**SCIENCE & RESEARCH INTERNAL REPORT NO.142**

# OFFSHORE ISLANDS CO-OPERATIVE CONSERVATION PROJECT WITH ICI CROP CARE DIVISION: PHASE TWO (RED MERCURY 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 0-478-01578-X



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**Keywords**: Talon 20 P, brodifacoum, eradicate, Pacific rats, *Rattus exulans,* little spotted kiwi, *Apteryx owenii,* saddleback, *Philesturnus carunculatus,* blackbird, *Turdus merula,* tuatara, *Sphenodon punctatus*

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# ICI CROP CARE DIVISION: PHASE TWO (RED MERCURY ISLAND)

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## ABSTRACT

On 21 September 1992 3.5 tonnes of Talon 20 P (brodifacoum) donated by ICI Crop Care Division was spread by helicopter to eradicate Pacific rats or kiore (*Rattus exulans*) from 225 ha Red Mercury Island, Mercury Islands group. Red Mercury was intensively checked for rats at one, six, ten, 22 and 36 weeks after the campaign, but despite 6180 trap-nights effort, no sign of rats was found. Susceptibility of little spotted kiwi (*Apteryx owenii*) to brodifacoum in pollard baits was tested in captivity and then by placing radio transmitters on nine birds (three males and six females) on Red Mercury Island. The kiwi with transmitters were continuously checked on Red Mercury Island for six weeks after the air drop. No birds in captivity took non-toxic baits and none in the wild showed any detrimental effects from the campaign against rats. No traces of brodifacoum were detected in water and soil samples obtained one month after the air drop. One saddleback (*Philesturnus carunculatus*) and five blackbirds (*Turdus merula*) were found dead after the campaign. The saddleback and two blackbirds tested contained lethal levels of brodifacoum. Live blackbirds captured eight months after the air drop still contained traces of brodifacoum in the liver. However, both blackbirds and saddlebacks were more abundant after the rats were removed than while they were present. Total cost of the operation (excluding kiwi monitoring) to ICI (commercial value of product) other sponsors (San Diego Zoo and Fay Richwhite) and the Department of Conservation was $41 728. Once Red Mercury Island is confirmed free of rodents it will be the largest island from which rats have been removed and will also be the largest island free of predatory mammals inhabited by tuatara (*Sphenodon punctatus*).

## 1. INTRODUCTION

In November 1990 a sponsorship agreement was signed between ICI Crop Care Division and the Department of Conservation (DOC) for a three-phase campaign against introduced rats in the Mercury Islands. The agreement was based on the staged development of aerial drop techniques using Talon products (brodifacoum) against

Pacific rats or kiore (*Rattus exulans*) that were threatening three populations of tuatara (*Sphenodon punctatus*). A range of other threatened species, such as tusked weta, rare lizards, plants and seabirds would also benefit from the campaigns (Towns 1990).The sponsorship agreement was designed to run from 1991-1994 and to follow three phases: Stanley Island (100 ha) as phase 1, Cuvier Island (170 ha) as phase 2, and Red Mercury Island (225 ha) as phase 3.

Phase 1 of the agreement was completed on target in 1991 (Towns *et al.* 1993) following which ICI endorsed its commitment to continue the sponsorship. Success of the Stanley Island campaign against kiore and rabbits was such that DOC Protected Species Policy Division expressed interest in using similar techniques for very large islands such as Kapiti (1970 ha) with two species of rats. However, aerial spread of rodenticide on large islands is complicated by the wide range of potential non-target species that might be affected by the operation. On Stanley Island Talon 20 P and Talon 50 WB had little detrimental affect on native insectivorous birds such as saddlebacks (*Philesturnus carunculatus*) that fed on or near the ground surface (Butler and 1991). Little spotted kiwi were released onto Red Mercury Island in 1983, and the population is still expanding. To enable DOC to assess the risks posed by the aerial spread of Talon 20 P beyond the data gained from Stanley Island, ICI Crop Care agreed to deviate from the original agreement by reversing phases 2 and 3. Red Mercury Island was, therefore, timed to precede Cuvier Island. This report describes the campaign on Red Mercury Island.

