Hedgehog (Flagship) Species Action Plan

"The hedgehog hides beneath the rotten hedge
And makes a great round nest of grass and sedge,
Or in a bush or in a hollow tree;
And many often stoop and say they see
Him roll and fill his prickles full of crabs
And creep away; and where the magpie dabs
His wing at muddy dyke, in aged root
He makes a nest and fills it full of fruit"

The Hedgehog, John Clare, 1820

1 Aims

- To reverse the decline of hedgehogs across the borough, and strive towards supporting self-sustaining, viable and thriving populations, utilising evidence based conservation actions with the integration of population monitoring.
- Promote hedgehogs as a 'Flagship Species', to encourage a wealth of beneficial conservation practices that support an array of other less known and less charismatic species.
- To raise the awareness amongst Council Officers and the public of the importance of hedgehogs to encourage greater levels of council & community driven conservation and appreciation across the borough.

Acknowledgements

We thank Chris Carbone from the Institute of Zoology and ecologist and author Hugh Warwick for their time and expertise in reviewing this plan.

2 Introduction

The Western European Hedgehog (*Erinaceus europaeus*) has been regularly voted as the UK's favourite mammal and is a true icon of British wildlife. They are closely related to shrews and moles and there are 15 other recognised species of hedgehog across the globe, which are distributed across Africa, Asia and Europe.

This distinctive nocturnal creature is the only mammal in the UK to have spines which are made from keratin - the same protein which makes fingernails and hair. Spines are hedgehog's primary defence which erect when the individual feels imperilled. Hedgehogs do not possess a flight or fright response, they will simply roll into a ball and wait patiently for predators to move on in what is known as a 'defence curl'.

While spines provide protection, they have a very limited thermal efficiency compared to typical fur. Therefore, hedgehogs are one of few British mammals to hibernate when food is limited and temperatures are colder. Hedgehogs are generalists and have a broad range of target prey species. The majority of their diet is made up of invertebrates, such as worms, slugs, caterpillars, beetles, earwigs and millipedes. Less regularly, hedgehogs will take advantage of carrion, frogs, baby rodents, baby birds, birds' eggs and fallen fruit, though these are not an important part of their diet. There is evidence to suggest that their main preference is for beetles followed by slugs.

Unfortunately, hedgehog populations are in steep decline, although there is still some uncertainty on absolute population numbers. Research indicates that since the year 2000, urban hedgehog numbers have decreased by at least 25%. The situation in rural areas is even worse with declines of between 30% - 75%, making hedgehogs one of the UK's most threatened mammal species. The drivers behind these dramatic declines remain unclear but factors such as the loss hedgerows (around 50% since WWII), the intensification of agriculture, predation and competition with badgers, and road collisions are likely to contribute.

In Kingston, there is a limited understanding of the current hedgehog situation. There are records held by the ecological record centre and a number of anecdotal sightings. These suggest that hotspots in the borough include areas of Berrylands and Old Malden. There have also been anecdotal reports in Kingston Town Centre.

Since 2021, the council has been working with the Institute of Zoology (as part of the London HogWatch project) and the local community to run the most comprehensive hedgehog surveys ever conducted in the borough. For this survey, 60 wildlife cameras were deployed in private gardens and public open spaces which identified hedgehog presence in these areas. Investigations will need to be continued to gain a more in-depth understanding of both population trends and health. This survey was undertaken in the Surbiton neighbourhood in 2021, and in the Old Malden and Coombe neighbourhood in 2022. We hope these surveys will be undertaken on an ongoing basis, targeting areas across the borough. It should also be noted that Kingston University has proactively engaged with the Hedgehog Friendly Campus scheme and is working to improve their grounds for hedgehogs.

