

Rodent surveillance tools - why, what, how and when.

Surveillance for rodents is used as a major component of permanent, on-going biosecurity measures in order to be able to deal swiftly with any biosecurity breaches and so prevent a full invasion of the island (which would then require another expensive and risky eradication operation).



Rodents can be detected through the signs they leave: nests, runs, droppings, footprints or feeding marks. They may also be sighted or captured in traps (live, kill or camera).

If a rodent is detected at any point after the eradication, you must be prepared to **respond immediately.**

Individual rodent behaviour must be taken into account. **Deploy as many different surveillance devices and techniques as possible in order to be able to detect and identify all rodents.**

Rodents are very difficult to detect when present in small numbers - i.e. individuals invading an island after eradication or those surviving an initial baiting attempt. However, it is crucial to detect them as soon as possible, and to determine which species of rodent is present so that your response is appropriate. Lone rats may roam widely - do not assume that where you detect the sign is where you will catch the rat. Lone rats are likely to be more interested in roaming around looking for other rats.

Rats and mice are prolific breeders: if you fail to spot their presence early, within a few months you may have to eradicate a large, widespread, breeding population. **Early detection and intervention is of the utmost importance. Using multiple detection devices is integral to this.**

Pros and cons of surveillance methods

Brown rats are neophobic - i.e. they are wary of new things in their environment. For a rat which has recently arrived on an island all aspects of the environment will be new, and this 'bedding in' time may be less important. If you do not detect them early, however, neophobia could still be an issue.

Use as many types of device as the logistics of your island and resources allow. Bear in mind the reproductive capacity of rats and mice: checking devices monthly decreases the risk that a breeding population will already be established on the island before you detect there is a problem.

Most devices will only show that a rodent is present. Only traps and poison will kill the rodent (or capture it so that you can kill it), but these methods cannot usually be used in the UK as part of surveillance measures due to welfare concerns and risks to non-target species.

Pros and cons of surveillance methods (Adapted from Bell *et al.* 2014.)

Surveillance method	Requirements for use	Pros	Cons
Permanent plastic station	<ul style="list-style-type: none"> • 1 visit per month • OR daily if using traps/rodenticide 	<ul style="list-style-type: none"> • Can be used to house monitoring tools such as flavoured wax • Can target rodent incursion directly by adding bait or trap 	<ul style="list-style-type: none"> • Non-target consumption of monitoring tools possible between checks
Wooden rodent motel	<ul style="list-style-type: none"> • 1 visit per month • OR daily if using traps/rodenticide 	<ul style="list-style-type: none"> • Can be used to house other monitoring tools • Can target rodent incursion directly by adding bait or trap • Can be highly attractive as new home for invading rodents (i.e. may help locate as well as detect rodent) 	<ul style="list-style-type: none"> • Non-target consumption of bait/ monitoring tools possible between checks
Tracking tunnel	<ul style="list-style-type: none"> • 1 to 3 consecutive nights per month • A lure such as peanut butter can be added to the tracking cards 	<ul style="list-style-type: none"> • Can identify species (or at least distinguish rats and mice) • Tunnels can be placed out permanently, with plates/cards added when necessary • No risk to non-target species 	<ul style="list-style-type: none"> • Does not kill the rodent • Cards left for long periods may be unreadable due to weather/ volume of activity
Flavoured wax	<ul style="list-style-type: none"> • 1 visit per month • Range of wax flavours can be used (chocolate, peanut etc.) 	<ul style="list-style-type: none"> • Can identify to rat or mouse level • Can be left <i>in situ</i> for long periods • No risk to non-target species 	<ul style="list-style-type: none"> • Does not kill the rodent • Non-target consumption possible between checks
Visual searches	<ul style="list-style-type: none"> • 1 visit per month - or as often as you visit the island • Search for tracks, droppings, runs, burrows and chew signs 	<ul style="list-style-type: none"> • May be able to identify species if you get a good look • Does not require species to interact with any detection device • No risk to non-target species 	<ul style="list-style-type: none"> • Does not kill the rodent
Trail camera	<ul style="list-style-type: none"> • Strategically positioned or <i>ad hoc</i> in response to suspected sign 	<ul style="list-style-type: none"> • Can be used to confirm whether or not suspected sign is from target or non-target species 	<ul style="list-style-type: none"> • Does not kill the rodent
Trap station (kill)	<ul style="list-style-type: none"> • 3 to 5 nights per month • Guidance in Chapter 3 must be adhered to 	<ul style="list-style-type: none"> • Can target rodent incursion directly (depending on species and trap size) • Allows for DNA comparison with original rodent population 	<ul style="list-style-type: none"> • Ideally check daily when set • Traps must be maintained regularly to ensure functioning correctly • Potentially high non-target risks