As originally envisaged, the Red Mercury operation was to follow development of techniques that "… could be based on Talon 20 P with little need to use 50 WB." (Towns 1990: 6). The agreement with ICI Crop Care was to use 3.5 tonnes Talon 20 P and to hold 0.5 tonne Talon 50 WB in reserve in case it was required as a follow-up. In view of the additional data required, the Red Mercury campaign was extended to cover the following objectives:

1. Further develop the aerial broadcast methods for use against kiore and other rats on islands.

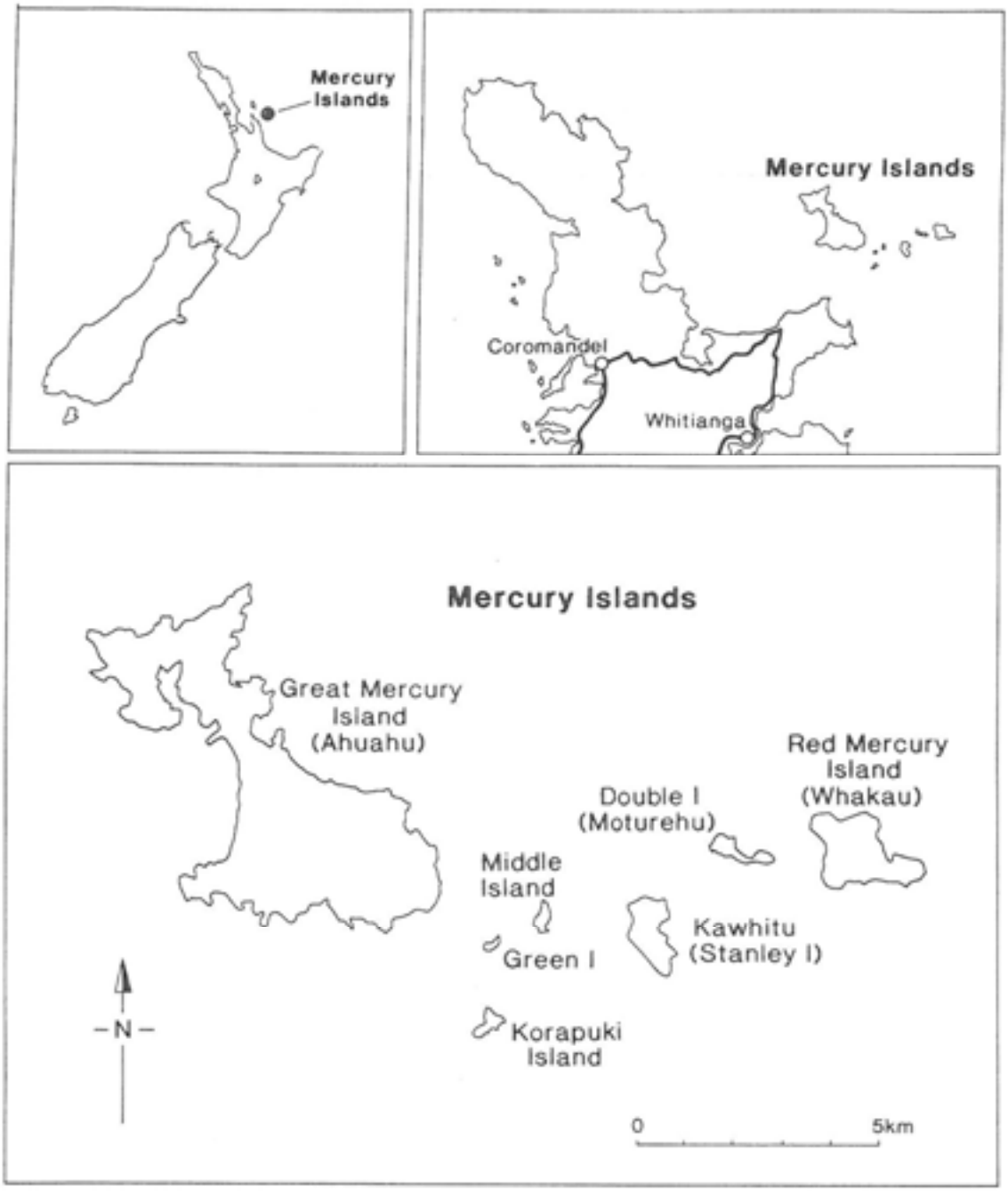
2. Determine whether the aerial broadcast of Talon 20 P has detrimental effects on little spotted kiwi.

