**Monitoring bait availability, target and non-target species during the**

**2017 Lehua Island rat eradication**

June 2017

**Background**

As part of the larger Lehua Island rat eradication project, parallel activities will be carried out during and between bait applications to provide information crucial to the successful implementation of the operation, and to inform if the observed is in line with the expected outcomes as outlined in the EA. This document describes the objectives and methods (protocols) for monitoring on the ground bait coverage and availability, and impacts on target species (Pacific rats). Note that additional bait application monitoring will be carried out at the bait loading site informed by the GIS monitoring and bait loaded into and spread by the helicopter – this document does not cover that monitoring.

Although these activities are standard practice for IC rodent eradications, the case of Lehua Island will take into account two important factors:

* **challenging terrain**, which can impact the quality of the baiting operation (i.e. complete and consistent coverage) as well as limit staff operational capacity. Despite its relatively small size (115 ha, 212 m high), Lehua is very steep, has vertical cliffs, and the sharp volcanic rocks make it difficult, unsafe or time-consuming to access certain areas even when wearing boots with micro-spikes.

* **limited infrastructure** on the island, which restricts the size of the field team. The campsite (a weatherPort) is located close to the shore and is small (max capacity 4 people) in terms of both sleeping and storage capacity. Others could be present for limited periods, for example around the drop days. The monitoring proposed is then to be mainly conducted by an experienced 5-person team stationed on the island for up to 6 weeks (starting 1 week prior to baiting).

The value of continuity is recognized, therefore most if not all the team members will remain constant throughout the operation. This will help maintain any biases constant, and will also minimize down time with training or getting familiar with the island. Some activities will commence days before the implementation of the eradication, as described below. An adaptive management approach will be applied throughout; activities will be combined as much as possible to maximize efficiency.

The following descriptions assume that diphacinone 50ppm will be used as the toxicant.

1. **Bait coverage and availability**

On the ground monitoring will be performed to ensure that all individual rats are at risk by the eradication strategy. Specifically, bait must be present in every rat territory in enough quantity and for long enough that all rats have access to a lethal dose. Bait availability plots will be used to evaluate the application rate (pellet density), and bait consumption/degradation over time. The data collected will inform the bait application strategy and may trigger responses to ensure adequate bait quantities or adjust the bait application on the island.

**Monitoring Protocols**

**Bait availability plots**

The detailed bait availability monitoring, measured in plots, will provide data on bait availability. Monitoring protocols will use 3m radius (28.3 m2) circular bait availability plots within rat habitat areas which are representative of rat territories. A total of 40 permanent circular plots will be marked in advance with chalk or stakes and string across the island: 20 in each slope, including varying altitudes and suitable rat habitat types (bush and grass). This design will allow the analysis of slope (north or south), altitude and habitat as potential factors influencing bait availability. The location of the plots will be selected rather than random, as large expanses of bare ground, although proportionally abundant on Lehua, will be avoided. Bare ground provides neither cover or food for rats, and it is likely that bait availability there will be lower due to steepness of the terrain. In other words, bait will be measured where rat activity is most likely. The plots will be distributed along transects when possible (Fig. 1) to facilitate logistics. Each plot will have an individual code and will be monitored every 24 hours in a consistent order. Each observer will monitor 10 plots daily (five at each slope). At each plot, pellets will be collected, counted, weighed collectively using a Pesola scale and collectively assessed for bait degradation on the Craddock (2004) scale before being placed back within the same plot.

All monitoring will commence the day of the first bait application and continue daily for at least 10 days, depending on the results. By evaluating bait availability on the day of the drop the on-the-ground bait application rate can be confirmed, and the values can be used as the basis upon which to start estimating daily bait consumption. Most likely, a similar regime will be used after each bait application. All observers will be trained on the practical definition of ‘pellet’ to ensure systematic monitoring.

Importantly, the area covered by the plots will be only a fraction of the island. Observers will visually evaluate if the general bait density matches the density measured inside the plots. This is necessarily a subjective process, but it would allow the team to validate the extrapolation to larger areas.

