# RODENT CONTROL MANUAL

## A practical guide for Rodent Control for Communities and technicians working in Samoa

**Prepared by:**

**Samoa Conservation Society and MNRE Division of Environment and Conservation in association with Auckland Zoo**

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# Contents

# 1. Introduction and Purpose of Manual

This manual was written by staff of the Samoa Conservation Society (SCS) and the Ministry of Natural Resources and Environment (MNRE), in particular Piula Hakai, Moeumu Uili and James Atherton. The purpose of the manual is to provide practical guidance to technicians attempting to plan and control rodents (rats and mice) using poison baiting for biodiversity conservation purposes under Samoan forest conditions. The methodology outlined in this manual is the result of efforts to assess the effectiveness of using rodent bait at the Malololelei Recreation Reserve since 2017. Key factors that are of particular importance to the regime used are the presence of non-target species that also find the bait palatable, as well as the rapid spoiling of bait in the moistness of the forest. We hope that this manual will be revised as knowledge of effective and efficient rodent management methods under Samoan conditions improves.

## 1a. General information about Rats and Mice

- There are three invasive species of rat found in Samoa – the Ship or black rat (*Rattus rattus*), the Norway or brown rat (*Rattus norvegicus*) and the Pacific rat (*Rattus exulans*) and just one species of mouse, the house mouse (*Mus musculus)*.
- Rodents are a major pest and are common in many environments including areas where humans live and native habitats. Both rats and mice are good climbers and Black Rats, and Norway Rats are good swimmers, the other species avoid water where possible.
- Rodents can climb vertical walls if the surface is rough enough for them to climb and even to the highest peaks on our islands. They are identified as a significant cause of the declining number of other animals, including native birds.

## 1b. Why do we need to control Rats and Mice?

- Rodents can spoil possessions including damage to homes and any type of buildings through gnawing on woodwork, electrical cables and water pipes, nest-building and defecation
- They can eat and ruin crops and foodstuffs
- They can spread diseases to humans i.e., leptospirosis and scrub typhus both are fatal in many Pacific Islands.
- Rodents cause harm to native ecosystems by predating on bird eggs, skinks and plant seeds and compete with other animals for food. They are a particular threat to our native birds such as the Manumea (*Didunculus strigirostris*), Maomao (*Gmnomyza samoensis*), and others, especially ground nesting birds.

## 1c. Methods Applicable to Control Rats and Mice

The selection of methods that are effective for rat management in a site such at the Malololelei Reserve is based on the location and size of the target site, the status of the native biological diversity, the presence of different rat species and their distribution throughout the reserve and other factors including people and their animals, such as cats and dogs, living near the control area, as well as free-range pigs and chickens. All poison baits have the potential to harm the environment, non-target animals and human health. These risks posed by using a toxin can be minimized, but can never be completely removed. To ensure toxins are used appropriately they must be carefully assessed and only selected where they can be safely used.

An approved methodology adopted for controlling the rat population at Malololelei involves the application of rodenticide baits through elevated and secure bait stations covering the whole project area. The two main activities required for this control program include the use

**Safety Tips:**

- Your safety is important. Please wear gloves when handling baits!
- All bait stations are to be elevated 1m above the ground to avoid being scavenged by non-target species
- Use the key to open and lock the station during the baiting operation
- Ensure stations are locked after every re-baiting activity. This prevents baits from falling out of the station to ensure that no animals on the ground can eat it.

of solid toxic bait blocks secured inside bait stations and the use of monitoring devices to assess the effectiveness of the baiting programme. The Rodenticide *Roban* (made by PelGar International) containing the active ingredient Difenacoum, was chosen for the relatively low secondary poisoning risks to non-target species. However further strategies should be carefully considered in order to reduce accumulation of toxins to the environment. The following principles can be applied at various stages depending on the frequency of bait application where needed and the natural surrounding response to baiting procedures:

- Use the minimum amount of bait necessary
- Recover all mouldy and degraded bait and dispose of in accordance with manufacturer recommendations (usually burial away from potential areas of contamination i.e. waterways) or discard bait at the Tafaigata landfill
- Targeting bait application only for the periods in which rodent suppression is necessary
- Monitoring of non-target species population and for toxin residues
- Consider frequent rotation and use of different types of toxins

# 2. Methodology

## 2a. Bait Station Layout

- The layout was based on stations at 50m spacing along 8 lines, also 50m apart, covering the whole project area (except where it is too steep to put in a station). Refer to map 2b below.
- The 50x50m grid was chosen to ensure all rat species (*R. norvegicus*, *R.rattus and R.exulans*) are exposed to the bait, as *R. exulans* has smaller home ranges than the other two species. In the absence of *R. exulans* the stations would still be 50m apart, but the lines could be 100m apart. (If mice were also to be controlled the grid would need to be much tighter (25m x25m at most, some recommend 15m x 15m for complete control, but this may be excessive).
- Each station is given a name using alphabetical letters and numbering for ID purposes. i.e. line A has 2 stations labeled starting from A1, A2 etc. until the end of the line.
- For monitoring and reporting purposes, all stations must be marked with a unique x,y coordinates location using a GPS.
- Different colored flagging tapes are used to mark monitoring tracks and baiting tracks. Monitoring lines are marked with blue flagging tape and baiting lines are marked with pink flagging tape.
- In each station, we put 4 pellets or blocks of bait which is equivalent to 100% of bait available in the stations. The 4 pellet baits are put inside a sealed zip lock bag just big enough to fit them all, put the zip lock inside the station and use a square mesh wire (as shown in picture below) to cover the space inside the station to avoid rats taking whole baits out of the station. This means, the rat can only eat the bait inside the station but very little chance to take it outside. This further reduce the risks of non-target species eating from the bait. The stations are then regularly checked. The frequency of checks depends primarily on the results of previous checks and how much was taken and the frequency with which checks occur (weekly, fortnightly, monthly, etc.). All degraded baits, e.g., ones that are mouldy, must be collected in a sealed bag and transferred to the landfill at Tafaigata (Upolu) or Vaiaata (Savaii) for proper disposal.

