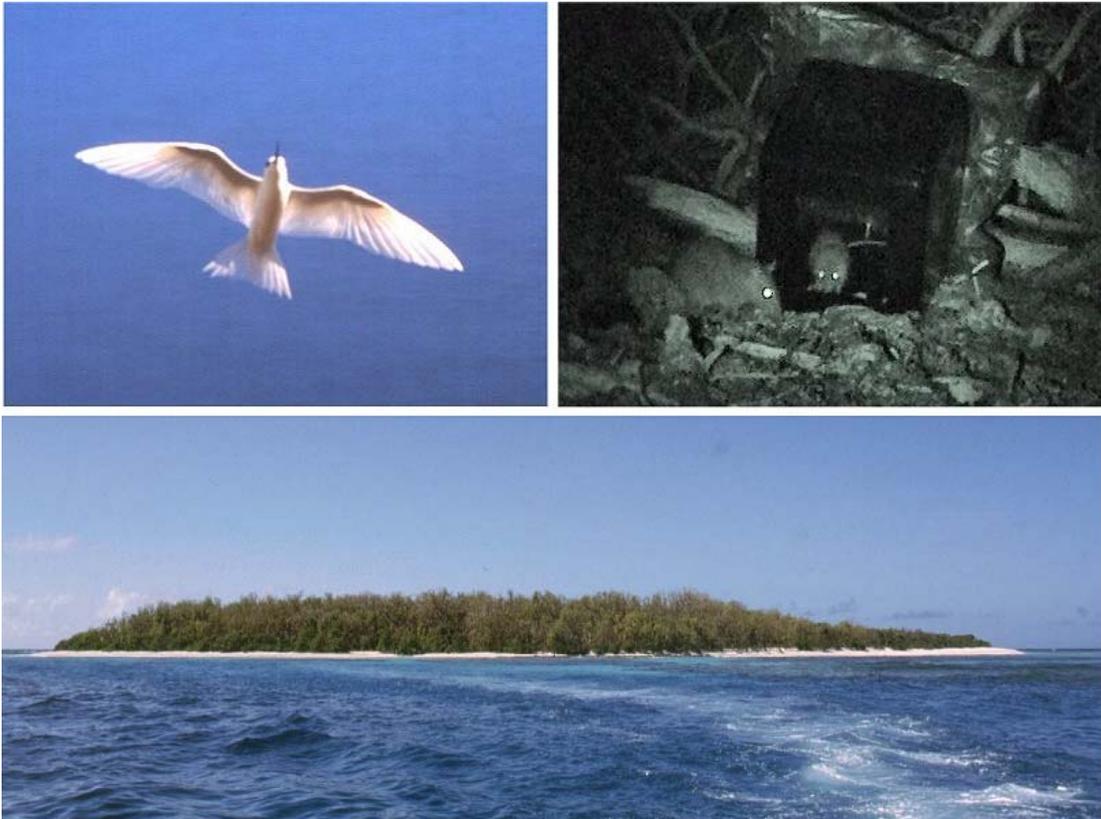


# Eradicating rats from Maninita Island, Vava'u, Kingdom of Tonga

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**Prepared for:**

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## 1 Executive Summary

In June/July 2002 an eradication programme to remove Pacific rats from Maninita Island in the Vava'u group of the Kingdom of Tonga was initiated. The techniques used were similar to those used in successful rat eradications in New Zealand, in that *Pestoff 20R pellets* and a network of bait stations were used.

Conditions on the island were not what was expected, the forest having been adversely affected by cyclone Waka and subsequent defoliation by caterpillars, resulting in an open forest canopy. Rats were found to be present on the island in high numbers and were breeding.

At this stage it appears that the operation was successful, as no rats were caught in monitoring trapping after 20 days of operations, although follow-up monitoring needs to be carried out in late 2002 to confirm this. There appears to have been no negative impact on non-target species.

## 2 Introduction

Maninita Island is one of a group of three small islands in the Vava'u group proposed as a protected area by the Tongan Department of Environment. An exploratory visit to the island in May/June 2001 by personnel from the Tongan Department of Environment, Ministry of Lands, Survey and Natural Resources, The New Zealand Department of Conservation and Tourism Resource Consultants concluded that there was a good possibility of establishing a rat-free protected area based on the three islands, of Maninita, Taula and Lualoli.

A baseline survey of the flora and fauna of Maninita was carried out in November 2001 by Dr Dick Watling of Environment Consultants Fiji.

This project was managed by Tourism Resource Consultants and supported by the New Zealand Ministry of Foreign Affairs and Trade through the NZ Official Development Assistance Agency for International Development programme. The NZ Department of Conservation contributed staff expertise to the project.

