Trial of a new bait station design to improve the efficiency of rat *Rattus* control in forest at Black River Gorges National Park, Mauritius

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SUMMARY

A field trial showed that a newly designed, post- or tree-mounted 'hockey stick' rat bait dispenser incorporating 20 g fixed bait blocks, was both more practical and more efficient in terms of rodenticide bait use, compared to a traditionally used 'ground pipe' dispenser containing loose, 5 g bait blocks. Bait in the hockey stick dispenser was less affected by mould and slower to breakdown, therefore making it more effective for longer and reducing the bait replacement rate required compared to the old design. It was also considered that there was also less incidental bait take by both introduced giant land snails *Achatina* spp., and of greater concern, endemic snails.

BACKGROUND

The biodiversity of oceanic islands is very vulnerable to invasive species of which rats *Rattus* spp. are amongst the worst culprits due to their adaptability and omnivorous diets. Introduced rats, especially ship (black) rats *R.rattus* may predate eggs and young of birds, reptiles and other fauna, and eat seeds of native plants. Eradication of non-native rats from some small islands worldwide has had positive outcomes, such as increases in populations of endangered seabirds, reptiles and plants. On larger islands such as Mauritius 'main' island (part of the Mascarenes Archipelago) rat eradication would be all but impossible, but a reduction in numbers to reduce their impact over small areas can be achieved and has been shown to benefit recruitment of native plants and animals. On Mauritius, rat control is considered essential to allow native fauna to persist.

In the Black River Gorges National Park in southwest Mauritius, control of rats (principally ship rats, but also brown rats *R.norvegicus*) is carried out around the four managed populations of endemic, highly endangered, pink pigeons *Nesoenas mayeri* and echo parakeets *Psittacula eques.* Blocks of rodenticide bait (brodifacoum in a tropical wax base) have been up to now, mostly placed in 'ground pipe' bait dispensers (50 cm lengths of 75 mm diameter grey PVC drainpipe) to protect them from the rain and to reduce access by non-target species (e.g. feral pigs *Sus scrofa*, tenrecs *Tenrec ecaudatus*, macaques *Macaca fascicularis*, and birds). These dispensers are secured horizontally on the ground and arranged in a grid system around the areas where the pigeons and parakeets feed and breed.

The Mauritian Wildlife Foundation (MWF) has been traditionally supplied brodifacoum cubes in 5 g, tropical grade wax blocks through the National Parks and Conservation Service (Government of Mauritius). The pipes are placed around all field stations (except Ile aux Aigrettes, a small offshore islet) and incorporate all supplemental feeding hoppers and aviaries. Each bait dispenser has 10 or 15 toxic baits placed loosely inside, each replenished mostly at 7-day intervals. In practice, the bait goes off so badly that to be effective it is replaced weekly most of the time (dependent on staff availability). Rats access the bait through either end of the pipe.

This system (hereafter termed the 'ground pipe') allows easy access for rats to bait whilst protecting it from most inclement weather, when used correctly. To place baits near the centre of a ground pipe requires the tunnel to be lifted up and bait carefully rolled into place. This technique however, is not full proof as not all baits will be protected during wet weather and once damp it quickly becomes unattractive to rats. With the current toxic bait used, rats can take from 4-10 days to succumb to the poison. During much of this period, they will continue to eat, and also remove baits to cache in dens in surrounding forest. Baits have been observed 12 m off the ground in the fork of a tree by staff climbing to echo parakeet nests (J. Malham, pers. comm.). The baits that are cached by rats before they die will probably often deteriorate to the extent that they are unpalatable before the original cacher returns, or other rats locate them, with possible negative environmental effects (possible secondary poisoning of non-target species) and considerable financial cost due to bait being lost. Introduced giant snails *Achatina spp*., have access to the bait, causing further unwanted bait losses. Dead *Achatina* (those badly poisoned) have been found at low frequency but of more concern is the occasional observed poisoning of endemic snails.

An experiment was therefore designed to determine if a system using 20 g fixed bait blocks manufactured with a hole in the middle to allow retention in a newly designed 'hockey stick' bait dispenser could be more cost effective and environmentally friendly in controlling rats in the forest at Black River Gorges, than the current loose block ground-pipe system.

ACTION

Assessment of efficacy of ground pipes vs. hockey stick dispensers: Reducing the cost of essential management procedures enables larger areas to be actively managed for conservation – an essential part of the equation for establishing self-sustaining populations of critically endangered plants and animals on Mauritius. As part of this process, MWF wish to improve the efficiency of rat control and reduce amounts of poison bait used, hence the rational behind the trials.