As requested by ICI in the sponsorship agreement, DOC scientific staff were involved in the development and implementation of the experimental baiting procedures as well as in monitoring the effects of the operation on the kiwis.

## 2. STUDY AREA

Detailed descriptions of the Mercury Islands and their conservation values is given in Towns *et al*. (1990, 1993). Red Mercury Island (225 ha) is the largest of the Mercury Islands in the Hauraki Gulf Maritime Park (Fig. 1). Except for Pacific rats, there are no introduced mammals on the island. Vegetation on the island is distinctive because of the predominance of second-growth species following periodic fires until about 1934 (Lynch *et al*. 1972). Rare vertebrates of particular interest on Red Mercury are a relict population of tuatara, a large population of the rare Pycroft's petrel (*Pterodroma pycrofti*), saddlebacks, introduced in 1966 (Fogarty and Douglas 1972), and little spotted kiwi, introduced in 1983 (Robertson *et al*. 1993).

Red Mercury Island was proposed as a possible site for re-establishing rare Whitaker's skinks (*Cyclodina whitakeri*) and robust skinks (*C. alani*) resident on rat free islands elsewhere in the group (Towns 1992). However, this measure would depend on removal of Pacific rats from Red Mercury. Removal of rats was also regarded as a key to recovery of the tiny resident Red Mercury tuatara population (possibly less than 20 individuals) (Cree and Butler 1993, Cree *et al*. in press).




Reproduced from Towns *et al.* 1993.

**Figure 1 Position of the Mercury Islands in relation to New Zealand (*upper left*), and the Coromandel Peninsula (*upper right*). Islands of the Mercury Group are shown (*lower*).**

## 3. METHODS

### 3.1 Preparatory work

In anticipation of this campaign, but also to mitigate against recruitment failure, most (12) of the resident population of tuatara was removed from Red Mercury Island in October 1990 and held in captivity at Auckland Zoo. Two females produced fertile clutches of eggs that were incubated at Victoria University of Wellington and the 14 hatchlings were transferred to Otorohanga Kiwi House in July 1992 (Field 1992).

### 3.2 Consultation and licensing

Before the campaign, agreement for the removal of kiore was sought from all Maori groups associated with the Tainui waka that have an interest in the Mercury Islands. *As* part of this process, the young tuatara destined to be returned to Red Mercury were placed into the care of the Maniopoto Maori by the Hauraki Kaumatua Council at Otorohanga Kiwi House (Field 1992). The tuatara are to be returned to the Hauraki tribes by the Maniopoto Maori once Red Mercury Island is confirmed free of kiore and the tuatara are large enough for release.

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, resource consent for the operation was sought from the Waikato Regional Council.

### 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 Red Mercury Island programme was envisaged originally as differing from the Stanley operation in three ways:

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

A spreader (Hele-tranz Limited) was bench-tested using two grades of non-toxic pellets. These trials were used to test the friability of the pellets. Short aerial trials were also undertaken to test swath width and the effects of impact on the baits using both spreader and monsoon buckets. For reasons discussed in **4. Results**, below, a monsoon bucket was used for the air drop.

### 3.4 Bait spread by helicopter

The air drop of 3.5 tonnes Talon 20 P was conducted on 21 September 1992 to coincide with a forecast of up to four days of fine weather. The operation was also timed for early spring when periodic heavy falls of rain rapidly leach toxin from the pellets, and when rats are few in number and foraging widely for food (Towns *et al*. 1993). The bait was dropped from a monsoon bucket with a base plate modified to regulate flow and was spread using a Squirrel helicopter.

Following the air drop approximately 140 kg of Talon 50 WB was spread by hand.

