DOC tracking tunnel guide v2.5.2: using tracking tunnels to monitor rodents and mustelids

This specification was prepared by Craig Gillies and Dale Williams.[1]

Contents

[1] Recommended citation: Gillies, C.A.; Williams, D. 2013: DOC tracking tunnel guide v2.5.2: Using tracking tunnels to monitor rodents and mustelids. Department of Conservation, Science & Capability Group, Hamilton, New Zealand. www.doc.govt.nz

Background

Conservation managers and researchers at mainland sites throughout New Zealand now commonly use tracking tunnels as a method of indexing rodent and mustelid abundance. In 1997 we wrote a guide (DOC tracking tunnel guide version 1) as a direct response to repeated requests by DOC staff for some basic guidelines on how to use tracking tunnels. However, there were several important issues that needed to be resolved with the technique, particularly for monitoring mustelids. These issues were investigated as part of DOC Science and Research Unit investigation 3275; the fieldwork for that project was completed in June 2002. This guide was written as an update for the original version based upon what we learned during the course of that investigation. This guide describes a technique for monitoring rodent and mustelid activity. This document updates the original method described in 'DOC tracking tunnel guide v.2.5.1' (olddm-118330) with minor improvements and modifications. We recommend users also read an overview of this method in 'Animal pests: tracking tunnel indices of small mammal abundance'—docdm-322684.

Introduction

Using tracking tunnels as a method for monitoring small mammal abundance in New Zealand was first described by King & Edgar (1977). The technique uses a 'run through' tunnel containing two pieces of paper either side of a sponge soaked with a tracking medium (food colouring). As an animal passes through the tunnel it picks up the tracking medium on its feet, then as it departs from the tunnel it leaves a set of footprints on the papers. There are several reasons why tracking tunnels are now a commonly used way of indexing small mammals instead of kill-trapping. Information can be gained on a variety of animals from large insects to whatever can fit through the tunnels. It is a non-destructive sampling technique so it does not impact the target population or for that matter any non-target species. Tracking tunnels are perceived as being more sensitive than snap traps for detecting the presence of rodents at low abundance. The method is also less labour intensive than trapping because the tunnels remain permanently in place between monitoring sessions.

Methods

Some things to consider before setting up a tracking tunnel operation

For monitoring rodents and mustelids, tracking tunnels only provide a coarse index of relative abundance; they are not a direct measure of population density, but a measure of activity. The technique is best suited for providing simultaneous comparisons of the relative abundance of rodents (particularly rats) or mustelids between similar habitat areas (e.g. treatment and non-treatment) or gross changes in relative abundance over time at a single site. We suspect that the technique can become 'saturated' when rodents or mustelids occur at high densities, so you should be cautious how you interpret the results in those situations.

Tracking tunnels can be reasonably sensitive to the presence of rodents (particularly rats) when they are present at low densities. Therefore, the technique can be a useful management indicator for determining the results of rodent control operations. We recommend that tracking tunnels are used for monitoring the effects on rodents of ongoing (over a season or longer) pest control operations but if you wish only to monitor the effects of a one-off poison operation on rodents, or survey to identify what rodent species are present in an area you may want to consider using snap traps and follow the guidelines produced by Cunningham & Moors (1996)[2].

If you are planning to use tracking tunnels for monitoring mustelids, or you plan to use them to monitor mustelids at some time in the future, then we strongly suggest that you discuss this with predator specialists within DOC before setting up any monitoring operation. Tracking tunnels are not always sensitive to the presence of mustelids when they are present in very low numbers so we recommend that if you plan to use these as a management result indicator you treat a 'not detected' result with caution. We currently do not know if the tracking tunnels can be used to provide a useful relative index of abundance for monitoring hedgehogs. Hedgehogs are certainly detected in tracking tunnels at some sites, but we have not determined whether or not the technique is sensitive to the presence of these animals.

