

Possible Re-invasion

Rodent motels and bait stations were placed on both islands to detect possible survivors or a re-invasion (four motels and 12 bait stations on Pomona and one motel and...
In October 2006 24 double set DOC 150 traps were set to reduce the risk of re-invasion of either island by stoats. The rationale is replaced quarterly. The mainland trap lines were checked and bait replaced bimonthly. Chew sticks are operation in July 2007 and February 2010. The traps are has been caught on each island between the aerial poison operation on both Pomona and Rona Islands. No further evidence of mice has been found on Rona Island.

In July 2009 a single mouse was also found in a trap inside a rodent motel on Pomona Island. Judging by its condition, it had been in the trap for a while so may have appeared on Pomona around the same time as the mouse found on Rona Island. Fifty temporary mouse traps were placed around all potential landing sites on the island. Again these traps have now been replaced with permanent mouse traps in vulnerable locations and mouse traps have been placed inside each of the 47 stoat traps boxes on the island. No further evidence of mice has been found on Pomona.

Both mice were caught in traps located close to preferred boat landing sites on each island. In spite of intensive trapping in the location of both finds, no further evidence of mice has been found on either island. It is likely that the single mice found on each island were the result of re-invasions rather than remnant populations on either island. The most likely source of re-invasion is from a boat.

POST ERADICATION MONITORING AND BIOSECURITY

Pomona and Rona are Open Sanctuary Islands and are accessible to the public. Anyone with their own boat can visit either island at any time. Biosecurity is an important issue and is being handled in three ways: i) through on-going monitoring on both islands, ii) through the installation of trap lines on the adjacent mainland and iii) through public education.

Monitoring

There are 47 traps capable of catching both stoats and rats permanently in place on both islands. A network of 16 bait stations and rodent motels have been placed on Pomona Island and five on Rona Island. The 12 bait stations contain brodifacoum poison bait and the four rodent motels contain rat traps, mouse traps, chew sticks and poison bait. Chew sticks containing peanut butter have also been placed alongside each stoat trap location on both islands and along some of the tracks around Pomona Island. The chew sticks may identify the presence of rats, mice and possums. No evidence of animals chewing the chew sticks has been found between August 2007 and February 2010. One stoat has been caught on each island between the aerial poison operation in July 2007 and February 2010. The traps are checked and bait replaced bimonthly. Chew sticks are replaced quarterly.

Mainland Trap Lines

A network of stoat and rat traps has been established on the mainland adjacent to the two islands. The rationale is to reduce the risk of re-invasion of either island by stoats. In October 2006 24 double set DOC 150 traps were set out along the coast opposite Pomona Island. In September 2009 an additional 48 single set DOC 200 traps were placed on the peninsula and along the coastline opposite Pomona. This was done in response to a moderate beech mast in Fiordland, which would be expected to lead to an increase in the numbers of stoats and to reduce the risk of stoats swimming across to Pomona. Between October 2006 and February 2010 a total of 73 stoats, 156 rats and 14 mice were caught in these traps.

In order to protect Rona Island from a potential stoat re-invasion, two mainland trap lines were established at the closest points to the island. Ten double set DOC 150 traps on the mainland, approximately 980 m to the north of Rona, caught nine stoats, two weasels, 24 rats and four mice between October 2008 and February 2010. To the west of Rona and only 600 m away, a network of 11 double set DOC 150 traps and 23 single set DOC 200 traps caught six stoats, 69 rats and 12 mice between October 2008 and February 2010. The mainland traps are checked and freshly baited every two months, with the frequency increased to monthly following a beech mast event.

Education

Since completing the eradication of pests from Pomona and Rona Islands, the Trust has turned its attention to educating the local community on the need to keep the islands free of introduced animal pests, especially rats and mice. The Trust has produced a quarantine brochure aimed at users of the lake. These are available at all boat launch sites on Lake Manapouri and encourage users of the lake to help protect Pomona and Rona by ensuring that they do not accidentally re-introduce rodents to the islands. Boat owners are encouraged to have rodent bait stations or traps on their boats to help minimise the risk. Local boat clubs have been informed of the islands’ pest-free status and are asked to encourage their members to adopt the necessary precautions to keep them pest-free. All volunteers and commercial boat operators that visit the two islands to work on the restoration project have been provided with a bait station and rodent traps for their boats. Permanent signs at key landing sites on the islands inform the public of their pest-free status and provide a reminder of the checks that individuals should undertake before setting foot ashore.

RESTORING POMONA AND RONA ISLANDS

No rats have been seen or trapped on either island since the second aerial poison operation in August 2007. Eradicating pests on both Pomona and Rona Islands simultaneously has proven to be a cost effective approach to the islands’ restoration and having two island sanctuaries close together acts as an insurance policy for species native to Fiordland. In the unlikely event that one of the islands suffered a re-invasion of pests, the flora and fauna on the other is still safe and can be used to re-populate the other island if needed.

Five minute bird counts on both Pomona and Rona Islands show that the numbers of birds have increased significantly as a result of the eradication of pests from both islands. Baseline bird counts were undertaken prior to the pest eradication programme (Porter and MacTavish, 2006). Pomona Island has seen an increase of 103% in the number of birds recorded and Rona Island an increase of 50% following the eradication (Fig. 5). The smaller increase in the number of birds recorded on Rona Island since pests were eradicated could be a consequence of the fact that this island had no rats or possums prior to the eradication, so may have been less affected than Pomona.

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The Pomona Island Charitable Trust has now shifted its attention away from pest eradication to maintaining the islands as pest-free sanctuaries and to restoring Pomona and Rona back to their former glory. A restoration plan has been prepared (Shaw and Whitehead 2008) and, in February 2009, the first of many planned species translocations took place with the transfer of South Island robins (*Petroica australis*) to the two islands. Translocations planned for the future include mohua (*Mohoua aerocephala*), saddleback (*Philesturnus carunculatus*) and kiwi (*Apteryx australis*).

**ADDENDUM**

In March and May 2010 single mice were trapped on Pomona Island. In addition to the 92 mouse traps, a network of 84 tracking tunnels was placed on the island. In June 2010 six mice were trapped and since August 2010 a further 78 mice have been trapped in locations across the whole island. Mouse tracks have been found in 80% of the tracking tunnels. With the assistance of the IEAG, DNA testing of the island mice versus a sample of mainland mice will be undertaken.

In March 2010 a single mouse was trapped on Rona Island. In addition to the 60 mouse traps, 16 tracking tunnels were placed on the island. No mice have been trapped and no evidence of mice has been found in the tracking tunnels.

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Thanks to the Department of Conservation for the technical support provided throughout the eradication programmes and also for trusting us to get on and do the job properly.

The Trust is also extremely grateful to the many volunteers who have put in over 4700 hours to eradicate pests from Pomona and Rona Islands over the last three years.

**REFERENCES**