The eradication operation was carried out between June 20 and July 26th 2002.

## 3 Objectives

The objectives of the project were to;

- To undertake a rat eradication operation on Maninita Island, Vava'u, Tonga.
- To completely eradicate all rats on the island.
- To transfer skills to Tongan counterparts during the operation.

## 4 Personnel

The Maninita rat eradication team was:

- Fine'eva Taumalolo, 'Utui, Vava'u
- Nonga Toumohuni, 'Utui, Vava'u
- Dr Dick Watling, Environment Consultants, Suva, Fiji
- Dave Houston, Department of Conservation, Oamaru, New Zealand



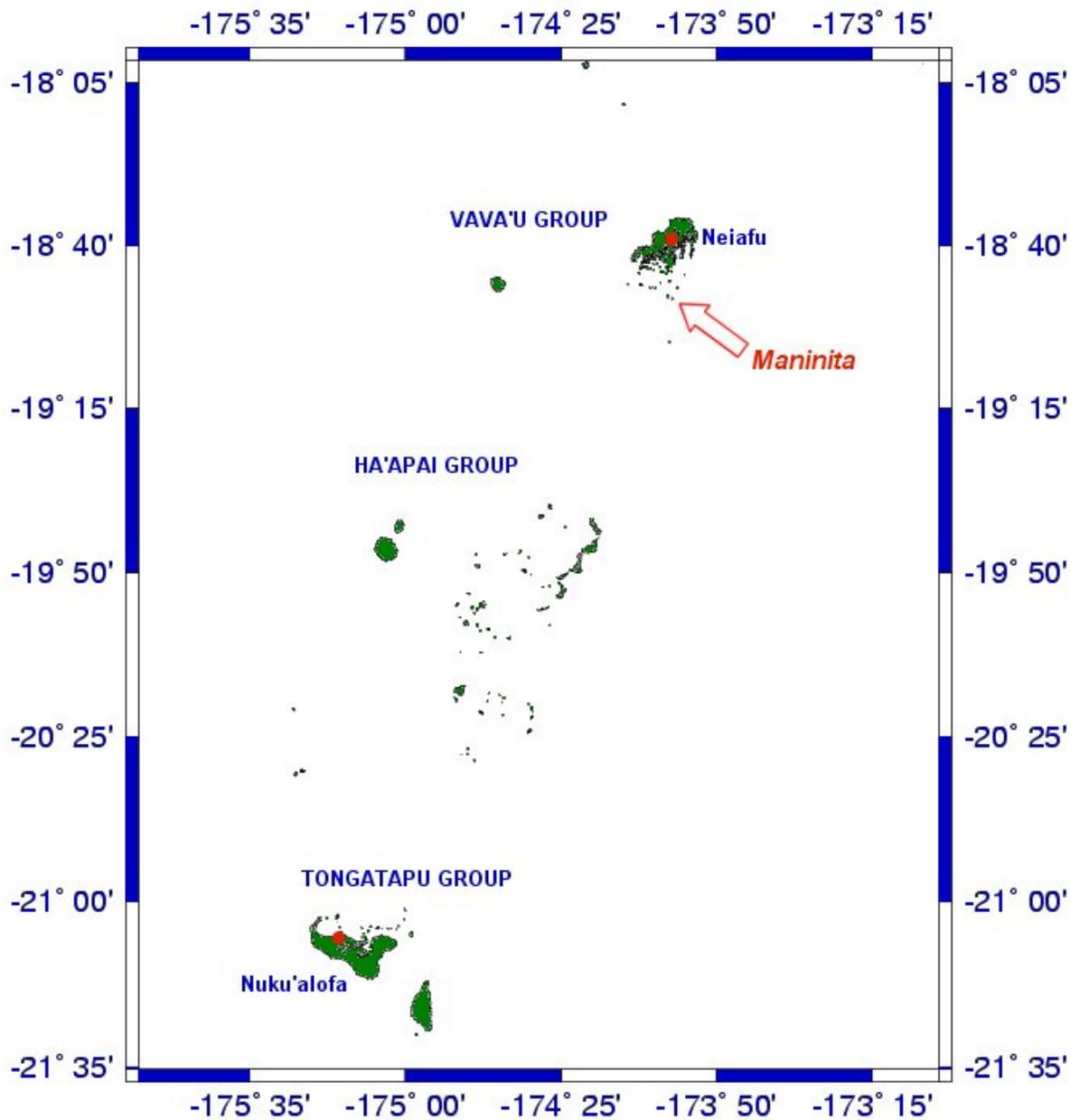


Figure 1. Location Map



## 5 Schedule of activities

- June 20 Arrival, test stations, index traps laid
- June 21 Laid out stations and baited majority, index trapping
- June 22 Checked stations, baited remainder, index trapping
- June 23 Baits checked and replenished, index trapping
- June 24 Baits checked and replenished
- June 25 Baits checked and replenished
- June 26 Baits checked and replaced, visited Taula and Lualoli to lay index traps
- June 27 Baits checked and replenished, visited Taula and Lualoli to retrieve index traps
- June 28 Baits checked and replenished
- June 29 Baits checked and replaced, index traps laid
- June 30 Baits checked and replenished, index trapping
- July 1 Baits checked and replaced, index trapping, departed island
- July 5 Day visit - Baits checked and replaced
- July 9 Returned to island, baits checked and replaced, index traps laid
- July 10 Baits checked and replenished, index trapping
- July 11 Baits checked and replenished, index trapping
- July 12 Baits checked and replaced, index trapping, departed island
- July 19 Day visit - Baits checked and replaced
- July 26 Day visit - Cleaned up and installed permanent bait stations

## 6 Conditions on Maninita

Cyclone Waka (Jan 2002) caused considerable damage to the forest canopy on Maninita. Many of the spreading canopy branches of the dominant *Pisonia* were broken off and lay on the forest floor and a small number of trees, including two coconuts, were felled. New growth on both the trees and the fallen branches had been ravaged by caterpillars of several as yet unidentified species of moth, resulting in a largely defoliated forest and an open forest canopy.



Figure 2. Caterpillars and moths. 1 & 5 - *Hippotion velox* (Hawkmoth), 3 & 4 *Agrius convolvuli* (sweet potato hawkmoth).

It was noted that hermit crab numbers were considerably fewer in number than in previous visits (Dick Watling, pers comm.) and that crab numbers on nearby Mounu Island had also dropped dramatically after cyclone Waka and were returning slowly (Lyn Bowe, pers comm.).