Choosing line locations for monitoring rodents and/or mustelids

For most study sites (c. 300 to 10 000 ha), 6 to 20 tunnel lines in the treatment area (and a similar number set in the non-treatment area if applicable) should be sufficient for surveying rodents, and anywhere between 4 and 15 lines should be sufficient for surveying mustelids. We have suggested some guidelines (based upon our experience) for the number of tunnel lines for different sizes of survey area (Table 1), obviously some areas will be easier to survey than others, but the more lines you can set up the better. If you are planning only to survey for mustelids in areas ≤ 300 ha, you should discuss the limitations of using this technique with predator specialists within DOC prior to setting up any monitoring operation. Each tunnel line consists of 10 tunnels set at 50 m spacing for rodents or if you only intend to use the tracking tunnels to monitor mustelids then each tunnel line consists of 5 tunnels set at 100 m spacings. Any lines you intend to use to monitor mustelids should be an absolute minimum of 1000 m from the nearest adjacent mustelid line at the closest point (the greater the distance between lines the better). Those lines that you intend to use exclusively to monitor rodents need only be a minimum of 200 m from the nearest adjacent rodent line at the closest point.

[2] http://www.doc.govt.nz/documents/science-and-technical/rodent-identification.pdf

Table 1. Suggested number of tracking tunnel lines to use for surveying both mustelids and rodents.

Approximate area to be surveyed	≤ 300 ha	300–600 ha	600–900 ha	900–1200 ha	1200–10 000 ha	> 10 000 ha
Suggested number of tracking tunnel lines for rodents	6–8	8–10	10–12	12–15	15–20	20 (or more if logistically feasible)
Suggested number of tracking tunnel lines for mustelids	4–5	6–7	7–8	9–10	10–15 lines	15 (or more if logistically feasible)

When setting out tracking tunnel lines it is very important to ensure that representative environments are sampled within the areas you are interested in (e.g. a rodent control block). The easiest way to do this is to consider the gross environment types that make up your study site or management block and what proportion of that area they make up. So, for example, if 50% of your study area is red beech forest, then 50% of your sampling effort should include that environment. Generally speaking, the start points for each line should be determined by environment type, access, logistics (all lines need to be serviced on the same day) and the distance away from the next nearest tunnel line.

When determining the direction the tunnel line runs, avoid running lines entirely along geographic features (e.g. roads, ridgelines or streams) or other potential sources of bias such as along bait station lines. The best way to avoid any bias is to randomise the direction each tunnel line runs. A simple method we use is to roll a six-sided die and the number rolled determines the compass bearing from the start point along which the line is set out (Table 2). Run the line in the most practicable of the two bearings either Easterly or Westerly from the designated start point. If you can't decide which to choose, roll the die again. Pick the Westerly bearing if the result is an odd number; pick the Easterly if the result is an even number.

Table 2. Suggested method for determining the direction (compass bearing) of each tracking tunnel line.

Die roll	Angle of tunnel line (magnetic)
1	285°W–105°E
2	315°W–135°E
3	345°W–165°E
4	15°E–195°W
5	45°E–225°W
6	75°E–255°W

Setting out the tunnels and lines for monitoring rodents and mustelids

1. Set out the tunnels at least 3 weeks (ideally even longer if you plan to survey mustelids) prior to the first survey session to ensure any resident animals are conditioned to the presence of the tunnels.

2. Leave the tunnels in place between survey sessions.

3. Mark the tunnel locations with flagging tape (or if you have the funds use permanent plastic triangle track markers). Since the tunnels are left in situ between surveys (in some cases several years) the locations of the tunnels need to be well marked. When using flagging-tape to mark tracks it is a good idea to use one colour to mark the track and another to mark the tunnel.

4. Write each tunnel number on the flagging-tape or plastic triangle at the tunnel site with a permanent indelible ink marker pen.

5. Assemble the tunnels as you put them out in the field. It is a lot easier to carry the bases, trays and pre-cut corflute for 10 tunnels than it is to carry 10 fully assembled tunnels.

6. Site the tunnel at the most suitable spot within 2 m of the 50-m marker along the line (e.g. places that look like they would provide a good 'run' for small mammals).

7. Place each tunnel on reasonably level ground as this will reduce the chances of the food colouring running from the middle sponge tray and blotting out the paper on the downhill side.

8. Ensure that the tunnel is firmly in place by pegging the tunnel down with two No. 8 wire loops. This is particularly important in areas were disturbance by possums is likely to be a problem and especially important if you plan to use the tunnels to monitor mustelids.

