

The Nottinghamshire Barbastelle Project – Summary Report (January 2018)

The (western) barbastelle *Barbastella barbastellus* was first recorded in Nottinghamshire in June, 2011. It is one of the UK's rarest mammals¹ and despite some recent discoveries there are very few known breeding sites for this species in the UK². The barbastelle is considered a priority species for national conservation measures³ and it is the bat species of highest conservation concern in the East Midlands. This region is at the northern extent of the barbastelle's current UK range; the species has a predominantly southern distribution across England and Wales although colonies are sparsely distributed and absent from many areas⁴. Population declines across most of its European range have also resulted in the barbastelle being afforded legal protection above most other European bat species under EU law, and its presence can result in a site being designated a Special Area of Conservation under the Natura 2000 protected sites network⁵. The IUCN (International Union for Conservation of Nature) Red List (Piraccini, 2016) categorises the barbastelle as 'near threatened' with a fragmenting and declining population across most of its international range, primarily caused by habitat loss.



Adrian Orrell

The Nottinghamshire Barbastelle Project (NBP) had four main objectives when it commenced in 2015:

- To acquire more barbastelle records in and around Nottinghamshire;
- To establish if there are breeding populations of this species in and bordering the county;
- To locate the first barbastelle roost(s) in Nottinghamshire; and,
- To gather data on the habitats used by this species in the areas where it is present.

The overall aim is to then use this information and the existing wider evidence (see below) to encourage landowners and land managers where barbastelle are present, and perhaps also where they are likely to be, to retain; enhance; and create the habitats of most value to the species. Previous studies of barbastelle populations in England have shown that this species requires ancient broadleaf woodland with naturally damaged and decaying trees for roosting (often with a high proportion of oak *Quercus spp.*), and riparian habitat, meadows (including those on floodplains), woodland, mature hedgerows, field margins and tree lines for feeding, which is almost exclusively on moths. They also prefer to commute between these habitats via naturally covered and dark, linear woodland rides and landscape features. Greenaway (2004), Greenaway & Hill (2004), Greenaway (2008), Goerlitz *et al.* (2010), Zeale (2011), Zeale *et al.* (2011), Andreas *et al.* (2012),

¹ JNCC (2018) website: <http://jncc.defra.gov.uk/ProtectedSites/SACselection/species.asp?FeatureIntCode=S1308>.

² The Bat Conservation Trust (2018) factsheet: http://www.bats.org.uk/data/files/Species_Info_sheets/barbastelle_11.02.13.pdf.

³ The barbastelle bat is a Species of Principal Importance under the Natural Environment and Rural Communities Act (England and Wales), 2006, and was also listed as a Priority Species in HMSO (1994) Biodiversity: The UK Action Plan (http://jncc.defra.gov.uk/PDF/UKBAP_Action-Plan-1994.pdf).

⁴ The Vincent Wildlife Trust (2018) website: <http://www.vwt.org.uk/species/barbastelle/>.

⁵ Annex IV of Council Directive 92/43/EEC 1992 on the conservation of natural habitats and of wild fauna and flora (the EC Habitats Directive) lists animal and plant species of Community interest in need of strict protection, and Annex IV lists animal and plant species of Community interest, the conservation of which requires the designation of Special Areas of Conservation (SACs). All bat species are listed in Annex IV but some, including the barbastelle, are also listed in Annex II. The EC Habitats Directive is currently transposed into national law (in England and Wales) via the Conservation of Habitats and Species Regulations 2017.

Zeale *et al.* (2012) and Davidson-Watts (2014) provide more detailed information on this as well as the autoecology of this species, as do several other studies. A comprehensive and ongoing review of literature pertaining to the barbastelle has underpinned the NBP, and extensive desk-based studies of the landscape and habitats within target survey areas have also been essential.