## 2b. Monitoring bird populations and other biota as indicators of project impact

As noted rodents are a major threat to the survival of both land and sea birds as they attack bird's nests and predate on bird eggs. A major indicator of the success of rodent operations is therefore bird populations and distributions, especially of birds most impacted by rodents such as ground nesting birds and other birds particularly sensitive to rat predation, such as Maomao and pigeons. It is therefore recommended that bird monitoring be conducted regularly as a key indicator of project impact. If resources are available, other biota impacted by rodents such as reptiles, land snails and plants, should also be monitored.

## 2c. Project Site Map

Map showing location of bait stations and monitoring line stations, and how a set of monitoring results can be represented

## 2d. Comparison of devices used for control and monitoring during the Pest Management Operation

A range of device options are available for the control and monitoring of rodents and the features of each are shown in table 1 below.

**Table 1. Comparison of options for rodent monitoring and management**

| Device Name | Bait station | Tracking tunnel and ink card | Chew card | Motion-triggered camera | Self-resetting kill trap | Snap Trap |
|---|---|---|---|---|---|---|
| Photo of device |  |  |  |  |  |  |
| Purpose of device | Control device (containing poison bait) | Monitoring device | Monitoring device | Monitoring device | Control device | Monitoring and/or Control device |
| Species controlled/ detected | Rats<br>Mice<br>Snails, ants, lizards (detected not controlled) | Rats<br>Mice<br>Lizards<br>Ants and other invertebrates | Rats<br>Mice<br>Cats | Rats<br>Mice<br>Lizards<br>Birds<br>Pigs and Cats | Rats<br>Mice | Rats<br>Mice |
| Item detected | Teeth marks /bait ingestion / physical presence of non-target species attracted by bait or shelter of the box | Footprints | Teeth marks | Footage of:<br>Species presence<br>Weather<br>Time | Animals killed | Animals killed |

| Device Name | Bait station | Tracking tunnel and ink card | Chew card | Motion-triggered camera | Self-resetting kill trap | Snap Trap |
|---|---|---|---|---|---|---|
| Advantages | - Securely contains and protects poison bait blocks used for control of rodents<br>- Suitable for any weather conditions<br>- Can stay out as long as required (if undamaged) | - Can detect lizards, snails and ants<br>- Does not cause any harm to non-target species, including humans<br>- Tunnels can be left in place in between monitoring rounds<br>- Footprints unusually easy to identify | - Can detect cats<br>- Does not cause any harm to non-target species, including humans<br>- Suitable for rainy seasons and wet areas<br>- Can stay out for 3-7 nights | - Can stay out for 6 months depend on the battery used<br>- Can capture photos and record videos simultaneously | - Records number of animals killed on a counter<br>- Can be left in the field for a month without being checked<br>- No risk to non-target species of secondary poisoning | - Catch, confirm and records carcass<br>- safe for the environment<br>- can reduce the risk of bycatch and interference (cats / pigs) by setting in a wooden safety box |
| Disadvantages | - Station requires adjustments every month to avoid tree growing into the plastic. A solution to this would be to mount on a post and attach to the tree.<br><br>- Bait is attractive to non-target species snails and ants. | - Not suitable for rainy seasons or wet areas or where there are land crabs<br>- tracks can get obscured by snails ingesting the paper-Ink cards can only stay out in the field for one night | - Require skills to interpret marks<br>- Large bite marks like cats can obscure marks of rats/mice<br>- Ants can quickly eat the peanut butter if there is a nest in the area | - Easy to remove by passersby | - potentially harmful to human interacting with it – warning signage required<br>- Expensive and can be stolen easily<br>- If not checked regularly carcasses are likely to be scavenges and so species identification not possible<br>- Not proven effective yet for the Pacific rat | - Potential non-target species captures particularly lizards and some bird species<br>- Metal spring easily gets corroded if left out for long periods |

## 3. Station set-up

- The setup of bait stations requires screws or nails (for plastic triangle labels), screwdriver, hammer and there must be a solid surface for the station to be attached to.
- Remember to elevate the station 1m above the ground

- Open the station cover with its unique key provided. Do not lose the key for you will need it all the time.
- Mount the station to a sturdy post or tree trunk 1m above the ground. Use screws to fix the station in place.
- You can leave the installed stations for about 3 weeks prior to starting the baiting program; to give the rats a good chance of overcoming a fear of new things in their territory (neophobia). However, to reduce costs of making several trips to bait them separately, you can also choose to bait the stations at the same time they are installed.

- Put four blocks of baits in a zip lock bag, attach the bag to the rod and place it inside the station as shown here.
- Add a 4 inch square size mesh wire with a 2 x 2inch size hole in the middle for the rat to crawl in. Make sure there are no spikey edges that can put rats off entering.
- Make notes and close the cover to lock the station. Now the bait station is ready for the rats.

## 4. Monitoring Setup

Prior to the start of the baiting program, it is important to get a baseline index of rodent activity in the control area. Two comparable methodologies were used initially – **tracking tunnels** and **chew cards**. Although the tunnels are a good engagement tool and can also be used to record presence of species such as lizards, it was decided that under the circumstances of this particular environment, chew cards provide the most reliable data set

Disadvantages of the tunnel system are the damage to the ink card by land crabs and snails. Chew cards do not have these constraints. Refer to table 1 for advantages and disadvantages of ink cards versus chew cards.

