SCIENCE & RESEARCH INTERNAL REPORT NO.150

OFFSHORE ISLANDS CO-OPERATIVE CONSERVATION PROJECT WITH ICI CROP CARE DIVISION: PHASE THREE (CUVIER ISLAND)

by

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Published by
Head Office,
Department of Conservation,
P O Box 10-420,
Wellington
New Zealand

ISSN 0114-2798
ISBN 01178-01721-9

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Keywords: Talon 20 P, brodifacoum, eradicate, Pacific rats, *Rattus exulans,* tuatara, *Sphenodon punctatus,* helicopter, spreader, mouse

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ABSTRACT

On 7 September 1993 2.5 of Talon 20 P (brodifacoum) donated by ICI Crop Care Division was spread by helicopter to eradicate Pacific rats or kiore (*Rattus exulans*) from 170 ha Cuvier Island. The island was intensively checked for rats immediately following and at 6, 24 and 36 weeks after the campaign, but despite over 3500 trap-nights of effort, no sign of rats was found. No dead birds were found after the campaign. Total cost of the operation (excluding helicopter positioning and use of GPS) to ICI (commercial value of product) and the Department of Conservation was $30,765. Significant savings were achieved by use of a bait spreader rather than a monsoon bucket. However, because of technical difficulties, the trial use of Global Positioning System was not possible. The reported appearance of a mouse (*Mus musculus*) on Cuvier Island after the campaign was apparently mistaken, but demonstrates the need to establish pest prevention measures with the Maritime Safety Authority to ensure that servicing operations do not compromise the rodent free status of islands with lighthouses and beacons.

1. INTRODUCTION

A sponsorship agreement signed in November 1990 between ICI Crop Care Division and the Department of Conservation (DOC) proposed a three-phase campaign against introduced rats in the Mercury Islands. The proposal aimed to develop cost-effective rodent eradication methods through the staged development of aerial drop techniques of Talon products (brodifacoum).

If successful, the programme would remove introduced mammals from three islands where they were a threat to native vegetation and endemic animals, especially tuatara (*Sphenodon punctatus*). Relict populations of tuatara showing consistently failed recruitment were present on each of the islands (Cree and Butler 1993). The first phase of the programme was against rabbits (*Oryctolagus cuniculus*) and kiore or Pacific rats (*Rattus exulans*) on 100 ha Stanley Island (Towns *et al.* 1993) and the second phase was against kiore on 225 ha Red Mercury Island (Towns *et al.* 1994). These first phases, although out of sequence from the original proposal (see Towns *et al.* 1994) had dual aims. The first aim was to test the quantities of toxin required for aerial applications against rats (and rabbits). The second aim was to monitor resident bird species that could be vulnerable to toxic baits.

Despite alterations to the sequence of eradications, the goal of the sponsorship agreement remained unchanged: to develop a rapid aerial application method of spreading Talon 20 P (licensed for aerial sowing) that required little need for Talon 50 WB (licensed only for ground laying) other than in bait stations for follow-up work. Unlike previous operations the third phase was therefore envisaged as "based on Talon 20 P with little need to use 50 WB" (Towns 1990).

Emphasis in the final phase (Cuvier Island) was, therefore, to test the maximum efficiency of aerial applications of Talon 20 P. All bird species that were vulnerable to the air drops of toxin on Cuvier Island were monitored during previous operations on Stanley or Red Mercury Islands (Towns *et al.* 1993, 1994).

On Stanley and Red Mercury Islands baits were spread by monsoon bucket beneath a helicopter. The intention had been to test a bait spreader for the Red Mercury operation, but problems with bait consistency forced the use of a monsoon bucket there also (Towns *et al.* 1994). Both operations successfully eradicated the target pest species, but they suffered actual or potential problems with uneven spread of baits dropped from the air. These problems were overcome by some hand laying of Talon 50 WB either concurrent with, or soon after, the air drops of Talon 20 P. Because ground-based operations with Talon 50 WB were employed in addition to the air drop of Talon 20 P, the relative effectiveness of Talon 20 P from the air versus Talon 50 WB on the ground could not be determined.

