



people's
trust for
endangered
species

Guidance for surveying hedgehogs



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Hedgehog Street is a joint campaign run by People's Trust for Endangered Species and The British Hedgehog Preservation Society.

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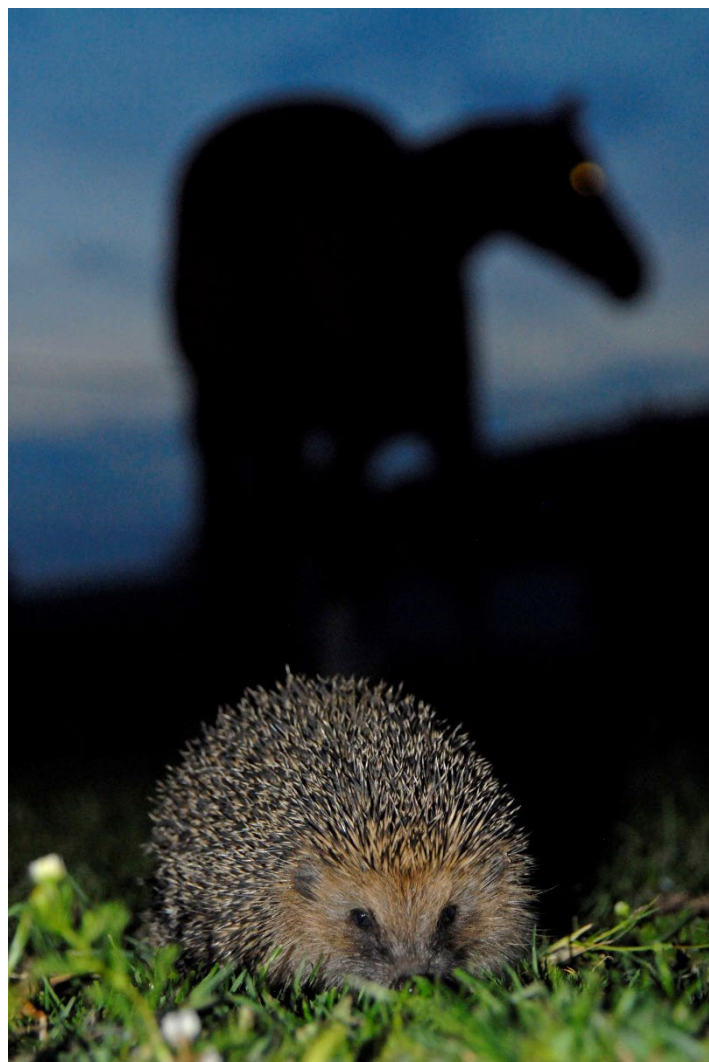
Introduction

Hedgehogs are notoriously difficult to study, particularly as they are nocturnal and so typically only active at night. They usually frequent habitats where access can be limited (i.e. urban areas) or they can be difficult to detect due to their association with dense vegetation. It's therefore challenging to get accurate population estimates for the species.

This guide outlines the key survey methods that are currently used for hedgehog research with some recommendations for implementation for undergraduate, postgraduate or professional study. This is just an overview and further guidance should be sought in the recommended literature.

We strongly recommend against lone working. An adequate health & safety assessment must be carried out prior to any survey (a risk assessment form should be completed). Always check with your university or supervisor before undertaking any data collection and ensure legal and ethical compliance.

All surveys should be conducted between May and November when hedgehogs are active.



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Spotlighting

Cost	Advantages	Disadvantages
£ (£40-174 per torch)	<i>Determines presence</i> <i>Simple method</i> <i>Relative index of abundance</i>	<i>Night time survey</i> <i>Low detection rate</i> <i>Can be labour intensive</i> <i>Habitat dependent</i> <i>May require a licence</i>

Method

Spotlighting involves searching for hedgehogs at night using a powerful torch (typically 1 million candle power). This technique can allow you to confirm presence, as well as providing a relative index of abundance, if the hedgehog count data is combined with a measure of survey effort (e.g. distance walked or time surveying). Spotlighting can also be used to find marked individuals as part of a capture-mark-recapture study which would yield density estimates.

Surveys are conducted along set transects or routes, using the torch to scan the ground either side as you walk along. Care should be taken to walk quietly because hedgehogs alerted to the surveyor's presence may seek cover or freeze, making them harder to detect. Frequent pauses (e.g. every 20 metres or so) to listen for sounds aids detection of animals which sometimes can be heard moving amongst leaf litter or huffing during courtship encounters.

Spotlighting works best in short grass habitats where animals are more easily seen or along linear features, such as woodland rides or the base of hedges. It can also be used in urban areas. However, the encounter rate for this technique is low (less than one hedgehog per hour in most habitats) which means that transects will need to be sufficiently long (1km or longer) and walked repeatedly to ensure sufficient recaptures to be made for density estimates. Fewer repeat surveys will be required to confirm presence. The survey effort required by spotlighting to be confident of hedgehogs being absent from a site is currently unknown. This method needs to be applied rigorously and consistently in order to provide reliable data that can be statistically analysed.