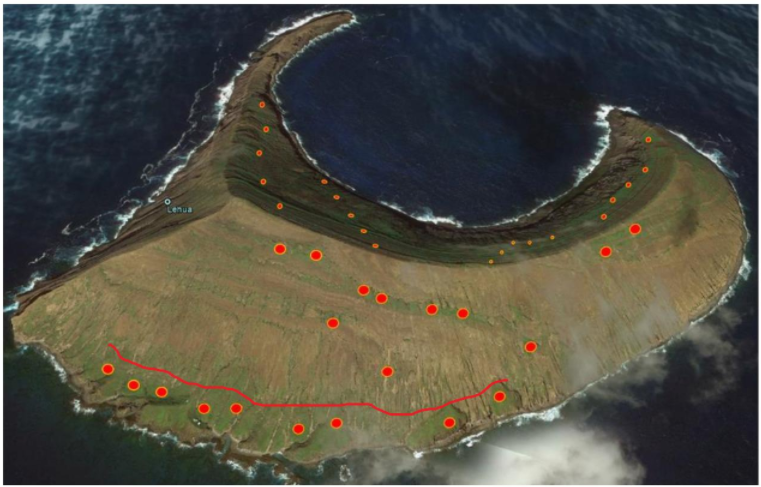


Fig. 1: Example of monitoring plots (40 circles) along the inner and outer slopes in the two main rat habitats: shrub and grass. One observer will check 10 plots per day in a set order. Actual distribution will depend on current vegetation coverage. The line indicates the transect for the live traps to be set both before and after the operation.

**Analysis**

The rate decrease will be monitored within bait availability plots by collecting data on the total weight of pellets in each plot over time.

1. **Impacts on target species (Pacific rat)** - Efficacy

Efficacy of the bait applications will be evaluated with a pre/post bait application monitoring protocols using multiple indicators. In the short term, efficacy of the baiting will be evaluated with radio collared rats monitored pre/post baiting until mortality (or not) is confirmed. In the longer term, rats will be monitored using direct and indirect detection tools. All tools used will have been tested on the target population on Lehua before the operation, and monitoring will be conducted every 3-6 months for 1-2 years.

**Pre-operation**

One week prior to the first bait application, up to 20 rats will be fitted with radio-collars. To capture rats, approximately 30 live traps will be set and baited using coconut bait in high quality rat habitat near the camp site. Ideally, a balanced sex ratio and a range of age classes and breeding status will be targeted. However, animals in reproductive condition and juveniles will be preferentially collared because there is limited data on bait acceptance by these groups. Individuals will be fitted with the radio-collars and released at the capture site.

Capture success rates will be calculated from the live traps and will be used to assess population status prior to the eradication. Additionally, body condition, morphometrics, and phenology data will be collected from captured rats.

Radio-collared rats will be monitored for 1-2 days prior to the first application to ensure they are alive and to identify burrow locations. Motion trigger cameras will be placed at the entrance of identified burrows to document bait acceptance and social interactions as well as survival (i.e. lack of activity) during the operation.

**During operation**

Radio telemetry monitoring will commence five days after the first bait application and will continue until all collared rats are confirmed dead. All rats will be monitored every other day around sunset to check for movement. Once an individual is suspected to be dead, the site will be marked with GPS, and a recovery operation will be carried out as soon as possible.

Recovery may involve digging/moving rocks. Staff will be informed of all archaeological or other sensitive sites which are not to be disturbed. If dead rats are found to be within these areas, the monitoring team will only attempt to recover the radio collared individual if it does not compromise the site.

Body condition, morphometric, and phenology data will be recorded for all recovered radio collared rats. Additionally, fresh carcasses will be collected to assign cause of death and for toxicology analysis.

**Post-operation**

Passive detection devices that have been successfully trialed on Lehua will be deployed. This includes chew cards, wax tags, and tracking tunnels. A minimum of 50 devices will be distributed as widely as possible across the island.

1. **Impacts on non-target species**

Environmental (water and soil) and non-target species monitoring will be lead by USDA-NWRC following specific protocols developed for Lehua.

The monitoring team will perform a full-island search for carcasses prior to the start of baiting. This will be done by dividing the island into quadrants (see Fig. 2) and workers will walk as much of the accessible area as possible while looking for bird carcasses. Staff will use a GPS to track coverage within their zone. The goal will be to get good coverage of the whole island rather than detailed coverage of a small portion of the island during this survey. fresh carcasses will be collected to assign cause of death and for toxicology analysis.



Fig. 2: Zones of the island for ground operations.