In light of these experiences, the Cuvier Island campaign aimed to focus on bait quality and accuracy of spread of Talon 20 P (Towns *et al*. 1994). The Cuvier campaign therefore had the following objectives:

1. Undertake a campaign against kiore using aerial application of Talon 20 P as the only method of eradication.

2. Restrict hand laying of Talon 50 WB in bait stations for follow-up and monitoring.

3. Test the use of a bait spreader using Talon 20 P.

4. Trial the use of Global Positioning System (GPS) to plot the flight path during bait deposition.

2. STUDY AREA

Cuvier Island is one of the few offshore islands where information about the flora and fauna pre dates major habitat modification after European occupation. The island was purchased from Maori in the 1880s and a lighthouse erected in a 26 ha lighthouse reserve at the eastern end of the island in 1888-1889 (Wright 1981) (Fig. 1). The lighthouse was serviced by successive keepers and their families who farmed the lighthouse reserve for almost 100 years until the light was automated and the families withdrawn in 1981. In 1956 the remainder of the island was purchased by the Crown and in 1957 was declared a reserve for preservation of flora and fauna (Merton 1970).

When Cuvier Island was first visited and named by Dumont D'Urville in 1827, the island was occupied by Maori and kiore were the only introduced mammals present (Merton 1972, Wright 1981). By 1957 wandering stock (cattle, *Bos taurus*, and sheep, *Ovis aries*), introduced in 1889, had damaged the forest vegetation, and cats (*Felis catus*) and goats (*Capra hircus*) were feral. As a result of browsing, the forest vegetation was reduced to an open woodland (mostly of pohutukawa, *Metrosideros excelsa*) that lacked an understorey. Some previously reported plants were extinct on the island, and scmb on coastal faces was reduced to eroding grassland. Predation, largely by cats, had eliminated previously recorded North Island saddleback (Philesturnus carunculatus), tit (Petroica macrocephala), tui (Prosthemadera novaeseelandiae) and red-crownedparakeet (Cyanoramphus novaezelandiae), burrowing seabirds were reduced to two species breeding on the island (sooty shearwater, *Puffinus griseus* and grey-faced petrel, *Pterodroma macroptera gouldi*), and tuatara were reduced to seven known individuals (Merton 1970, Bellingham *et al.* 1981, McCallum and Harker 1981).

Eradication of goats was completed in 1961, a new boundary fence for the lighthouse settlement was completed in 1963, excess stock were destroyed, feral cats were removed by 1964 and domestic cats banned from the island from 1970 (Merton 1970).

In 1968 saddleback were returned to Cuvier Island (Merton 1970) and red-crowned parakeet were reintroduced in 1974 (Atkinson 1988, Cree and Butler 1993). Stitchbirds (*Notiomystis cincta*) were introduced to Cuvier Island in 1982 (Angehr 1985), but after breeding successfully soon after release, this population appears to be declining to extinction (Atkinson 1988).

Despite removal of the cats, tuatara showed no signs of successfully breeding on Cuvier Island (McCallum and Harker 1981, Cree and Butler 1993). Even if the tuatara successfully produced eggs, their low density, and the continued presence of kiore, has almost certainly contributed to their recruitment failure. The Cuvier Island population was therefore identified as requiring removal of rats if the resident tuatara are to survive (Cree and Butler 1993).