Whichever monitoring system is used, the devices need to be installed on lines independent of the bait station grid and located randomly following a set compass heading. Each monitoring station needs to be 50m apart and each line should be at least 200m from any point on a neighboring line, clearly marked on the ground and saved in a GPS, as per bait stations. These points remain the same throughout the programme and provide a consistent monitoring method that shows presence/absence of rodents in particular locations through time. No more than 3 lines are needed at a site of around 100ha, ten stations per line and should be spread through as many different habitat types as possible. This monitoring should be carried out quarterly (i.e. every three months) and is useful to show whether there is a problem with the level of control provided by the baiting regime, something which can then be investigated closely.

## 4a. Employment of Detection Devices (Chew Cards and Ink Tunnels)

The following steps show tips on the installation of devices we used.

### i. Chew Card

- Label each card with the appropriate number sequence using a permanent marker. See photo 1.
- Monitoring lines are often given the Z prefix, so as not to get confused with the letters of bait lines at a site. For our case, we used letter C to mark monitoring lines.
- Apply peanut butter to the grooves on both sides of each card alternately. Filling to about halfway across the card.
- Fold it in half, and attach it to a tree trunk about 10cm from the ground using a nail. See photo 2 and 3. Photo 4 shows chewed card.


1

2

3


4

### ii. Ink Tunnel

- Fill out the required information as given on the card. This is important for data collection. See photo 1.
- Open the card and add peanut butter on the black area (ink). You can add a small piece of roasted coconut for attraction purposes. Label the tunnels with white-out for ease of identification. See photo 2.
- Make sure the ink tunnel is securely fastened to the ground using a u-shaped staple on each end. See photos 3 and 4.
- Put the card inside the tunnel and fix each end with a paper clip to ensure the card sits flat and cannot be easily removed.
- Tunnel station should be the same as the chew card station
- Ink card must stay out in the forest for one night then collect it

1

2

3

4

## 5. The Baiting Process and frequency of checks

The bait used in this operation is the Rodenticide Roban (active ingredient - Difenacoum) in addition with the use of roasted coconuts. The strong scent of the roasted coconut entices rats from afar into the station. However, a very insignificant amount of coconut is needed to avoid rats from consuming too much coconut and not eating the baits. It is likely that the initial bait uptake at a new site will be fairly low, as rats are usually wary about trying a new food.

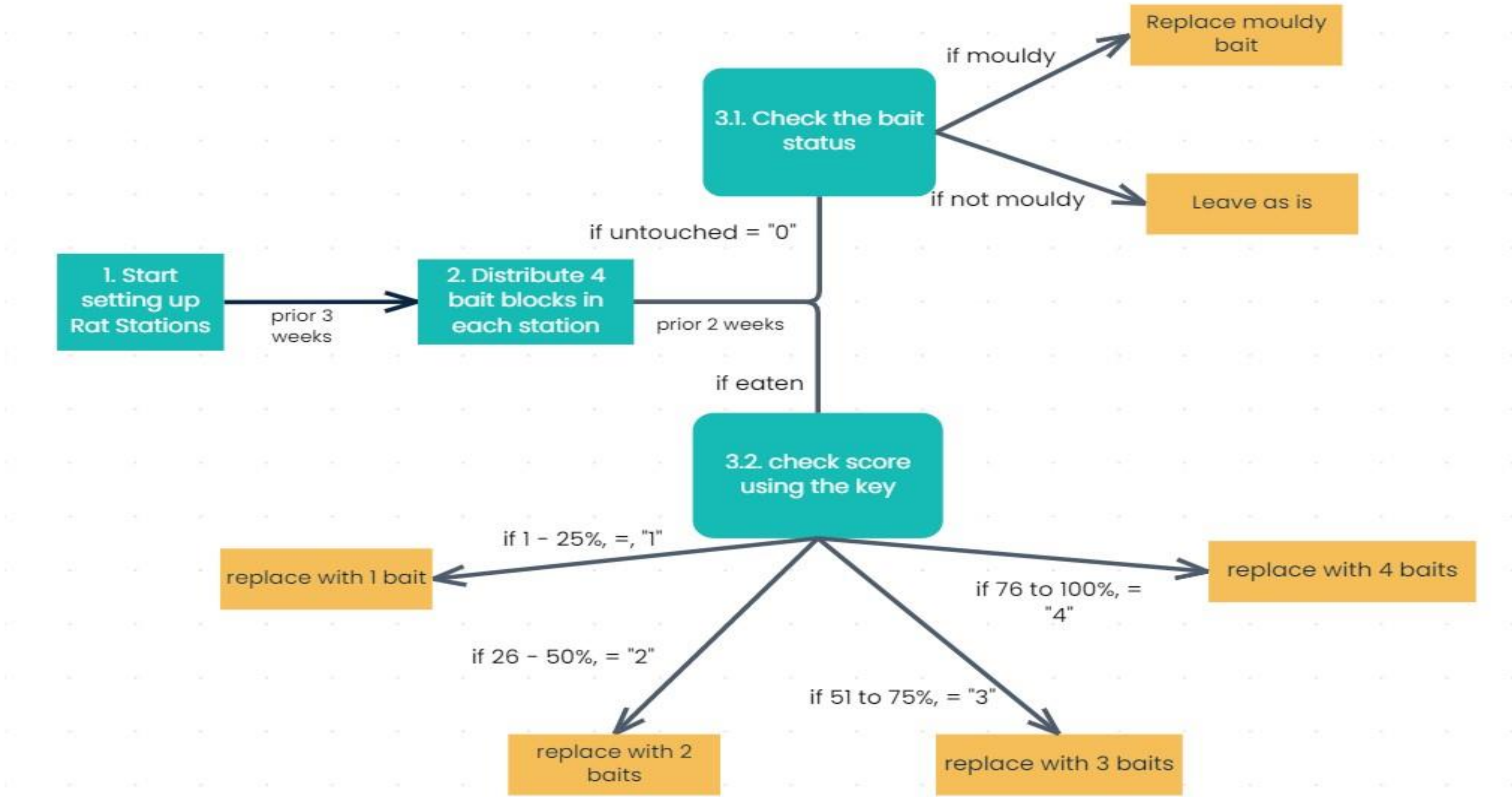
After the initial baiting, stations should then be regularly checked every two weeks for three to six months before assigning another schedule based on the results collected so far. Keep baiting the stations every two weeks until there is a change to the level of bait intake by rats. You can then extend the period of baiting from monthly to every three months once the results show very low bait intake.

