

ANNEX 1: ERADICATION TECHNIQUES IN THE UK

Planning and implementing a ground-based bait station operation

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1 Background information

1.1.1 Currently the best proven method for eradicating rodents from islands is via the distribution of cereal-based baits laced with an anticoagulant rodenticide. Distribution needs to be achieved across the entire island in a methodical and comprehensive manner. Eradication methods have been developed and refined over many years: do not consider or attempt any other method unless there is a very clear and justifiable reason why anticoagulant rodenticides cannot be used.

1.1.2 Trapping may be used *in conjunction* with poisoning, but eradication should not be attempted using trapping alone. Although trapping *may* be successful on very small islands (e.g. <5 hectares), the use of rodenticides is still the preferred technique as, almost invariably, some rodents will escape from / become wary of traps, thereby leading to eradication failure.

1.1.3 There are a number of different types of rodenticides, but those most commonly used in island restoration are anticoagulants which interrupt the Vitamin K cycle. After consumption of a lethal dose, death occurs through internal haemorrhaging. Many rodenticides have a delayed onset, so symptoms of poisoning are not associated with the bait until a lethal dose is likely to have already been consumed. This helps avoid bait shyness. Depending on the potency of the rodenticide used, consumption of a lethal dose may well require multiple feeds over several days. Death is likely to occur within ten days (generally 5-7 days) after ingestion of a lethal dose, but may well be longer.

1.1.4 Fast-acting acute rodenticides (e.g. brodifacoum) have been used successfully to achieve the eradication of some invasive mammals from islands, but their use carries a substantial risk of failure and they have not proven to be reliably effective for rodent eradication. The onset of poisoning symptoms from acute rodenticides is quite rapid – any animal which ingests only enough bait to receive a sub-lethal dose is likely to associate their sickness with eating bait. Such animals, when they recover, are more cautious about novel foods (bait shy/neophobic) and may avoid taking any further baits, thereby leading to eradication failure.

1.1.5 Circumstances (legal and social) in the UK mean that aerial baiting by helicopter is currently not a feasible option; therefore the deployment of rodenticides is restricted to ground-based (hand) placement in covered bait stations. This method involves:

- Rodenticide bait contained in custom made bait stations.
- Bait stations placed island-wide on a grid with a species-specific density such that every individual of the target species will encounter bait.
- Stations are checked and bait replenished frequently (ideally every 1-3 days, in order to ensure that attractive bait is always available) such that every individual of the target species will be exposed to a lethal dose.

1.1.6 Ground-based operations can reduce the risks of unintended primary poisoning of non-target species compared to other operation types, but the risks must still be properly assessed and mitigated before baiting commences.

1.1.7 There is an added element of risk to bait station operations (over aerial baiting by helicopter) as some individuals of the target species may be wary of entering a bait station or may be excluded from doing so by inter- or intra-specific competition.

Table A1.1: The advantages and disadvantages of ground-based rodent eradication operations using bait stations.

Advantages	Disadvantages
<ul style="list-style-type: none"> ○ Bait contained in stations reduces non-target effects (but does not eliminate them). ○ Generally uses less rodenticide per hectare than other methods. ○ Generally the safest option if livestock is present. ○ Generally less resistance from community to use of rodenticides by this method. ○ Allows detailed record keeping of both rodent and non-target species activity. 	<ul style="list-style-type: none"> ○ Very labour-intensive, requires intensive grid & multiple refills to achieve eradication. ○ Time-consuming operation – can take at least six months (depending on the island). ○ Coverage of island can be hampered by large areas of cliff (therefore may require rope access which is time consuming and has additional costs to consider), thick vegetation or bog, increasing risk of incomplete coverage (and subsequent failure). ○ Non target predatory or scavenging species such as raptors are potentially at risk by consumption of dead or dying rodents. Even with mitigation measures, still some risk of poisoning of non-target species.

2 Planning and knowledge required for the Feasibility Study

2.1 Defining the grid layout

2.1.1 **Clearly define the area to be treated.** The treatment area must include all dry land accessible to the target species including neighbouring islands, islets and rocks, as well as those in inland waters (e.g. lakes) etc. Bait stations will be required on rock stacks above high water around an island, especially those with vegetation on them, even if it seems unlikely that there are any rodents on them. **Use the known or suspected swimming ranges for the target species very conservatively when deciding which rock stacks do not need treatment. It is critical that all potential rodent habitat is baited.**

2.1.2 **Assess how treatment of all areas is to be achieved** – including on steep cliffs, offshore rock stacks, islets on inland waters (e.g. lakes) etc. If some areas cannot be accessed (e.g. by climbers), other options must be considered and trialled (e.g. lowering stations on to ledges) or the operation cannot proceed.

2.1.3 The **required density of rodenticide distribution** will depend on local circumstances (e.g. human habitation, habitat types) and the species of rodent to be eradicated. The required density should have been considered and identified during the Feasibility Study (i.e. in order to determine that baiting at that density was feasible).

2.1.4 For brown rats, the required density is usually a grid of 50m x 50m (max 100m x 100m in poor habitat, such as upland bogs, and up to 25m x 25m in preferred habitats and areas of human habitation), although some environments such as around farm buildings may require an even higher density of bait points. For black rats this is usually 30m x 30m (max 50m x 50m). For mice, this may be as little as 10m x 10m. Additional bait points will need to be set in all buildings.

2.1.5 **A monitoring grid is also required at the same density or smaller than the rodenticide grid**, in order to detect individuals that have survived the baiting operation or are reluctant to enter bait stations. It is desirable to place monitoring devices near to bait stations and also roughly half way between bait stations (in case any individuals will not enter or approach bait stations). In practice this means a 50m poison grid will form the basis of a 50m x 25m monitoring grid.

2.1.6 Ground-based operations may involve the **cutting of tracks** (with associated costs and environmental damage/disturbance) and the use of **specialist rope-workers** to ensure that all parts of the island can be baited and monitored. Feasibility of these must be properly assessed and costed during the Feasibility Study (e.g. will consent be granted to cut tracks on a ASSI/SSSI/SPA/SAC? From which relevant authority is consent required for operations within protected areas?).

2.1.7 Ground-based operations have a far longer implementation phase than aerial operations, and similarly lengthy planning requirements. **Plan for up to six months of work on the ground. For islands with permanent inhabitants, at least six months will be required to perform the eradication:**

- Depending on island area and team size, around one month will be required at the outset for final on-island preparations (e.g. clearing harbourage from buildings) and to establish a grid of bait stations (two months were required to establish the grid over the total of 1,317 ha of the islands of Canna & Sanday).
- At least 6-8 weeks will be needed to poison the rodent population. You should continue to lay rodenticide bait for at least one month after the last sign or suspected sign of rats.
- You should plan for several weeks of intensive monitoring as part of the operation to check for (and deal with) any surviving rodents after the initial baiting phase.

- Time is needed at the end to install permanent biosecurity measures (i.e. long-term monitoring), pack away the grid and all other equipment, and safely dispose of waste (i.e. used) bait. Remaining unused bait, which is still within the shelf-life timeframe, can be used for long term biosecurity responses or donated to other projects meeting the best practice requirements. Any bait left over past shelf-life will need to be safely disposed.