3 Current status

a. **Legal / policy status** - Hedgehogs themselves are partially protected from being killed, injured or captured under Schedule 6 of the Wildlife and Countryside Act 1981. It is illegal to treat a hedgehog cruelly under the Wild Mammals Protection Act (1996) and the NERC Act (2006) lists hedgehogs as a species of 'principal importance for conservation' whereby public bodies have a duty of responsibility to protect them. There is no current legislation to directly protect their habitat, however, habitats that they utilise may be protected under law (see Woodland and Hedgerow HAPs).

b. **Conservation status** - Hedgehogs are listed as a priority species in the UK Biodiversity Action Plan. They were also described as 'vulnerable' in the 2020 IUCN Red List for Britain's Terrestrial Mammals (of 'Least Concern' on the global scale). (See Appendix A for SINC sites in RBK with hedgehogs).

c. **Distribution**

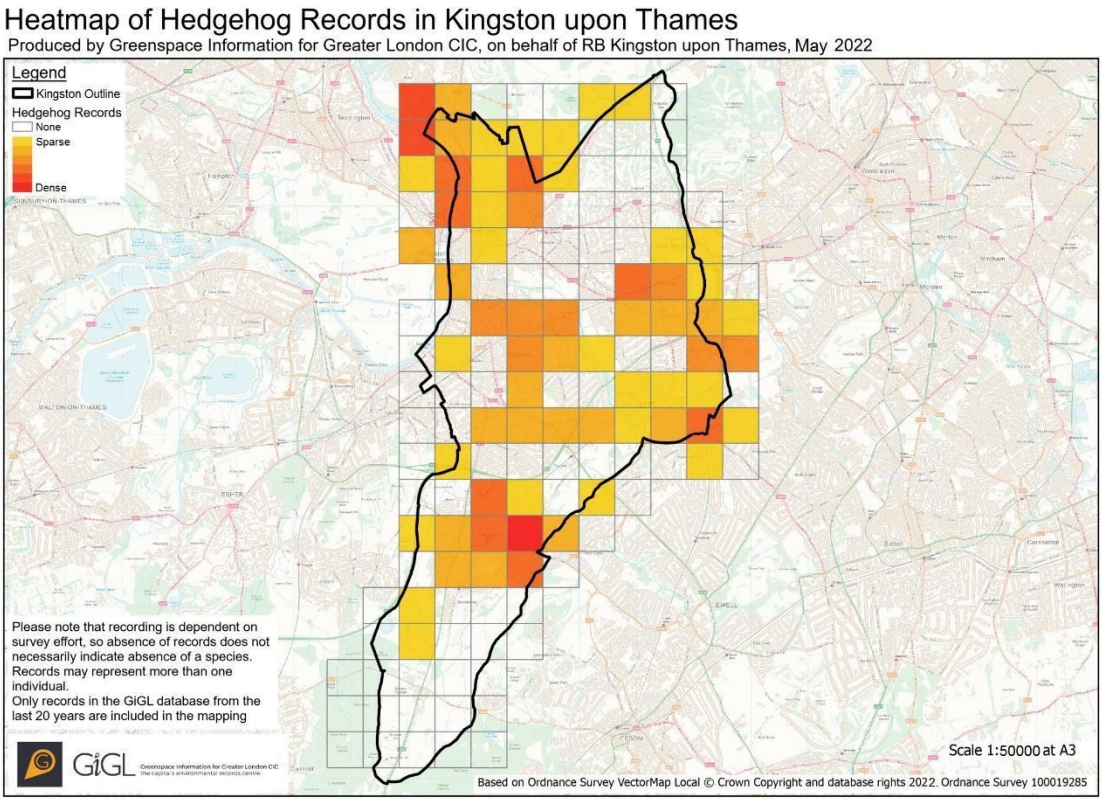

Figure 1 Distribution of hedgehogs across RBK (within the last 20 years).

Knowledge of the current state of hedgehogs in Kingston is limited. The London HogWatch project is working with RBK to quantify the relative abundance of hedgehogs in the borough to give a more accurate and more current depiction of hedgehog presence and absence in the Surbiton area. From June to August (2021) camera trap surveys were conducted in Berrylands Nature Reserve, Elmbridge Meadows, Hogsmill open space and surrounding

private gardens, the results of which can be found in Appendix B. Reports of sightings can also be made by the public through the BIG Hedgehog Map.