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Licence requirement

The use of ‘dazzling lights’ to detect Schedule 6 species (such as the hedgehog) for the purpose of ‘taking’ is technically illegal unless a licence is carried. If no ‘taking’ (e.g. handling, tagging) is planned then no license is required. Please contact the relevant Statutory Agency (details p.17) for advice on whether a licence is required for your work.

Equipment

A high powered torch (1 million clulite) is required which can cost £40-174 each. Each surveyor will need to have their own torch.

Pros

Determine presence – if the purpose is simply to detect the presence of hedgehogs, a quick survey requiring no more equipment than a torch can often provide a positive result in a few hours of appropriately conducted nocturnal fieldwork. Further work to demonstrate absence (or reveal a low density population) will require repeated surveys.

Simple to carry out – just requires a torch and some training on how to detect hedgehogs efficiently.

Index of abundance – can be determined if the hedgehog count data is combined with a measure of survey effort (e.g. distance walked or time surveying).

Population estimates – can be made using this method when combined with an appropriate capture-mark-recapture method. This, and the fact that animals found can be examined and additional data gathered, makes it appropriate for detailed studies of populations (e.g. The Regent’s Park Hedgehog Survey).

Cons

Night time survey - this method relies on detecting animals while they are active, so needs to be conducted at night, which brings with it health and safety considerations. Landowners will also need to be happy for surveyors to be on their land at night.

Low detection rate – the detection rate of this methodology can be low when hedgehogs are at low density or absent.

Potentially labour intensive – as the detection rate can be low, transects need to be both sufficiently long and also replicated if the method is being used to determine population size. Seasonal repeats will also be necessary (pre- and post-breeding monitoring). If surveying is being conducted at multiple sites, this can be a time consuming method which may not be cost effective.

Habitat dependent – this method works very well in open areas with short grass (e.g. amenity areas, parks, urban areas) and short grassland habitats (grazed pastureland) but is less effective in habitats with taller, denser vegetation (e.g. arable farmland, tall grassland, woodlands, scrubland).

Further information

Trewby ID, Young, R, McDonald RA, Wilson GJ, Davison J, et al. (2014) Impacts of Removing Badgers on Localised Counts of Hedgehogs. *PLoS ONE* **9**(4)

Parrott, D., Etherington, T. R. & Dendy, J. (2014) A geographically extensive survey of hedgehogs (*Erinaceus europaeus*) in England. *European Journal of Wildlife Research* **60**: 399-403

Haigh, A., Butler, F. and O’Riordan, R. (2012) An investigation into the techniques for detecting hedgehogs in a rural landscape. *Journal of Negative Results Ecology and Evolutionary Biology* **9**, 15-26

Yalden, D, Wheeler, P, Wray, S, Cresswell, WJ (ed.), Birks, JDS (ed.), Dean, M (ed.), Pacheco, M (ed.) & Trehwella, WJWD (ed.) (2012) UK BAP Mammals: Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation. The Mammal Society, Southampton, pp. 32-41

Footprint tunnels

Cost	Advantages	Disadvantages
££ (£100 for 10 tunnels or tunnels can be made)	<i>No night time surveying</i> <i>No licence required</i> <i>Minimal disturbance</i> <i>Simple method</i> <i>Effective detection</i>	<i>Multiple day survey</i> <i>Footprint identification</i> <i>Only presence/absence</i> <i>Unwieldy equipment</i>

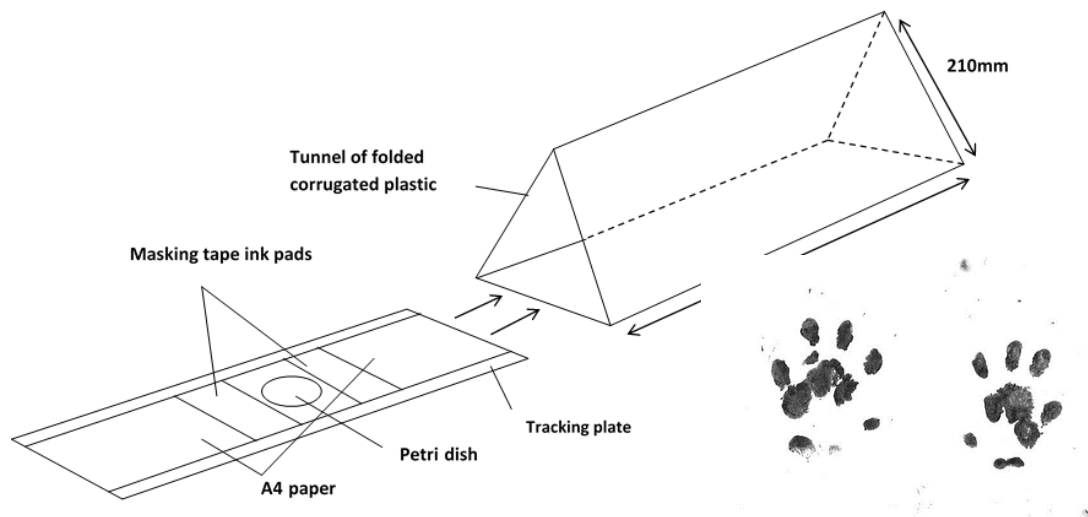
Method

Hedgehogs leave very distinct footprints and these can be used to determine whether they are present at a site. Footprint tunnels are simple, plastic triangular tunnels with a removable insert to which A4 paper is attached and ink painted on either side of a dish of bait (see below). As a hedgehog moves through the tunnel, it leaves footprints on the paper which can easily be identified.

