ZSL INSTITUTE OF ZOOLOGY

LONDON HOGWATCH

Hampstead Heath camera-trap survey

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Introduction

Hedgehogs in the UK have experienced a dramatic decline over the last 20 years, with estimates suggesting that numbers have fallen from 1.5 million in 1995 to under 1 million in 2015[1]. The causes of this decline are complicated, as many factors are likely to be interacting to produce this effect. These factors include habitat loss and fragmentation, use of pesticides and other agricultural chemicals, road traffic and possibly also the increasing badger population[2–4]. London HogWatch is aiming to help halt hedgehog population decline in London by understanding the abundance and distributions of major hedgehog populations in the capital to better develop future management strategies.

A key problem with conservation efforts for London hedgehogs so far is a lack of knowledge about the occurrence, size and levels of connectivity of the populations. Having this information would allow for efforts to be targeted and therefore more successful. Currently, data is predominately gathered from citizen science surveys, such as Hedgehog Street's Big Hedgehog Map[5]. Whilst this method can provide useful data on hedgehog presence, little can be inferred about their absence. London HogWatch uses a different approach, that of systematic camera trapping, to provide data on both presence and absence. In addition, the use of camera traps means data on other species that may impact hedgehogs is also collected, such as red foxes and badgers.

The 2017 Golders Hill survey was one of the first conducted by London HogWatch. This small survey was intended as a preliminary survey before the entirety of Hampstead Heath was surveyed at a later date. The results were very positive, with 207 sequences recorded over 26 of 30 sites. If this level of abundance occurred over the rest of the heath, it would be a significant hotspot for hedgehogs in London. A full-scale survey of 150 camera sites took place in 2018 to test this theory.

Survey Method

The survey of Hampstead Heath took place over a period of four months, from April to July 2018. Reconyx and Browning Strike Force Pro camera traps were placed across the entirety of the Heath, 150 sites in total (Figure 1). The traps were set to trigger and take a photo every second if an animal entered the detection zone of the camera. Use of infrared flash allowed the cameras to be active at night as well as day. To ensure even coverage of the greenspace, cameras were placed as close as possible to a predetermined grid pattern.

The Heath Hands provided volunteers to assist with camera set up and collection. Training was provided by members of the HogWatch team. The ideal site coordinates were uploaded to Google's MyMaps, so volunteers were able to use their smartphone GPS to locate the camera sites. The map, showing site numbers and their coordinates, can be accessed here: https://drive.google.com/open?id=1M_ClC551k0n50QdKxFwcTvckG9BYOCMw&usp=sharing

Only photos taken between the hours of 6pm and 8am were processed, as the species of interest (hedgehogs, foxes and badgers) are predominantly nocturnal. This restricted tagging interval also has the benefit of avoiding much of the human activity the cameras detect. Once tagged, the data was used to calculate trapping rates (number of sightings/the days the camera was active) for each site and species of interest. Maps generated from this data are provided in the results section.

For parks where a high number of hedgehog sequences are recorded, our camera trap survey method facilitates the use of a statistical technique known as Random Encounter Modelling to estimate the population density of a species[6]. As a high number of hedgehog and fox sequences were recorded at Hampstead Heath, these estimates should be possible for both species. This is currently being worked on by ZSL students.

Results

As expected, hedgehog sequences were recorded at Hampstead Heath, along with several other species. This includes foxes, muntjac, rabbits, squirrels, cats, rats and mice (Table 1). In addition, a badger was detected, a surprising result. Humans and dogs were also recorded by the cameras.

380 hedgehog encounters were recorded from 73 sites (49%). Hedgehog distribution and activity is shown in Figure 1, with presence indicated by a red circle and absence with a white circle. Larger circles indicate a higher trapping rate. Foxes (Figure 2) were seen very regularly during the survey, with 2027 encounters across 131 sites (87%).

Table 1: Summary of survey results from Hampstead Heath. Overall Trapping Rate is the number of sightings divided by the total number of camera trap nights (2239).