New bait dispenser design: A new bait dispenser the 'hockey stick' was designed to accommodate 20 g wax bait blocks with a hole through there centre. It consists of a 90 degree elbow joint of grey PVC drainpipe (75 mm diameter) attached to a straight 300 mm length of drainpipe at one end (Figs. 1 and 2). The end (top) of the straight section is capped with a removable cover. The 20 g bait blocks are retained inside the elbow on a length of thick galvanized steel wire (Fig. 3). The dispenser is mounted about 10 cm above the ground on a post or tree to deter snail and tenrec access. The rats (adept climbers) access the bait through the open bottom of the dispenser. In the initial design (Fig. 1), a slot was cut on both sides of the barrel at the top to allow the bait block locating pin to fit below the cap and a 2 mm hole was drilled in the bottom of the 90 degree bend to allow the tip of the bait block locating pin to protrude. After trial, this system was dropped in preference for a simpler design i.e. the locating pin is supported against the floor of the PVC bend (no holes are drilled).

Field trials: Trials were conducted as part of an MSc project in April to July 2006 (Robin 2006). This aimed to compare the efficacy of the new hockey stick dispenser + fixed 20 g bait blocks, with the conventional horizontal ground pipe + loose 5 g bait blocks. In both cases, the wax blocks used contained 0.005% brodifacoum.

Two bait grids were set up in upland forest; one in actively weeded (for introduced invasive plants) native forest in Black River Gorges National Park (termed a Conservation Management Area - CMA) at Brise Fer, the other in an unweeded forest. Each grid contained 36 bait dispensers within a 150 x 300 m area. The layout was based on an already established clearing grid (dispensers placed in six lines 50 m apart, at 25 m intervals along the lines).

Two trials were carried out with one trial for each type of dispenser in each forest type. Before and after each trial an 'Index of Abundance' for rats was determined to evaluate the effectiveness of each dispenser system through a baited (stiff mixture of peanut butter and rolled oats) snap trap grid within the two dispenser grid systems (36 snap traps per grid placed at the same location as the bait dispensers). These were run for three nights and numbers of rats encountered used to calculate the base line rat abundance indices.

The dispensers on the grids were initially left in place for one week without poison wax blocks so that the rats could get used to their presence. A period of one month was left between trials for the rats to re-establish in the trapping area, following which the type of dispenser was swapped over i.e. loose bait dispenser grid (ground pipe) was placed in Brise Fer CMA and the fixed bait dispenser grid (hockey stick) placed in the unweeded forest.

The relative success of the two grid types was compared in terms of quantity of poison used and the probable reduction in rat abundance (based on the abundance indices), as well as other possible benefits including resistance to rain, heat, humidity, mould and non-target animals.