Figure 3. Defoliated forest



Figure 4. Ngongo at nest

Numerous dead seabirds were found on the forest floor on our arrival. These were predominately ngongo (*Anous minutus*) with a small number of tala (*Gygis alba*). During our stay a small number of weak ngongo were seen on the forest floor, the majority of which subsequently died. These birds were fledglings in poor condition, which presumably died of starvation. On June 26th a count of dead birds was carried out along two 2m wide transects following the 300 and 500 bait station lines. A total of 41 ngongo and 1 tala were found, equivalent to 31.4 and 0.96 per hectare respectively.

## 7 Methods and techniques

### 7.1 Rat monitoring

Rat traps were run over three nights (21-23 June) at the start of the operation to determine the baseline rat population and the status of the breeding. The traps were also run for 2 nights (30 June – 1st July) nine days into the operation and again after 20 days of baiting (10-12 July) to monitor the decline in rat numbers.



Figure 7. Checking rat traps



Figure 8. Rat in trap

#### 7.1.1 Methods

A simple rodent index line (Cunningham and Moors 1983) was employed using 25 pairs of traps approximately 20m apart. To minimise interference by hermit crabs and other non-target species, the traps were placed off the ground on logs and the root buttresses of trees and baited with roast coconut. Covers were not used.



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Monitoring results are expressed in catches per 100 corrected trap nights (CTN) calculated using the formula [Index = Captures ÷ (Trap nights – ½ (captures + sprung traps)) x 100]. The maximum value thus possible is 200.

#### 7.1.2 Baseline monitoring

- Pacific rats (*Rattus exulans*) were the only species caught
- 65.93 rats per 100 corrected trap nights (CTN) were caught, this is higher than the 54.1/100 CTN observed by Roberts (Anon 2001) in June 2001
- The sex ratio was even – 29 females and 29 males were caught (2 were of indeterminate sex due to having been chewed)
- 8 rats were sub-adults
- 26/28 adult females were obviously pregnant or lactating
- Mean weight of adult males = 83.4 (range 51-107), females = 77.1g (range 57-122)
- Hermit crab captures at 12/100 CTN were low in comparison to the 31.9/100 CTN observed in June 2001.

#### 7.1.3 Operational monitoring

- No rats were caught in the two trapping sessions 10 and 20 days after poison baits were deployed.
- Hermit crab captures were 7.41 and 15.45 per 100 CTN. Other non-target species captured were 1 caterpillar and 1 moko.