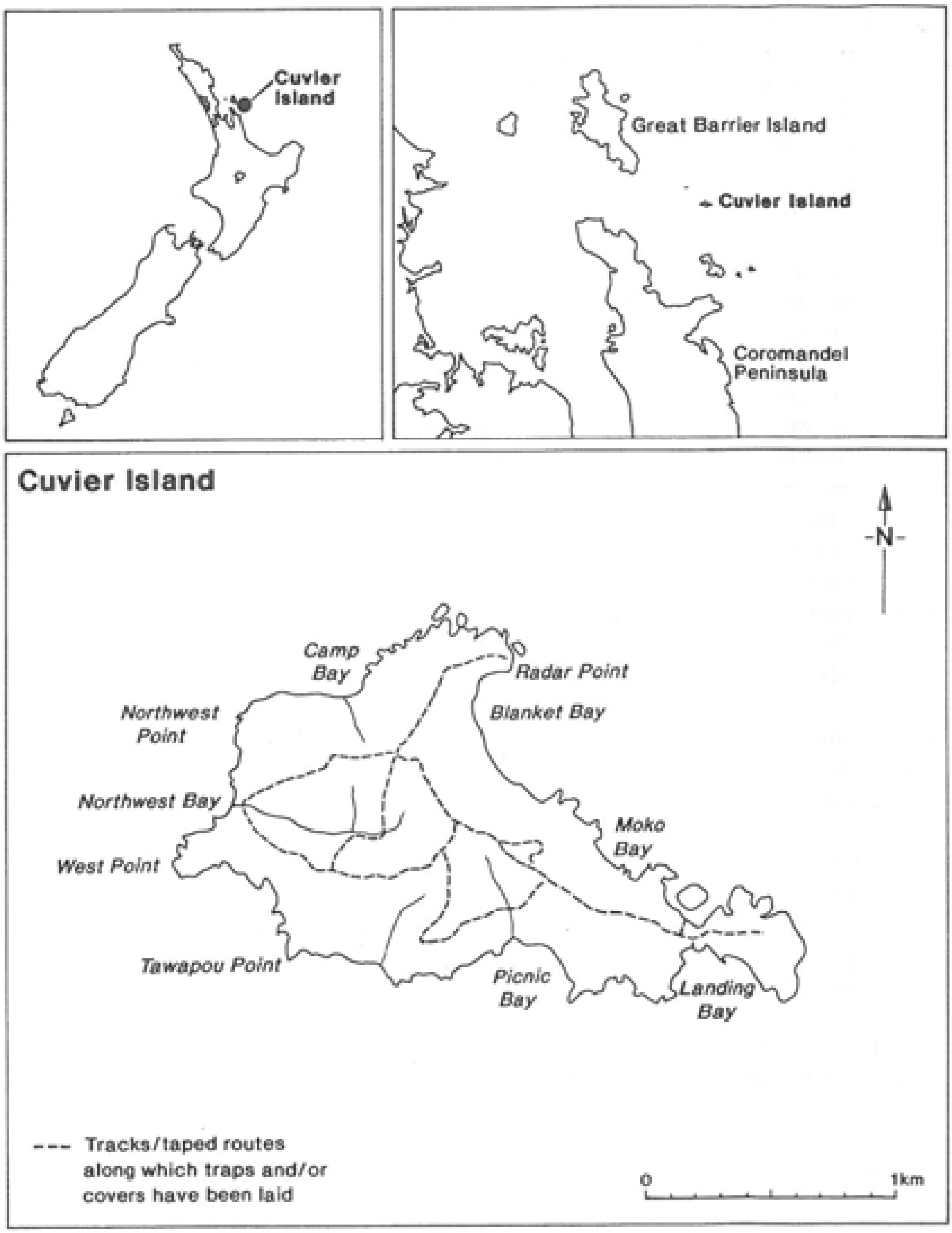

Figure 1 Position of Cuvier Island in relation to northern New Zealand.

3. METHODS

3.1 Preparatory work

In an attempt to induce breeding of the Cuvier Island population of tuatara all animals that could be located (six) were removed in August 1990 and February 1991 and taken into captivity at Auckland Zoo.

3.2 Licensing and consultation

As part of the sponsorship agreement ICI Crop Care Division undertook to assist with paperwork that would enable the Talon products to be used in accordance with label recommendations. Talon 20 P is licensed for aerial use by DOC on non-stocked islands and its use against rodents is covered by an Experimental Use Permit issued by the Pesticides Board. To ensure agreement with the Resource Management Act, the Waikato Regional Council Consents Officer was consulted over all operations in the Mercury Islands Ecological District (including Cuvier Island). Similarly, the Hauraki Maori Trust Board was consulted over all kiore eradications identified by Thomson *et al.* (1992) for the Ecological District.