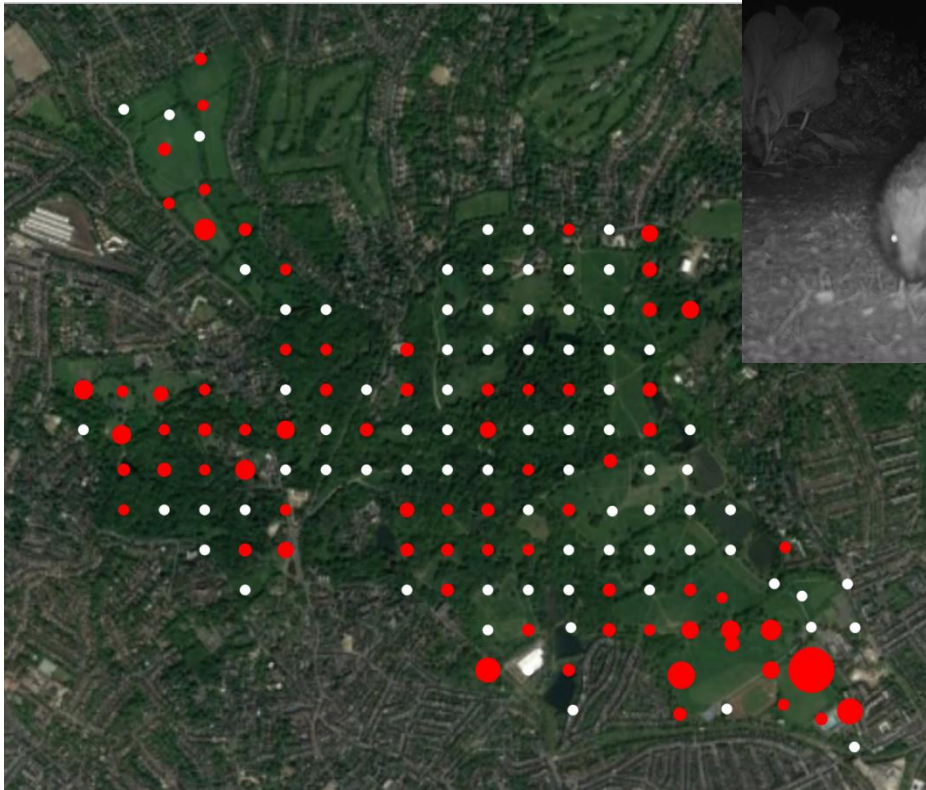| Species	Number of Sightings 6pm-8am	Number of Sites Present (% sites)	Overall Trapping Rate
Hedgehog	380	73 (49)	0.17
Fox	2027	131 (87)	0.91
Dog	1380	94 (63)	0.616
Mouse	384	27 (18)	0.172
Rabbit	108	6 (4)	0.048
Rat	71	8 (5)	0.032
Cat	56	10 (7)	0.025
Muntjac	17	7 (5)	0.008
Badger	1	1 (1)	0.0004