In the field, the NBP uses two main approaches to survey for barbastelle; bat detectors and 'advanced' techniques (catching and radio-tracking). Bat detector surveys consist of both walked and driven transects using Elekon Batlogger M bat detectors (with GPS capability), supplemented by the strategic deployment of various automated (static) units for more targeted survey effort and monitoring. Many of the habitat types described above have been surveyed for barbastelle using these acoustic methods, at different times of year, with the old growth oak woodlands often preferred by this species for roosting targeted in particular. Advanced survey methods comprising bat catching techniques (mist nets, harp traps, and occasionally acoustic lures) are then used where barbastelle activity has been recorded most often and are very important to this project because the sex and breeding status of any barbastelle caught can be ascertained, which is not possible using only bat detectors. By then attaching a tiny (<0.4g) temporary (Biotrack) VHF radio-tag to some of the healthy adult female barbastelle these animals can then also be radio-tracked back to their roosts, where there are hopefully other bats too, and their movements recorded.

The relatively invasive 'advanced' aspects of the NBP for bats is conducted under a Science, Education and Conservation 'project' licence from Natural England. The majority of the equipment used on this project has been paid for by the National Lottery Heritage Lottery Fund as part of NBG's wider *Echolocation Location Project* (ELP), which is gathering bat records across the county.

Timeline of Results

2015: Between 2011 and 2015 there were only three site records of barbastelle within Nottinghamshire. The first year of the NBP was therefore primarily about reconnaissance. There were the following key outcomes:

- By responding rapidly to a barbastelle detector record received from an ecological consultancy (Skyline Ecology) the probable location of a previously unrecorded barbastelle colony was pinpointed by deploying automated detectors in the nearest ancient woodland. The barbastelle activity recorded by these units in August, within a few minutes of sunset and sunrise, meant there was a high likelihood that a colony was present here;
- In preparation for radio-tracking in 2016 it was confirmed via trapping surveys that a breeding population of barbastelle continued to be present in the woodlands on our eastern border with Lincolnshire, following surveys there by Lincolnshire Bat Group in 2012;
- Following up a 2013 record, also submitted by an ecological consultant (David Hughes), regular barbastelle activity was confirmed at a site bisected by part of the Nottinghamshire – Derbyshire border. Bat detector transects, which traversed the county boundary several times, provided Derbyshire Bat Conservation Group with both their first barbastelle bat detector records and a new mammal species for that county⁶; and,
- In early October, a sub-adult male barbastelle was caught along the River Trent near Nottingham, which comprised Nottinghamshire's first 'in-the-hand' record of this species.

⁶ Derbyshire Bat Conservation Group website (2016) <http://www.derbyshirebats.org.uk/news.php>