### 3.5 Non-target species

Palatability of pollard baits to little spotted kiwi was tested in advance by exposing individuals in captivity at Otorohanga Kiwi House to non-toxic pollard pellets at higher density than would be encountered on Red Mercury Island (Robertson *et al*. 1993).

Before the air drop, nine little spotted kiwi (three males and six females) were captured by hand and by using a trained dog. Each kiwi was fitted with a radio-transmitter with an estimated life of 18 months. The birds were checked for six weeks after the air drop, following which most of the birds were recaptured and the transmitters removed (Robertson *et al*. 1993).

Saddlebacks are present on Red Mercury Island, hut no detailed monitoring of population was conducted in view of the data already obtained from Stanley Island (Towns et al. 1993). However, five-minute bird counts were conducted both before and after the air drop of baits (Robertson *et al*. 1993).

Samples of water and soil were obtained on 31 October 1992 (six weeks after the air drop) and six live blackbirds (*Turdus merula*) were obtained from Red Mercury in June 1993 (eight months after the air drop). Samples were tested for brodifacoum residues by Landcare Research.

Samples of invertebrates were obtained before, during, and after the operation as part of a separately funded project.

### 3.6 Follow-up

Staff were stationed on Red Mercury Island to check the little spotted kiwi for 5.5 weeks from the day of the air drop. In addition, five intensive searches for rat sign were undertaken 30 September-6 October 1992 (one week after the drop), 28 October-3 November (six weeks), 25 November-1 December (10 weeks), 25 February-2 March 1993 (22 weeks) and 1-8 June (36 weeks).

At conclusion of the late October-early November visit to Red Mercury Island 40 kg of Talon 50 WB was placed in sealed plastic bags in dry bait stations as a precaution against any remaining rats. Passive indicators (soap and wax candles) were also disturbed. The bait stations and indicators were spread over 500 stations in place for up to seven months. During each visit there were searches for signs of non-target losses.

## 4. RESULTS

### 4.1 Spread of baits

ICI Crop Care provided a small sample of trial non-toxic pellets that clearly were capable of passing through a spreader. However subsequent bulk supplies received from ICI for testing in the spreader were too friable to pass intact through the spinner mechanism. Problems of variable consistency were communicated to ICI, who undertook to improve the baits once the toxic shipment was manufactured.

Because of the problems with bait consistency a modified monsoon bucket was used to ensure that there was minimal breakage of baits. The monsoon bucket was test flown and calibrated for ideal flow rate of Talon 20 P using the shipment of friable non toxic pellets.

Unfortunately there was insufficient time between delivery of the toxic baits and the timing of the operation to test the newer formulation. Therefore, the first attempts at using the monsoon bucket loaded with baits on Red Mercury failed because many pellets were 10-20% longer than those previously supplied and formed bridges that blocked the base plate of the bucket. The base plate was modified on site and an adequate flow of baits was eventually achieved. The modifications, however, created delays and increased the time for which the helicopter was required.

Once problems were corrected, the baits were spread as required and those parts of the island poorly covered when the bucket was malfunctioning were covered for a second time.

Following the air drop on 21 September 1992 the weather remained fine for about five days.

Bait spread from the monsoon bucket appeared adequate, but was not as even as could have been achieved using a spreader. As a precaution 100 kg of Talon 50 WB was therefore laid by hand in areas where the density of Talon 20 P pellets appeared low.

Heavy rain between 23 and 25 October 1992 over northeastern New Zealand appeared to successfully break down almost all unused baits on Red Mercury Island. When the island was checked for baits on 28 October only one extremely weathered Talon 20 P pellet could be found.

### 4.2 Sign of rats

One kiore was caught in a snap trap one night after the air drop. Snap traps were set for a total of 6180 trap-nights during four visits to June 1993. No rats were caught and there was no sign of their presence at the 500 bait and indicator stations (most recently checked in December 1993).

### 4.3 Survival of little spotted kiwi

Trials at the Otorohanga Kiwi House indicated that little spotted kiwi were not attracted to the pollard baits, despite the baits being presented at 20 times the density that they would be during an air drop.