*Figure 1: Map showing the sites where the camera captured **Hedgehog** sequences. Red indicates presence and white absence. Trapping rates (the total number of sequences taken by the camera/ number of nights the camera was active) ranged from 0 to 3.23. Larger circles indicate a higher trapping rate.*
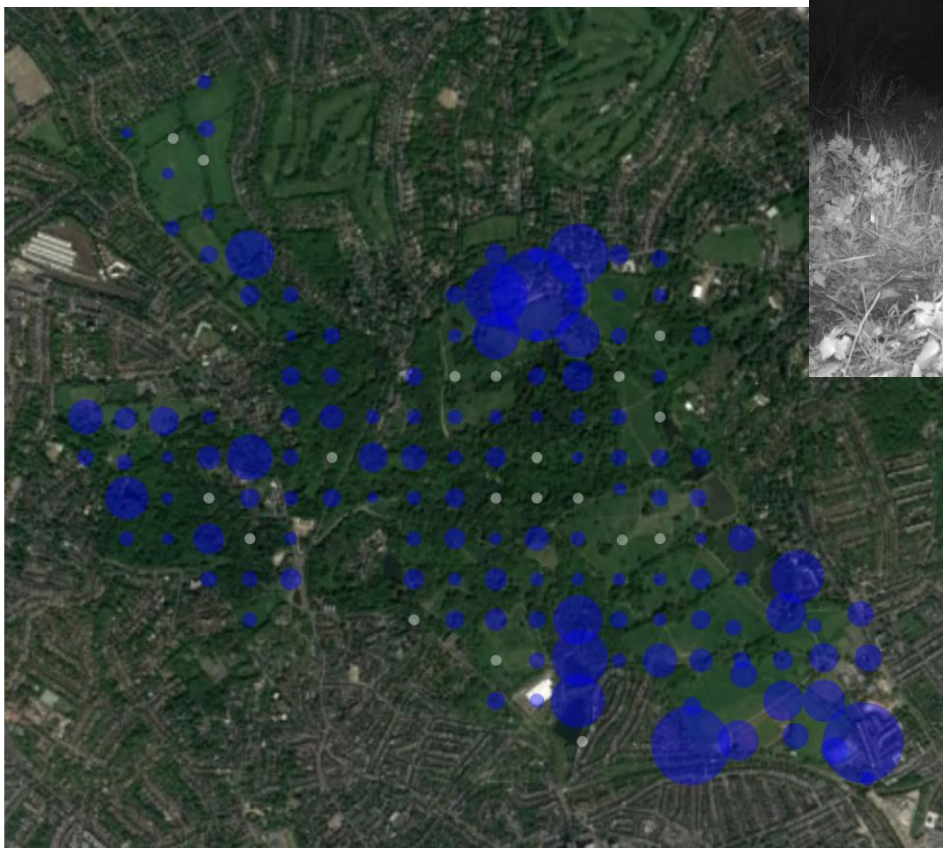

*Figure 2: Map showing the sites where the camera captured **Fox** sequences. Blue indicates presence and white absence. Trapping rates (the total number of sequences taken by the camera/ number of nights the camera was active) ranged from 0 to 7.4. Larger circles indicate a higher trapping rate*
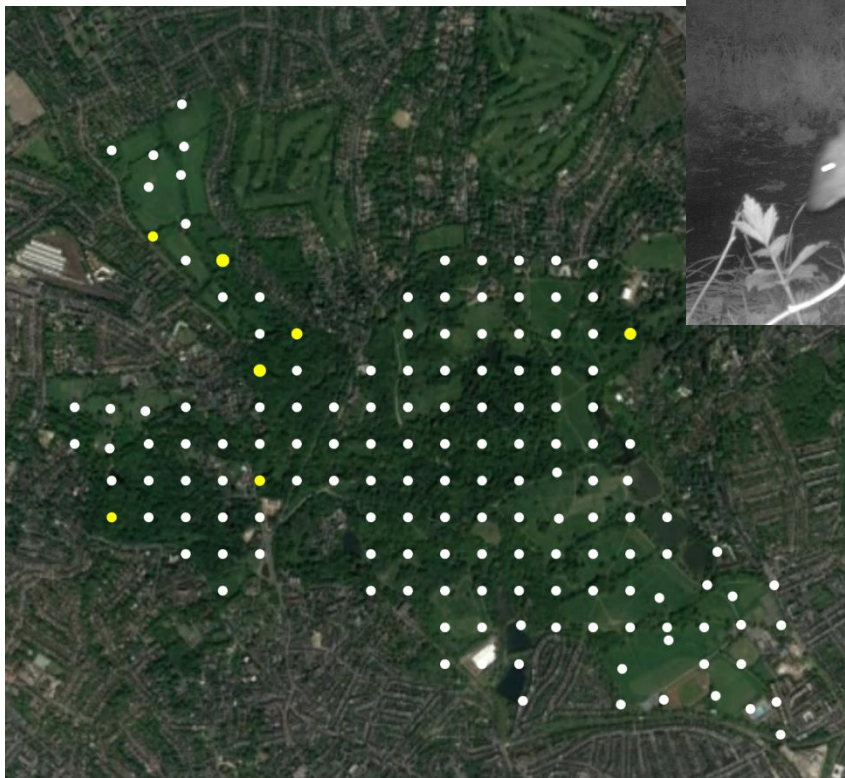
*Figure 3: Map showing the sites where the camera captured **Muntjac** sequences. Yellow indicates presence and white absence. Trapping rates (the total number of sequences taken by the camera/ number of nights the camera was active) ranged from 0 to 0.33. Larger circles indicate a higher trapping rate.*