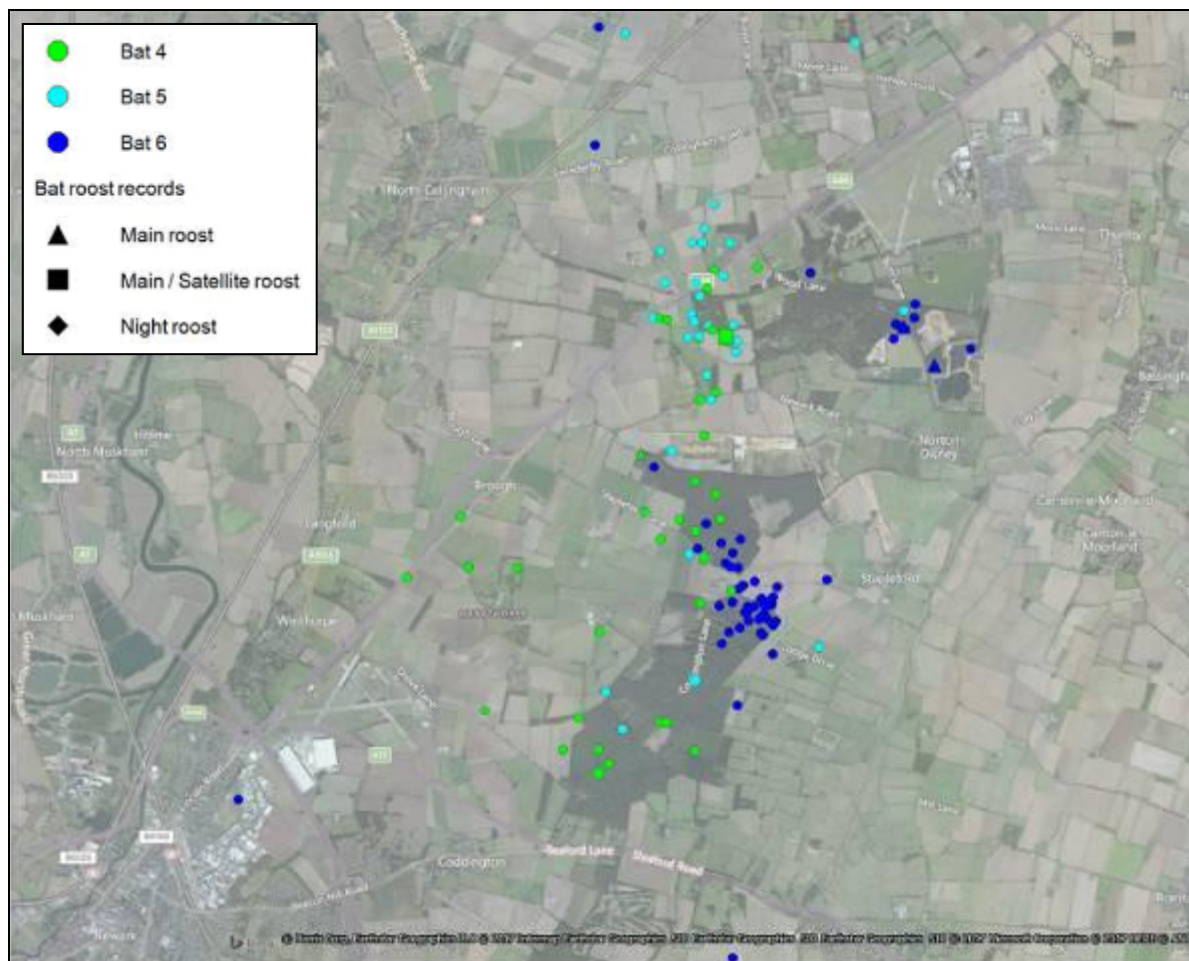


2016: This was the most intensive year of the NBP when the focus was primarily on radio-tracking adult female barbastelle from the colony along Nottinghamshire's eastern border with Lincolnshire. Six bats were radio-tagged and radio-tracked in the summer: three in late May and early June, and three in late July and early August. Each bat was radio-tracked for at least three nights following the first night when the radio-tag was fitted. A total of 12 roosts used by this colony were located by radio-tracking, which comprised six main or satellite roosts used by multiple bats, and six day or night roosts used by a single female during the study. The six roosts that supported multiple bats were all behind lifting bark (and associated cracks and fissures) on old damaged or decaying oak trees, such as the one shown in the photograph to the left. Five of

the six remaining barbastelle roosts were also in trees, including one animal that almost certainly roosted behind the lifting bark of a Scots pine *Pinus sylvestris*, although unfortunately this could not be documented before the bat flew off. The only barbastelle roost discovered that was not in a tree was Nottinghamshire's first for this species, which was in the dilapidated farm shed shown in the photograph to the right.



The data collected on the bats' nocturnal movements still requires some verification and analysis. As such, the preliminary map below shows only around half of the location data acquired for the three bats radio-tracked in late July and early August, and none yet for the three bats radio-tracked earlier in the summer. However, notwithstanding this, it is apparent that Bat 4, a non-breeding female, roamed over a wider area in late July and early August than Bats 5 and 6, both of which had recently ceased lactating and were presumably therefore rearing young at this time. Interestingly, in addition to foraging within many of the habitat types described in the previous studies (see above), these three bats also regularly foraged along linear rides within coniferous plantation woodland (which comprises much of the woodland cover shown in the southern half of the image below) as well as over small, immature willow *Salix spp.* plantations and within small mixed woodland copses. The bats were also predominantly faithful to certain flight-lines, especially within the 'roost woodland', although they would traverse open farmland during twilight hours as well. This activity perhaps explains some of the apparently random rural bat detector records for this species.



Preliminary map showing some of the locations visited by the three female barbastelle radio-tracked in late July and early August 2016, prior to verification and detailed analysis.