For large scale studies attempting to identify presence in an area of 1km², ten footprint tunnels can be placed across the site alongside linear features (hedges, walls, fences etc.). Tunnels are baited with commercially available hedgehog food.

The ten tunnels are then monitored for five continuous days. Each day they will need to be checked to see whether they've been visited by hedgehogs or not, and to replace food bait and footprint papers when necessary.

Tunnels can be used individually in gardens to identify presence but should be left for longer than five days (up to a few months to ensure any hedgehogs that may be present are detected).



Licence requirement

No licence required for using footprint tunnels

Equipment

For large scale studies attempting to identify presence in an area of 1km² 10 footprint tunnels are needed at each site (though the same set can be used concurrently at multiple sites. For garden

surveys, one tunnel is needed per garden. Tunnels can be purchased or made (guidance can be found at ptes.org/publications).

Pros

No night time surveying involved – the tunnels can be checked at any time during the day.

No licence required – as the hedgehogs aren't being trapped a licence isn't required.

Minimal disturbance – surveyors don't need to be present for the tunnels to detect the hedgehogs so the animals are undisturbed.

Simple method – once the tunnels are positioned it's just a question of checking them once a day, which shouldn't take longer than an hour. This makes the method appropriate for citizen science projects and it can also be used to detect other mammals that may use the tunnels.

Effective detection – tunnels can confirm presence and give a high level of confidence of absence. Such detection histories lend themselves to presence/absence analytical techniques such as occupancy modelling.

Cons

Multiple day surveys - as hedgehogs may not encounter tunnels every night, several days (usually five) of surveying are needed to be sure of detecting them, especially where they are present at low densities.

Footprint identification – while hedgehog footprints are distinctive there is still the chance that they can be confused with prints left by other medium-sized mammals (brown rats, squirrels and polecats). However an experienced surveyor should be able to validate the prints, or prints can be sent to PTES for identification (hedgehogs@ptes.org).

Presence/absence – currently this method can only be used to determine presence/absence of hedgehogs at sites, rather than population abundance. For many studies this should be a sufficient level of detail. Please see spotlighting and REM for information on methods that estimate abundance.

Unwieldy equipment – the tunnels are roughly 1m long and made of light commercially available plastic, so can be slightly unwieldy to carry about your site, especially if its windy! However, this will only be necessary to do on the first and last day of surveying when tunnels are being put out and taken in, for the other three days the tunnels are left in position.

Further information

Yarnell, R. W., Pacheco, M., Williams, B., Neumann, J. L., Rymer, D. J. and Baker, P. J. (2014) Using occupancy analysis to validate the use of footprint tunnels as a method for monitoring the hedgehog *Erinaceus europaeus*. *Mammal Review* **44** (3-4), 234-23

Johnson, H. & Marnham, E (2016) *Guidance for detecting hedgehogs using footprint tracking tunnels* <https://ptes.org/wp-content/uploads/2014/06/Guidance-for-detecting-hedgehogs-using-tracking-tunnels.pdf>



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Radio-tracking

Cost	Advantages	Disadvantages
££££ (£160 per VHF tag and £800-1,000 for radio-tracking receiver and antennae)	<i>Detailed data collected</i> <i>Applicable to all habitats</i>	<i>Expensive equipment</i> <i>Licence required</i> <i>Night time survey</i> <i>Labour intensive</i>

Method

Hedgehogs can be fitted with small tracking devices that can then be used to locate them with a handheld antennae and track them from a distance to observe their movements and behaviour. Hedgehogs will need to be located before the radio-tracking survey starts, using either spotlighting (p.3) or live traps (p.11), to allow radio-tags to be fitted. A licence from the relevant statutory agency will be required to both capture the hedgehog and attach a radio-tag.

Once animals are fitted with the radio-tags they can be located and tracked as frequently as required. However, due to hedgehogs' natural behaviour of bulldozing through the undergrowth and squeezing under fences and other obstacles, these radio-tags will have a limited lifespan. Radio-tags have been found to last anywhere from a few days to months. Battery life and number of beeps or fixes per day also have an impact on how long the radio-tags will last.

Radio-tracking can be used to establish an animals' home range as well as observing their nightly activities. The home range of a hedgehog can be robustly calculated with more than 30 fixes over time – this could be one fix per day over 30 nights, or one a week over a six-month period or, if using GPS to look at detailed movement, a fix every five minutes for a shorter period.



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Equipment

Radio-tracking equipment is expensive. Each animal being monitored will need to be fitted with a radio-tag (VHF tags can cost about £160 each, with rechargeable GPS pinpoint tags with in-built VHF costing about £600 each). A telemetry set of a transmitter and antennae will also be needed – antennae about £150 and a receiver with multiple channels about £800-1,500.

Licence requirement

A licence is required from the relevant statutory agency to catch hedgehogs and fit them with tracking devices.

Pros

Detailed data collected – radio-tracking allows the collection of detailed data on both individual hedgehogs and on populations. This data can be used to analyse home ranges, interactions between individuals and assess individual behaviour. It can also be used to identify nest locations and allows animals to be recaptured efficiently for monitoring.