Collecting accurate data is important because it informs the next steps in a program and identifies any changes that need to be made in a timely fashion, as well as hotspots within the habitat that the programme is taking place. Once the effects of a baiting programme have been observed, i.e., rat numbers reduced, it is expected that the bulk of the bait-take will be around the edges of the control area, where incursions will constantly be taking place. Once the rat population is removed/decreased in an area, rats from outside will try to obtain territories within the area where there is less competition and resources are plentiful.

## 5a. Method of Treatment

This section highlights the procedure to be followed using several methodologies based on the trials we had.

### Figure 1. Flow chart of baiting operations



## 5b. Bait presentation

The bait blocks need to be contained within the station to prevent access by pigs and chickens, as previously mentioned. In other environments where the rapid molding of bait and presence of giant snails are not concerns, the bait blocks would be secured on rods, and the rats would have to eat the bait from inside the station.

At Malololelei, Ziploc bags are used to seal the bait to prevent molding and to avoid snail, insects and geckos from eating the baits. The bait loses its taste and smell if it turns mouldy. The rats taking bait outside the station causes high risk of primary poisoning of non-target animals (e.g., feral pigs, gecko) eating from the bait or leftover. There are also risks of secondary poisoning when non-target animals (human, chickens, pigs) eat animals that have received a lethal dose of the bait and those that contain traces of the toxin in their tissues i.e. pigs, rodents, chickens and snails.

## 5c. Reactive Baiting Regime

This way of baiting takes into account previous results and allows for differences in rat activity in different areas, as well as reducing bait wastage and its availability to be eaten by non-target animals. The higher the percentage of the bait gone, the higher the number of baits to replace for the old ones. This ensures that bait is available for any remaining rats in an area after the dominant animals have emptied the bait stations. E.g., if 4 blocks were in a station, and on the next check no bait has been eaten (and the bait is also not mouldy), those 4 blocks can be reused, but if the 4 blocks had been completely eaten, then 4 would be added on the next check. If 2 blocks are eaten and the others are still in good condition (not eaten nor mouldy) then only 2 baits is replaced. Any bait that has gone mouldy or eaten must be replaced with another. The same process applies overtime. During this, the recorder must be very active with note taking of the results by referring to the result key (Annex 1) for on the spot analysis of the activities happening inside the bait stations. It is important that you understand and are able to read the results in the stations accurately because it does facilitate decision making for the next baiting

Fig 1: snail in station

Fig 2: bait eaten by rat

steps and monitoring of the area. See Annex 2 for the field note template to use for collecting results. Also refer to the flow chart above for a summary of the whole process.

## 6. Managing Non-target species

Giant African Snails are common in Samoa and are the main problem to the baiting process. They can eat baits before target species get to the stations for food. Baits are not toxic to the snails (meaning they can eat as much bait as they want without dying), but they are then effectively moving bait blocks themselves and can be toxic to other animals that eat the snails. *Ad hoc* euthanasia of snails using table salt is recommended to reduce populations around the bait stations. Also, the mesh wire barrier is used to reduce the risk of rodents removing bait blocks from the stations.

In addition, the presence of ants is also another negative impact to the baiting process. Ants act as the door for snails and slugs to the baits inside the bags as they can chew through the plastic, which allows in air causing the bait to go mouldy. Other species recorded include geckos, earthworms, millipedes and spiders are only present in stations as their homes. Geckos can be an indicator species to show how successful rat control is – when rat numbers are decreased, an increase in gecko numbers would be expected and data collected should show any such trends.

## 7. Species recorded during Baiting and Monitoring Operations.

Employment of chew cards and ink cards helps to identify the exact type of species present in the control site.

## 8. Expected Results and Observations

When collecting cards carefully observe the appearance of each card in order to collect accurate data. The following plates shows what is expected to see on the cards and tells you the different species that are present in the area based on their teeth marks or footprints on the cards. Also refer to the guide in Annex 3 for a comparison of rodent foot prints and refer here for images of actual tracking cards from the field:
https://www.pestdetective.org.nz/image?Type=clue&ID=461&Parent=119&Clue=15&Culprit=