3.3 Development of baits

Composition of the baits used is described by Towns *et al.* (1993). Briefly, Talon 20 P is a cereal-based (pollard) bait with a brodifacoum content of 20 ppm, whereas Talon 50 WB has cereal grains in a wax matrix and contains brodifacoum at 50 ppm.

The Cuvier Island programme differed from the Stanley and Red Mercury operations in the following ways:

1. The spread of bait would decrease from 17 kg/ha on Stanley (against rats and rabbits) to 15 kg/ha as on Red Mercury (rats only).

2. The baits would be deposited using a bait spreader (to provide more even spread than by monsoon bucket), which should decrease flying time (therefore cost) because of the wide swaths that would be obtained.

3. Talon 50 WB would be held in reserve and not used at all if the spread of Talon 20 P was judged to be adequate (see Fig 2).

4. Non-toxic baits used to calibrate the spreader would be produced from the same batch as the toxic baits to ensure that they were of comparable size and mass.

5. Helicopter flight paths would be checked using GPS.

To ensure that there was no confusion over sequence of tests of non-toxic baits, air drop of toxic baits, and ground-based follow-up, a decision pathway was developed (Fig. 2).

3.4 Bait spread by helicopter

The air drop of 2.5 tonnes Talon 20 P was conducted on 7 September 1993 to coincide with a forecast of up to four days of fine weather, at a time when potential non-target effects are minimal and kiore numbers are low (Towns *et al.* 1994). Baits were spread using a spreader (Hele-Tranz Ltd) beneath a Squirrel helicopter (further details of techniques will be provided by IM elsewhere).