*Figure 4: Map showing the sites where the camera captured **Badger** sequences. Orange indicates presence and white absence. Trapping rates (the total number of sequences taken by the camera/ number of nights the camera was active) ranged from 0 to 0.06. Only one badger was detected during the survey.*
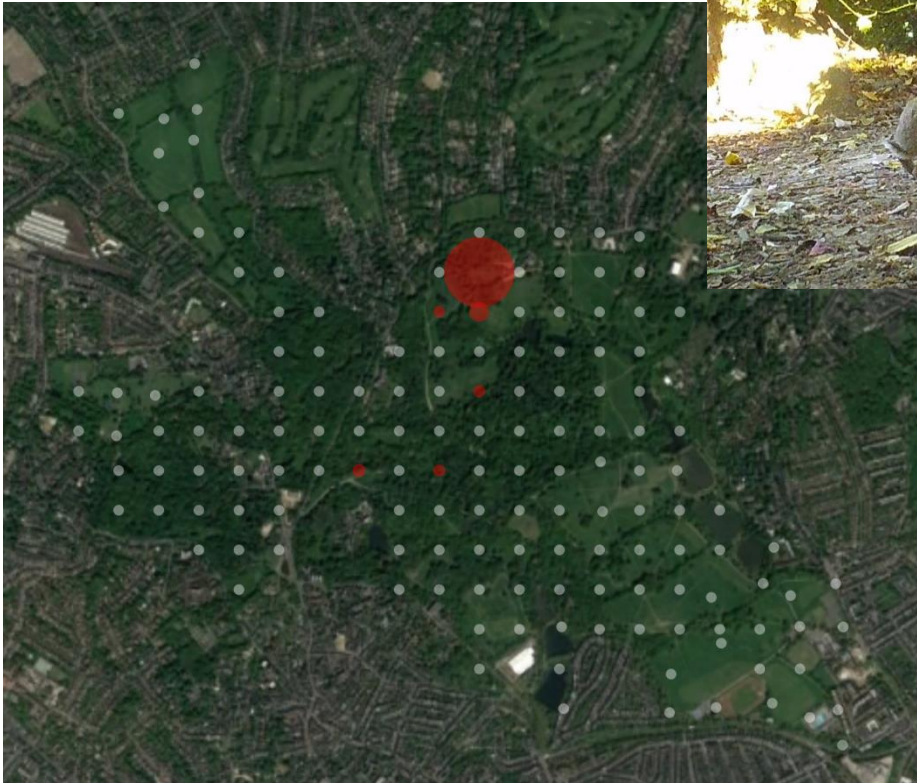
Figure 5: Map showing the sites where the camera captured **Rabbit** sequences. Orange indicates presence and white absence. Trapping rates (the total number of sequences taken by the camera/ number of nights the camera was active) ranged from 0 to 5.6. Larger circles indicate higher trapping rates.

Figure 6: Map showing the sites where the camera captured **Dog** sequences. Pink indicates presence and white absence. Trapping rates (the total number of sequences taken by the camera/ number of nights the camera was active) ranged from 0 to 14. Larger circles indicate higher trapping rates.

Discussion

A section of Hampstead Heath, Golders Hill Park, was first surveyed in 2017. This survey found a relatively high number of hedgehog sequences, suggesting that the Heath is an important location for hedgehogs in London. The 150-camera survey undertaken in 2018 has confirmed this, with hedgehogs present at 49% of the sites surveyed. The trapping rate for hedgehogs in the Heath was 0.17, the highest we have recorded so far, aside from the previous Golders Hill survey (a rate of 0.326). Survey results for other parks we have surveyed are provided in Table 2 for comparison. The south east area of the Heath appears to be the most active for hedgehogs (Fig.1), however which habitat features make it attractive to hedgehogs are unclear. Enough sequences were recorded for REM analysis (currently being done), which should give a more accurate indication of hedgehog numbers.