The scale on which detection devices are deployed depends on the stage of the project and the specifics of the island.

For ongoing biosecurity purposes, only one or two devices may be needed per hectare. On larger islands, logistics may dictate that devices are limited to high risk incursion areas and large parts of the island may be left with even more sparse surveillance.

Permanent plastic stations

These plastic boxes can be left in place permanently with detection devices secured inside. Lethal devices can be added quickly and easily in response to the confirmed or suspected detection of rodents. If poison is placed in them, warning/poison labels should be attached to the outside.

The boxes contain a locking device, which requires an Allen key (or similar) to open. This makes it harder for humans to tamper with the surveillance equipment or access rodenticide (especially important on islands where children live or visit). For ease of access when no rodenticide is laid you can place rocks on top to secure the lid instead.

Boxes should be secured to the ground e.g. via sturdy tent pegs/weighted down with rocks. However, if there are resident mice on the island and you only wish to detect rats, you may need to place them off the ground: rats can jump higher than mice.

Rodents (especially brown rats) may chew on the edges of the box: in this way the box itself may also act as a detection device. They may also drag nesting material in to the box, so be vigilant for this also. Soap is a useful detection device, but does not last well in the field - however, in weather-proof boxes it may present an additional option along with wax blocks. Small 'hotel bars' are ideal.

Most rodenticide manufactures will also produce a plastic station in which bait can be housed. In the UK, Protecta™ boxes are often used. They can be sourced from [Barrettine Environmental Health](#) and currently (2014) cost around £9 each. This does not include the costs of postage.



Above. Permanent plastic station raised from the ground to prevent access to non-target species.
Right: Permanent plastic station, opened to show a chocolate wax detection block. © WMIL

Rodent motels

Rodent motels are similar to permanent plastic stations, but are made of wood (treated plywood is fine, but treat with something not likely to be off-putting to rodents). Research has shown that wooden devices can be more attractive to rats than plastic ones (Spurr et al. 2006, Spurr et al. 2007) - but cost means plastic devices are used for the bulk of permanent surveillance stations.

If only a few rodent motels are used, they should be placed in the highest risk reinvasion areas and optimum habitats (e.g. coastal points, amongst seabird colonies, by farms or buildings) so as to increase chances of early detection. Place a lure inside, such as a wax detection block.

Rodent motels should measure around 530 mm square with an internal height of 140 mm. Two 55mm diameter holes should be made on opposite walls so rodents can see an exit route. Internal dividers/baffles help to shelter an area away from the entrances, encourage a rodent to set up home.

If you might place rodenticide in them at any point (e.g. to respond to post eradication rodent sign) a locking device - e.g. four padlock staples, or two if you make a hinged lid) - should be built in. Alternatively, use stainless steel screws in the corners and ensure that field staff carry screwdrivers. For ease of access when no rodenticide is inside, heavy rocks can be used to secure the lid instead.

You can add bedding material - but if you do, be sure to document that you have done so, otherwise someone else may mistake its presence as the result of a rodent making home there.



Above. A wooden box suitable for use as a rat motel, showing entrance holes, arrangement of internal baffles and an example of a good location. All photos © Alastair Wilson.

Tracking tunnels

Tracking tunnels are a simple and effective tool to monitor the prints of small animals.