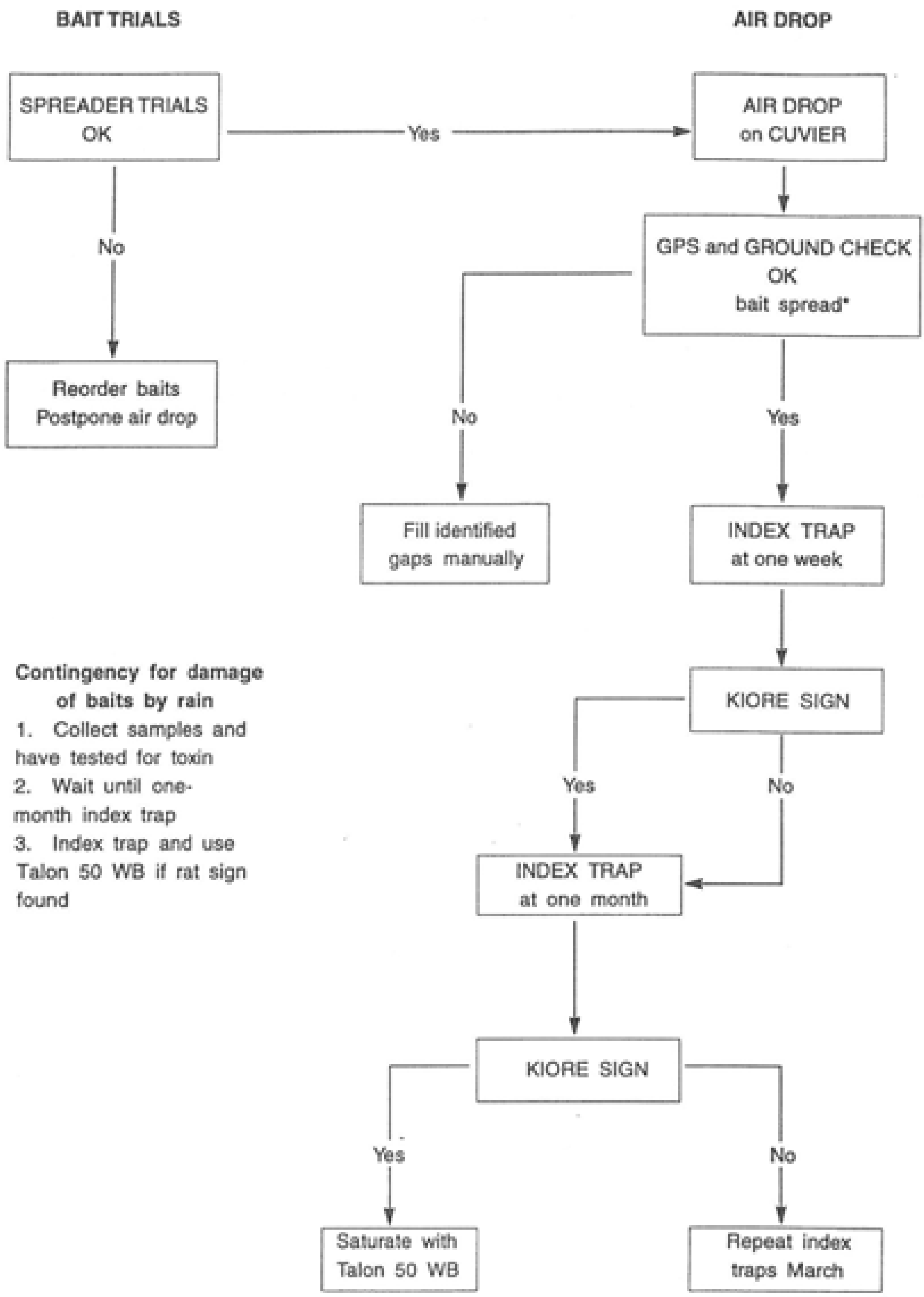

Figure 2 Decision pathway for kiore eradication on Cuvier Island.
* Criterion for poor bait spread: Gap dimensions more than 50 × 100 m.

Bait spread was set to average about 15 kg/ha on flat land and was based on the most recent published estimates of the area of the island (170 ha) (Atkinson and Taylor 1992). Effectiveness of the spreader was checked on the island immediately after the air drop.

Because of a malfunction, the GPS system could not be used.

3.5 Non-target species

The only non-target species of concern on Cuvier Island were saddlebacks and parakeets. However, previous experience on Stanley and Red Mercury Island indicated that neither of these species was likely to be significantly affected by the operations, especially in the dense understory on Cuvier Island. Consequently, no population monitoring was carried out during the air drop, but searches for dead birds were conducted following the operation.

3.6 Assessment and follow-up

Staff were stationed on Cuvier Island for six days after the air drop, and returned at six weeks, six months and nine months after the air drop to intensively search for rat sign.

Snap traps were set under metal covers for five nights after the air drop and again six weeks after the campaign. After each trapping session the traps were replaced with an array of passive indicators (chocolate, soap and candles) and plastic sachets of Talon 50 WB. Less than 12 kg of Talon 50 WB was used.

4. RESULTS

4.1 Spread of baits

A sample of non-toxic baits from the same batch used to produce the toxic baits was tested on the ground and in the air at the base (Albany). Swath width of the spreader using Talon pellets was measured as 120 m. Excluding positioning time for the helicopter (transfer of equipment, fuel and bait spreader to Cuvier), the actual air drop on Cuvier Island required 1.4 hours of flying time. Checks of the encounter frequency of baits on Cuvier Island after the air drop failed to reveal any follow-up spreading of bait by hand was required. Baits were not affected by moisture; there was no rain on the island in the five days staff were present. However, when the island was checked six weeks after the air drop no Talon 20 P pellets could be found, presumably as a result of rain in the intervening period.

The unavailability of the GPS system did not detrimentally affect this operation because of the relatively small size and somewhat elongated shape of Cuvier Island.

4.2 Sign of rats

Dead and dying rats were seen for up to five days after the application of baits. Snap traps set for five nights after the air drop for a total of 803 trap nights failed to catch any kiore. Further trapping sessions six weeks, six months and nine months after the air drop (3500 trap nights) failed to reveal the presence of any kiore. There has been no interference of baits or passive indicators that can be attributed to kiore.