As national research indicates, suburban areas may be key for the long term survival of the species. As the borough has significant areas of suburbia there is a good opportunity to create a hedgehog stronghold that could be of great importance to the national population. Furthermore, by enacting conservation measures for hedgehogs there will be a range of other species who benefit from improving the ecological functionality of the surrounding landscape. Hedgehogs also present a fantastic opportunity to engage the local community, by using this much loved species to connect people to our local natural heritage and encourage them to engage in conservation action.

4 Key Habitats

Unsurprisingly, hedgehogs are commonly associated with hedgerows and woodland edges. Indeed, their name is derived from their tendency to 'hog the hedges'. Well-tended hedgerows are an ideal environment for hedgehogs as they provide invertebrate prey, nesting resources and a sheltered route to commute through. Ancient and species-rich hedgerows are most likely to support this biodiverse environment, especially those that are continuous, well-managed and structurally complex (Garden et al., 2007).

Mixed pasture or meadow, composed of many small well-hedged fields, with livestock and deciduous copses is an ideal habitat for the hedgehog. Traditional meadows with their vast variety of plant species support the diversity of insect life that a hedgehog needs, while livestock churn up bugs from the ground and attract insects with their dung. These habitats however, are more characteristic of the rural environment, in which the hedgehog is largely absent, in part due to badger presence (Williams *et al.,* 2018). SINC sites in the borough that are grazed and could be enhanced for hedgehogs include Winey Hill, Jubilee Meadows and Tolworth Court Farm.

A habitat suitability study by Turner, Freeman & Carbone (2021) found that in the urban environment of Greater London, hedgehogs were significantly and positively associated with the availability of gardens, terraced housing, parks, allotments and 'play-space'. Private gardens were found to be of particular importance as they offer a range of habitats favourable for both hedgehog foraging and nesting. On the other hand, hedgehog presence was significantly and negatively related to woodland, as well as badger presence (within 250m). Impervious cover (i.e. roads and buildings) and human density had a quadratic relationship with hedgehog presence, meaning presence increased to a point of 31% of impervious cover and human densities of 2262 km², but decreased at higher levels. Contrary to expectations, traffic volume showed a significant positive relationship with hedgehog presence however more detailed research is needed to explain this relationship. Road traffic collisions with hedgehogs are still considered a risk to populations.

Overall, sub-urban areas have been shown to provide an important haven for hedgehogs, especially where badgers are absent and there is a well-connected mosaic of key habitats. A study of minimum viable population estimated that 32-60 hogs are needed per 90 hectares of high quality land to ensure a high probability of the populations' survival. Whereas 120-

250 hogs may be needed in the same quantity of land where the habitat quality is poor (Moorehouse, 2013).

As a flagship species who is generally known to be in significant decline, targeted conservation action should be taken to safeguard hedgehogs. Actions that work to promote conservation, namely improving ecological connectivity and creating, protecting or enhancing associated habitat, will deliver an 'umbrella effect' by supporting other non-target species such as bats, badgers, amphibians, reptiles and insect life.

5 Ecosystem Functionality and Services

5.1 Pest Suppression

Hedgehogs are insectivores and have a mid-position in the trophic cascade as secondary consumers. They therefore play a key role in maintaining healthy ecosystems, as they work to control insect populations as well as other ground-dwelling creatures such as slugs and snails. This is particularly useful for urban gardeners – preventing the need for the chemical control of pests.

5.2 Bioindicators

One of the most important services of hedgehogs is their potential as an indicator species, acting as a measure of health in the local environment. Hedgehogs are specialist animals but are not fussy and will make use of a number of food sources and habitats. When they are thriving, it is presumable that invertebrate supply is plentiful and there is a good diversity of habitats and connectivity (both important factors for other species). Where hedgehogs are in decline, there is likely to be a shortage of invertebrates, habitat loss or habitat fragmentation.

5.2.1 Pollution

Due to their invertebrate diet, hedgehogs are at risk from and can be used as bioindicators of environmental pollution. For example, Rautio (2014) found an age-related accumulation of the toxic heavy metal cadmium in hedgehogs, even in areas with low concentrations of cadmium in the environment. As hedgehogs can have a fairly restricted home range, pollution levels at the population scale may also allow local sources of pollution to be identified (Vermeulen, 2009).

