Bats in Greater London

Unique evidence of a decline over 15 years

Denys Ovenden

Pete Guest, Kate E Jones and John Tovey

All bats in the UK were given legal protection in 1981, but how effective have this and other conservation and protection measures been? That bats in the UK have been suffering a long-term decline is often stated (Harris *et al.* 1995; Stebbings 1988, 1995), leading to their being granted full protection under the Wildlife and Countryside Act 1981. The decline is also evidenced by anecdotal reports, including some from London. Such evidence is often difficult to assess, but there are a few written records which, though casual, strongly support the proposition that bats in Greater London have suffered a major population decline during the 20th century. Johnson's (1930) book, *Animal Life in London*, covered an inner radius of about five to six miles from Charing Cross, which even then was a heavily urbanised area. Typically for the time, bats get little attention, but the casual references to 'so common' in 'thickly populated neighbourhoods' and 'in the busy street', and to 'scores of bats' around St Paul's Cathedral are so very different from the current situation as to seem hard to believe.

The only reasonable conclusion from this is that bats, even in the highly urban areas of central London, were very much more common 70 years ago than now. As bats in the UK are dependent on insect prey, this suggest that insects were more common also, and Fitter (1945) certainly supports this, noting 'flies that flourish on refuse, horse droppings and various unsavoury paraphenomena of town life, ants, crickets, mosquitoes'. That this could sustain a comparably high population of bats in urban London may perhaps explain their presence in the numbers described by Johnson.

Figure 1 Survey site locations.

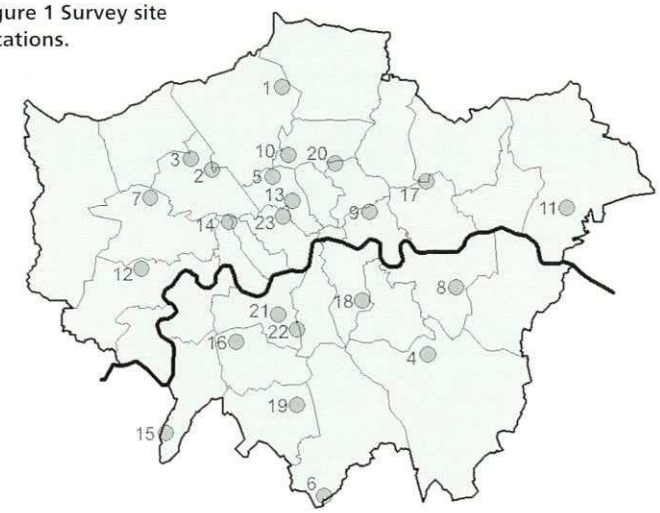


Table 1 Feeding areas selected for the 1999 survey.

Site	Borough	Site Name	NGR	Original Survey	1999 Survey
1	Barnet	Oak Hill Park	TQ 278948	08/07/86	15/07/99
2	Brent	Brent Reservoir	TQ 213871	24/06/86	24/06/99
3	Brent	Fryent Country Park	TQ 193881	03/07/86	09/07/99
4	Bromley	Sundridge Park	TQ 412700	15/08/85	09/08/99
5	Camden	Hampstead Heath	TQ 269865	05/06/85	16/06/99
6	Croydon	Coulsdon Common	TQ 317568	15/10/85	15/10/99
7	Ealing	Horsendon Hill	TQ 155845	16/06/85	21/06/99
8	Greenwich	Oxleas Wood	TQ 438762	10/06/85	21/06/99
9	Hackney	Stoke Newington Reservoirs	TQ 327877	09/07/87	15/07/99
10	Haringey	Highgate Wood	TQ 284885	24/07/85	31/07/99
11	Havering	Berwick Pond	TQ 540836	04/06/86	13/06/99
12	Hounslow	Osterley Park	TQ 146779	27/09/85	25/09/99
13	Islington	Regents Canal	TQ 287842	27/08/86	23/08/99
14	Ken. & Chelsea	Grand Union Canal	TQ 229823	22/05/85	10/06/99
15	Kingston	Winey Hill	TQ 170627	29/07/86	05/08/99
16	Merton	Wimbledon Common	TQ 235711	13/06/85	18/06/99
17	Newham	Wanstead Flats	TQ 410860	18/06/87	19/06/99
18	Southwark	Peckham Rye	TQ 352750	13/07/84	08/07/99
19	Sutton	Beddington Park	TQ 292653	09/07/86	08/07/99
20	Tower Hamlets	Regents Canal	TQ 358832	21/07/86	26/07/99
21	Wandsworth	Tooting Bec Common	TQ 292723	27/08/85	31/08/99
22	Wandsworth	Wandsworth Common	TQ 274737	12/08/85	12/08/99
23	Westminster	Regents Park	TQ 279828	16/07/85	15/07/99