2.2 Rodenticide requirements

2.2.1 **At least two types of rodenticide, with different active ingredients must be available (on island) for every eradication attempt.** Although rats are opportunistic omnivores, they are also fussy eaters and some individuals may avoid the first bait you use.

2.2.2 **If using a first generation anticoagulant rodenticide (FGAR) as your primary bait, your secondary bait ('back-up bait') must contain a second generation anticoagulant rodenticide (SGAR) as the active ingredient.** Any local restrictions on the use of such baits outdoors must be checked in advance and, if necessary, appropriate approval sought from the regulatory authority e.g. the Health and Safety Executive (HSE). Since rodents developed resistance to warfarin-based poisons, SGARs were developed and rodent eradication practices have adapted appropriately. Since that time, most likely as a result of several contributing factors, no eradication has been successful which has solely relied upon a FGAR (e.g. warfarin or coumatetralyl). See Annex 5, Section 2.1.6 for more details on rodenticide choice.

2.2.3 The most widely used rodenticide in island restoration worldwide is brodifacoum. Brodifacoum is a potent SGAR which can deliver a lethal dose to rodents in a single feed, as can some other SGARs. FGARs require multiple feeds over several days in order to be effective. The use of brodifacoum outdoors in the UK is heavily restricted. Permissions for extremely limited outdoor use may be granted where resistance to other rodenticides can be demonstrated, but it is highly unlikely brodifacoum will be permitted as an eradication's primary bait. There are also restrictions on other rodenticides in the UK, both FGARs and SGARs - their use is managed through a [Stewardship scheme](#). The [HSE website](#) has a searchable database of rodenticide products which can be used in different situations. Products registered for use outdoors 'in open areas' can be used in eradication projects. Special permission from HSE would be needed to use products not listed in this category.

2.2.4 People seeking to use anticoagulant rodenticides must be sufficiently and appropriately trained in rodenticide use and adhere strictly to Best Practice guidelines. From March 31st 2017 it will be compulsory to have undergone an appropriate training course in order to buy anticoagulant rodenticide baits for anything other than household use. **For all rodenticide baits, use must be in compliance with their label instructions.** See Annex 5 for more detailed information on rodenticide use in the UK.

2.2.5 **The logistical implications of UK rodenticide use restrictions are, most notably, that regular and repeated access will be required to all bait stations in all parts of the island(s) - preferably every 1-3 days for several months.**

2.2.6 **Winter to early spring** is the **preferred time** in the UK to apply rodenticide bait. This timing has been successful in the past and tends to coincide with times of natural food scarcity and no young rodents in the nest. (Although rodents *can* breed all year round in the UK, in many cases they are unlikely to be breeding in winter.) It can also coincide with times of low non-target species activity, though this may not hold true in all circumstances. **The risk of eradication failure is likely to increase substantially if a winter operation is not possible.**

2.2.7 **Bait must be available and sufficiently attractive to every individual** of the target species in order for eradication to be successful. Palatability is highest when bait is fresh and dry. Winter weather in the UK can adversely affect bait, even inside a bait station. Slug damage may also reduce palatability. Wet bait may crumble and go mouldy quickly, making it less palatable and harder to recognise species-specific signs on the bait. Therefore, **bait must be changed regularly, even when it has not been eaten.**

2.2.8 Stations must be serviced frequently throughout the eradication programme. Checking bait every two weeks is the longest time interval that should be contemplated, although such infrequent checking carries a higher risk of failure. Checks every two weeks should only be contemplated after an intensive (checks every 1-3 days) operation in the first 6-8 weeks. Checking every 1-3 days throughout is preferable on many levels (ensuring bait palatability, checking for/responding to surviving rodents, checking for/responding to non-target interference). It is very important that palatable bait is present in every bait station for the duration of the eradication – if bait take by rats is very high, more frequent checks may be needed to ensure a continuous supply. This is particularly critical for FGARs, where multiple feeds are needed to provide a lethal dose.

2.2.9 Anticoagulant rodenticides come in many different formulations including waxy blocks, grains and pastes. Those which are wrapped (e.g. paste forms) should be avoided as they may not be sufficiently attractive for every individual. Higher wax content in bait may help it last longer in the field, but it may also make it slightly less attractive to the target species.

2.2.10 For **all rodenticide baits**, there must be careful **evaluation** of the available evidence for:

- **Acceptability to target species;**
- **Risks to non-target species;**
- **Other environmental effects (e.g. possible impacts on soil and water); and**
- **Storage and handling properties** (see Annex 6).

2.2.11 For reasons of practicality, cost effectiveness and proven acceptability to rodents, the majority of bait stations are made out of corrugated plastic tubing/drainage pipe of 100 mm diameter, see Figure A1.1. Bait stations should be made before the start of the operation by cutting 750 mm lengths from a large coil of piping. Small access lids need to be cut from one side in the middle of each length (large enough to fit a hand in), and holes pierced for threading wires through. Wires are used to secure the stations to the ground and to help prevent bait from blowing out of the station. Smaller numbers of purpose-built lockable commercial stations and DIY wooden stations will also be needed for on-going biosecurity (see Annex 3). *The use of lockable bait boxes may be preferable in some situations, e.g. around buildings, where a high bait capacity is needed, or if grain-based baits are used. Wooden bait stations are well-accepted by brown rats (Figure A1.2) and can be made cheaply from easily-obtained materials, though labour costs may prohibit their use in large numbers.*

2.2.12 Use only those types of **bait stations** proven in prior eradication projects targeting the same species and in similar habitat. Extensive field testing would be required to ensure all individuals of the target species will willingly enter a new design. Wooden tunnel designs are most favoured by rats but plastic tunnels are most often used because of their lower cost, weight and durability. Consider whether some wooden tunnels may be an advantage to use if they will continue to play a part in the ongoing biosecurity of the island. **Use a bait station with appropriate-sized entrance for the species being targeted** - 90mm minimum for brown rats, 60mm for black rats (this can be reduced to 45mm if non-target species are an issue).

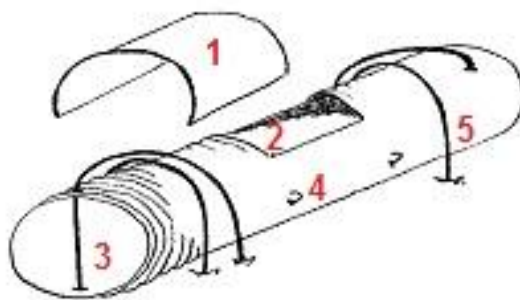


Figure A1.1 - Bait station design (diagram © WMIL and images © P.E. Garner- Richards/WMIL)

1 = removable inspection lid, 2 = access hole, 3= wire peg to halve entrance diameter,
 4 = wire to hold bait in centre of station and 5 = wire pegs to hold station securely to the ground
 6 = tag for numbering bait station/poison label. Left photo: Example in the field; Right photo: crow clip in place to secure lid.