5.2.2 Disease

Wildlife disease surveillance presents mankind with an opportunity to prevent the consequences of an epidemic or pandemic disease. Due to their susceptibility to zoonotic pathogens, hedgehogs may be able to indicate the presence of disease and may be a suitable candidate as a sentinel species (an organism that provides an advance warning of a threat that potentially represents a risk to humans or other species) (National Research Council, 1991; Jota Baptista, 2021). Any sign of disease in hedgehogs can be reported through the Garden Wildlife Health.

6 Threats to the Species

6.1 Pollution

Pollutants from roads, gardens and industry have the potential to accumulate in the environment and impact hedgehog populations. The diet of hedgehogs is partly to blame as slugs, snails and worms often take up persistent organic pollutants from the environment, such as metals, pesticides and herbicides (Vermeulen, 2010). Rodenticides have also been found to accumulate in hedgehogs (Dowding *et al.,* 2010).

The predominant effects of litter on hedgehogs are entanglement and ingestion when chewing through wrappers to reach food. The hedgehog's response to light pollution remains largely unknown however some studies do show a preference for less illuminated areas (Berger *et al.,* 2020). Little is known about the effects of microplastics in small mammals although there has been evidence of microplastics in earthworms, which are a staple part of a hedgehog's diet (Lahive, 2022). In fact, numerous studies have shown that worms fail to thrive in soils containing microplastics, which may have serious impacts for human life due to the worm's vital ecological role.

6.2 Badgers

Hedgehogs and badgers have what is known as an 'asymmetric intraguild predatory relationship' which means they share habitat and compete for resources. If food sources are limited (as is often the case in ecologically degraded environments), badgers may choose to predate hedgehogs and can exert significant pressure on their populations. While the two species can, and have coexisted for millennia, studies show that hedgehog distribution has a significantly negative relationship to badger sett density.

One national study found that hedgehogs were absent from 71% of sites that had no badger setts, indicating that hedgehogs are also absent from large areas of the rural landscape in the UK (Williams *et al.,* 2018). Instead, hedgehog presence has been positively correlated with the built environment, demonstrating that urban areas provide an important haven for hedgehog populations. However, a study by Turner, Freeman & Carbone (2021) found that badgers also influence hedgehog distribution in the urban environment and further research will be important for promoting species coexistence.

6.3 Roads

Most roads represent a major barrier for hedgehogs and are likely to be an important contributory factor to their decline, especially in environments where a mix of urban and grassland habitat occurs. Of the small mammals, hedgehogs are one the most frequent victims of road collisions yet the causal factors behind this are still poorly understood (Wright *et al.,* 2020). Females are most frequently killed in the late summer when starting to enlarge their range after weaning their offspring, while the juveniles themselves are often found dead in August and September, shortly after beginning independent life in late July or August (Rautio, 2014). In addition to collisions, roads fragment the landscape and are often avoided by hedgehogs. Solutions to these issues are currently being researched by The Mammal Society.

6.4 Fragmentation

Habitat connectivity is important for hedgehogs for the purposes of foraging, breeding, dispersal and immigration. Hedgehogs are poorly sighted and often rely on linear features, such as hedgerows, treelines and fences for navigation, as well as cover from predators and resource acquisition. The removal or degradation of these structures could therefore isolate hedgehogs and contribute to population declines. Additionally, while fences may be useful for some purposes, they are often impenetrable and act as barriers themselves, alongside wide and heavily used roads. Due to the fact that hedgehogs tend to avoid badgers, badger setts can cause hedgehogs to become isolated through 'behavioural fragmentation'.

Being conscious of these issues and maintaining connectivity is highly important in the urban environment, especially through private gardens, natural features such as species-rich hedgerows and hedgehog highway schemes such as Hedgehog Street. It is also important to maintain a well-connected mosaic of biodiverse habitats in the landscape, such as species-rich grassland and patches of semi-natural vegetation.