9. Check that access to both ends of the tunnel is unobstructed.

Tunnel construction

Each tunnel consists of a wooden base with a black plastic 'corflute' cover. Corflute is the material used for real estate signs; it is cheap, light in weight and reasonably rigid. In the majority of cases these tunnels are quite resistant to interference and damage by other animals. However, if kea, weka or possum interference is so bad that it is compromising the amount of data you are collecting from your surveys then we suggest you consider using the 'Te Anau Area Office tunnel design' (see Appendix B). The tracking papers and sponge are placed in a separate tray that sits inside the tunnel on the wooden base. Jurgen Fiedler Plastics in Rotorua manufacture polycarbonate trays specifically for this purpose (see Appendix A). At around $8 each these trays are quite expensive but they should last for 5–10 years. Use red (Amaranth 123) food colouring as the tracking media on the sponge. It is cheap, easy to use and prepare, and is readily available if supplies run out.

Alternatively, Gotcha Traps Ltd supply prefabricated tunnels and pre-inked cards for those people who would prefer not to construct their own tunnels or use the food colouring and paper tracking media (see Appendix A).

Tunnel dimensions and materials

- Wooden base, 100 mm (W) × 535 mm (L) plywood or 25 mm thick rough sawn pine (Figs 1 & 2).
- Tunnel cover, black corflute, stapled or nailed to the base, 615 mm (L) allows for 40 mm overhang each end of timber, tunnel internal clearance height should be 100 mm (Figs 1 & 2).
- Polycarbonate trays, 520 mm (L) × 95 mm (W), with each of the three partitions being 173 mm (L). (Fig. 3)
- Papers, each paper should be pre-cut to 173 mm × 95 mm in size (Fig. 3). We strongly suggest you source this pre-cut from a printer, as hand cutting can be very time consuming. The type of paper may be determined by local availability (and cost) but ensure it is sufficiently absorbent to retain the food colouring animal prints. Sponge, 173 mm × 95 mm in size and 3–5 mm thick.
- Tracking media, use liquid red (Amaranth 123) food colouring at approximately 1:3 dilution in water. In extremely dry conditions or where you think freezing is likely to be an issue, mix the food colouring and water solution with polyethylene glycol (approximately 20%).

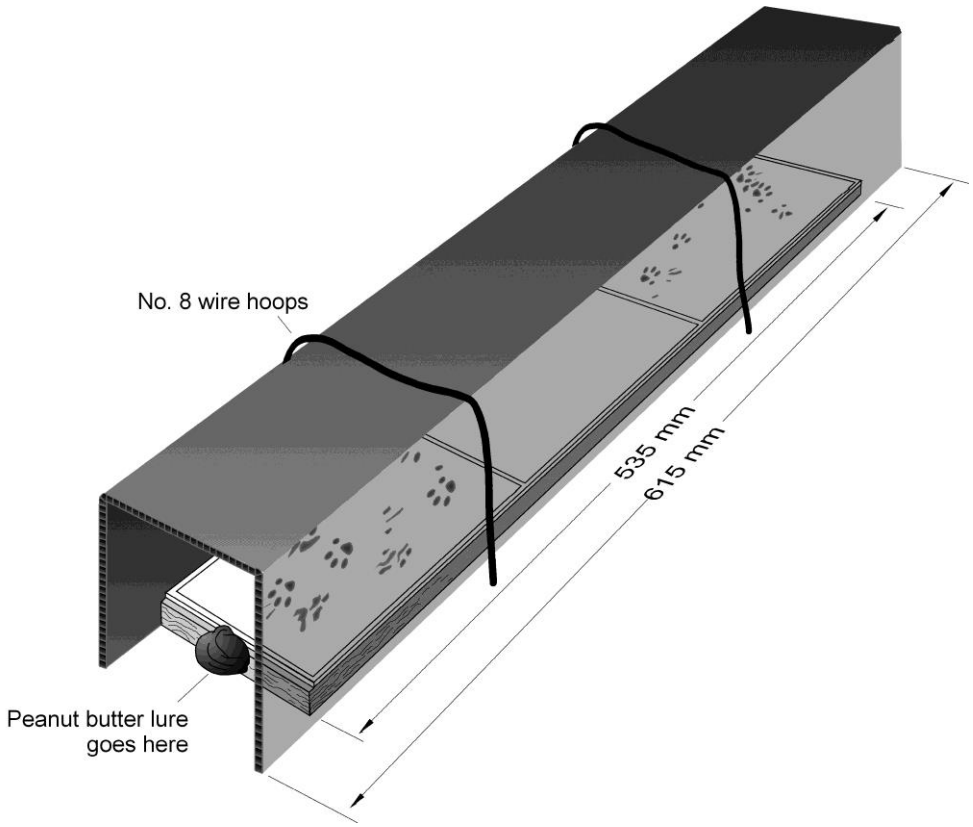

Figure 1. Black corflute tracking tunnel cover and wooden base, showing tunnel dimensions. Also shown is the location for smearing peanut butter on the vertical face of the wooden base at each end of the tunnel for rodent surveys.