#### 7.1.4 Taula and Lualoli

Taula and Lualoli were visited on June 26th and 27th and index trapping run overnight, 25 pairs of traps on Taula and 5 pairs on Lualoli

##### Taula

- Pacific rats (*Rattus exulans*) were the only species caught.
- 14 females (11 adults, 3 juveniles) and 17 males (10 adults/4 juveniles) were caught.
- A number of rats were seen in daylight and this is reflected in the catch of 110.7 rats per 100 CTN.
- 10 out of 11 female rats were obviously pregnant or lactating.
- Only 1 crab was caught (0.79/100 CTN)
- 1 juvenile veka (*Gallirallus philippensis*) was caught and killed in a trap. Another juvenile veka was found dead next to a trap containing a rat, but as the bird was not retrieved the cause of death could not be ascertained.
- Forest conditions were similar to those on Maninita, although there are a greater number of caterpillar resistant trees (coconut, etc) on Taula.

##### Lualoli

- No rats were caught and none were seen, although this should not be taken as confirmation that there are no rats on the island

## 7.2 Bait stations

### 7.2.1 Design

4l black “liver pack” containers (product code 6666PHBK - Stowers Containment Solutions Ltd, Petone, Wellington) were used. These were mounted on their sides and a hole was cut in the base of the container approx 150x150mm to allow rats access. Experimentation showed that rims of >50mm were more effective at keeping hermit crabs out than those with lower rims. It was planned to use the black plastic lids fitting the containers (product code 6667PHBK), however these failed to arrive so plastic bags secured by rubber bands were substituted.





Figure 9. Constructing bait stations



Figure 10. Bait station on tree buttress

The bait station design and placement was tested on the night of June 20th. Two stations were placed close together on a tree root buttress and baited with 10 pellets. The stations were then monitored after dark for 1 hour using a Sony HandyCam digital video camera in infrared mode during which no rats visited. Roasted coconut was added to the stations and the stations monitored for a further one and a half hours. This time a single rat visited the stations, ate the piece of coconut between the stations and left.

The monitoring was repeated on June 23rd on a ground-based bait station, which was observed to have had baits taken from it on the night before. On this occasion up to three rats at a time were observed feeding at the bait station, often removing baits from the station and consuming them outside.



Figure 11. Rat eating coconut between test stations



Figure 12. Rats feeding at bait station 301

### 7.2.2 Placement

The bait stations were placed in a 25m grid. The grid was established by determining the long axis of the island using a Garmin® GPSII+ and then using a compass following the bearings thus gained to mark lines 25m apart through the bush. A cotton thread hip-chain was used to both mark the lines and to measure the distance between stations.





Figure 13. Laying out bait station lines



Figure 14. Hermit crab in bait station

The stations were affixed to trees as close as possible to the line, usually on root buttresses to reduce hermit crab interference and at a sufficient slope to minimise entry of rain into the stations. Where suitable trees were not present, stations were placed on ground and attached to sticks.

The location of the bait stations was recorded using the GPS to  $\pm 6\text{m}$ . These were later downloaded to a computer and mapped using GPS Trackmaker®. 6 additional bait stations were placed in the area between the 400 and 500 lines where the lines were found to be up to 40m apart.

### 7.2.3 Permanent stations

33 permanent bait stations (Philproof pest control products, Hamilton, New Zealand) were placed around the island at the end of the operation in a 50m grid to serve as a defence against rats reinvading the island. The stations were fitted with spiked floors and baited with 30g Pestoff rodent blocks containing 0.002% Brodifacoum (Animal Control Products Ltd, Wanganui, New Zealand).

The durability of the baits in this tropical environment is unknown, so half the baits were wrapped in a single layer of aluminium foil to keep them dry and to stop insects and crabs from eating them. The bait stations will be inspected periodically (~monthly) and the baits replaced if necessary.



Figure 14. Philproof station

## 7.3 Baits and lures

### 7.3.1 Poison baits

The baits used were 2g *Pestoff rodent bait 20R pellets* containing 0.002% Brodifacoum and supplied by Animal Control Products Ltd, Wanganui, New Zealand. Initially 25 baits were placed in each station per day, but in stations where the less than 10 baits remained, this was raised to 50 baits. Any wet or soiled baits were replaced daily and all baits were completely replaced every three days during the first two weeks of the operation and every four days thereafter.





Figure 15. Bait station locations

### 7.3.2 Coconut lure

The use of roast coconut as an additional lure was recommended by Roberts. The efficacy of coconut in improving bait take was examined by placing three pieces of roast coconut in all odd-



numbered stations for two consecutive nights and monitoring bait take. The results of the experiment are shown in table 1 below.