Figure A1.2 - Wooden bait station (dimensions 35cm long x 25cm wide x 13cm high) with a galvanised metal lid and internal baffle; such stations offer a higher bait capacity for use in areas of particularly high rat density, e.g. around farm buildings, and are well accepted by brown rats. Photo © National Wildlife Management Centre (Animal and Plant Health Agency).

2.3 Reducing the risk to non-target species

2.3.1 Risks to non-target species can be reduced by, for example, placing additional wire through the entrance hole to halve the entrance size or securing the lids with a 'crow clip' (an additional wire bent around the tube and lid). There will be a slight curve to the piping which should be used so that the ends are raised slightly off the ground, making it harder for invertebrates to enter (N.B. this can lead to water pooling inside – if this occurs make small drainage holes in the bottom of the tube at its lowest point). Do not assume these provisions will make the rodenticide unavailable to non-target species. Consider and, if in doubt, test the possibility of exposure with non-rodenticide bait.

2.3.2 Risks to non-target species can also be reduced by the choice of rodenticide, as some rodenticides have a higher risk of secondary poisoning. See Annex 5 for more details.

2.3.3 Non-target species present both direct and indirect risks to project success.

2.3.4 **DIRECT / PRIMARY:** where animals (e.g. livestock, voles/native mice, slugs) **eat bait intended for the target species**, thereby **dying as a result of direct bait consumption** and **limiting the amount of bait available to the target species**, thereby reducing the chances of eradication success.

2.3.5 Such non-target species may have to be removed before the eradication project begins or the design of the bait station modified to reduce access and interference with the bait.

2.3.6 In the UK, bait competition is most likely to occur from non-target rodents, although a full assessment should be conducted for all non-target species. Rats are *likely* to be the dominant rodent species on UK islands where they are present; suppressing the populations of other rodent species, but this should be confirmed via population density assessments during the feasibility stage (see Annex 2).

2.3.7 As such, the risk of non-target species directly compromising eradication success should be low, but should still be assessed to ensure such assumptions are valid for your island: corvids and livestock have interfered with stations in a number of UK projects (which can be mitigated for by using crow-clips (see Figure A1.1) and re-positioning stations), whilst invertebrates may also consume bait. Regular replenishment of bait is crucial in these situations, and daily servicing of bait stations may be necessary in cases of regular and sustained interference from non-target species. It may be necessary to increase baiting rates in order to take account of competition. (N.B. this may address the availability issue for target species, but could exacerbate the issue of non-target species poisoning). Livestock eating bait is also a potential problem for human health if those animals are due to enter the food chain and, if it cannot be prevented, their owners need to know what has happened. Good record-keeping means it should be possible to tell fairly accurately how much bait has been eaten by non-target species.

2.3.8 **INDIRECT / SECONDARY:** where animals who have eaten bait (e.g. the target rodent species, or non-target invertebrates etc.) are the **poisoned prey for other non-target species** (such as raptors) **resulting in the unintended death** of individuals or even entire island populations.

2.3.9 The death of non-target species may not lead to project failure *per se* (i.e. the eradication itself may be successful), but could compromise support for future projects and/or lead to unacceptable deaths in non-target species.

2.3.10 The grid size for laying bait stations should be determined as a result of considering the risks from both direct and indirect non-target impacts, e.g. if brown rats (target species) and wood mice (non-target species) are both present, you may wish to opt for a maximum of a 50m grid in the densest areas (rather than 25m), to maximise the chances of at least some mice surviving the baiting operation, whilst not moving to 100m which may compromise the success of the rat eradication.

2.3.11 If non-target issues are significant, you may wish to review the timing of the operation to see if these risks can be reduced, but this may also increase the chances of project failure.

2.3.12 To manage non-target risks:

- Identify the non-target species present on the island;
- Assess whether the project poses any risks to them;
- Assess whether non-target species will interfere with the project; and
- Implement management plans to deal with each of the risks you have identified.

2.3.13 Basic information on non-target risks can be collected from other UK eradication operations but each non-target species should be assessed for each specific island as their behaviour and ecology may differ between islands.

2.3.14 A **peer reviewed Environmental Impact Assessment** (EIA) is the best means of achieving this so that any necessary mitigation measures can be built into project planning from the outset e.g. mitigation actions are used as evaluation indicators/objectives/outcomes for the project. Furthermore, for Natura 2000 sites in the UK a Habitats Regulations Appraisal (and Appropriate Assessment) may be needed.

2.3.15 Consider all of the proposed eradication techniques and phases and the logistical and support systems required to undertake the operation and review the effects of these on the environment e.g. use of *each* type of rodenticide, use of *each* type of trap, the need to cut tracks, daily trampling along the same paths, installation of temporary accommodation/sanitation for the team, biosecurity requirements.

2.3.16 N.B. If **rodenticides** are already being used to control rodents on the island, **their use must cease about 6 months before the start of the eradication operation.** Residents may wish to use traps in the interim to control rodents, which will incur different risks for animal welfare and non-target issues. All such use of traps must be in accordance with the stipulations outlined in Annex 2.

2.3.17 If any non-target species are found to be at an unacceptably high level of risk, either through direct or indirect poisoning during the feasibility stage, plans should be made to remove *at least* one genetically viable captive population for reintroduction post rodenticide administration (consider the risks of holding just one captive population were they to succumb to disease or other catastrophe). Although this option may be scientifically acceptable, you must consider whether or not this will still be socially and legally acceptable, or whether this impacts on project feasibility. Experts would be required to catch, translocate, house and care for the animals while in captivity and this will add significant cost to the project. It also comes with additional animal welfare considerations. Seek advice from veterinarians and captive breeding centres/zoos. Laws and Codes of Practice will be dependent on the species to be held in captivity, but all that are applicable must be adhered to.

3 Operational planning and execution

3.1 Peer review

3.1.1 **Have operational planning peer reviewed as it is being developed**, to ensure the eradication design matches the terrain and ecology of the island and you've thought the details of the logistics through completely.

3.1.2 Before the operation commences, you need an independent expert to conduct an **Eradication Readiness Check** and conclude that the project is ready to proceed. **If the project is not ready, DO NOT PROCEED. The chances of failure will be high and you may only have one shot at eradication.** Do not jeopardise the probability of success when there are unnecessary risks. It can be challenging to make the decision to postpone implementation, but ultimately it will waste less money, time and resources than continuing and failing the eradication.

3.2 Personnel/team considerations

3.2.1 **Health and safety of the team is always paramount** and an independently-reviewed Health and Safety Plan must be in place. All team members should have a copy of the plan and should declare that they have read it and commit to working in accordance with its stipulations.

3.2.2 Those involved in the operation need to understand eradication is different from control as *all* individuals of the target species must be targeted. Unlike typical conservation projects, expect the resources and commitment for eradication projects to **increase** rather than decrease throughout the project life. Killing the last rat (which is essential) may require orders of magnitude more operant time than the first few hundred. It requires commitment from the whole team to achieve this. In ground-based rat eradications, **every team member must be fully committed to the operation** – a mistake, careless action, or failure to carry out work in accordance with operational requirements by any one person could easily result in failure of the entire project.