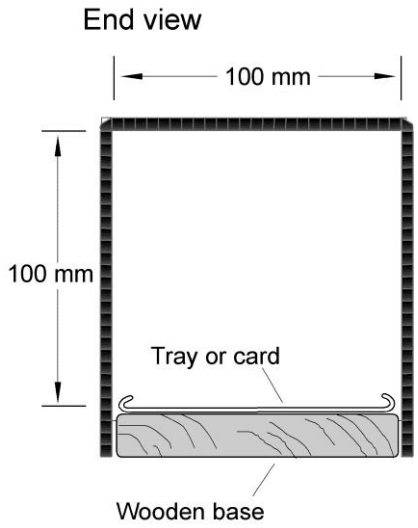

Figure 2. Black corflute tracking tunnel cover and wooden base—end view showing tunnel dimensions.

Figure 3. Tracking tunnel tray showing paper/card and tracking ink tray/panel dimensions.

Using the tracking tunnels to monitor rodents

Each rodent monitoring survey is conducted over one fine night.

Day one:

1. Place fresh papers (or cards) in each tunnel.

2. Check that the sponge is in good condition, fits neatly into the tray, and contains adequate food colouring. An old 'H_2Go' or similar type of plastic water bottle is an easy (and less messy) way of applying food colouring to the sponges in the field. You will need to carry spare sponges and scissors to ensure replacement sponge fit the trays.

3. Bait each tunnel with a generous 3–4 cm sized blob of ('No Frills' crunchy) peanut butter. This is smeared on the vertical face of the wooden base at each end of the tunnel (Fig. 1).

Day two:

1. Keep the papers in order when collecting them; write the tunnel number on each paper on the end closest to the tunnel entrance. Writing the numbers on the outside edge of the paper will help you to sort the papers after the survey (it is often easier to identify footprints if the papers are arranged in the same direction as most of the tracks will be heading from the inside outwards). Keeping the papers in order will help you to identify any mistakes (i.e. if you miss a tunnel or make an error with the numbering).

2. Check the papers in the field (if you have mastered the identification process) and keep a running total of the results in a notebook. This may help to eliminate mistakes and problems with identifying faint tracks.

3. Make a note of any fresh scats found in a tunnel, and count that particular species being present, even if there are no tracks in the tunnel. So remember to remove any scats from the tray when setting up the tunnel with fresh papers and food colouring.

4. Note anything of interest or importance (e.g. possum disturbance, particularly if the papers and/or trays have been pulled out. These tunnels need to be accounted for when analysing the data).

5. Record when the bait is taken from untracked tunnels.

6. Remove the bait from the ends of the tunnel bases.

Once you are back in the office:

1. Spread the papers out to dry (if needed) and double check your results.

2. Label the bundles of tracking papers with the survey area and the date, and store for later reference.

The frequency of sampling (number of surveys) should be determined by the desired outcomes and management objectives at your site; for example, you may only want indices of rodent abundance at critical times, such as during bird breeding seasons or before and after control operations. The minimum number of surveys we recommend for ongoing studies is at least four times per year (February, May, August and November are the usual months). However, more frequent sampling (e.g. once a month or every 2 months) will give you a better picture of any gross fluctuations in relative abundance for the year.

Using the tracking tunnels to monitor mustelids

Mustelid surveys should be conducted over 3 consecutive fine nights (or at least 3 nights where you can reasonably expect a period of weather with no heavy rainfall).

Use the same procedure as for rodent monitoring except:

1. Tunnels should be spaced at 100-m intervals.

2. Bait the tunnels with a generous 4–6 cm^3 sized chunk of skinned rabbit meat placed in the centre of the sponge (on a 4 cm × 4 cm square of polythene or suitably sized leaf to keep maggots off the sponge). Ensure any uneaten peanut butter left over from any rodent surveys is flicked off the base.

