

SMALL MAMMAL RADIO-TRACKING PROTOCOL

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PURPOSE

Lemmings are fitted with radio tags to monitor movements, to assess cause of death and estimate survival and to measure habitat use.

EQUIPMENT

Radio Tags - There are now several suppliers of small mammal radio tags. We are using tags made by Biotrack (www.biotrack.co.uk). Biotrack's tags are expensive (£108 each) but the company is very reliable and the tags are high quality. The tag type is CTW with an AG392 battery cell and a replaceable cable tie collar. The tags, complete with collar, weigh about 1.8 grams each. The frequency of each tag must be unique and not overlap with any other projects in the area.

Receiver & antenna – You will need a receiver and directional antenna to locate radioed animals. Telonics (<http://www.telonics.com/>) make good receivers (models TR4 or TR2). Yagi antennae are the best model for detecting direction of the radio signal. The frequency range of both receiver and antenna must match the frequency range of the radio tags.

Radio refurbishing – When batteries need to be changed on the radio tags, the ideal option is to return the tags to Biotrack for refurbishing. The cost is 60% of the original cost of the tag but the result is an “as new” tag ready for re-deployment. If this option is not possible, batteries will have to be changed in the field. This is delicate work and requires patience. It's very time consuming (1-2 hours per tag) and the potential for damaging the tags is high. You will need:

- New cable ties for collar
- Fresh batteries
- Battery tester
- Heatshrink (to cover collar and hold antenna in place)
- Hot-air gun for shrinking the heatshrink (propane models available)
- Cigarette lighter if no hot-air gun available
- Plastidip (covering to protect and moisture proof the tag and battery)
- Acetone (for dissolving plastidip and revealing old battery)
- Toothpicks or very small ‘jewellers’ screwdriver for spreading plastidip
- Small stand with alligator clips (known as a ‘third hand’) is useful for holding the tag while you work on it
- Magnifying glass on a stand
- Fine wire cutters
- Dissecting scissors
- Small needle nosed pliers
- Small strong knife

- Rosin core solder (very fine, e.g. 0.5mm wire diameter). Most solder is now lead-free but leaded solder works better if you can find it.
- Soldering iron [if mains power available, use a reasonable quality low-voltage iron that has a transformer and stand (not just a cable directly from the hand piece to the mains plug); if no mains power available then use a propane powered model but try to keep the temperature below maximum when using since they can get extremely hot)
- Wet sponge for cleaning soldering iron.
- Phosphoric acid (10% solution, NOT neat acid!)

PROCEDURE 1 – FITTING RADIO COLLARS ON LEMMINGS

Radio collars should not be more than 8% of the body weight of the animal. For a 1.8 gram radio, the lemming should weigh 22 grams or more. If a lemming is obviously pregnant, the cut-off weight should be higher.

Before fitting a radio tag to a lemming, start it, check that it's working, and record the frequency. Remove the frequency label from the antenna, if it has one.

Fitting collars on lemmings is tricky. *Never* attempt this with only one person. One person should hold the lemming while a second person fits the collar. Do *not* hold the lemming by scruffing the neck skin because that will affect the fitting of the collar. Keep the lemming's eyes covered as this helps to calm the animal. Keep voices low and avoid sudden movements. The goal is to keep the lemming relaxed and not squirming while not letting it escape!

First prepare the collar and tighten the cable tie so that the collar is about 3 cm in diameter (just big enough to slip over the head easily). Slip the collar over the head of the lemming. Start synching the cable tie one ratchet at a time with your thumb and forefinger of one hand while holding the radio in place with the other hand. This will give the most control when tightening the cable tie. If the ratchets are tightened any other way, there is a risk of slipping and the collar becoming too tight and having to be cut off immediately.

When you think you are getting close to the right size, start checking the fit after each ratchet. To check the fit, release the radio and let the animal re-position itself. Check that the collar cannot be pulled over the head and that the fit is snug. Check that it is not too tight by sliding a pair of blunt tweezers under the collar. This should be easy to do without risk of hurting the animal but they should be snug. If any more space than this is left, there is risk that the animal could put a paw in the collar and get it stuck. Let the animal re-position itself several times and re-check. Check that the lock mechanism of the cable tie is free of fur and is secure.

When you are satisfied with the fit of the collar, use fine wire cutters to clip the cable tie as close as possible to the lock mechanism. If necessary, swing the collar around so that the tag and battery portion is under the chin.

PROCEDURE 2 – TRACKING LEMMINGS

For general information on radio tracking see “Practical radio-tracking” by Brian Cresswell (<http://www.biotrack.co.uk/pdf/howtoradiotrack.pdf>) and Kenward, R.E. 2001. A Manual for Wildlife Radio Tagging. Academic Press. London. [An excellent introduction to all aspects of radio-tagging and radio-tracking, including a section on DIY tag construction.]

The detectable range of radio transmitters on a lemming in a burrow is usually about 100-300 meters. The range is affected by location of the radio (below or above ground), terrain, position of animal (whether the radio antenna is pointing toward you or not), and condition of the transmitter (a chewed antenna could reduce the range to zero).

There is a trade off between tracking the animals too often, and possibly disturbing them, and not tracking them often enough to find them if they disperse a long distance or get carried off by a predator.