3.2.3 There is a **trade-off in team size**. More people may allow the project to be completed faster but also mean greater logistics and costs for transport and living on the island. More people increase the chance of someone doing substandard work but too few people leads to fatigue and subsequent mistakes. With ground-based operations, every single field assistant has the potential to cause the project to fail. The **plan needs to be simple** so that it becomes very difficult to get it wrong.

3.2.4 **Considerable fitness is required** for ground-based rat baiting operations. Often large distances are walked with heavy loads of bait. A high level of fitness in each team member will reduce the likelihood of mistakes being made through fatigue.

3.2.5 For those projects involving **extended stays on remote islands**, all people involved on the island need the **ability to live and work harmoniously** in such an environment. Poor group dynamics can lead to mistakes which can affect the success of the project.

3.2.6 Inexperienced people should be provided with adequate training and deployed on non-critical tasks to allow the more experienced people to focus on servicing bait stations correctly. Alternatively, pair inexperienced people with an experienced 'mentor' or supervisor. Select the team very carefully, with employment of experienced Team Leader(s) and **at least 50% of all field staff having prior eradication experience**, if at all possible, so each 'novice' can be assigned an experienced on-site mentor or supervisor.

3.2.7 **Create task specifications** for team members to use and **provide adequate training** from experienced Team Leader(s), for example for positioning or servicing bait stations, see Figure A1.3 for an example specification. This approach can also be used to specify other complex or important tasks in the project.

3.2.8 The Project Manager (or Operations Manager if different) should **provide an operational briefing** to all personnel just before the start of the operation. Provide information to the entire team at the same time to be sure everyone has the same information. Describe the tasks ahead, assign responsibility for each task and remind people of the hazards associated with the project, health and safety provisions and emergency procedures. Identify the Project Manager and Team Leader(s) and ensure that the entire team is familiar with each other. Before commencing any work ensure those taking part understand the why, what, who, when and how of the work.

3.2.9 **Gather the team at the end of each day for a debrief.** This allows issues to be identified and rectified early. Ensure the whole team are present so everyone gets the same information. Brief the team about the following day's tasks then or hold a morning meeting before teams disperse. All team members must report observations of target and non-target species, whatever the probable cause of death.

3.2.10 **Stick to the plan.** Any changes once the work is underway should be taken only after careful consideration of the impacts and with input from the Independent Technical Advisor(s). Communicate any changes to the plan to the entire team, e.g. at the morning or evening team briefing.

Task Specification: Filling bait stations and re-baiting them	
Delegated to:	Jim Harris – Volunteer Eradication Operator Supervised by Jane Taylor , who holds ultimate responsibility to see task is performed as specified
Project:	Isles of Scilly Seabird Recovery Project
Target Species:	Brown rat
Background to task	
The task specification provides guidance and standards for those involved in using rodenticide rodenticide baits in bait stations on the islands of St Agnes and Gugh in the Isles of Scilly. In order to achieve the eradication of rats on the island every single individual rat must have access to bait. Therefore it is vital that every bait station on the island has a steady supply of palatable bait .	
Included in scope of task specification	
<ul style="list-style-type: none"> Distributing rodenticide baits via bait stations established on the island Measuring and recording the amount of bait taken from each bait station Maintaining the level of bait available in each bait station 	
Outside Scope	
<ul style="list-style-type: none"> Establishing the grid of bait stations (see separate Task Specification) Establishing or checking the grid of monitoring stations (see separate Task Specifications) 	
Standards	
<ul style="list-style-type: none"> All bait stations are filled with 3 blocks of bait which are placed loose in the middle of the station. Every bait station is checked every day and bait take is recorded on the attached form. Each bait block is closely inspected for signs of rodent nibbling and the results recorded at each station before moving on to the next. Records are made of the amount of bait taken at each station as well as any other information (e.g. station lost/dislodged/tampered with, other signs of rodent/non-target activity), before moving on to the next station. Any spoiled, wet or mouldy bait is removed and returned to base using the bucket provided. Every checked bait station is left with a total of 3 entire and palatable blocks of bait in it. A GPS is carried and a track log is collected for the entire day. Each transect in each section is assigned to one person to complete the bait application task. <i>Bait will be wired in to the station when decided by the supervisor. At this point, each station will be left with 2 blocks of bait at each check.</i> 	
Equipment	
Buckets with rodenticide/poison label attached – one for fresh/replacement bait and one for used bait Personal Protective Equipment (gloves, hand sanitizer, waterproof clothing, sturdy boots) Rodenticide Safe Handling sheet Material Safety Data Sheet (MSDS) for the rodenticide being used & COSHH assessment This task specification Recording forms (in waterproof notebooks where appropriate) and pencils Colour coded map of transects with names of each person assigned to each transect GPS and instructions	

Figure A1.3 - An example of a task specification document for servicing bait stations (RSPB).

Date:	12/11/14	Staff:	Jim Harris	Bait check round:	7	Transects:	A-G incl.
Station	Bait taken: blocks / species	Notes					
A1	2 / presumed rat	Blue rat droppings outside station (bagged and removed).					
A2	½ / rat	Rodent chew marks. Part-eaten bait replaced, untouched block left.					
A3	0 / n/a	Station loose: secured with extra wire. Bait replaced as was damp.					
B1	¼ / invertebrate	Suspected slugs, none present in station during check.					

Figure A1.4 - An example of a completed recording form (RSPB). Note: in the field it is easier to collect data in a waterproof notebook to keep everything together, but small laminated crib cards could be made so that personnel are aware of what information must be recorded and how.

3.2.11 It is the roles of Project Manager, Operations Manager and Team Leader(s) who are *responsible* to do everything possible to maintain positive morale, though it is likely that it is the Project Manager who is *accountable*. This should be clearly identified in the **project plan** and made clear how the responsibility will be allocated. This includes ensuring working conditions are as comfortable and achievable as possible, and set the work schedule according to the abilities of the slowest team members. Keep the team informed of progress. Keeping the team's morale high increases the chances of project success. Projects can involve long hours working in difficult and demanding conditions, so pay particular attention to this.

3.3 Laying out the grid

3.3.1 **Establish the grid of bait stations** at least one week and **preferably two weeks or more prior to baiting**, to reduce potential neophobic reactions from rats. Mice are inquisitive and this time is less crucial if mice are your sole target species. Spacing will vary depending on the target species. For multiple target species use the smallest grid recommended. For operations targeting both *R. norvegicus* and *R. rattus* a 50m x 50m grid should be sufficient. If robust island-specific home range information exists for the target species, use the minimum home range size to inform grid size.

3.3.2 **Concentrate on one task at a time** – get the grid marked out before returning to lay the bait stations, Fig. A1.5. Number the stations only after they have all been laid out, reducing the chances of mis-numbering. This also gives *all* stations 'bedding in' time so that neophobic rodents are ready to enter them island-wide when bait is laid.