The nine kiwi with transmitters were checked for almost six weeks after the air drop. of the birds survived through the campaign. All transmitters were removed by March 1993. None of the birds showed any ill effects from the baits or from the transmitters. Kiwi call frequencies recorded before and after the air drop of Talon 20 P confirmed that there was no significant decline in the kiwi population on the island (Robertson *et al*. 1993).

### 4.4 Non-target species

No traces of brodifacoum could be detected in the soil or water samples analysed after the air drop (D. Morgan pers. comm. 1993). Red Mercury Island was intensively checked for sick or dead birds after the air drop. The deaths of five blackbirds and one saddleback could be attributed to the baits. Liver samples revealed a brodifacoum content of 0.6 µg/g for the saddleback and 0.6-1.1 µg/g for the two blackbirds analysed. The six blackbirds collected eight months after the air drop all showed traces of brodifacoum that ranged from 0.004 µg/g (the minimum level detectable) to 0.2 µg/g (D. Morgan pers comm. 1993). The invertebrate samples have yet to be analysed.

Five minute bird counts indicated that all ground-feeding forest birds (parakeet, blackbird and saddleback) considered to be at risk from the campaign against Pacific rats had increased significantly by March 1993, including saddlebacks and blackbirds (Robertson *et al.* 1993). A pair of kaka (*Nestor meridionalis*) (possibly susceptible to baits) were observed on the island both before and after the air drop, and (*Ninox novaezealandiae*) (vulnerable to secondary poisoning via rats), were numerous in February/March 1993 (Robertson *et al*. 1993). The latter species, being nocturnal, was rarely included in the five-minute counts, although a fledged juvenile was seen 22 weeks after the air drop.

Although most tuatara were removed from the island, two previously unrecorded tuatara, apparently in good health, were seen during summer visits after the air drop.

## 5. DISCUSSION

The absence of any sign of rats on Red Mercury Island during all checks after the air drop confirms the effectiveness of the aerial application method.

Unlike Stanley Island, Red Mercury Island had no rabbits, and therefore supported a dense vegetation understorey. Potentially, this vegetation might have supported more kiore per unit area than Stanley because of the range of alternative foods (vegetation and invertebrates) available. If this was the case, it was not reflected in any short term difficulties with the campaign, which appears to have succeeded despite a reduction in the application rate from 17 kg/ha on Stanley Island to 15 kg/ha on Red Mercury.

The understorey vegetation may have provided an advantage on Red Mercury Island by helping to conceal the Talon 20 P pellets. The number of non-target birds found on Red Mercury was half the number on Stanley, where baits were more visible on the open forest floor. For example on Stanley Island the air drop was estimated to cause between 1-5% mortality of saddlebacks (Towns *et al*. 1993), whereas on Red Mercury one dead saddleback was found (<1%). Although no traces of brodifacoum could be found in water or soil samples, detectable (sublethal) levels of brodifacoum were present in the livers of blackbirds obtained eight months after the campaign. The accumulation rate of brodifacoum in insects feeding on baits is very low (Wright and Eason 1991) and all baits on Red Mercury disintegrated in heavy rain a month after the air drop. Brodifacoum in live blackbirds must therefore have been ingested from baits on the ground soon after the air drop and persisted in the liver for at least seven months. These results confirm observations by Laas *et al.* (1985) that brodifacoum may persist for considerable periods at sublethal levels in the liver of vertebrates. However, despite the evidence of some ground-feeding birds such as saddlebacks and blackbirds feeding on the rat baits, both species were significantly more abundant after the air drop than before it, so any losses were apparently offset by increased productivity in the absence of kiore (Robertson *et al*. 1993). The lack of any measured adverse effects of the air drop on kiwi, either during the operation or subsequently (some males were incubating eggs), indicates the potential safe use of the method on islands such as Kapiti with this species. However, ground-feeding species such as robins (*Petroica australis)* and weka (*Gallirallus australis*), absent from Mercury Islands but present on Kapiti, will need to be tested independently for their susceptibility to rat baits.