6.5 Feeding

Leaving food in gardens can provide a supplementary food source for hedgehogs, but may also attract unwanted species such as foxes and rats (unless carefully managed), can increase the incidence of fights between individuals and can contribute to zoonotic disease transmission.

Hedgehogs are mainly solitary animals, except in the breeding and nursing seasons. The presence of several individuals gathered to exploit a food source in a garden constitutes an unnatural situation whereby fights between individuals can occur, leaving wounds open to bacterial infection. Additionally, close contact between individuals can facilitate the transfer of zoonotic diseases, which can be exacerbated by the offering of unsuitable food items (such as cow's milk) which can contribute to salmonella infections (Keymer, 1991; Rautio, 2014). Cleaning surfaces or bowls used to feed hedgehogs (with gloves) can reduce the transmission of disease between hedgehogs, pets and humans.

While hedgehogs can benefit from supplementary food, their generally flexible feeding behaviour reduces the likelihood of dependence on these sources. To reduce the potential negative side-effects, feeding can be discontinued at times when natural food is easily available. Hedgehogs are most likely to benefit most from feeding during the late summer and autumn as they build their fat stores for winter hibernation.

6.6 Climate Change

Climate change may significantly influence the survival and distribution of hedgehogs in the future, as the UK is set to have hotter and drier summers – similar to that of Barcelona's current climate by 2050 (Bastin *et al.,* 2019). Warmer and wetter winters are likely to interfere with hibernation cycles and the occurrence of extreme weather events may further disturb them. Temperature change is a particular concern for urban hedgehogs as London has been shown to be more than 3°C warmer during the day and more than 7°C warmer in the night than surrounding rural areas (Watkins *et al.,* 2002).

6.7 The Tidying of Parks and Gardens

The tidying up of materials such as leaf litter and wood piles reduces the suitability of parks and gardens as habitat for hedgehogs, as well as other small mammals and their insect prey.

7 Conservation actions (Tabulated)

Action	Timeframe	Lead	Partners	Evidence base
HH01 - Contribute to a database of species records through national, regional and local recording schemes, including work with the institute of zoology on HogWatch, with an aim to run community supported surveys annually.	2023 - ongoing	RBK	GiGL Hedgehog Street (PTES / BHPS) Zoological Society of London	BIG Hedgehog Map - Hedgehog Street Submit Records - GIGL London HogWatch - ZSL
HH02 - Continue to work with the Institute of Zoology on HogWatch, with an aim to run community supported surveys annually.	2023 - ongoing	RBK		
HH03 – Set up a hedgehog working group to identify areas for new 'hedgehog highways' - encourage implementation and recording of the species	2023 - 2028	RBK		Hedgehog Highway Campaign – Hedgehog Street Hedgehog Highways - The Royal Parks
HH04 - Promote best practice in hedgehog friendly fencing design and installation with the public and private sectors.	2023 - 2028	RBK		See **HH03** Hedgehog-friendly fencing - Hedgehog Street
HH05 - Encourage planning applications to enhance green connectivity and prevent or mitigate deterioration of habitat, e.g. links between gardens.	2023 - ongoing	RBK		Hedgehog Ecology & Land Management – British Hedgehogs

HH06 - Work towards integrating hedgehog highways as a standard condition in planning applications.	2023 - 2028	RBK		See **HH03** & **HH04** Hedgehog Highways - GOV.UK
HH07 - Encourage local schools and universities to implement hedgehog highways and/or hedgehog habitat on their grounds.	2023 - 2028	RBK	AfC Kingston University	Toolkit for schools - Hedgehog Street Hedgehog Friendly Campus - HFC UK
HH08 - Implement signs on roads to avoid collisions in high risk areas	2023-2028	RBK		N/A
Engagement & Awareness	**Timeframe**	**Lead**	**Partners**	**Evidence base**
HH09 - Develop wildlife friendly gardening and education projects and good practice advice for managers of greenspaces in all sectors.	2023 - 2028	RBK		Hedgehog Friendly Gardening – Wildlife Trust
HH10 – Run one or more annual event(s) as part of Hedgehog Awareness Week	2023 - 2028	RBK		N/A
HH11 - Run a hedgehog highway campaign and encourage communities to create Highways in their gardens, as well as report hedgehog sightings				See **HH01**

8 Planning Context - Biodiversity Net Gain

As a priority species for the borough, hedgehogs should be protected through the planning system and, where possible, habitat creation and enhancement for hedgehogs is encouraged. Planning conditions should be applied which enhance green connectivity and prevent or mitigate the deterioration of relevant habitats, e.g. links between gardens.