3.3.3 Create a computer shape file of the project area and required grid. Load the grid points from your shape file onto **GPS devices for establishing grid points in the field**. Practice this before going to the island if unfamiliar with the equipment. Accuracy of GPS fixes should be < ±8m for a reliable (rat) grid to be established using GPS. This will not be sufficiently accurate if you are establishing a mouse grid. At each point, place a highly visible marker flag (e.g. bamboo cane and/or high visibility tape).

3.3.4 Start the **transect lines** at a logical point, ideally, the centre of the island, so a straight 'backbone' or reference line can be established at correct spacing between transects, Fig A1.5. This reduces potential for error in establishing transects, as transects from centre to coast are shorter than coast-to-coast lines. Establish 'cross-island' transects at right angles to this central line. Where dense vegetation makes a central line impractical, transect lines should start from the coast and, where possible, head parallel to the coast. Transect lines must be individually numbered and the number of grid points along that transect should also be established and mapped.

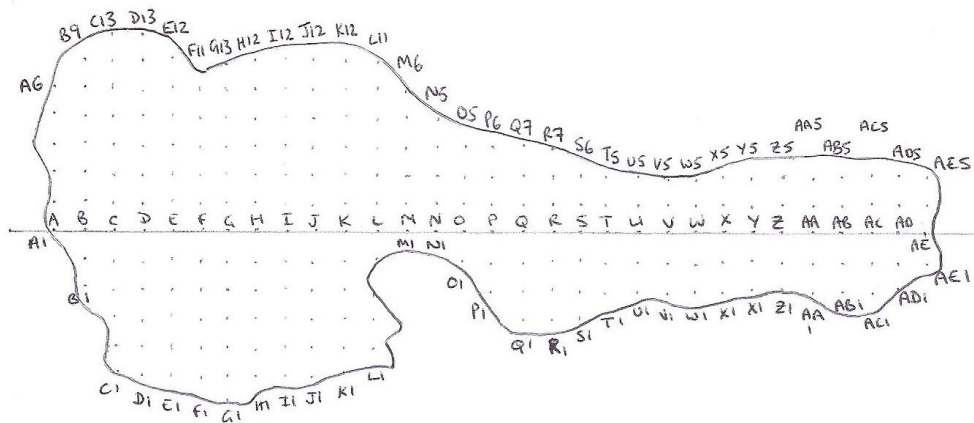


Figure A1.5 - A backbone transect grid

3.3.5 **Keep the grid/transect system as simple as possible**, preferably parallel lines across the whole island. However, natural features or settlements/stone walls may preclude this, and the island may need to be divided into sub-sections, Fig. A1.6. Sometimes ridgelines or other natural features may be easier to follow, and subsections created from those. Ensure end/start points are very clearly identified for each sub-section and that there are no gaps between the end of one sub-section and start of another.

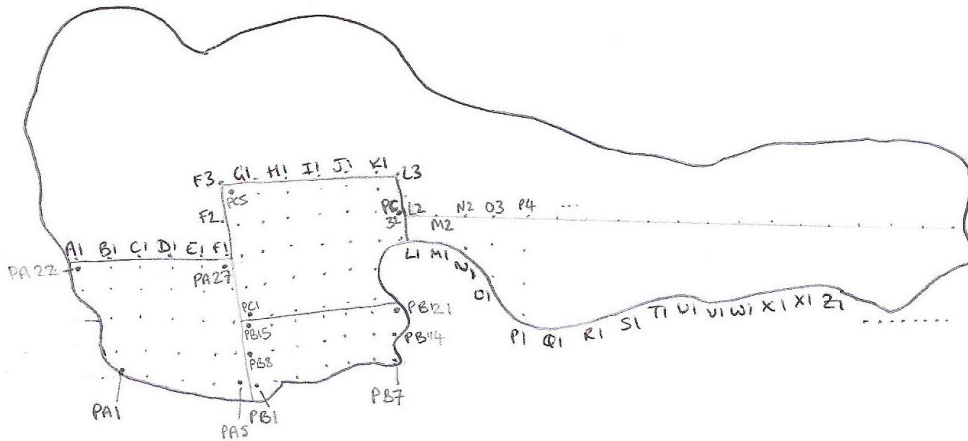


Figure A1.6- Grid based backbone system, with subdivisions to take account of three paddocks bounded by stone walls.

3.3.6 **Cut tracks** where necessary or desirable – clear tracks will greatly aid the efficiency of regular servicing, and will minimize the potential for wasted time attempting to find 'lost' bait stations and the associated risk of some stations being left unserved. Such tracks must be subject to consent/agreement on protected areas.

3.3.7 Particularly on larger islands, create bait station equipment depots at strategic locations to reduce the amount of times teams have to return to base and the distance they have to carry bulky equipment.

3.3.8 Establish a bait station at each **grid point** and ensure it is **clearly marked** (e.g. with flagging tape on a bamboo cane). Once all bait stations are established, label each one with the transect identifier and sequential number (A1, A2, A3 etc). Visibility of grid points is very important – where practical, ensure the subsequent grid point is clearly visible from the previous one. Where this is not feasible (e.g. very dense forest), mark the route to it using a cut track and/or a different coloured tape.

3.3.9 All bait station locations should be recorded on GPS and this information safely stored and mapped. This should be checked by someone trained in GPS mapping systems to identify if any gaps in coverage are apparent. This should be done prior to the commencement of baiting.

3.3.10 Once these sites are established and marked, use the information to check prior calculations on amount of bait/bait stations required – does the actuality on the island match the prior planning? Check carefully for potential gaps both on the map and in the field before commencement of baiting. Ensure you have enough bait on hand to cover all baiting stations, with extra allowed for contingency.