Guidelines:

- Locate the lemmings at least every second day
- When the signal is strong and you feel you are nearing the animal, approach slowly, quietly and be *very* careful where you step!
- Avoid stepping on tussocks because the lemmings often freeze and hide in a tussock.

Replacing batteries:

Remove the old plastidip by exposing the battery area to acetone until it softens. This may take several hours, so it is best to suspend the tag in a sealed jar with only the battery submerged in the acetone. Try not to dissolve the Plastidip over the transmitter, though this may be difficult to avoid. Maintaining intact Plastidip on the transmitter helps to protect it in later operations. Once softened, cut and pull off the old Plastidip with fine wire cutters and tweezers. Be careful not to chip too far towards the transmitter and risk damaging the leads or transmitter.

Although Plastidip is easier to remove after softening with acetone, it can – with great care – be removed directly without softening. Use fine wire cutters to cut and pull away the Plastidip to expose the wires where the battery is soldered.

Once the solder points are exposed, de-solder the wires from the battery by applying the soldering iron and pushing sideways on the wire so that it pushes away from the battery when the solder melts. The temperature to which the battery may be exposed during this process can cause it to explode, so always wear eye protection when soldering or de-soldering batteries.

You can check the new battery with a battery tester to be sure that it is not old and dead (although there is no way to properly test battery quality without discharging it – the best you can do is be sure to always use fresh new batteries). Set the new battery in place and hold the tag and battery securely with alligator clips (be sure the jaws are insulated so as not to short the battery!) so that you have both hands free. Use a toothpick to apply a small amount of phosphoric acid to the soldering surfaces (this roughens the surface and makes the solder hold better). Place the negative lead so that it touches the negative side of the battery (the circular plate on top of the battery) and the positive lead on the positive side of the battery (the ‘can’). Make sure the soldering iron tip is in good condition, clean (wipe on wet sponge after each use to clean it) and hot. Place a very small amount of solder on the hot iron tip and apply it as quickly as you can to the wire and battery. The acid will dissolve with a hiss and the solder joint should be formed almost instantaneously (at most within 2 seconds). Do not allow the soldering iron to remain in contact with the

battery for longer than two seconds because the battery will be damaged through overheating. Pull on the wire to check the bond.

Replacing cable ties:

A cable tie runs through a short tube on the radio tag and forms the collar. The antenna lies along the cable tie and is held in place with heatshrink.

Cut the old cable tie and remove the heatshrink with fine wire cutters or dissection scissors, starting from the open end. Be careful not to damage the antenna. Slide the cable tie out of the tube on the radio tag and replace it with a new cable tie. Cut a piece of heatshrink just long enough to completely cover the antenna and shrink it over the new cable tie using a heat source such as a lighter or a hot-air gun if available. Avoid heating the tag and battery area too much and shape the collar into a nice round shape while it is still hot. Cover the base of the heatshrink with plastidip.

Time requirements:

Radio tracking animals is time consuming and difficult to predict. If all the radioed animals are close together and all goes well, a radio check of 15 animals could be completed in about 1 hour. Usually the animals will be located over a large area so the checks will take longer, more likely 2-3 hours. If an animal goes missing, you could spend a whole day just trying to locate the one animal.

Assume a minimum of 3 person hours every 2 days for radio tracking 15 animals, plus an extra 8 person hours a week for locating missing radios.

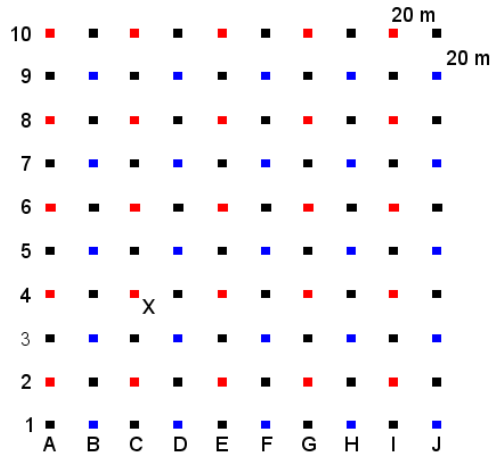
Batteries last only 6 weeks and the animals need to be trapped to remove the radio. (If you are really lucky, you'll be able to avoid trapping and catch a lemming by hand as it hides in a tussock when you are locating it.) Trapping to remove or replace radios can also be time consuming. You may need to carry traps with you as you track the target animal then set the traps so that you will maximize your chances of catching it. Take careful notes of where the traps are set and how many are set and check them every 6 hours.

Set aside 4 person-days for at the beginning of the study to collar animals and another 4 person-days every month afterwards for trapping to remove or replace radios.

Assume 2 person-days per month for changing batteries and refurbishing collars.

Data collection and management:

The study area should be carefully marked in a grid pattern with marker labels clearly visible from a distance. When an animal is located, the coordinates of the location should be estimated and recorded to the nearest meter. In the illustration below showing a portion of a grid with 20 meter spacing the location of x would be C.2/3.8. These coordinates are quick to record and can be converted to UTM coordinates based on the UTM coordinates of the grid corners.



If an animal disperses a long distance, UTM coordinates should be taken with a GPS unit.

At present we do not have a general purpose database for recording radio-tracking data on individuals.