Applicable to all habitats – radio-tracking has been used successfully in a range of habitats (gardens, parkland, farmland, scrubland and woodland) though detection distances will vary depending on the habitat and the obstacles in the area.

Cons

Expensive equipment - as highlighted above, a radio-tracking survey can be expensive.

Licence required – to catch hedgehogs and tag them with a tracking device a licence will be needed from the relevant statutory agency.

Night time survey - this method relies on detecting animals while they are active, so needs to be conducted at night, which brings with it health and safety considerations. Landowners will also need to be happy for surveyors to be on their land at night.

Labour intensive – to ensure sufficient data is collected to allow robust conclusions to be drawn, each hedgehog will need to be tracked repeatedly. Depending on what information is being collected, hedgehogs may need to be surveyed continuously throughout the night (9pm – 5am) and these nightly surveys will need to be repeated across the survey period. This will require a serious time commitment from surveyors. For these reasons this method is suitable for studying local population studies but doesn't lend itself as well to large scale studies.

Further information

Glasby, L., & Yarnell, R. W. (2013) Evaluation of the performance and accuracy of Global Positioning System bug transmitters deployed on a small mammal. *European Journal of Wildlife Research*, **59**

Reeve, N. (1982) The home range of the hedgehog as revealed by a radio tracking study. In C. Cheeseman & R. Mitson (eds) *Telemetric Studies of Vertebrates*, 207-230. Symposium of the Zoological Society of London

Morris, P. A. (1988) A study of home range and movements in the hedgehog (*Erinaceus europaeus*). *Journal of Zoology*, **214**, 433-449

Doncaster, C. (1992) Testing the role of intraguild predation in regulating hedgehog populations. *Proceedings: Biological Sciences*, **249**, 113-117

Doncaster, C. (1994) Factors regulating local variations in abundance: field tests on hedgehogs, *Erinaceus europaeus*. *Oikos*, **69**, 182-192

Dowding, C., Harris, S., Poulton, S. and Baker, P. (2010) Nocturnal ranging behaviour of urban hedgehogs, *Erinaceus europaeus* in relation to risk and reward. *Animal Behaviour*, **80**, 13-21

Thermal imaging

Cost	Advantages	Disadvantages
£££££ (£500-7000 per camera)	<i>Observe natural behaviour</i>	<i>Expensive equipment</i> <i>Night time survey</i> <i>Habitat dependent</i> <i>Low detection rate</i> <i>Labour intensive</i>

Method

This involves searching for hedgehogs at night using a thermal imaging camera or scope. The sensor detects the heat signature given off by the hedgehog, showing it as a distinct bright spot or colour against the background habitat as viewed on the device screen. This technique allows confirmation of presence and can be used to follow individuals. As it allows hedgehogs to be watched from a distance, natural behaviour can be observed and recorded with minimal disturbance.

Surveys may be conducted systematically using set routes or transects, in a similar way to spotlighting. At the start of the transect, stand still and use the camera to slowly scan the surrounding area (in favourable conditions hedgehogs can be detected up to 70m away, though this does vary with camera model), then walk a little way along the transect, stop and repeat the process. Please note the screen can affect your night vision so it is not advisable to use the camera while you are walking. Also, obstacles and other hazards may not show on the screen display. Thermal imaging can be used in conjunction with spotlighting if there is more than one surveyor taking part in the survey.

It works best in open or mosaic habitats with areas without tall, dense, ground vegetation (such as short grass) where animals are more easily detected. Long, thick vegetation can screen the animals. The technique is still in the initial testing phase but it has proved to be a very successful in The Regent's Park Hedgehog Study.



Licence requirement

If this method is just used to determine presence or observe hedgehogs, then no licence is required. However, if it's being used to detect hedgehogs for capture and marking, then a licence is required from the relevant statutory agency for capture (details on p.17).

Equipment

Thermal imaging cameras are expensive, currently costing between £500 - £7,000, but they can be hired at much lower cost. If this method is combined with spotlighting, then a high-powered torch will also be needed.

Pros

Determines presence – in suitable habitats (open or mosaic habitats without tall dense vegetation) this method can determine presence in a few hours of appropriately conducted nocturnal fieldwork. Further work to demonstrate absence (or reveal a low density population) will require repeated surveys.

Natural behaviour can be observed – as hedgehogs can be detected and observed without being disturbed (e.g. no torch needed), natural behaviours can be recorded.

Cons

Very expensive equipment – thermal imaging cameras are expensive to buy but can be hired for short term use (around £350 per week <https://www.test-meter.co.uk/hire/>)

Night time survey - this method relies on detecting animals while they are active, so needs to be conducted at night, which brings with it health and safety considerations. Surveyors should not walk while watching the screen. Landowners will also need to be happy for surveyors to be on their land at night.

Habitat dependent – Vegetation can screen the animals from being detected so it may not be effective in all habitats, especially those with longer, dense, vegetation (e.g. arable farmland with tall crops, tall grassland, woodlands, scrubland).

Low detection rate – the detection rate of this methodology can be low when hedgehogs are sparse or absent.