**Plate 1: Mice tooth marks**


**Plate 2: Rat tooth marks**

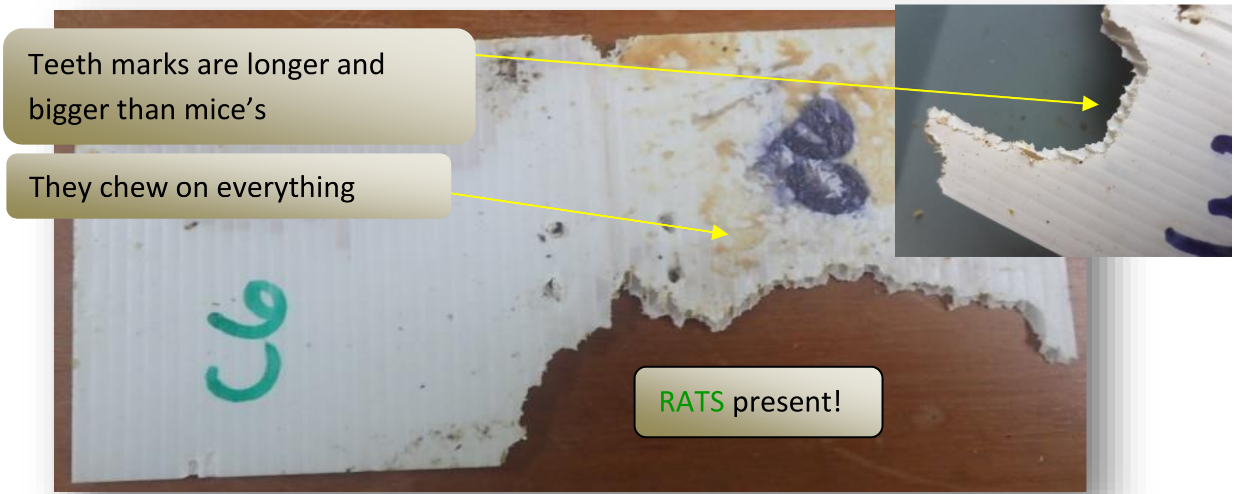


Plate 3: Cat tooth marks

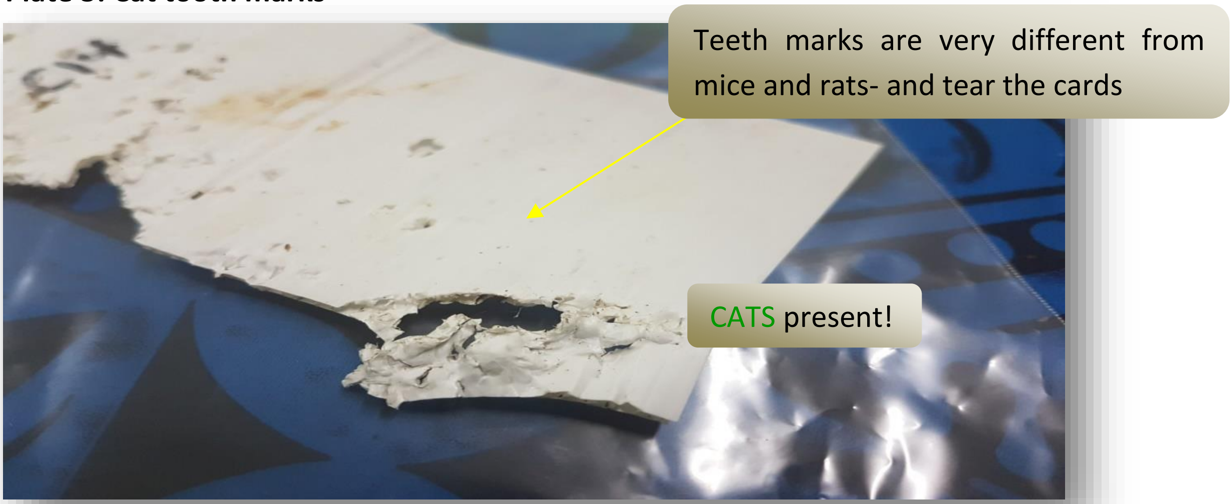



Plate 4: Rat foot prints


Plate 5: Lizard foot prints

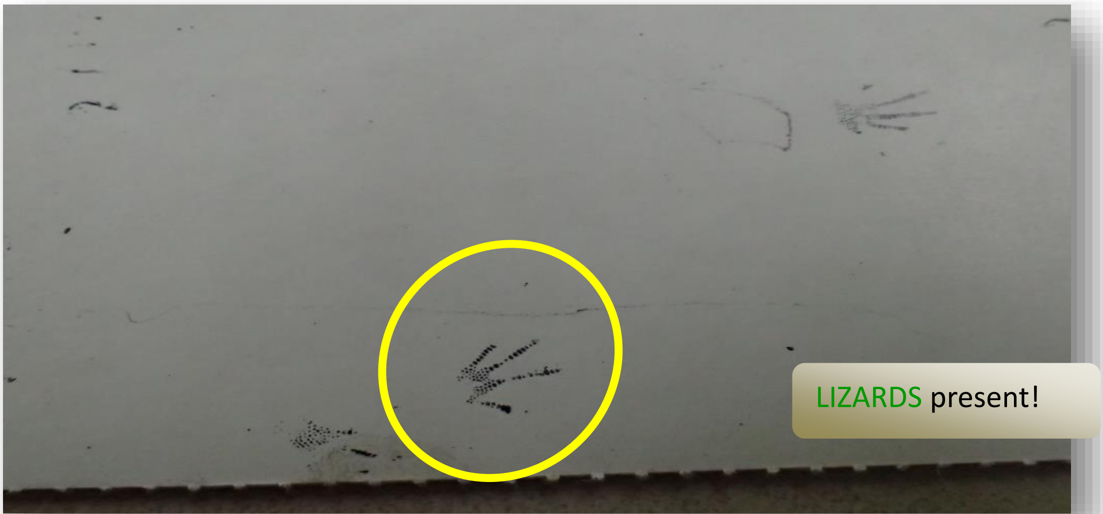


**Plate 6: African snail foot print**


## 9. Conclusion

This manual has attempted to document our experiences since 2017 controlling rodents using poison baiting for biodiversity conservation purposes under Samoan forest conditions. In the few years we have been involved in rodent management in Samoa we have seen the significant positive impact of rodent management on native biodiversity, especially in terms of bird numbers and diversity. We hope that there will be a concerted effort to continue the rodent management work at Malololelei, and more recently at Faleaseela, and perhaps at new sites in Samoa for the benefit of native biodiversity as well as for increased ecosystem resilience. We also hope that this manual will be revised from time to time as the experience of effective and efficient rodent management methods under Samoan conditions improves.