The size of the Heath (320 ha) could partly explain why hedgehogs are abundant, as a healthy population requires a large area[7]. However, as surveys of other large parks (such as Home Park in south London) did not find hedgehogs, other factors must be involved. This could be the mix of habitats available or the absence of a significant badger population. London HogWatch has surveyed other parks in north London, Highgate Wood, Queens Wood and Alexandra Park (Table 2), with hedgehog populations either absent or small and at risk. As Hampstead Heath appears to have a strong population, it could act as a source of hedgehogs for these and other surrounding greenspaces, aiding hedgehog conservation. However, connectivity between these spaces would need to be improved to facilitate dispersal.

Foxes were abundant and widespread on the Heath, only absent from 19 of the 150 sites. The site trapping rates (Figure 2) suggest that foxes may be favouring areas around the edges of the Heath. This could be due to the proximity of human housing, a potential food source. Further analysis is currently being performed on the fox data from the Heath and other sites to see if this is a true pattern in fox distribution.

The most surprising result from the survey was the presence of a badger at one site (Fig.4), as we were not expecting to find this species on the Heath. Had they been a common species in this area, we would have expected to find more recordings, as they are easily detected by the cameras. This suggests that this badger could be a lone dispersing badger, rather than part of a nearby sett. Should badgers become more common, they may have an impact on the hedgehog population through predation or competition for food[8].

The survey highlighted the high number of dogs that make use of the Heath. The results shown in Table 1 are a poor reflection of true numbers (which will be significantly higher), as they were only counted between 6pm and 8am. The presence of dogs may have an adverse impact on wildlife, including hedgehogs.

Table 2: Survey results from greenspaces London HogWatch has surveyed.

Park	Hedgehog			Fox			Badger		
	Contact events	Camera Sites	Overall Trapping Rate	Contact events	Camera Sites	Overall Trapping Rate	Contact events	Camera Sites	Overall Trapping Rate
Alexandra Park (2017)	63	8 (85)	0.0616	1196	71 (85)	1.17	0	0 (85)	0
Barnes Common (2018)	19	7 (29)	0.032	499	26 (29)	0.823	12	3 (29)	0.02
Bushy Park (2017)	1	1 (15)	0.003	174	14 (15)	0.58	3	3 (15)	0.01
Golders Hill (2017)	202	25 (30)	0.326	1046	30 (30)	1.687	0	0 (30)	0
Hampstead Heath (2018)	**380**	**73 (150)**	**0.17**	**2027**	**131 (150)**	**0.91**	**1**	**1 (150)**	**0.0004**
Highgate Wood (2017)	1	1 (44)	0.0016	239	33 (44)	0.379	0	0 (44)	0
Home Park (2018)	0	0 (147)	0	492	88 (147)	0.244	506	64 (147)	0.289
Queen's Wood (2017)	0	0 (34)	0	582	34 (35)	1.0172	0	0 (34)	0
Regent's Park (2016)	73	18 (68)	0.0788	744	65 (68)	0.8026	0	0 (68)	0
Richmond Park (2018)	0	0 (32)	0	122	25 (32)	0.355	240	19 (32)	0.698

Conclusion

In conclusion, this survey confirmed our prediction that Hampstead Heath is an important location for hedgehogs in London. Hedgehog presence was widespread across the survey area and the high number of sightings suggests they are relatively abundant. A more accurate picture of the population will be produced by a REM estimate. The survey also showed that other wildlife is also abundant, with badgers occasionally present.

Research using the survey photos is still ongoing, with REM estimates expected for foxes, as well as investigations into fox distribution and the impact of dogs on the Heath.

In terms of hedgehog conservation, an eventual goal would be to increase connectivity between the Heath and the surrounding greenspaces to improve dispersal. This would allow populations to interbreed, avoiding the potential problem of inbreeding in the future. More habitat would also become available, increasing the number of hedgehogs that can be supported in this area of London.

On a smaller scale, raising awareness of hedgehogs and encouraging visitors to the Heath to make their gardens hedgehog friendly (such as making holes in garden fences) would be beneficial. As a result of volunteer groups like Heath Hands and the very high number of visitors the Heath receives, the message would reach a high number of people.

References

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