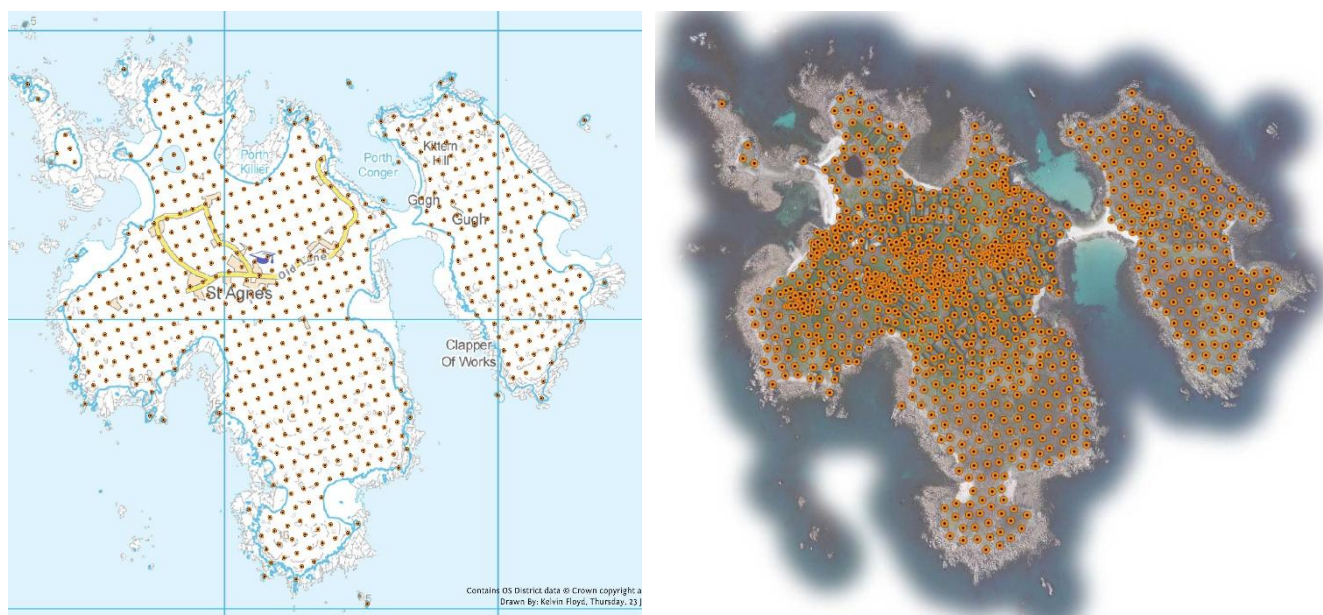


Figure A1.7- Schematic grid overlay compared with actual grid, once special areas (mainly buildings and stone walls) were accounted for. Isles of Scilly Seabird Recovery Project, © WMIL and Ordnance Survey.

3.3.11 Ensure **other** 'special' **areas** are **treated** by specifically targeted actions. Bait should be applied in, around and, where practical, under all buildings (all portions, including cellars, attics, etc.), in large caves, on offshore rock stacks that are still exposed at high tides, on islets within inland lakes, steep cliffs etc. See figure A1.8 for example.

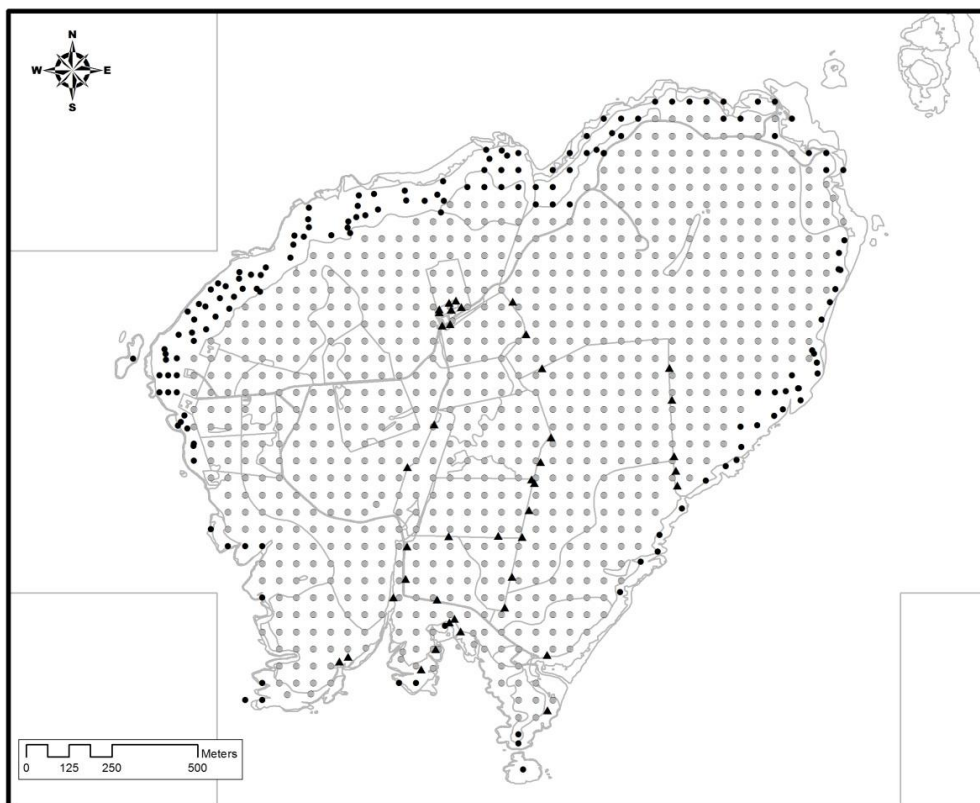


Figure A1.8 - the bespoke grid for the Calf of Man operation, illustrating greater density of stations around the coast, buildings and stone walls (APHA).

3.3.12 Very steep areas (i.e. slopes exceeding 50°) that are over 25m in vertical height need to have additional or specialized treatment. Consider how bait can be placed in adequate density on steep cliffs, and trial methods by which to position bait as far as possible up, down or across cliff areas. Where possible, choose routes that can be safely accessed by foot. For larger cliff areas (where all other options may leave gaps of more than 50m x 50m for rats) abseiling may be an option. If cliffs have no vegetated areas, ledges or seabird nesting sites, then there is less chance that rats will be living permanently in these areas. In these cases fewer stations can be used (i.e. equating to a 100 x 100m grid or 1 per hectare) but it is advisable to put out as many monitoring devices as possible to assess rat activity.

3.3.13 If rat sign is found, then the cliff area will need to be baited as intensively as the rest of the island. For cliffs with ledges and vegetated areas bait stations should be set at the higher density of 50 x 50m. Space the stations regularly wherever possible, but it is better to put a station on a vegetated ledge a few metres out, rather than exactly 50m from the previous station but in an inhospitable location unlikely to be used by rats.

3.4 Other preparations prior to baiting

3.4.1 As far as possible, **eliminate or reduce all other potential sources of food for rodents before baiting** (e.g. all food scraps from the field team or island residents should be stored inside sealed, rodent-proof containers, seal all emptied food containers and tins inside rodent-proof containers, etc). Clearing up the island before poisoning begins can be a major, time-consuming task on inhabited islands. Good waste management is important both for the success of the eradication operation and for the success of any future responses to biosecurity breaches. The project should assist island residents to improve their waste management by providing and installing rodent-proof bins, for example.

3.4.2 **Harbourage must also be reduced before the baiting begins.** On inhabited islands, this will mean ensuring that all outbuildings, sheds etc. are tidy and easily accessible around wall edges, with large bulky items stored on pallets. As well as reducing hiding places for rodents, this will also ensure such spaces can be accessed easily to lay bait. Again, assistance should be provided to residents to achieve this. All island residents should be consulted before this work begins to ensure they are happy with this aspect of the eradication.

3.4.3 In accordance with local regulations, prior to the operation, **remove any wildlife carcasses found** to minimize the risk of rats utilizing alternative foods in preference to the rodenticide baits. During the operation, ensure carcasses of wildlife and of the target species are collected; see section 3.4.6.

3.4.4 **Warning signs must be in place prior to the commencement of baiting** to alert visitors and residents to the presence and danger of the rodenticides being used. See Fig. A1.9 for an example.

3.4.5 Warning signs must include:

- Details of the specific rodenticides being used, their active ingredient and brand name;
- How to recognise the bait (a photo is recommended);
- Instructions for what visitors/ residents should and should not do;
- Emergency contact details; and
- Consider providing information in different languages, as well as the local language(s), if the island is frequented by tourists.