The gross cost of the operation on Stanley Island was estimated at $36 603 based on the entire task being done at full commercial rates (this excludes cost savings through sponsorship and use of volunteers) (Towns et al. 1993). Using a similar method of accounting, the Red Mercury campaign had a gross cost of approximately $41 700 ($190/ha) (costs exclude kiwi monitoring and brodifacoum assays) (Table 1). This is well below the cost per hectare of the Stanley Island campaign but could have been reduced further with some technical improvements. For example, had problems not been encountered on site with the size of the baits up to $2 800 could have been saved in cost of the helicopter and Talon 50 WB used for backup. Highest potential savings would have been with the use of a spreader and Global Positioning System (GPS) to plot the flight paths during bait deposition. Despite the cost of leasing GPS, reduced flying

time and improved efficiencies with bait spread could have reduced costs by over $4000, to an overall cost around $170 ha. Further development of this method of eradicating rats should therefore focus on robustness of the baits and on accuracy of spread.

There are very tangible benefits that could accrue from the Red Mercury campaign. Red Mercury will be the largest island from which rats have been eradicated, will be the largest mammal-free island occupied by tuatara, and will be the largest rat-free continental shelf island in northern New Zealand. Possibly the real value of the exercise is best assessed in conjunction with the campaign on Stanley Island. The availability of Stanley Island alone as a rat-free habitat for tuatara could eventually increase their numbers by at least 200% (Towns *et al.* 1993); combined with Red Mercury the increase could be over 600%. The two islands (along with neighbouring 33 ha Double Island) could provide the rare Whitaker's skink (Cyclodina robust skink (*C. alani*) with two orders of magnitude increase in area occupied (Towns 1992). Such increases could lead to reassessment of the conservation status of all species involved.

### 5.1 Recommendations

1. In the absence of any sign of kiore, monitoring for rat sign could now be reduced to biannual or even annual visits to check and replenish bait stations and passive indicators.

2. Further surveys for birds using counting sites established by Robertson *et* (1993) should be undertaken (possibly annually in September or March) so that

**Table 1 Costs of Red Mercury Island rat eradication (September 1992–March 1993)**

| Item (donor organisation) | Cost ($) | |
|---|---|---|
| Product (ICI Crop Care) | | |
| Talon 50 WB: 0.14 tonne | 1148 | |
| Talon 20 P : 3.5 tonne | 10325 | |
| Subtotal | | 11473 |
| Logistics (San Diego, DoC) | | |
| Helicopter hire | 6835 | |
| Boat charters | 4000 | |
| Subtotal | | 10835 |
| Other costs (DoC) | | |
| Consumables | 1000 | |
| Field salaries | 13920 | |
| Report writing | 4500 | |
| Subtotal | | 19420 |
| **Total gross cost of campaign** | | **41728** |

the longer term responses of resident species to removal of kiore can be assessed.

3. Tuatara hatched in captivity should be large enough to be returned to Red Mercury Island at 4-5 years of age (1995). While tuatara numbers are still low, other species that could be affected by them as prey should be considered for release on Red Mercury. High priority species are Whitaker's and robust skinks (Towns 1992) and tusked weta.

## 6. ACKNOWLEDGMENTS

We are especially grateful to ICI Crop Care Division for providing Talon 20 P and Talon 50 WB at no charge for the campaign. We also wish to thank the Zoological Society of San Diego for their contribution towards helicopter hire; Fay Richwhite who transported baits from Whitianga to Red Mercury; the Bank of New Zealand for their support of the monitoring of little spotted kiwi as part of the Kiwi Recovery Programme; Roche Products (NZ) Ltd and Hillcrest Veterinary Clinic who donated materials needed to administer brodifacoum antidote (should it be required); the Waikato District Council for the loan of the monsoon bucket; Theo Stephens and John Greenwood for co-ordinating conservancy planning; Dr Charles Daugherty (Victoria University of Wellington) for overseeing incubation of Red Mercury Island tuatara; Otorohanga Zoo for access to kiwi; Hauraki Maori Trust Board and the Ngati Karamu, Ngati Whanaunga and Ngati Hako for their participation in the project; and Folkert Nieuwland for help with kiwi monitoring.

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