## 10. Acknowledgements

We thank all the expertise and experiences shared by various partners in the development of this manual. In particular we thank Dr Rebecca Stirnemann who developed the original project concept and Auckland Zoo technical staff especially Sian Buley for her dedication to support this work since the very beginning. We appreciate the support of Ian Fraser formerly of Auckland Zoo and for his trust in us. We appreciate the technical advice of IAS experts Steve Cranwell from Birdlife Pacific and Souad Boudjelas from the NZ Department of Conservation. Our sincere thanks to site landowners Tuiaopo Fa’amausili Andrew Ah Liki and the Catholic Land Board for working in partnership with us to save our endangered wildlife from threats caused by rats and feral cats. Last, but not least, we thank the various donors and sponsors who have supported the Malololelei rat management project since 2017 including the Pacific Development and Conservation Trust (PDCT), Pelgar International, Auckland Zoo, the New Zealand Department of Conservation and the New Zealand Ministry of Foreign Affairs and Trade. Thank you all for your kind and continuous support for this important work.

## Annex 1: Bait result key

Table 1: Use this key to guide assessment in the field and mark the results.

| | |
|---|---|
| 0 | 0% - No action, untouched |
| 1 | 1 < 25% |
| 2 | 25 < 50% |
| 3 | 50 < 75% |
| 4 | 75 < 100% |
| 5 | 100% |

## Annex 2: Field note template and data collected

| **Malololelei Field work Data 28th and 29th April 2022** | | | | |
|---|---|---|---|---|
| **Item** | **Station Number** | **Results** | **Notes** | **Action** |
| 1 | A1 | 5 | 4 mouldy | replace all 4 baits |
| 2 | A2 | 5 | 4 mouldy | replace all 4 baits |
| 3 | B1 | - | missing station | replace station |
| 5 | B2 | 0 | no action, leave as is | leave as is |
| 8 | B3 | 5 | 4 mouldy | repace all 4 baits |
| 9 | B4 | 0 | no action, leave as is | leave as is |
| 10 | B5 | 0 | no action, leave as is | leave as is |
| 11 | B6 | 5 | 4 mouldy | replace all 4 baits |
| 12 | B7 | 5 | 4 mouldy | replace all 4 baits |
| 13 | B8 | 5 | 4 mouldy | replace all 4 baits |
| 14 | C1 | 5 | 4 mouldy | replace all 4 baits |
| 15 | C2 | 5 | 4 mouldy | replace all 4 baits |
| 16 | C3 | 4 | 4 mouldy | replace all 4 baits |
| 17 | C4 | - | missing station | replace station |
| 18 | C5 | 0 | no action, leave as is | leave as is |
| 19 | C6 | 0 | no action, leave as is | leave as is |
| 20 | C7 | 5 | 4 mouldy | replace all 4 baits |
| 21 | C8 | 5 | 4 mouldy | replace all 4 baits |
| 22 | C9 | 5 | 4 mouldy | replace all 4 baits |
| 23 | C10 | 0 | no action, leave as is | leave as is |
| 24 | C11 | 5 | 4 mouldy | replace all 4 baits |
| 25 | C12 | 0 | no action, leave as is | leave as is |
| 26 | C13 | 0 | no action, leave as is | leave as is |
| 27 | D1 | - | missing station | - |
| 28 | D2 | 5 | eaten | rebait with 4 baits |
| 29 | D3 | - | missing station | - |
| 30 | D4 | 0 | mouldy, ants | rebait with 4 baits |
| 31 | D5 | 5 | gecko | rebait with 4 baits |
| 32 | D6 | 5 | eggs 2 | rebait with 4 baits |
| | | | ants | |

| Malololelei Field work Data 28th and 29th April 2022 | | | | |
|---|---|---|---|---|
| **Item** | **Station Number** | **Results** | **Notes** | **Action** |
| 33 | D7 | 5 | gecko 2 | rebait with 4 baits |
| | | | ants | |
| 34 | D8 | 0 | all mouldy | leave as is |
| 35 | D9 | 0 | no action, leave as is | leave as is |
| 36 | D10 | 0 | no action, leave as is | leave as is |
| 37 | D11 | 0 | 4 mouldy | rebait with 4 baits |
| 38 | D12 | 4 | 4 mouldy & smudge | rebait with 4 baits |
| 39 | D13 | 0 | 4 mouldy | rebait with 4 baits |
| 40 | D14 | 5 | eaten | rebait with 4 baits |
| 41 | D15 | 5 | ants | rebait with 4 baits |
| 42 | D16 | 5 | ants, eggs | rebait with 4 baits |
| 43 | D17 | 0 | no action, leave as is | leave as is |
| 44 | E1 | 0 | 4 mouldy and wet | rebait with 4 baits |
| 45 | E2 | 0 | ants, eggs x 4 | rebait with 4 baits |
| 46 | E3 | - | missing station | - |
| 47 | E4 | 0 | no action, leave as is | rebait with 4 baits |
| 48 | E5 | 0 | 2 mouldy | rebait with 2 baits |
| 49 | E6 | 0 | 2 mouldy | rebait with 2 baits |
| 50 | E7 | - | missing station | - |
| 51 | E8 | 0 | 4 mouldy | rebait with 4 baits |
| 52 | E9 | 0 | 4 mouldy | rebait with 4 baits |
| 53 | E10 | 2 | 2 mouldy | rebait with 2 baits |
| 54 | E11 | - | missing station | - |
| 55 | E12 | - | missing station | - |
| 56 | E13 | 2 | 2 mouldy | rebait with 4 baits |
| 57 | E14 | 5 | ants, eggs | rebait with 4 baits |
| 58 | E15 | 0 | 4 mouldy | rebait with 4 baits |
| 59 | F1 | 0 | all mouldy | rebait with 4 baits |
| 60 | F2 | 0 | all mouldy | rebait with 4 baits |
| 61 | F3 | 0 | all mouldy | rebait with 4 baits |
| 62 | F4 | 0 | all mouldy | rebait with 4 baits |
| 63 | F5 | 0 | no action, leave as is | rebait with 4 baits |
| 64 | F6 | 1 | - | rebait with 1 |
| 65 | F7 | 0 | no action, leave as is | rebait with 4 baits |
| 66 | F8 | 0 | all mouldy | rebait with 4 baits |
| 67 | F9 | 0 | all mouldy | rebait with 2 baits |
| 68 | F10 | 0 | no action, leave as is | rebait with 2 baits |
| 69 | F11 | 0 | no action, leave as is | rebait with 4 baits |
| 70 | F12 | 0 | all mouldy | rebait with 4 baits |
| 71 | F13 | 1 | baits are mouldy | rebait with 4 baits |
| 72 | F14 | 0 | all mouldy | rebait with 4 baits |
| 73 | G1 | 0 | all mouldy | rebait with 2 baits |
| 74 | G2 | 0 | all mouldy | rebait with 2 baits |
| 75 | G3 | 0 | all mouldy | rebait with 4 baits |
| 76 | G4 | 1 | all other baits are mouldy | rebait with 2 baits |