RAT ERADICATION IN PROGRESS

Invasive non-native rats are being eradicated from [Insert site name] to conserve birds and other wildlife.

Rat bait containing [Insert rodenticide name] have been distributed across the island in bait stations from [Insert baiting start date] until further notice.

The rat bait is in **small blue cubes** contained within **black plastic tubing** wired into the ground.

Ensure that **pets and children** remain under close supervision at all times.

In case of emergency, contact [Insert staff name] on [insert number].

DO NOT TOUCH OR REMOVE

Figure A1.9- Warning sign example. Consult the product label for any further instructions on information to include in warning signs.

3.5 Bait application

3.5.1 Attempt to **start baiting all stations on the same day**, or within as close a time period as possible. Apply a known quantity of bait to each station by counting out individual baits (or using a standard scoop). This will allow the amount of bait taken between checks to be calculated. It is particularly important *toward the end of the baiting operation* to be able to distinguish any possible rodent take from individual stations (and so to effectively target remaining individuals), so bait is *wired in to the stations* at this point. Until then, bait is not wired in – this allows shyer individuals to remove bait and eat it at their own leisure, rather than in a bait station. It also means bait can be taken back to any nesting females who may not otherwise encounter bait.

3.5.2 **Each member** of the baiting team should be personally **allocated transects** to complete, and this information should be recorded. If issues arise later it may be possible to determine if a single individual is responsible – if so, other lines completed by that person should also be inspected. Staff can be moved around between sections of the island on different days. This is particularly useful if different parts of the island vary in terms of ease of working, e.g. rugged versus flat terrain, thus enabling all staff members to see all parts of the island and to share out the more challenging transects. In all cases the Operations Manager, Project Manager, Team Leader(s) or other experienced staff (whoever is identified as being responsible for the field operation) should check all transects as often as possible, e.g. checking those in section 1 on day 1, section 2 on day 2 etc.

3.5.3 Create a comprehensive list of stations per transect and tick them off in field notepads when baiting of each has occurred.

3.5.4 **Record bait take** from each individually numbered station whenever bait stations are checked, on a daily basis if possible. **Data should be inputted immediately (same day) into a project database** to allow for adaptive management (e.g. via identification of rodent hotspots or areas of ongoing activity).

3.5.5 Any **interference with the stations or the bait by non-target species should also be recorded**. If this is observed, it will require immediate adaptive management to be deployed, e.g. removal of livestock, making the stations more secure, further refinement of the bait station design.

3.5.6 **Searches for carcasses** should be carried out. Any dead target species should be removed and disposed of in accordance with rodenticide label instructions. Any dead non-target species should be necropsied by a trained individual. If there is **any evidence that poisoning played a part in death, this should be reported to the Chemicals Regulation Directorate** (see Annex 5).

3.5.7 **Stations** should be **checked** (and bait replenished if necessary) on a **daily** basis if possible. Regularity of checking can be reduced where logistic constraints are in place, but only when wholly confident that palatable bait will remain available in all stations over the entire time between checks.

3.5.8 **Replace** any bait that has become **mouldy** or **damaged** with fresh **bait whenever necessary**. Dispose of old bait away from possible rodent access until it can be correctly disposed of (see Section 3.6.6). If bait has gone mouldy between checks, the frequency of checks must be increased to ensure all available bait remains attractive.

3.5.9 **Leave** bait **stations** in place (**baited**) for **at least 1 month after the last evidence of rat bait-take or suspected take**. There are usually two peaks in bait take – the first usually occurs in the first few weeks after bait is laid. As initial bait take subsides, it can be tempting to think the poisoning has been successful and that baiting can cease. However, this first wave may have only knocked back the dominant individuals. Once these animals have been killed, subdominant individuals are able to start accessing bait. Bait consumption is then usually seen to rise again before tailing off to zero.

3.5.10 An **alternative type of bait/rodenticide should be used** once bait consumption has dropped off in case any surviving rats have an aversion to the original bait type. Wire bait in to the stations so that any take can be more easily attributed to a specific species.

3.5.11 It is prudent to continue baiting of buildings long after the application of bait elsewhere. Islands with permanently occupied human habitation should be baited for six months or longer.

3.6 Monitoring operation

3.6.1 **Intensive monitoring should not start until bait take has diminished**, to enable identification of fussy individuals and focus areas. It is important to ensure alternative food sources are not being provided (such as with baiting tracking tunnels with peanut butter). Rodenticide bait should still be laid during the monitoring operation. It can be useful however to put out some monitoring at the beginning of the operation to obtain a reference sample of teeth marks and footprints on all types of monitoring equipment. This will enable the team have comparison samples for later in the project (as many may not be very experienced in identifying sign).

3.6.2 Establishment of the monitoring grid should be comparatively easy: **place a monitoring device** (such as flavoured wax, soap or chew sticks) **at each bait station and another as you walk from one station to the next, approximately halfway between the two**. Placing the device outside the bait station will help identify if a target individual has survived as it is not willing to enter stations. Mark the 'in between' monitoring point with flagging tape (e.g. on nearby vegetation). Use **as many different types of detection device as possible**. Refer to Annex 3.

3.6.3 Monitoring points should be checked as regularly as the poison grid and data should be entered on to the database immediately after each check. **Any suspicious sign will require a prompt response**. Placing a trail camera out (see Annex 3) will help confirm whether a target individual has indeed survived, whether or not they are avoiding entering a station or just not taking the bait. Alternative methods are likely to be required at this point, such as placing traps out in the vicinity, reducing the size of the bait station grid, offering an alternative bait.

THE IMPORTANCE OF GOOD FIELD DOCUMENTATION

A lot happens during the eradication operation and intensive monitoring. It is easy to think that a specific detail can be remembered and recorded later/when you are back at base, but in practice this rarely happens – something else occurs which distracts you and then the information is lost. Station numbers are easy to confuse (was it B6 or B7?) and it is easy to forget if you meant the bait that was taken or the bait that was left in a station (Was it a ¼ block gone or a ¼ remaining?)

Good record-keeping can mean the difference between success and failure.

Correct identification of any sign of a target species during the operation is crucial to making the right decision on how to respond. In many cases the evidence will be open to interpretation, therefore it is important that evidence collection techniques maximise the information available and minimise the chance of wrong conclusions being drawn from it. Ask open-ended questions, gather all evidence (e.g. all droppings in the pile, not just one or two), label samples thoroughly (location, date, observer), take photos (including *in situ* with a size comparator), take time to search for other evidence, make notes of discussions, conclusions and resulting action.

Good records allow you to refer back to specific events or look for patterns that might require stitching together observations from different people (e.g. people working on adjacent transects) or different days. Evidence dismissed as unlikely one day might suddenly be crucial if other sign is spotted nearby a week or two later.

Document more rather than less – you will have many opportunities to delete superfluous data later, but only one opportunity to record it in the first place. Consider providing recording sheets/templates to ensure consistency in record-keeping across the team.