Potentially labour intensive – as the detection rate can be low, transects or routes need to be both sufficiently long and also replicated if the method is being used to determine population size. Seasonal repeats will also be necessary (pre- and post-breeding monitoring). If surveying is being conducted at multiple sites this can be a time-consuming method which may not be cost effective.

Further information

Haigh, A., Butler, F. and O'Riordan, R. (2012) An investigation into the techniques for detecting hedgehogs in a rural landscape. *Journal of Negative Results Ecology and Evolutionary Biology* **9**, 15-26

Gurnell, J., Reeve, N. and Bowen, C. (2015) A study of Hedgehogs in The Regents Park, London – May and September 2015. The Royal Parks Foundation, London

Gurnell, J., Reeve, N. and Bowen, C. (2016) A study of Hedgehogs in The Regents Park, London – May and September 2016. The Royal Parks Foundation, London

Live trapping

Cost	Advantages	Disadvantages
££ (£20 for each trap, 20 traps needed)	<i>Determines presence</i> <i>Relatively inexpensive equipment</i>	<i>Requires a licence</i> <i>Low detection rates</i> <i>Bycatch and disturbance</i> <i>Labour intensive</i>

Method

Live capture traps shut when triggered by an animal entering them but don't cause any harm to the individual. They can be used for capture-mark-recapture studies on local populations, where individuals are caught and then conspicuously marked to allow recognition when they are either re-caught or observed. This can be used to make estimates of how many animals are present at a site. Each site will need to be surveyed using 20 live capture traps for five days. At each site traps will need to be set under cover along linear features (e.g. hedges, fences, walls). Traps can be baited with commercially available hedgehog food. The cages will need to be checked each morning to record and release any hedgehogs and then visited in the evening to set and replenish the food bait. Trapped hedgehogs can be individually marked by attaching coloured plastic tubing to individual spines (see additional information (p.17) section for guidance on marking hedgehogs). This method can also be used as a way of capturing hedgehogs to tag for use in a radio-tracking (p.7) or REM (p.15) studies. There are stringent licencing guidelines for the use of live capture traps that must be adhered to.



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Equipment

Twenty live capture traps at £20 each and then plastic markers for each hedgehog.

Licence requirement

To catch hedgehogs in a trap a licence is required from the relevant statutory agency.

Pros

Determines presence – allows animals to be detected, and detailed data to be collected or animals to be marked for capture-mark-recapture studies.

Relatively inexpensive equipment – compared with several other methods used to survey hedgehogs, this is relatively cheap. It requires 20 live capture traps which cost between £20-£30 each. However, this should be carefully weighed against the licence constraints and also the labour cost associated with having to visit the survey site twice a day to check the traps.

Cons

Licence required – to catch hedgehogs in a trap a licence is needed from the relevant statutory agency.

Low capture rates – trapping success is often low and previous studies have found that live capture can fail to detect hedgehogs.

Bycatch and disturbance - incidental capture of other species such as rats and birds is likely and traps can also easily be disturbed by inquisitive dogs and cattle.

Animal welfare concerns – the welfare of animals can be compromised if animals become stressed when captured or are without access to food and water. Regular checking is essential.

For capturing animals, spotlighting is probably the best method.

Further information

Haigh, A., Butler, F. and O’Riordan, R. (2012) An investigation into the techniques for detecting hedgehogs in a rural landscape. *Journal of Negative Results Ecology and Evolutionary Biology* 9, 15-26



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Camera traps

Cost	Advantages	Disadvantages
£££ (£100-300 per camera - see below for full list)	<i>No night time surveys</i> <i>No licence required</i> <i>Minimal disturbance</i> <i>Simple methodology</i> <i>Records natural behaviour</i>	<i>Multiple day survey</i> <i>Only presence/absence</i> <i>Expensive equipment</i>

Method

Camera traps can be put out across a survey site and set up to take videos or photos of any animals that trigger them as they pass. The great advantage of using camera traps is that they can record the animals without disturbing them. Camera traps can be used to determine presence, calculate relative index of abundance or density estimation depending on the analytical technique used.

Camera traps should be set up near linear features (hedges, walls, fences etc.). Cameras should be put low to the ground to ensure they detect hedgehogs. In public areas cameras will need to be securely fastened to permanent fixtures to ensure they are not disturbed or removed.

Cameras need to be checked every couple of days to replace the memory cards and batteries, and to make sure they are still secure.

Camera traps can be used to determine presence, relative index of abundance or density estimates depending on the analytical technique used on the data.



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Equipment

For each site you will need a sufficient number of cameras (dependent on the size of the site) and twice the number of DS memory cards (so these can be replaced every few days) and a padlock and chain for each camera to keep it secure.

Licence requirement

No licence required for using camera traps.

Pros

No night time surveying involved – the cameras can be checked at any time during the day.

No licence required – as the hedgehogs are not being trapped a licence is not required to use cameras.

Minimal disturbance – the cameras can detect hedgehogs without the monitors being present, meaning the animals aren't disturbed. This also increases the chances of natural behaviour being recorded by the cameras.

Simple method – once the cameras are positioned it is just a question of checking them every couple of days. This makes the method appropriate for citizen science projects and it can also be used to detect other mammals that may use the survey site.