The need for evidence

The effectiveness of monitoring in helping to focus conservation is demonstrated by the British Trust for Ornithology, whose long-term work involving volunteers is widely acclaimed (Anon 2000) and whose farmland-bird indexes have now been incorporated into the UK Government's 'Quality of Life Counts', as part of the UK's sustainability indicators.

Few of the previous studies on bat populations used methodologies that would enable declines in species abundances to be rigorously detected. Concern over this led to the establishment of the Bat Conservation Trust's National Bat Monitoring Programme (NBMP) to quantify and monitor the population status of Britain's bats, funded mainly by the UK Government. This will have enormous importance for the future of bat conservation, enabling population changes to be rigorously detected and aiding the actions taken to halt and reverse any further declines.

London Bat Project

Between 1985 and 1987, the then Greater London Council, its successor bodies and others funded the London Bat Project, to co-ordinate a survey of bats in Greater London (Mickleburgh 1987, 1988). The project included the first comprehensive survey of the feeding habitat exploited by London's bats, using data from 144 bat feeding sites within 29 of the London boroughs. To give some idea of geographical scale, the 33 Greater London boroughs cover nearly 158,000ha (over 600 square miles). More than 40% of this total land area is green open space and nearly half of that is considered valuable as wildlife habitat, from inner-city parkland through urban and suburban areas to outer rural areas, including farmland.

In 1998, the Bat Conservation Trust obtained funding from the Bridge House Estates Trust for a London Bat Officer, Kate Jones, who realised the value of the detailed original documentation from the London Bat Project, and it was agreed that the London Bat Group would undertake a repeat survey in 1999 to assess the changes. Thus, we would be able to help to fill in the information deficit on bat population changes while the NBMP got underway.

Site selection and methodology

Twenty-one sites were selected from separate boroughs, with two additional sites chosen in Brent and Wandsworth adjacent to boroughs not originally surveyed (see Table 1 & Fig. 1). The sites were selected because the records included the exact survey locations and the amount of time spent at each location, and included observations from multiple locations within the same site on the same evening, giving a total of 74 recording positions.

Following as closely as possible the methods of the original 1980s survey, the number and species of bats seen were counted at each recording position when weather conditions were optimal, on a date within a week either side of the original survey date, and with the same start time and duration. Bat detection was aided by using a heterodyne bat-detector (mainly Stag Electronics Bat Box III). Although two species of pipistrelle bat, the Common Pipistrelle *Pipistrellus pipistrellus* and Soprano Pipistrelle *P. pygmaeus*, were separately identified in the 1999 survey, their numbers were combined in order to compare the results with those from the original survey. Similarly, no separation of Noctule *Nyctalus noctula* and Leisler's Bats *N. leisleri* was attempted.

We compared the total numbers of individuals and species recorded at each location within a site (n =74) and pooled across each site (n = 23) with those from the original survey, and evaluated the statistical significance of the result with the Wilcoxson Sign Rank test. For both surveys, we took the lower value where the estimated numbers of bats present were expressed as a range (see Table 2).

Table 2 Total numbers of bats and numbers of different species seen across 23 sites in the original survey (1985-87) and the 1999 resurvey. Z represents the Z score for the Wilcoxson Sign Rank test comparing data from each recording point (n=74) and data pooled across the different sites (n=23); * indicates p<0.05 and ** p<0.001. The total number of bats also includes five unidentified in 1985-87, and one unidentified and one Brown Long-eared Bat in 1999. The total number of species in 1999 includes both pipistrelle species and the Brown Long-eared Bat, but the statistical results on species richness are based on the numbers seen at each location, not these overall totals, and with the pipistrelles considered as one species.

Survey Year	No. of bats	No. of species	No. of each species			
			Pipistrellus spp.	*Myotis daubentoni*	*Nyctalus* spp.	*Eptesicus serotinus*
1985-87	134	4	79	1	42	7
1999	126	5	102	10	12	0
Z (n=74)	**2.01***	**3.91****	0.86	1.63	**2.30***	**2.12***
Z (n=23)	1.16	**2.58***	0.26	1.07	**2.54***	1.60

Table 3 Comparison of the total results from inner and outer boroughs.