9 Monitoring

Metric	Process of Monitoring	Timeframe	Lead	Partners
HH01, HH03, HH05, HH06, HH07, HH11 – Register of species records	Ad hoc, annual report	2023 - ongoing	RBK	GiGL, Hedgehog Street (PTES/BHPS)
HH02, HH03 – Number of monitoring programmes supported / undertaken	Annual report	2023 - ongoing	RBK	
HH02, HH03 – Number of surveys conducted and results	Annual report	2023 – 2028	RBK	
HH04 – Number and map of hedgehog friendly fences installed on council land	Annual account	2023 – 2028	RBK	
HH05 – Record of hedgehog highways implemented through planning	Annual account	2023 – ongoing	RBK	
HH08 – Number and map of traffic signs produced	Annual account	2023 – 2028	RBK	
HH09, H11 – Collation of resources used	Annual account	2023 – 2028	RBK	
HH10 - Number of events and number of attendees	Annual account	2023 – 2028	RBK	

10 Other relevant HAPs/ SAPs

a. Hedgerow
b. Pollinator Parks
c. Standing Open Water
d. WildWays
e. Woodland
f. Badger
g. Stag Beetle

11 References

Bastin, J.-F., Clark, E., Elliott, T., Hart, S., van den Hoogen, J., Hordijk, I., Ma, H., Majumder, S., Manoli, G., Maschler, J., Mo, L., Routh, D., Yu, K., Zohner, C. M., & Crowther, T. W. (2019). Understanding climate change from a global analysis of city analogues. *PLOS ONE*, *14*(7), e0217592. https://doi.org/10.1371/journal.pone.0217592

Berger, A., Lozano, B., Barthel, L. M. F., & Schubert, N. (2020). Moving in the Dark—Evidence for an Influence of Artificial Light at Night on the Movement Behaviour of European Hedgehogs (Erinaceus europaeus). *Animals*, *10*(8), 1306. https://doi.org/10.3390/ani10081306

Dowding, C. v., Shore, R. F., Worgan, A., Baker, P. J., & Harris, S. (2010). Accumulation of anticoagulant rodenticides in a non-target insectivore, the European hedgehog (Erinaceus europaeus). *Environmental Pollution*, *158*(1), 161–166. https://doi.org/10.1016/j.envpol.2009.07.017

Garden, J. G., Mcalpine, C. A., Possingham, H. P., & Jones, D. N. (2007). Habitat structure is more important than vegetation composition for local-level management of native terrestrial reptile and small mammal species living in urban remnants: A case study from Brisbane, Australia. *Austral Ecology*, *32*(6), 669–685. https://doi.org/10.1111/j.1442-9993.2007.01750.x

Jota Baptista, C. V., Seixas, F., Gonzalo-Orden, J. M., & Oliveira, P. A. (2021). Can the European Hedgehog (Erinaceus europaeus) Be a Sentinel for One Health Concerns? *Biologics*, *1*(1), 61–69. https://doi.org/10.3390/biologics1010004

Keymer I F, Gibson E A & Reynolds D J (1991) Zoonoses and other findings in hedgehogs (Erinaceus europaeus): a survey of mortality and review of the literature. Veterinary Record 128: 245–249

Lahive, E., Cross, R., Saarloos, A. I., Horton, A. A., Svendsen, C., Hufenus, R., & Mitrano, D. M. (2022). Earthworms ingest microplastic fibres and nanoplastics with effects on

egestion rate and long-term retention. *Science of The Total Environment*, *807*, 151022. https://doi.org/10.1016/j.scitotenv.2021.151022

Moorhouse, T. (2013). Population Viability Analysis of Hedgehogs in Rural and Urban Habitats.