3. Collect the papers after 3 nights.

The minimum number of mustelid tracking surveys for ongoing studies should ideally be at least once per season, but you should be aware that the summer peak in stoat abundance usually lasts only for a very brief time and this is when many species of native birds appear to be most vulnerable to these predators. As with rodent surveys, the desired management outcomes at your site should determine when you conduct these surveys. However, if you are mostly interested in stoat abundance (as opposed to ferrets or weasels) we recommend, as a minimum, you should run surveys at least once a month in November, December, January and February.

It is possible to use rodent survey lines to also survey for mustelids, provided the lines you intend to use for mustelids are a minimum of 1000 m from the nearest adjacent mustelid line at the closest point. On those lines that you intend to use for both types of survey, just use every second tunnel (use the odd numbered rodent tunnels) for mustelids. When you are sharing tunnels and lines between rodent and mustelid surveys make sure you run the surveys independently and not at the same time. There is, however, no problem running a mustelid survey immediately following a rodent session if the timing is appropriate for your situation. You can save yourself some time on shared lines by re-papering and baiting (with rabbit meat) every second tunnel as you are removing the papers from the previous night's rodent session.

Identifying small mammal tracks

This can often be one of the more difficult aspects of the technique. However, after some practice it becomes relatively easy to quickly identify the tracks of different small mammals at a glance. We have included a brief description of the various small mammal prints with associated pictures in 'DOC tracking tunnel prints' (docdm-1237739). If you are having difficulty identifying tracks, fax copies to your conservancy technical support staff who should be able to assist you or put you in touch with people who can.

General tips

We strongly recommend you get a copy of the paper by Hiltrun Ratz (1997) on identification of footprints of some small mammals and read it before you start. If the tracks appear extremely faint, check to see if they have not been transferred from another paper. This is most likely to happen if the papers were wet when they were collected. When we were trialling this technique we found that placing each paper separately between the pages of an old paperback novel whilst we were collecting them stopped this from happening, plus it helped absorb any excess moisture from the papers. If you see faint tracks when collecting the papers and are concerned that they may be overlooked later, note the species and highlight the tracks by circling them in pencil, while in the field. This is also a good reason for handling the papers carefully when you are collecting them and keeping a running total of the results in a notebook as you check each tunnel. Partial tracks or footprints can often occur if the sponge has dried out, the food colouring was too dilute, or if the animal has backed out after placing only one foot on the sponge. If a set of prints is too obscure to identify, don't take a guess, mark it down as unidentified.

Counting the tracks, calculating the activity/tracking index

The tracking index of relative abundance for rodents is expressed as the mean percentage of tunnels tracked by rodents per line. This will enable some statistical comparison between treatment and non-treatment sites and/or between surveys over time at the same site. The information you record is the presence or absence of a particular species in a tunnel, so it is not important how many tracks are on each paper and it does not matter if only one paper is tracked.

1. Total the number of tunnels on each line that have tracks present (or fresh scats that indicate the animal had been present). Do this separately for each species.

2. Total the number of tunnels on each line that were badly disturbed (e.g. by possums) with papers that do not show rodent tracks then multiply this number by 0.5. Subtract this number from the total number of available tunnels on each line (10). We define a tunnel as being badly disturbed when both papers are removed from the tunnel and it is obvious that the target animals would not have been able to leave tracks on the papers.

3. Divide the number of tunnels tracked on each line by the number of available tunnels in each line and multiply this figure by 100. This gives the percent-tracking rate (for each line). Do this separately for each species.

4. Calculate the mean (average) percent-tracking rate over all the lines. To do this, add the percentage of tracking rates from each line and divide the total by the number of lines. Do this separately for each species.

5. Calculate the standard error of the mean. The standard error (SE) is simply a measure of the precision of the mean. It is often very useful to express the mean tracking rate percentage plus or minus SE (e.g. the mean rat-tracking rate was 35% ± 6%). If you use a calculator with statistics functions you can calculate the standard deviation (δn-1 button) of your sample (of the

tracking rate percentage from each of your survey lines). The standard error can then be calculated from the standard deviation. The standard error is equal to the standard deviation divided by the square root of the sample size, which for these surveys is the square root of the number of lines. Do this separately for each species.

6. For mustelids we suggest you also express the total number of tunnels tracked by mustelids as a percentage of all the tunnels (minus 0.5 times the number of badly disturbed tunnels not tracked by mustelids) baited for mustelids. We also suggest that you also express the results as the percentage of tunnel lines tracked by mustelids (as opposed to individual tunnels).