4.3 Non target species

No dead birds were found after the air drop or during subsequent visits to the island.

5. DISCUSSION

Spectacular regeneration of coastal broadleaf forest since stock and goats were removed has produced a dense understorey beneath the original pohutakawa canopy on Cuvier Island (Merton 1970), but the area retired from farming in 1981 has retained a cover of rank grasses interspersed with scattered pohutukawa trees (some planted as cover for native species). Kiore densities in rank grass can be higher than in forest because of the readily available (although seasonal) seed sources (Craig 1986). Densities of kiore were not assessed immediately before the present campaign and have not been estimated separately under forest and in grassland on Cuvier Island. However, relative trap success for kiore on Cuvier Island in forest before all goats had been removed, and while cats were still present, was 4.21100 trap nights in winter (June) 1960 compared with 17.4/100 trap nights in summer (January) 1977 (when cats and goats were absent) (Moller and Craig 1986).

Any differences in density of kiore between areas in forest and rank grass disappear during late winter and spring when rat densities in both habitats decline to the annual minimum (Moller and Craig 1986). There was therefore no need to vary the average density of baits (15 kg/ha) over both habitats in September on Cuvier Island. A separate campaign in September 1993 against kiore on Tiritiri Matangi Island, with more extensive areas in rank grass than on Cuvier, appears to have been successful with a bait density of only 10 kg/ha (C.R. Veitch, pers comm.).

The eradication of kiore from Cuvier Island using only Talon 20 P appears to have been successful, although confirmation of this must await completion of quarantine and monitoring in September 1995. Completion of the Cuvier Island phase has also completed the sponsorship agreement with ICI Crop Care. All goals identified in the agreement were met, each phase has been successful and the project was completed by September 1993, one year ahead of schedule. The project was also completed at below the estimated cost to ICI. In addition to the Talon 20 P provided at no charge, up to 1.5 of Talon 50 WB was allocated to the eradications; a commercial value for Talon 50 WB of $ 12,300. However, because of effective use of Talon 20 P only about 0.25 tonne of Talon 50 WB was required at a saving to ICI of $10,250.

The gross cost of the operation was estimated at $30,765 ($181/ha) based on the entire task done at full commercial rates (Table 1). This was half the cost of eradicating and rabbits from Stanley Island which is 40% smaller than Cuvier Island (Towns *et al.* 1993). A more direct comparison can be made with a campaign against Norway rats (*Rattus norvegicus*) in a ground based operation with Talon 50 WB on 170 ha Island. By excluding track cutting costs (also excluded from the estimates for Cuvier Island), the Island campaign was 1993). In ground operations labour is the largest single cost and Towns 1991). During the present three-islands programme the proportional cost of labour increased from 43% of the total cost on Stanley Island to 52% on Cuvier Island as efficiencies were made with spread of baits. Labour costs could be reduced by decreases in time spent on location during the spread of baits and emphasis on monitoring one month after the operation.

The removal of kiore from Cuvier Island is particularly significant because it completes removal of an array of introduced mammals from the island. Cuvier Island is a model of what can be achieved on an island that in European times has undergone drastic habitat modification followed by spectacular regeneration (Merton 1972). Cuvier is also the first island where species removed by introduced predators (saddlebacks and parakeets eliminated by cats) were restored to the same location (Atkinson 1988). In the absence of kiore, there are now prospects for restoring tuatara as the last surviving resident species threatened by introduced mammals. It will also now be possible to return to the island previously recorded rare plants eliminated by browsers, such as milktree (*Streblus banksii*), and rare lizards such as the large Duvaucel's gecko (*Hoplodactylus duvaucelii*) apparently eliminated by cats.