| Malololelei Field work Data 28th and 29th April 2022 | | | | |
|---|---|---|---|---|
| Item | Station Number | Results | Notes | Action |
| 77 | G5 | 0 | no action, leave as is | rebait with 4 baits, mounted the station with tape |
| 78 | G6 | 0 | all mouldy | rebait with 4 baits |
| 79 | G7 | 0 | all mouldy | rebait with 4 baits |
| 80 | G8 | 0 | no action, leave as is | rebait with 4 baits |
| 81 | G9 | 0 | all mouldy | rebait with 2 baits |
| 82 | G10 | 1 | all other baits are mouldy | rebait with 4 baits |
| 83 | G11 | 5 | - | bait with 2 baits |
| 84 | G12 | 2 | all other baits are mouldy | rebait with 2 baits |
| 85 | G13 | 0 | no action, leave as is | rebait with 4 baits |
| 86 | G14 | 5 | - | rebait with 2 baits |
| 87 | G15 | 1 | - | rebait with 4 baits |
| 88 | G16 | 0 | no action, leave as is | rebait with 4 baits |
| 89 | G17 | 0 | no action, leave as is | rebait with 2 baits |
| 90 | G18 | 0 | all mouldy | rebait with 2 baits |
| 91 | G19 | 0 | all mouldy | rebait with 4 baits |
| 92 | G20 | 0 | all mouldy | rebait with 4 baits |
| 93 | G21 | 0 | all mouldy | rebait with 4 baits |
| 94 | H1 | - | missing station | - |
| 95 | H2 | 1 | mouldy, ants | rebait with 4 baits |
| 96 | H3 | 0 | mouldy, ants | rebait with 4 baits |
| 97 | H4 | 0 | ants | leave as is |
| 98 | H5 | 0 | mouldy, ants | rebait with 4 baits |
| 99 | H6 | 0 | gecko eggs, ants | leave as is |
| 100 | H7 | 5 | rat poop | rebait with 4 baits |
| 101 | H8 | 1 | mouldy, ants | rebait with 4 baits |
| 102 | H9 | 0 | ants | leave as is |
| 103 | H10 | - | missing station | - |
| 104 | H11 | 0 | mouldy, gecko | rebait with 4 baits |
| 105 | H12 | 1 | seeds in box | - |
| 106 | H13 | 5 | ants | rebait with 4 baits |
| 107 | H14 | - | missing station | - |
| 108 | H15 | 0 | no mould, ants | leave as is |
| 109 | H16 | 0 | no mould, ants | leave as is |
| 110 | H17 | 0 | gecko x 3 | leave as is |
| 111 | H18 | 0 | no mould | leave as is |
| 112 | H19 | 0 | no mould, ants | leave as is |
| 113 | H20 | 0 | gecko eggs x 2, ants | leave as is |
| 114 | H21 | 0 | mouldy | rebait with 4 baits |
| 115 | H22 | 0 | mouldy, ants | rebait with 4 baits |
| 116 | I1 | 0 | mouldy and wet baits, ants | rebait with 4 baits |
| 117 | I2 | 5 | ants, rat poop | rebait with 4 baits |
| 118 | I3 | 0 | mouldy, wet baits, ants | rebait with 4 baits |
| 119 | I4 | 0 | ants | leave as is |