Natural behaviour – as mentioned above this method does not disturb the animal, meaning that natural behaviours are likely to be recorded. Also the number of detections can give insight into activity patterns on a nightly and seasonal basis.

Cons

Multiple day surveys - as hedgehogs may not encounter the cameras every night, cameras will need to be left out for longer periods of time to ensure any hedgehogs present are detected. This is especially important where they are present at low densities.

Expensive equipment – cameras cost between £100-300, and multiple traps will be required to put out across the site, which can add up to quite an expense.

Further information

Gurnell, J., Reeve, N. and Bowen, C. (2014) A study of Hedgehogs in The Regents Park, London – May and September 2014. The Royal Parks Foundation, London

Glen, A., Cockburn, S., Nichols, M., Ekanayake, J. and Warburton, B. (2013) Optimising camera traps for monitoring small mammals. *PLoS ONE* 8 (6)

Random Encounter Model (REM)

Cost	Advantages	Disadvantages
£££££ (total cost £12,000) see equipment list below)	<i>Robust population info</i> <i>Day time surveying with cameras</i>	<i>Expensive equipment</i> <i>Licence required</i> <i>Labour intensive</i> <i>Long survey period</i> <i>Night time surveying for tagged animals</i> <i>Complicated data processing</i>

Method

The Random Encounter Model (REM) method involves randomly placing a number of camera traps across a survey site during a suitable survey period in order to capture images of a minimum number of individuals of the target species. Survey effort, camera detection rates, the area covered by the cameras and the distance travelled by individual animals are then combined to estimate population density.

Camera traps can be attached to fixtures such as trees near to the assigned location or stakes put into the ground. Cameras should be put out low to the ground to ensure they detect hedgehogs. In public areas cameras will need to be securely fastened to permanent fixtures to ensure they are not disturbed or removed.

Studies are underway using this method and further information can be requested from People's Trust for Endangered Species enquiries@ptes.org



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Licence requirement

No licence is required for putting out and checking camera traps. However, if hedgehogs are being caught and tagged to establish home ranges then a licence from the relevant statutory agency is needed (for capture).

Pros

Potentially robust population density information generated – the REM method has been successfully trialled with other species and been found to produce reliable estimates of animal densities and is currently being tested for hedgehogs.

Day time survey for camera trapping – checking the camera traps can be done during the day.

Cons

Expensive equipment – many camera traps (30-120) are required for this method which makes it very expensive.

Licence required – if hedgehogs need to be caught and tagged to calculate home range sizes a licence is needed from the relevant statutory agency (for capture).

Long survey period required – the camera trapping part of this method will run for multiple weeks at each site.

Extensive data processing required – all the photos collected from the cameras need to be collated and assessed and then a formula is used to allow an estimate of hedgehog density at the site to be calculated.

Further information

Rowcliffe, J. M., Field, J., Turvey, S. T. and Carbone, C. (2008) Estimating animal density using camera traps without the need for individual recognition. *Journal of Applied Ecology* **45**:4

Nottingham Trent University/University of Reading project in progress <https://ptes.org/grants/uk-mammal-projects/hedgehog-populations/>

Detection dog use

Cost	Advantages	Disadvantages
££££ <i>(£300 - £400 per day for surveying, travel and accommodation may be required in addition). Additional cost may be required for initial training of the dog.</i>	<i>Applicable to all habitats Locate hedgehogs that are not visible (e.g. in nest) Day or night surveying Large areas can be covered quickly</i>	<i>Licence required for handling Welfare of dog and hedgehog must be considered Labour intensive Expensive</i>

Method:

A carefully trained detection dog is essential, as is a high level of experience for the detection dog handler. Careful selection of the dog is paramount, as they are searching for live animals. Low prey drive is crucial so the dog will not chase hedgehogs or other wildlife encountered. Dogs should be carefully trained using spines obtained from animals which have died naturally (such as on roads or from those which died in wildlife hospitals) prior to beginning work searching for live animals. A high level of reliability (e.g. >90% success) in these training sessions should be achieved before embarking upon field work. The dog should be trained to indicate quietly (e.g. sitting or pointing with nose) when locating the scent of hedgehog. Under no circumstances should the dog bark, scratch or dig at hedgehog scent, including when the training odour is located underground/beneath vegetation. This may exclude many dogs from being suitable for hedgehog detection, as this may be their natural/habitual response.

Surveying can be undertaken during the day or night. Dogs should work on a long lead in order to carefully manage the situation and ensure successful removal of the dog if needed. Dogs should be managed according to relevant industry guidelines for conservation/wildlife detection dogs and further details of this should be sought as this is beyond the scope of this document.

Two surveyors should work in tandem, with one handling the dog (ideally the dog's usual handler/trainer) and a second individual with responsibility for handling any hedgehogs located and/or investigating undergrowth, potential indications by the dog and/or suspected nests (ideally the licence holder). This avoids the dog remaining near any located animals and/or nests for extended periods of time.