Removal of kiore from Stanley, Cuvier and Red Mercury Islands in combination has particular significance for the northern subspecies of tuatara (Sphenodon p. punctatus) (Cree and Butler 1993). At present, the Cook Strait subspecies of tuatara is more numerous than the northern subspecies, with at least 30 000 individuals on 150 ha Stephens Island forming the single largest population anywhere (Newman 1987, Cree and Butler 1993). Two of the three islands included in the present three phases of eradication (Red Mercury and Cuvier) are larger than Stephens. Potentially, these islands might eventually support population densities equivalent to those found on Stephens Island. For this to be possible, recovery of other parts of the island system will be necessary. Foremost amongst these are burrowing seabirds, lizards and invertebrates. Stanley and Red Mercury Islands already support diverse populations of seabirds that in the absence of kiore could greatly increase in numbers. However, the burrowing seabird fauna of Cuvier Island appears to have been reduced through predation by cats. Only two species of burrowing seabirds breed on the island even though wild cats were eliminated 30 years ago (Merton 1970). Further restoration of Cuvier Island may require the development of techniques to encourage the return of seabirds no longer breeding there.

Table 1 Costs of Cuvier Island rat eradication (September 1993–March 1994).

Item (donor organisation)	Cost ($)	
Product (ICI Crop Care)		
Talon 20 P: 2.5 tonnes	7375	
Talon 50 WB	monitoring only	
Subtotal		7375
Logistic support (DOC)		
Helicopter hire	1820	
Boat charters	1650	
Consumables and food	2000	
Field salaries	13920	
Report writing	4000	
Subtotal		23390
Total gross cost of campaign		30765

The islands covered by this programme are now amongst the largest islands free of introduced mammals in northern New Zealand. They are therefore likely to play a pivotal role in conservation of many species and biotic communities. The greatest threat to their potential value for conservation is the reinvasion of a pest species, the most likely of which are rodents, especially Norway rats, ship rats (*Rattus rattus*) and mice (*Mus musculus*). Norway rats and ship rats can be spread either through illegal landings (small boats with rats on board) or through ship wrecks. Mice, however, are more likely to be transported in stores or personal belongings carried by visitors. As long as rodents are attracted to baits, invasions of these species can be prevented by exercising care when transporting material to the islands and though use of permanent bait stations near potential landing sites. The agreement with ICI provides for bait stations on those three islands covered by their sponsorship to be stocked with ICI products at no cost to DOC. The only real threat to these islands is therefore lack of commitment or ability of DOC staff to reach the islands to ensure that baits are maintained in good condition.

The need for well-maintained bait stations was amply demonstrated on Korapuki Island, where a ship rat was caught in index traps after completion of a campaign against kiore (McFadden and Towns 1991). Further emphasis came with reports in early 1994 that a mouse may have reached Cuvier Island. Although this report seems to have been mistaken, it has highlighted the need for DOC to develop protocols with the Maritime Safety Authority to ensure that mice are not accidentally transported to rodent-free islands where there are lighthouses and beacons.

5.1 Recommendations

1. GPS used to plot helicopter flight paths has potential to provide accurate assessment of bait coverage on large islands (>200 ha) where some areas may be difficult of access. This potential use of this technique should be investigated further.

2. Baits in permanent bait stations are the first line of defence against reinvasions of rodents. However the baits can degrade rapidly if the stations are subject to damp conditions. Longevity of baits could be improved by suspending the baits off the ground surface. ICI Crop Care should be approached to determine whether more moisture-resistant baits are available (such as the tropical formulation of Talon) or can be developed for use in permanent bait stations.

3. Cuvier Island is one of several islands where the Maritime Safety Authority (MSA) has right of access to service lighthouses and beacons. Some of these islands are naturally free of rodents and others, such as Cuvier, have recently had rodents removed. Agreed protocols should be developed with MSA to minimise risks of rodents (and other pests such as insects or garden snails) being carried ashore either with stores or on aircraft servicing the islands.

6. ACKNOWLEDGEMENTS

We are particularly grateful to ICI Crop Care Division for providing Talon 20 P and Talon 50 WB at no charge for the campaign; to Theo Stephens and John Greenwood for co-ordinating conservancy planning; to Alan Saunders for his enthusiastic support of the programme; to the Department of Conservation National Priority Pool co-ordinators who provided developmental funds for use of the helicopter and to Graeme Taylor for helpful comments on a draft of the report.

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