**Table 1. Coconut experiment results**

	No coconut	Coconut
% stations bait taken from	75%	82%
% poison baits taken	40%	42%
% coconut baits taken	-	63%

Although more stations with coconut had baits taken from them than those without, there was little difference in the total amount of baits taken and 27% of coconut lures in bait stations were not eaten. Because there appeared to be no major advantage in using coconut lure, its use was curtailed after this experiment.

## 8 Results

### 8.1 Bait take

The number of bait pellets available and the number consumed are shown in table 2 below. The percentage taken per day is baits taken ÷ baits available ÷ nights available. The actual amount of bait taken by rats is unknown, as hermit crabs were not able to be totally excluded from the stations and consumed a portion of the bait.

**Table 2. Baits taken**

Date	Baits taken	Baits available	% taken/day
22/6/02	522	2026	25.77%
23/6/02	1249	2300	54.30%
24/6/02	1863	2565	72.63%
25/6/02	1526	4127	36.98%
26/6/02	1132	4600	24.61%
27/6/02	532	4651	11.44%
28/6/02	380	4650	8.17%
29/6/02	381	2325	16.39%
30/6/02	196	2325	8.43%
1/7/02	192	2325	8.26%
5/7/02	913	2325	9.82%
9/7/02	898	2325	9.66%
10/7/02	282	2325	12.13%
11/7/02	289	2325	12.43%
12/7/02	182	2325	7.83%
19/7/02	1296	2575	7.19%
26/7/02	1318	2650	6.22%

Dead rats were first seen on June 26th. These were on the forest floor a few metres from bait stations. Further dead rats were seen the next day, one having died in a bait station, and a dying juvenile rat was observed in the camp that night. A small number of newly dead rats were seen over the next couple of days, but the smell of dead rats was widespread.

Rat droppings, often containing green dye from the baits, were found in the bait stations during the first few days of the operation. No rat droppings were found in stations after June 29th.



## 8.2 Non-target impact

During the bait station checks and other work about the island, we kept a watch for birds or reptiles that might have been adversely affected by the poison baits. Crabs and other invertebrates are not susceptible to brodifacoum.

Veka and sikota (*Todiramphus chloris*) were both regularly observed around the island and were apparently unaffected by the operation. At least 2 pairs of veka were present on the island, both with chicks.



Figure 17. Sikota (Kingfisher)

Skinks were seen rarely throughout the operation and seemed to be present in low numbers. Geckos were seen more often, but no reptile was found dead.

## 9 Issues

- Some materials and equipment were lost in transit resulting in materials having to be re-ordered from New Zealand, requiring some patience and ingenuity to overcome the immediate problems.
- The lack of proper bait station lids was a problem. The plastic bags and rubber bands worked to some extent, but the rubber bands perished and the plastic bags gave way under pressure – particularly in heavy rain.
- The lips of the bait stations could have been higher. A height of around 75mm would probably have been more effective in keeping out the larger hermit crabs.
- Nearly all the female rats were pregnant. Normally, rat eradication programmes are timed for a period of low food availability when it is unlikely they will be breeding. The fact the rats are breeding year-round and apparently have a plentiful food supply will diminish the chances of a successful eradication.
- Cyclone Waka considerably changed the conditions on the island in comparison to the initial and baseline visits to the island in June and November 2001 respectively. It is possible that the recovering vegetation and abundance of caterpillars benefited the rats.
- An eradication operation on Taula and Lualoli will require the use of an inflatable dingy or similar to enable access across the reefs.

## 10 Achievements

- There is a reasonable probability that rats have been eradicated from Maninita.
- The field skills necessary to carry out future eradication operations have been transferred – principally to 'Eva Taumalolo.
- The palatability and acceptance of Pestoff pellets to Tongan rats has been confirmed.
- No negative impact of the operation on non-target species was observed.
- The species and abundance of rats present on Taula and Lualoli has been ascertained.



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## 11 Recommendations

- Maintain the network of permanent bait stations on Maninita.
- Determine the durability of the block baits and adjust the replacement schedule of the baits accordingly.
- Check Maninita for presence of rats in summer 2002 using rat trapping, rodent ink tunnels and any other techniques available. At same time prepare Taula and Lualoli for the laying of poison bait.
- If rats are not detected on Maninita;
  - Proceed with the eradication of rats from Taula and Lualoli using the same techniques as employed on Maninita.
  - Maintain a permanent network of bait stations on Maninita and check/replenish baits on a regular basis.
- If rats are found on Maninita
  - Terminate Taula and Lualoli eradication plans.
  - Determine density and age/sex structure of rat population on Maninita.
  - Remove or stop servicing permanent bait station grid on Maninita.
  - Evaluate effectiveness of poisoning technique and possible alternatives.

## Acknowledgements

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