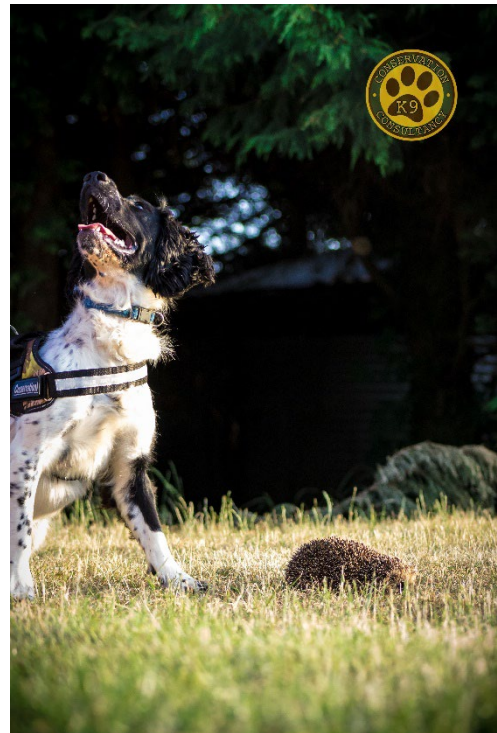
The designated area should be systematically searched, with particular focus placed on areas of long grass, vegetation, or areas where hedgehogs could be nesting. The potential for hedgehog nests to be located in rabbit holes, under built structures (e.g. sheds, compost heaps) or patches of dense vegetation should not be ignored. Nests and hedgehogs may be in inaccessible places, requiring considerable careful investigation so the dog must be trained to wait for long periods of time, and must be supervised and restrained at all times.

If the dog indicates on a suspected hedgehog in the nest, visual confirmation of a presence of hedgehog should be achieved before rewarding the dog (e.g. viewing a small patch of spines) to

avoid encouraging false positives by the dog (dogs may indicate on a recently inhabited nests, for example). The dog should be rewarded accordingly, dependent on the animal, but always maintaining a focus on the welfare of the hedgehog. For example, provision of the ball, if used, should be away from the hedgehog and should not involve a noisy, excitable game.



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Licence Requirement:

A licence is required from the relevant statutory agency for handling hedgehogs.

As a dog is being used to seek out mammals, the Hunting Act 2004 is relevant, and so animals must not be pursued or flushed out with the dog. If a dog indicates upon an area or it is suspected a hedgehog is present, the dog should be removed from the area immediately, with searching to confirm the hedgehog's presence carried out by a human surveyor.

If the intention is to remove hedgehogs from a site this would require further licencing from the relevant statutory body. It is strongly recommended that removal is in pre-arranged partnership with a reputable wildlife hospital to provide professional care and release at an alternative, suitable site. Removal of hedgehogs from a site should be the last resort, and only when the area of habitat cannot be preserved long enough for the hedgehog to move on naturally.

Equipment:

Highly trained detection dog, long line, head torches if searching at night. A location for the dog to rest (ideally a vehicle which the dog is used to travelling in) plus other requirements for dog welfare. Water should be offered to the dog every 15-20 minutes to maintain moist mucus membranes; essential for effective searching.

Pros:

Hedgehogs can be located in myriad habitats and locations – if it is safe for the dog and handler to enter the space, the dog will be able to search it. Professional detection dogs should be trained to

work safely in a range of habitats and responsible handlers should provide protective clothing for their animals if required (e.g. to protect against thorns and nettles) to increase the areas they can search.

Hedgehogs can be located day or night, including in their nest – there are no other reliable methods for finding hedgehogs in the nest.

High detection rate – a well trained dog handled by an experienced handler should be able to reliably locate hedgehogs regardless of where the animal is.

Cons:

Potential welfare concerns for both hedgehogs and dogs if not carefully managed, including injuries, stress and transmission of disease. If hedgehogs are being located in the nest there is a risk of disturbance, resulting in the animal leaving its nest, making it vulnerable to injury, stress and predation.

Expensive, particularly if the dog is not already trained to detect hedgehogs, as there may be an initial training fee with a consultancy and/or an extensive training period.

Labour intensive – whilst the dog will save considerable time in locating hedgehogs not otherwise visible, it is still important the area is searched systematically which does require considerable work. Limits on how long the dog can work for will also increase survey time, as frequent rest breaks are essential for the welfare and reliability of the dog.

Further Information:

Bearman-Brown, L.E., Wilson, L.E., Evans, L.C. and Baker, P.J., 2020. Comparing non-invasive surveying techniques for elusive, nocturnal mammals: a case study of the West European hedgehog (*Erinaceus europaeus*). *Journal of Vertebrate Biology*, 69(3), pp.20075-1.

Additional information

Hedgehogs in Britain are suffering a serious decline in numbers. *The State of Britain's Hedgehogs* (2018), produced by the British Hedgehog Preservation Society and People's Trust for Endangered Species, indicates that urban populations have fallen by up to 30% and rural populations by at least 50% since the turn of the century.

Robust evidence is required to understand hedgehog ecology, and how we can best conserve this species. All research projects should consider legal requirements, along with ethical and practical considerations before they begin.