If you are comfortable using MS Excel, the 'DOC tracking tunnel calculator' (docdm-1237643) is a spreadsheet we use for calculating the mean tracking rate per line for rodent surveys, which also includes sheets for calculating the overall proportion of tunnels tracked by mustelids (plus mean tracking rate per line with standard errors and proportions of lines tracked by mustelids).

References and recommended reading

Bang, P.; Dahlstrøm, P. 2001: Animal tracks and signs. Oxford University Press, Oxford, United Kingdom.

Brown, J.A.; Miller, C.J. 1998: Monitoring stoat (*Mustela erminea*) control operations: power analysis and design. *Science for Conservation 96*. Department of Conservation, Wellington.

Bullion, S. 2006: A guide to British mammal tracks and signs. FSC/Mammal Society identification keys to British mammals & habitats—laminated field guide. Field Studies Council and The Mammal Society, London, United Kingdom.

Cunningham, D.M.; Moors, P.J. 1996: Guide to the identification and collection of New Zealand rodents. (3rd ed.). Department of Conservation, Wellington.

Gouldsbury, P.A. 1967: Predatory mammals in Britain (a code of practice for their management). Council for Nature Zoological Gardens, Regents Park, London.

King, C.M.; Edgar, R.L. 1977: Techniques for trapping and tracking stoats (*Mustela erminea*): a review, and a new system. *New Zealand Journal of Zoology 4*: 193–212.

King, C.M.; O'Donnell, C.F.J.; Phillipson, S.M. 1994: Monitoring and control of mustelids on conservation lands. Part 2: field and workshop guide. *DOC Technical Series No. 4*. Department of Conservation, Wellington.

Lawrence, M.J.; Brown, R.W. 1973: Mammals of Britain: their tracks, trails and sign. Blandford Press, London.

Ratz, H. 1997: Identification of footprints of some small mammals. *Mammalia 61(3)*: 431–441.

Appendix A. Suggested suppliers for tunnel materials

- Prefabricated tunnels and pre-inked tracking cards. Gotcha Traps Ltd., www.gotchatraps.co.nz, 2 Young St., Scotts Landing, Mahurangi Heads, Warkworth, (ph 09 425 6483, mob 027 273 0648, email sales@gotchatraps.co.nz or wagnew@best.net.nz).

- Black corflute sheets. Mico Wakefield (Mico *Pipelines* Division), www.mico.co.nz, contact nearest branch. Sometimes they will also cut these to size if you can afford the additional cost.

- Polycarbonate trays. Jurgen Fiedler Plastics (PO Box 6071 Rotorua), ph (07) 343 5542 or fax (07) 348 0952.

- Sponges. Para Rubber, www.pararubber.co.nz, contact nearest branch. A 1350 mm × 1500 mm sheet should make around 180 pads.

- Food colouring. Hansells (NZ) Ltd., www.hansells.co.nz, Opaki Rd, Private Bag 410 Masterton, (ph: 0800 733 663, fax: 06 377 3114, e-mail orders@hansells.co.nz); will bulk supply food colouring. Please specify that you require the red colour code Amaranth 123.

- Papers. EC Attwoods Ltd., www.attwoods.co.nz, Head Office, PO Box 37-568, Parnell, (ph 0800 722 548, fax 0800 377 758). This company will supply pre-cut papers for tracking tunnels. Other printing firms will often supply pre-cut papers at relatively low cost too.

Appendix B. The ‘Te Anau Area Office tunnel design’

- Tunnel cover, one sheet of black polypropylene plastic: 350 mm (W) × 900 mm (L) × 1.5 mm thick.
- Wooden base, H4 treated rough sawn timber: 100 mm (W) × 535 mm (L) × 25 mm thick.
- Nails: 30 mm Anualer S/S lumberlock flatheads, 10 nails for each tunnel.
- No. 8 wire brackets (fashioned to shape at local engineering shop). The wire not only helps prevent possums, kea and weka from reaching in, but also keeps the plastic tray from sliding out. The wire may not be suitable for a lot of areas where you want larger animals using the tunnels.

(text and photo courtesy of Megan Willans)

Appendix C. Department of Conservation documents referred to in this method

docdm-1237643	DOC tracking tunnel calculator
olddm-118330	DOC tracking tunnel guide V.2.5.1
docdm-1237739	DOC tracking tunnel prints
docdm-322684	Animal pests: tracking tunnel indices of small mammal abundance