The Operations Manager should keep a daily log of activities. This should record general observations such as the weather conditions, and what work was planned for and actually achieved during the day. It should note who was responsible for specific tasks, detail any issues that arose and document any deviation from the Operational Plan.

This is one of the best ways of learning and building capacity for future projects.

3.7 Post-operation activities

3.7.1 The field team should make preparations so that the detailed **Biosecurity Plan is operational when they leave the island**. More details are provided in Annex 4. This is likely to involve a range of activities including:

- Identifying an appropriate storage area for biosecurity equipment;
- Stocking the storage area with all equipment required to carry out both the ongoing surveillance operation and incursion response operations (the Incursion Response Kit), including making supplies of detection devices such as flavoured wax;
- Installing and mapping the location of permanent surveillance devices;
- Providing training to those who will be responsible for implementing the Biosecurity Plan;
- Ensuring there is a clear chain of decision-making and emergency contact numbers in the event of a suspected incursion/reinvasion.

3.7.2 It is important to be familiar with the Biosecurity Plan – depending on the island, it may be considered prudent to leave out the grid of bait stations so that any incursion response can be executed rapidly (e.g. on an island deemed at higher risk of reinvasion which has no residents/visitors).

3.7.3 If all **equipment** is being brought in, **take time to store it well**. If a grid is required in future, the ability to lay it quickly and efficiently is crucial. E.g. create an inventory of what is in the storage area and label boxes clearly so people can quickly access the specific equipment they need; straighten wires and re-bundle them in sizes that are easy to transport and are helpful for re-laying a grid (e.g. in bundles sufficient to establish 10 stations); bag consistent numbers of bait stations in large dumpy bags so they are kept contained and can simply be carried straight out into the field.

3.7.4 **Rodenticide** bait should be **kept in a locked container** which is **able to withstand fire** for 45 minutes. Bait containers must be labelled with the label from the manufacturer. The Material Safety Data Sheet (MSDS) should also be attached. It is important to have a record sheet to quantify the amount of bait used during any incursion response, in order to keep an accurate record of the amount of bait remaining (i.e. 15 x 10 kg buckets in depot on 1 May 2015, 1 bucket used for incursion response on 12 May 2015, total 14 buckets remaining).

3.7.5 Additional equipment which would not be needed in the event of a reinvasion, and **all rubbish generated by the project should be removed from the island**.

All used **rodenticide bait** should be removed from the environment and stored in labelled containers until it is disposed of. **Plans for its disposal should be in place before the operation commences**. The MSDS should provide details on safe disposal and arrangements should be made with the local authority in advance. Not many landfills in the UK are registered to take waste bait for deep burial. The most common option at present is incineration at a registered hazardous waste plants. This can be expensive and movement of bait to the incinerator requires a hazardous waste transportation certificate as well as a registered waste transporter. It is advised to seek advice from the Environment Agency/SEPA/NRW.

3.7.6 It is important to **debrief the team before it is disbanded**. Arrangements should also be made for the Operational Review (see Overview document) if this is to happen off-island. If not all of the team will be able to attend the review workshop, it is important to capture their ideas before they leave the island or provide an opportunity to feedback/contribute to the Technical Report.

3.8 Declaring the eradication to be successful

This section is taken largely from New Zealand's extremely useful Department of Conservation (DOC) rodent eradication best practice guidelines (Broome *et al.* 2011), as referenced in Section 4.

3.8.1 It is often much harder to be confident that a species is absent from an island than to be confident it is present. To get the same confidence level that nil sign is confirmation of a successful eradication you need to deploy more effort early, less effort later. Too early and huge effort will still give you little confidence, very late and minimal effort will give you good confidence, provided eradication failure can be distinguished from biosecurity failure through DNA samples. Make these judgements on the facts available at the time (i.e. what has actually been done/what is the situation).

3.8.2 The variables to be considered when declaring an eradication successful are:

- a) *The length of time with no detections.* Longer timeframes in theory will allow survivors to build up to detectable numbers so species productivity and timing of breeding must be considered. As a rule of thumb in the UK this final intensive search should be undertaken **two years** after the last rodent sign was detected, as this gives sufficient time for a population to rebuild to more easily detectable levels due to rodent breeding capacity and life span. Ensure you have managed stakeholder expectations and that they are aware of the delay between the end of the poisoning operation and the declaration of eradication success.
- b) *How hard have you looked?* This should incorporate a judgement on the quality of detection effort as well as the quantity (e.g. a diverse array of detection devices is better than relying solely on chocolate wax).
- c) *What are the species involved?* Think about: vulnerable species present in low numbers or previously present that may (re)establish if eradication is successful; species proposed to be translocated; and the species targeted for eradication (some are easier to detect than others). Highly vulnerable native species might actually be good detection devices, e.g. the natural return of vulnerable seabirds on some islands with no sign of predation can be a good indication that the predators have gone, though of course is not conclusive evidence in itself.
- d) *What is the urgency for confirmation?* Perhaps better expressed as what management action requires this information and how urgent is it? If you have a critical species that needs the island sooner rather than later or if confirmation allows you to wind down or defer another project, then confirmation is more urgent. If it's just so you know the eradication was successful with no urgent management action either way (recognising that for eradication planning elsewhere the confidence of transferring lessons from a confirmed eradication is preferable) what's the rush?
- e) *What are the consequences of wrongly declaring eradication success?* If the translocation proposal is to release a relatively robust or common species then the biological consequences of being wrong about the eradication outcome are not that serious and perhaps you could afford to take a greater risk. Reputational consequences may be more damaging, however.
- f) *How effective is biosecurity?* If it is not up to standard (or reinvasion risk is high) then a successful eradication might only be temporary. See Annex 4.
- g) *What is the cost?* Extremely remote islands can be very costly to visit so monitoring visits may be more cost effective if combined with other reasons for making the journey.

3.8.3 Use a range of indicators to detect the presence of rodents following an eradication. Detection devices include snap traps, live capture traps, flavoured wax blocks/tags, inked footprint tracking tunnels, candles, lard, chocolate, flavoured resin blocks, fur traps, wooden boxes providing shelter and wood shavings as nesting material (rodent motels), trail cameras and, potentially, rodenticide baits a (waxy type) secured in bait stations.

3.8.4 Deploy detection devices in the most likely places. It does not have to be on a transect or grid, just try to sample different habitats and choose places most likely to have rodents.

3.8.5 Look for rodent sign wherever you go but especially around burrowing seabirds, sandy beaches or soft mud. Beware of signs that pre-date the eradication which may be still present – faeces (rat droppings) can often last for years in sheltered sites.

3.8.6 Consider some night searches if you have a likely area which you can search safely.

3.8.7 If the use of kill traps results in a capture and death of a non-target species, leave the carcass secured in the trap for a few days to see if it gets scavenged by a rat.

3.8.8 All work should be recorded on GPS and mapped to show the amount of island coverage achieved. Any tangible sign or indication of non-native rodent presence should be photographed and if possible retrieved as a labelled sample for expert opinions on identification and for DNA analysis.

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