National Research Council (1991). Animals as sentinels of environmental health hazards. National Academies Press: Washington, DC, USA.
Rautio, A. (2014). On the northern edge: Ecology of urban hedgehogs in eastern Finland (Doctoral dissertation, Itä-Suomen yliopisto).
Vermeulen, F. (2009). Spatially explicit exposure assessment of persistent pollutants through the food chain of the European hedgehog *(Erinaceus europaeus).* Ph.D. thesis, University of Antwerpen.

Turner, J., Freeman, R., & Carbone, C. (2021). Using citizen science to understand and map habitat suitability for a synurbic mammal in an urban landscape: the hedgehog *Erinaceus europaeus*. *Mammal Review*, *52*(2), 291–303. https://doi.org/10.1111/mam.12278

Vermeulen, F., Covaci, A., D'Havé, H., van den Brink, N. W., Blust, R., de Coen, W., & Bervoets, L. (2010). Accumulation of background levels of persistent organochlorine and organobromine pollutants through the soil–earthworm–hedgehog food chain. *Environment International*, *36*(7), 721–727. https://doi.org/10.1016/j.envint.2010.05.006

Watkins, R., Palmer, J., Kolokotroni, M., & Littlefair, P. (2002). The London Heat Island: results from summertime monitoring. *Building Services Engineering Research and Technology*, *23*(2), 97–106. https://doi.org/10.1191/0143624402bt031oa

Wembridge, D., Johnson, G., Al-Fulaji, N. and Langston, S. (2022). The State of Britain's Hedgehogs 2022. Available at: www.hedgehogstreet.org/wp-content/uploads/2022/02/SoBH-2022-Final.pdf (Accessed: September, 2022)

Wembridge, D., Newman, M.R., Bright, P. and Morris, P., 2016. An estimate of the annual number of hedgehog (Erinaceus europaeus) road casualties in Great Britain. Mammal Society.

Williams, B. M., Baker, P. J., Thomas, E., Wilson, G., Judge, J., & Yarnell, R. W. (2018). Reduced occupancy of hedgehogs (Erinaceus europaeus) in rural England and Wales: The influence of habitat and an asymmetric intra-guild predator. *Scientific Reports*, *8*(1), 12156. https://doi.org/10.1038/s41598-018-30130-4

Wright, P. G. R., Coomber, F. G., Bellamy, C. C., Perkins, S. E., & Mathews, F. (2020). Predicting hedgehog mortality risks on British roads using habitat suitability modelling. *PeerJ*, *7*, e8154. https://doi.org/10.7717/peerj.8154

12 Abbreviations

AfC: Achieving for Children
BHPS: British Hedgehog Preservation Society
GiGL: Greenspace Information for Greater London
PTES: Peoples Trust for Endangered Species
RBK: Royal Borough of Kingston

13 Contact information

Elliot Newton (Biodiversity Officer)
The Royal Borough of Kingston upon Thames
Guildhall 2
High Street
Kingston upon Thames
KT1 1EU

Email: elliot.newton@kingston.gov.uk

14 Appendix

Appendix A. Table of SINC designation sites with reports of hedgehog presence.

Site	SINC Designation
Kingston Cemetery	Local
Tolworth Court Farm Fields and Medieval Moated Manor	Borough (Grade 1)
Malden Golf Course and Thames Water Pipe Track (Kingston)	Borough (Grade 1)

Appendix B. Mapped results of hedgehog camera trapping surveys in the Surbiton Area.

Figure 2 *Map showing the camera locations included in the London Borough of Kingston survey 2021. Blue – park cameras in Berrylands nature reserve, Elmbridge Meadows and Hogsmill open space, Yellow- gardens.*

Figure 3 *Berrylands nature reserve, Elmbridge Meadows, Hogsmill open space and surrounding gardens. Hedgehog distribution. Red indicates presence and white absence. Trapping rates ranged from 0 to 0.92. Larger circles indicate higher trapping rates.*