| Malololelei Field work Data 28th and 29th April 2022 | | | | |
|---|---|---|---|---|
| **Item** | **Station Number** | **Results** | **Notes** | **Action** |
| 120 | I5 | 0 | lizard eggs x 2 | leave as is |
| 121 | I6 | 0 | gecko, mouldy, ants | rebait with 4 baits |
| 122 | I7 | 0 | gecko eggs x 4, mouldy, ants | rebait with 4 baits |
| 123 | I8 | 5 | ripped plastic bag | rebait with 4 baits |
| 124 | I9 | 5 | geckos x2, ants, rat poo | rebait with 4 baits |
| 125 | I10 | 5 | rat poo, ants | |
| 126 | I11 | 0 | ants, mouldy | rebait with 4 baits |
| 127 | I12 | 5 | stations found on ground, ants | rebait with 4 baits |
| 128 | I13 | 0 | mouldy, ants | rebait with 4 baits |
| 129 | I14 | 0 | gecko poo | leave as is |
| 130 | I15 | 0 | gecko, mouldy | rebait with 4 baits |
| 131 | I16 | 0 | ants | leave as is |
| 132 | I17 | 0 | ants, snail poop | leave as is |
| 133 | I18 | - | missing bait, open box | rebait with 4 baits |
| 134 | I19 | 5 | gecko, rat poo, ants | leave as is |
| 135 | I20 | 0 | mouldy, ants | rebait with 4 baits |
| 136 | I21 | 0 | ants, snail poop | leave as is |
| 137 | I22 | 0 | mouldy, ants, fallen tree | rebait with 4 baits |
| 138 | I23 | - | missing bait, fallen tree, open box | rebait with 4 baits |
| 139 | I24 | 0 | mouldy, ants, snail | rebait with 4 baits |
| 140 | I25 | 0 | mouldy, ants | rebait with 4 baits |
| 141 | J1 | 0 | mouldy, gecko eggs | rebait with 4 baits |
| 142 | J2 | 0 | all mouldy | rebait with 4 baits |
| 143 | J3 | - | missing station | - |
| 144 | J4 | 0 | all mouldy | rebait with 4 baits |
| 145 | J5 | 0 | all mouldy | rebait with 4 baits |
| 146 | J6 | 0 | missing station | - |
| 147 | J7 | 0 | all mouldy | rebait with 4 baits |
| 148 | J8 | 0 | all mouldy | rebait with 4 baits |
| 149 | J9 | 0 | no action, leave as is | leave as is |
| 150 | J10 | 0 | no action, leave as is | leave as is |
| 151 | J11 | 0 | all mouldy | rebait with 4 baits |
| 152 | J12 | 0 | no action, leave as is | - |
| 153 | J13 | 1 | all mouldy | rebait with 4 baits |
| 154 | J14 | 0 | all mouldy | rebait with 4 baits |
| 155 | J15 | 0 | all mouldy | rebait with 4 baits |
| 156 | J16 | 0 | no action, leave as is | leave as is |
| 157 | J17 | 0 | all mouldy | rebait with 4 baits |
| 158 | J18 | 0 | all mouldy | rebait with 4 baits |
| 159 | J19 | 0 | no action, leave as is | leave as is |
| 160 | J20 | 0 | all mouldy | rebait with 4 baits |
| 161 | J21 | 0 | all mouldy | rebait with 4 baits |
| 162 | J22 | 0 | no action, leave as is | leave as is |
| 163 | J23 | 0 | all mouldy | rebait with 4 baits |

| Malololelei Field work Data 28th and 29th April 2022 | | | | |
|---|---|---|---|---|
| **Item** | **Station Number** | **Results** | **Notes** | **Action** |
| 164 | J24 | 0 | no action, leave as is | leave as is |
| 165 | K11 | 0 | all mouldy | rebait with 4 baits |
| 166 | K13 | 0 | no action, leave as is | leave as is |
| 167 | K14 | 0 | no action, leave as is | leave as is |
| 168 | K15 | 0 | no action, leave as is | leave as is |
| 169 | K16 | 0 | all mouldy | rebait with 4 baits |
| 170 | L1 | 0 | all mouldy | rebait with 4 baits |
| 171 | L2 | 0 | no action, leave as is | leave as is |
| 172 | L3 | 0 | no action, leave as is | leave as is |
| 173 | L4 | 5 | eaten | rebait with 4 baits |
| 174 | L5 | 0 | no action, leave as is | leave as is |
| 175 | L6 | 0 | no action, leave as is | leave as is |
| 176 | L7 | 0 | all mouldy | rebait with 4 baits |
| 177 | L8 | 0 | no action, leave as is | leave as is |

## Annex 3: Guide for rodent footprint tracking tunnel ink card

Source: Gillies, C. & Williams. D. *A short guide for identifying footprints on tracking tunnel papers.*

**Identifying rodent footprints on tracking tunnel papers.**

**Rats** ***(Figs 1a – 1d)***

The layout of rat tracks are fairly circular in shape, and if a line is drawn between the toes 1 and 4 on the fore foot (Fig 1a Line A-B) or between toes 1 and 5 on the hind foot (Fig 1b Line C-D) the line will bisect or lie behind of the central foot pad.

**Mice** ***(Figs 2a – 2b)***

Mouse tracks are similar in layout to rat tracks but are much smaller. Even the footprints of a juvenile rat would be about twice the size of the tracks from a mature mouse. Sometimes mice only leave sets of three toe prints. These may difficult to spot particularly if they are mixed in with many rat tracks (Figs 1a & 1b). Look for patterns that repeat themselves at regular intervals.


Fig 1a. Rat and mouse prints.


Fig 1b. Rat and mouse prints.


Fig 1c. Rat prints.

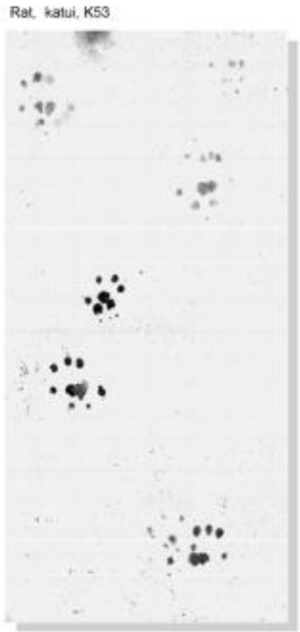



Fig 1d. Rat prints.

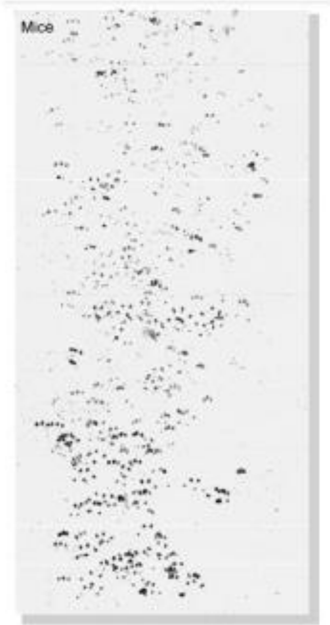



Fig 2a Mouse prints.