Tracking tunnels consist of a rectangular box (c. 50cm x 10cm x 10cm) with a piece of card/ paper (a tracking plate) with an inked section in the middle. A lure (peanut butter is recommended) is placed on the ink to attract rodents. Anything going through the tunnel will leave footprints.

Gotcha Traps www.gotchatraps.co.nz sell ready-inked cards, tunnels and pegs which are easy to transport and assemble in large numbers in the field. Tunnels cost around £5 each and ink cards around 70p each (2014 prices and exchange rate), not including postage.

Their website provides useful information on how to identify prints as well as set the tunnels.

The Mammal Society have tracking tunnels available through Wildcare www.wildcareshop.com These are around £15 each (tunnel and kit to make cards). They are bulkier than the Gotcha tunnels.

Tracking plates can also be placed in natural tunnels built from stones/wood.

Homemade devices can be made using a mixture of powder paint and oil and paper fastened to a rigid, flat base. Other, more weatherproof, systems can be created using carbon coated plates or mixing: ~80g ferric nitrate (technical grade); ~120g polyethylene glycol (PEG 300/400); ~40g non-foaming, unscented concentrated detergent; and water to a total of 270g (or any multiple) for the ink, and a solution of 5% tannic acid in 75% ethanol sprayed over the paper evenly and finely.



Above. Gotcha tracking tunnels, above, A, B (Morton & Cole, 2013). Mammal Society tunnel (below left, © www.mammal.org.uk) and DIY plate baited with peanut butter (below right).

Carbon-coated tracking plates can be made by painting a suspension of one part carbon powder to 10-15 parts industrial denatured alcohol (methylated spirit) onto the surface of the plate. The IDA evaporates to leave a thin layer of carbon powder on the tile, which is weather proof once dry. The method has been calibrated against rat populations of known size on UK farms, and has been used to generate indices of brown rat activity on UK islands.



Brown rat footprints recorded on a carbon-coated tracking plate. Photo © National Wildlife Management Centre (Animal and Plant Health Agency).

Wax blocks

Flavoured wax blocks are simple to make and deploy and can last for several months in the field. Rodents are particularly attracted to them and leave teeth marks when they nibble on them. Rodent teeth marks can be distinguished from other species that might be attracted to them (such as invertebrates, shrews, rabbits, birds).

Blocks can be placed in Protecta™ boxes or rodent motels, or can be simply pegged in the ground using a tent peg/piece of wire, or tied to vegetation using wire. However, they are at increased risk of interference from non-target species such as birds if they are placed in the open. They are non-toxic, but also useless if other species have removed or eaten them.



Left: large and small chocolate wax blocks.

Right: blocks in production using silicon ice cube/ cupcake moulds © WMIL.

Recipe for making flavoured wax blocks (from WML):

Makes approximately 30 large or 60 small blocks.

Equipment:

Standard 25 cm saucepan

Gas ring and gas bottle (Can use a hob, but it is a messy business: may ruin your cooker)

Silicon cupcake tray (12 large or 24 mini)

Wooden spoon for mixing

Heatproof glass jug for pouring

Chocolate wax:

Ingredients:

12 standard white wax candles

5 heaped tablespoons of **pure cocoa powder** - **N.B. Do not use drinking chocolate as it burns**

Instructions:

6. Melt candles in pot, remove wicks, add cocoa powder and stir thoroughly to mix.

7. Then carefully pour into the silicon tray using the heatproof jug. Just before wax sets, put a hole through centre of the block. Another option is to let the wax blocks set overnight and then drill a hole using a battery-drill. Alternatively put a bent paperclip (for tying to vegetation) in the centre of the wax block while it sets.

Coconut wax:

Ingredients:

12 standard white wax candles

5 teaspoons of coconut essence (or ½ block of creamed coconut)

1 heaped tablespoon of pure cocoa powder (cocoa is added to make teeth-marks easier to see on the wax block)

Instructions:

Melt candles in pot, remove wicks, add cocoa powder and stir thoroughly to mix. Take off the heat and add coconut essence one spoonful at a time taking care as the mixture will bubble and fizz.