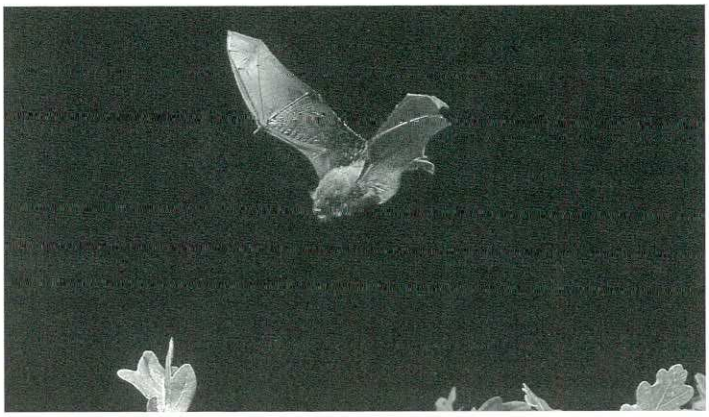
Inner boroughs	No. of bats	Outer boroughs	No. of bats
1985-87	96	1985-87	38
1999	112	1999	14
	+16.7%		-63.2%
Z (n=52) = -0.82, 2-tailed p 0.41		Z (n=22) = -2.54, 2-tailed p< 0.05	

Results

A total of 247 bats was detected in 1999. Of these, pipistrelles were the most common species recorded, followed by the Noctule/Leisler's Bats and Daubenton's Bat *Myotis daubentoni* (see Table 2). Unlike the earlier survey, no Serotines *Eptesicus serotinus* were detected in 1999 but one Brown Long-eared bat *Plecotus auritus* did make an appearance.

As the 1985-87 survey counted bats seen, only the number of bats that were actually seen by the participants in the 1999 resurvey (a total of 126) were used in the comparison, with the result showing a significant 6% reduction in 1999 (Wilcoxson Sign Rank test: Z = 2.01, n = 74, p <0.05). However, when data were pooled per site rather than for each location within the site, the difference lost significance (Z = 1.16, n = 23, p 0.25). Species richness was significantly lower in 1999 than in the previous survey whether data from location within the site or pooled per site were used (Z = 3.91, n = 74, p <0.001). Numbers of pipistrelles and Daubenton's Bats showed an increase since the original survey, although this was not statistically significant. Noctules/Leisler's Bats and Serotines showed a significant decrease in abundance between the original and the 1999 survey (Z = 2.30, n = 74, p < 0.05 and Z = 2.12, n = 74, p < 0.05 for Noctules/Leisler's and Serotines respectively), although the Serotine reduction was not significant when data were pooled across the 23 sites.

A further comparison of collected data was made between the inner and the outer London boroughs (Table 3), with an outer borough being defined as one sharing a boundary with a neighbouring county. The sites within the inner boroughs showed a 17% increase in the numbers



The most common species recorded in the survey was the Common Pipistrelle. Hugh Clark/Nature Photographers

of individuals, although this was not significant ($Z = -0.82$, $n = 52$, p 0.41). The sites within the outer boroughs showed a significant 63% fall in the number of individual bats recorded ($Z = -2.54$, $n = 22$, $p < 0.05$).

Discussion

We recorded six bat species using sites in Greater London for feeding. The most common were the pipistrelles, suggesting that these species are well adapted to the mosaic of habitats in an urban environment. Indeed, pipistrelles seem to be one of the most abundant bats in London (Hooper 1981) and throughout the UK (Jones *et al.* 1996; Walsh *et al.* 1995). We found that in London, at least, the Common Pipistrelle seems to be more abundant than the Soprano Pipistrelle, a result in line with recent distribution estimates across Europe (Mayer & von Helversen 2001). Interestingly, although Brown Long-eared Bats are thought to be common and widespread elsewhere in the UK, we do not find them in large numbers at feeding sites monitored in London. This may be due to their more cryptic biology and echolocation calls (Russ 1999), which mean that they are less likely to be seen or detected in this type of survey. However, other evidence from roost surveys also suggests that these species are not present in more urbanised habitats (Jones *et al.* 1996), indicating that our result probably reflects a real absence of Brown Long-eared Bats in urban habitats.