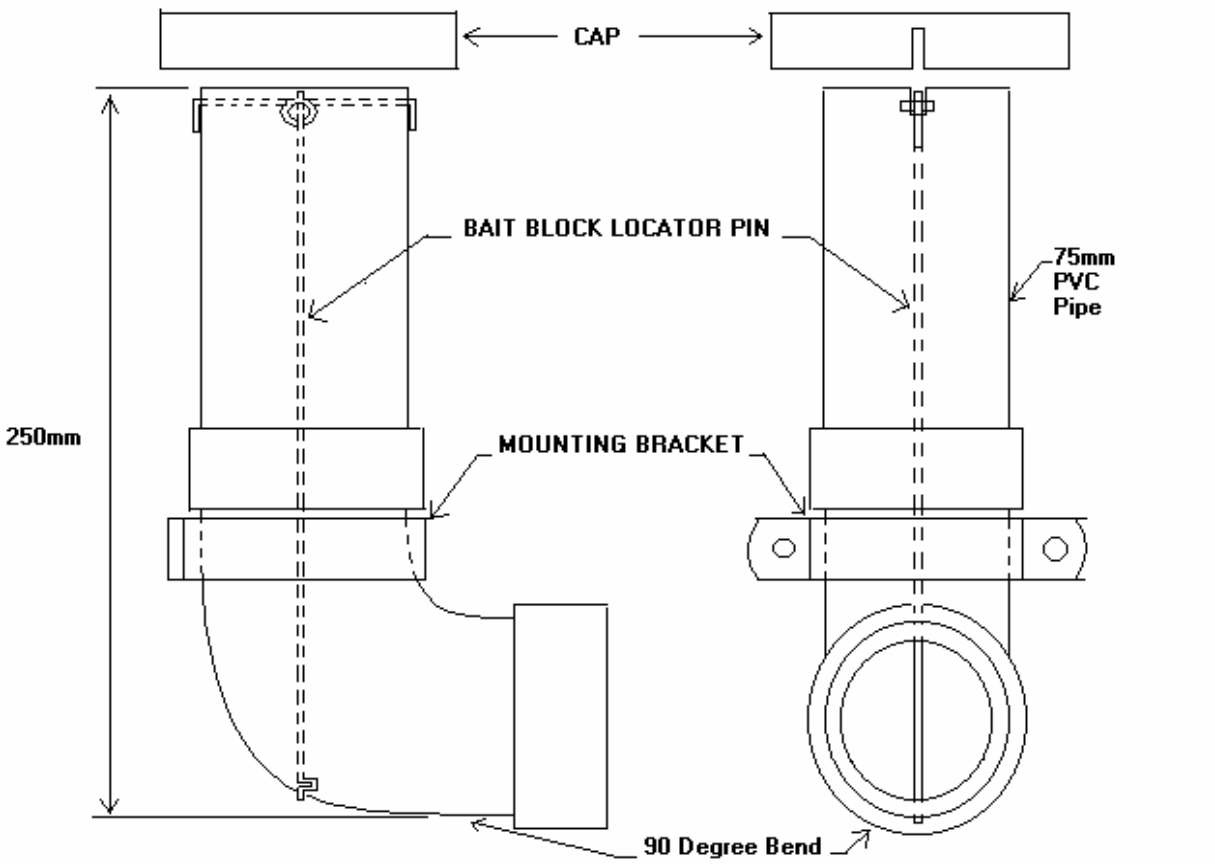

Figure 1. Bait dispenser designed by D.Wills, final modifications by P.Haverson (not to scale). In the initial design shown above, a slot was cut on both sides of the barrel at the top to allow the bait block locating pin to fit below the cap, and a 2 mm hole was drilled in the bottom of the 90º bend to allow the tip of the locating pin to protrude. After the trial, this system was dropped in preference for a simpler design i.e. the locating pin is supported against the floor of the PVV bend (no holes are drilled).

Figure 2. Front view of a 'hockey stick' dispenser designed for 20 g fixed bait blocks. Note the vertical wire at the entrance to prevent large *Achatina* snails from raiding the bait blocks. The dispenser is raised 10 cm above ground to deter snails and tenrecs and also to reduce humidity from the ground.

Figure 3. The 20 g wax blocks are threaded onto a length of thick wire. Checking the bait and refilling is straightforward.

CONSEQUENCES

Bait uptake and depletion: There were no major differences at the onset of bait consumption by rats, suggesting that there were no differences in rat recognition/acceptance of the hockey stick bait dispenser system (placed on a post or tree), compared to the traditionally used ground pipe. The rate of depletion of rodenticide was lower for hockey sticks compared to the ground pipes. This may be explained by *in situ* consumption for the first compared to 'take-aways' for the latter.

A comparison of the remaining bait in the two dispenser systems showed that that within the hockey sticks it was less affected by mould than the ground pipes, presumably due to lower humidity in the former. The hockey sticks are covered by a cap at the top of the pipe with only one open end at the bottom (to allow rat access) and are positioned above ground, whereas the ground pipes are open at two ends and are more susceptible to ground humidity. The slower breakdown of the bait in the hockey sticks, as well as larger bait block size, also makes them effective for longer. There are obvious financial implications.

Bait take by non-target species: The vertical wire attached across the PVC bend (Figs. 1 and 2) was effective in keeping out large *Achatina* snails but smaller individuals are occasionally found dead or dying at low frequency (presumably those that have ingested a lot of poison). Of more concern is the occasional endemic snail poisoning. Two cases of poisoning of the endemic snail *Pachystyla bicolor*, have been recorded. Although no data is available it is considered on the basis of ease of access and positioning, that ground pipe dispensers are far more accessible and hence more detrimental, to the snails, compared with the hocky stick dispenser. Eliminating snail take completely may not be possible unless copper guards are also incorporated in the design (Tatayah *et al.* 2007).

Implications for breeding birds: During the hockey stick dispenser trial in Brise Fer (April-July 2006) in an area of high pink pigeon nesting density, four chicks fledged, compared to none in the same period for the previous year (2005), and prior to that in earlier years few to no chicks fledging successfully with the ground pipe dispenser system operative. Although these

results are not conclusive and identifies that a longer study is required to confirm this trend, it gives weight to the efficacy of using the hockey stick system.

Conclusions and discussion: Although the trial was of short duration, some results were conclusive, and the need for a much bigger trial has been substantiated. As the trial showed the practical superiority of the hockey stick dispenser design over the ground pipe, the former will be adopted at all Mauritian sites once the National Parks and Conservation Service initiates the import of the 20 g wax blocks in large quantities. This will reduce labour input as the larger blocks lasting longer will necessitate less refilling. Bait stashing is reduced since the fixed bait can not be carried away by rats, and loss due to mould is also less as the blocks are contained in a more weather proof dispenser and less humid environment. In New Zealand, the Department of Conservation uses single 50 g blocks (with a central securing hole), with 50-100 g per bait station (50 mm diameter PVC tube dispensers). These 50 g blocks have been shown to more efficient still than 20 g blocks, requiring less management than when using smaller ones, lending further weight to adopting a similar strategy on Mauritius.

REFERENCES

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