Legal

Hedgehogs are protected, in England, Scotland and Wales, under the Wildlife and Countryside Act 1981, Schedule 6 and in Northern Ireland under the Wildlife (NI) Order 1985, Schedules 6 & 7. They are *“protected from being killed or taken by certain methods under Section 11(1) of the Wildlife and Countryside Act 1981. The methods listed are: self-locking snares, bows, crossbows, explosives (other than ammunition for a firearm), or live decoys. The species listed are also protected from the following activities: trap, snare or net, electrical device for killing or stunning, poisonous, poisoned or stupefying substances or any other gas or smoke, automatic or semi-automatic weapon, device for illuminating a target or sighting device for night shooting, artificial light, mirror or other dazzling device, sound recording, and mechanically propelled vehicle in immediate pursuit.”*

Licencing

Licences to undertake research come from Natural England, Natural Resources Wales, NatureScot and the Northern Ireland Environment Agency.

A survey licence is required for work on hedgehogs if the animals are to be trapped, taken with the use of artificial light (such a torch or spotlight), or fitted with a radio or GPS tag. A licence is not required for surveys of hedgehog field signs, for direct observation or for presence/absence surveys where they are observed or detected without 'taking' (such as trapping or handling) e.g. for the use of footprint tunnels, remote camera traps and thermal imaging cameras or for habitat appraisal or general ecological survey purposes.

If in doubt the relevant statutory agency should be consulted (details below) for licenses related to conservation work or scientific research. In addition to this, anyone applying sedatives to animals for research purposes must be a vet or licensed under the Animals (Scientific Procedures) Act 1986.

Natural England: <https://www.gov.uk/guidance/wildlife-licences>

Natural Resources Wales: <https://naturalresources.wales/permits-and-permissions/protected-species-licensing/uk-protected-species-licensing/small-mammal-licensing/?lang=en>

NatureScot: <https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/licensing/licensing-process>

Northern Ireland Environment Agency: <https://www.daera-ni.gov.uk/articles/wildlife-licensing>

Competencies for carrying out hedgehog research

The Chartered Institute of Ecology and Environmental Management (CIEEM) has put together a series of criteria they consider to be a minimum for research to be undertaken:

Knowledge

Individuals should have a knowledge and understanding of:

- conservation status
- distribution
- threats to populations, species range (including introduced populations) and species survival
- hedgehog ecology, breeding biology and behaviour
- known ecological requirements
- legal protection
- licensing and permissions
- appropriate survey seasons
- survey methods used to survey for hedgehogs (including trapping, marking/tagging, field searching and using footprint tunnels and camera traps) and the strengths, weaknesses and limitations of these methods
- appropriate equipment, methods and licensing requirements for humane live-capture, handling and sedation of hedgehogs (if intending to use these techniques) and the legal issues surrounding potential by-catch
- range of factors that might lead to bias in the survey results, and false negatives
- sources of information on known occurrence and distribution of hedgehogs (including NBN Gateway, local biological/environmental records and local contacts)
- metadata standards/data sharing
- health and safety and welfare issues commonly associated with surveying for hedgehogs (including live trapping and handling of wild animals if relevant).

Skills

Individuals should have skills and experience enabling them to confidently:

- identify field signs of hedgehogs
- assess habitat potential for hedgehogs
- scope fieldwork appropriately
- plan and implement sound scientific surveys (appreciating the effect of season and habitat on survey methods)
- use relevant non-invasive survey methods for hedgehogs
- analyse and interpret survey data
- take appropriate health and safety precautions.

If trapping is used, individuals should also be able to:

- deploy and monitor live traps effectively
- legally and humanely handle live hedgehogs
- effectively record biometric data from live hedgehogs
- legally and humanely mark/tag hedgehogs (if using this technique)
- correctly handle a range of potential by-catch from live traps (with due regard to relevant legislation).

(Much of this material was put together by Dr Richard Yarnell and Dr Nigel Reeve on behalf of the CIEEM)

Without the work undertaken by researchers we will not be in a position to argue for better protection for hedgehogs. Research is crucial to furthering our understanding of the threats hedgehogs face and to formulating responses.

All hedgehog research projects being considered and carried out should adhere to the above standards

Marking hedgehogs

Hedgehogs can be marked so they can be individually identified for capture-mark-recapture studies. The most common ways of marking them are:

- Colour marking spines - painting small areas of their spines with water based emulsion paint (rather than nail varnish or Tipp-Ex which are too pungent). Avoid using red coloured paint as this can make it look like the animal is injured. White or lighter colours show best on camera footage or during night time surveys.
- Colour tubing on spines – small lengths of coloured plastic tubing can be attached to the spines, either through using heat to shrink wrap them onto the spines (this does not hurt the animal and is similar to humans applying fake nails) or by using super glue to attach them. These lengths of plastic can either be a combination of different colours or they can have numbers written on them. More information on this method can be found in The Royal Parks hedgehog research reports <https://www.royalparks.org.uk/managing-the-parks/conservation-and-improvement-projects/hedgehogs/hedgehog-research-reports>

Hedgehog welfare

If during your project you find a hedgehog involved in your research in distress, please contact the British Hedgehog Preservation Society (Tel: **01584 890801**) or your local RSPCA centre <https://www.rspca.org.uk/whatwedo/yourlocal> after making sure the animal is safe and secure in a cardboard box (or similar) so that they can advise on the nearest rescue.

Baiting and food advice:

Hedgehog bait can be any combination of meat-based wet dog or cat food, dry hedgehog food or cat biscuits. Please avoid using bread and milk as hedgehogs are lactose intolerant.