Evidence for population declines

Our results suggest that bat populations across London have declined by a statistically significant 6% over the past 15 years. However, the decline was not found to be uniform across species or between inner and outer London. For example, although other evidence suggests that the pipistrelle has declined in the UK by an estimated 70% between 1978 and 1993 (Stebbings 1995), our data do not reflect this. In fact, pipistrelle numbers recorded in our feeding survey show an increase of 29%, although this was not statistically significant. Our data suggest that the species that have suffered the greatest declines in London have been the Noctule/Leisler's Bats and the Serotine. Our figures also indicate that there has been a larger decline in bat abundances in the outer boroughs compared with the inner ones. It is possible that the greatest habitat changes affecting bats have occurred in the wider countryside as a result of agricultural intensification and urbanisation. By contrast, land use in the already urban areas has probably changed less in terms of its effect on bats over recent decades, and has perhaps been suboptimal throughout that time.

Biases

There are likely to be several biases in the methodology that we applied here to detect bats. For example, the start times may have been too early to detect some species (Jenkins *et al.* 1998), and times spent at each location within a site may have increased the risk of counting the same individuals more than once. Indeed, at a meeting to discuss the results, some participants in the survey expressed concern about these points. We consulted the original surveyor, Simon Mickleburgh, who confirmed that he attempted to estimate the numbers present in his counts, which was why he expressed his totals in ranges; but he, too, was not able to differentiate individuals, so he also faced the possibility of repeat counts. However, as we took care to employ the same methods as in the previous survey, we are reasonably confident that the results of the two surveys are comparable in these respects.

We do suspect, however, that the decline in bat populations in London is greater than our result suggests. While the basic methodologies of both surveys were comparable, the sensitivity of hetero-

dyne detectors has increased dramatically over the intervening period (Forbes & Newhook 1990; Walters & Walsh 1994). Although the analysis uses only the numbers of bats seen, participants in both surveys were using ultrasonic bat-detectors to alert themselves to the presence of bats. Tests have shown that the Bat Box III (used in 1999) has a greater sensitivity than the Mini QMC (used in 1985-87), such that it results in the detection of approximately 50% more bat passes (Walters & Walsh 1994).

Applying a correction factor to our data to take account of the increased sensitivity of the Bat Box III, the data suggest that the actual population decline is nearer 38% ($Z = -3.43$, $n = 74$, $p < 0.001$). Although this is a crude method of estimating the actual population declines, we suggest that the 6% decline in bat abundance is therefore an extremely conservative estimate and that the real figure is likely to be much larger. This is of major conservation concern, as this decline has taken place despite all bats being given protection under the Wildlife and Countryside Act 1981, which has been in force during the period being considered. It is to be hoped that the improved protection introduced by the CRoW Act 2000, and action through the Greater London Biodiversity Action Plan Partnership, will be capable of arresting and reversing this decline. In time, we hope that the people of Greater London will once again be able to enjoy the spectacle of large numbers of bats even in the heart of the capital, perhaps even once again at St Paul's Cathedral.

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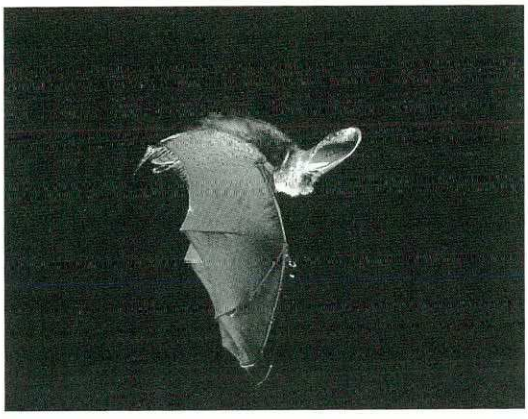
The authors wish especially to record their thanks to Simon Mickleburgh for his foresight in the detail recorded in his 1985-87 survey work, as it was this that enabled the London Bat Group to repeat the survey in the confidence that the surveys would be comparable.



Low numbers of Brown Long-eared Bats recorded on the survey probably reflects a real absence of this species from urban habitats.
Hugh Clark/Nature Photographers

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Pete Guest is a Conservation Officer at the London Wildlife Trust and volunteers with the London Bat Group and Bat Conservation Trust. Kate Jones is a research fellow at the University of Virginia, USA, studying the ecology, evolution and conservation of bats. John Tovey is an active volunteer in the London Bat Group.