Then as from instruction 2, chocolate wax recipe, above.

Peanut wax: N.B. Does not last or store as long as chocolate or coconut wax.

Ingredients:

12 standard white wax candles

½ jar of smooth peanut butter

Instructions:

Melt candles in pot, remove wicks, add peanut butter and stir thoroughly to mix. Do not leave on a high heat too long as the peanut butter can burn.

Then as from instruction 2, chocolate wax recipe, above.

2.2.25 Plain candles can be used during the intensive monitoring phase, but are considered less reliable for detecting very low numbers of rodents. Consider them an extra device rather than a primary technique, especially for biosecurity purposes.

2.2.26 WaxTags^R (a wax lure mounted on a plastic tag which can be stuck in the ground) can also be purchased and used in a similar manner to wax blocks.

2.2.27 **Flavoured resin** is an innovative device developed by Jenny Daltry/Flora & Fauna International, which mixes plastic with cocoa, meat gravy or other flavours: it *might* be less attractive to non-target species but has not been widely tested in the UK to date. More information and recipes are available.

Visual searches

Searches for rodents or rodent sign can be conducted at any time or place on the island and require no equipment. See 2.3 below for information on identification of rodents and rodent sign. If you need help confirming sign, photograph it *in situ* alongside an object that will help determine size (e.g. a coin, pen lid, match), collect all that you can (e.g. *all* droppings/carcass/chewed item) and seek expert advice (see Chapter 1 for further information).

Sightings of target rodents are *most likely* at night around the coast or buildings. Mud and sand are good places to look for footprints, although the prints are quite different and can be harder to identify than those left in tracking tunnels. Droppings may be left in latrines along runs or near burrows. Target species may nest in cavities and buildings as well as burrows. Brown rats leave oily marks along their regular routes - e.g. walls or trees. Chew signs may be found on egg shells, seeds, bones, wood and woody vegetation, and plastic (e.g. rubbish along beaches).

Trail cameras

Rodents can be detected by identifying them in either still images or video from (night vision) trail cameras. There are a number of trail cameras available in the UK, costing £100-300. Bushnell® Trophy Cams were used during the St Agnes & Gugh (Isles of Scilly) brown rat eradication. Cameras can be set to record still images or short videos at specific times or when the motion sensor detects movement. They are particularly useful when suspicious but unconfirmed sightings or sign have been reported. They can be left to record over multiple days.



Above. Night vision cameras were used to confirm last remaining black rats were feeding on poison bait (Dog Island, Anguilla, 2012 © WMIL)

Traps - Live and kill

Traps should be used in response to detecting rodent sign post-eradication: some traps are designed to fit into permanent stations such as T-Rex™ traps in Protecta™ boxes.

However, great care and consideration must be given before using traps - either live or kill - as part of on-going surveillance, due to the potential risks to animal welfare and non-target species. Tracking tunnels are more likely to detect rodents in small numbers than traps.

If you do use traps, you must adhere to the guidance provided in Chapter 3.

Hair traps

Sticky traps (glue boards or tape traps) can be used to help identify some animals by collecting hair, fur or skin. DNA can then be used to confirm the species.

Glue traps should only be used if they are registered and appropriate to use at the site. They should not be used to trap animals - it is not humane, but rather to collect fur/hair. Set them so that the tape / glue is on the roof of a tunnel. A full assessment of risk is required before use.

Alternatively, a hair trap using Velcro™ can be made using a small diameter drainage pipe (or a bait station from the initial eradication) with a piece of adhesive Velcro™ attached to the top or side of the pipe - this is far preferable to the risks associated with using 'upside-down' glue traps. Velcro™ can also be placed on entrances to wooden motels, permanent plastic stations, tracking tunnels etc.

Hair should be preserved by wrapping it carefully in paper and placing it with silica desiccants in a paper envelope. DNA can be extracted from the hair follicles.

UV light

A UV light passed over sites of suspected rodent activity at night, will cause urine to fluoresce. Urine of other mammal species will also fluoresce, however, so this is likely to be of limited use.