Adrian Orrell

In 2016, Dr Orly Razgour, a leading molecular ecologist and conservation biologist from Southampton University, also joined NBG for fieldwork. Orly was seeking genetic samples from barbastelle (under Home Office licence) to help her model how climate change and habitat loss may interact to affect the future distribution of European forest bats. Using Next-Generation Sequencing Orly is looking to understand what drives the bats' evolutionary responses to such global change, which should then facilitate an assessment of the likelihood of long-term population survival. Orly was particularly interested in Nottinghamshire's barbastelle populations because they are at the northern extent of this species' UK range. We therefore helped Orly acquire several samples from barbastelles at the site above, in addition to samples from two adult male

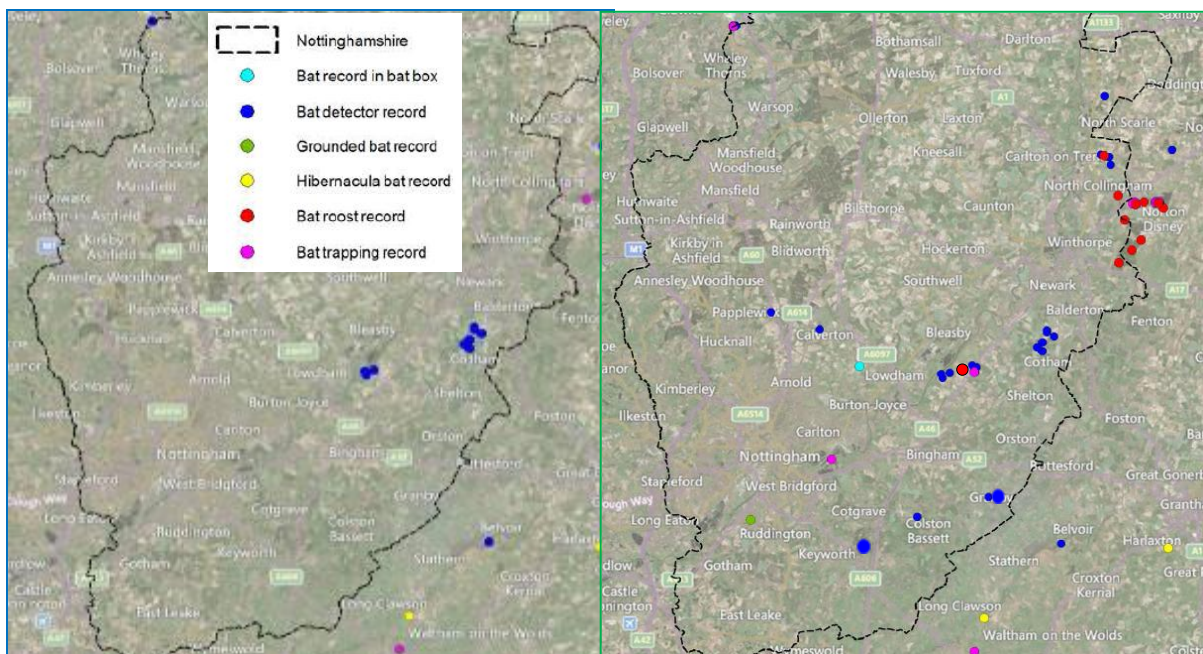
bats caught at the site bisected by our border with Derbyshire, which we had been monitoring through 2016. Because these two bats were caught a few metres into Derbyshire this also provided that county with their first 'in-the-hand' records for this species - one of these bats is shown above.

2017: Last year, with reduced volunteer availability compared to in 2016, the focus was on finding a barbastelle *nursery* roost in Nottinghamshire. The target site was the one discovered in 2015, where regular barbastelle activity was being recorded on detectors (see above). In early August a healthy (11.5g) post-lactating barbastelle (top picture) was successfully caught, radio-tagged and radio-tracked back to her roost. This comprised lifting bark on a decaying oak tree that had been previously assessed as being highly suitable for this species. Up to five barbastelle were recording emerging from this tree roost on a series of emergence surveys although it is likely that other roosts remained undiscovered. The radio-tagged bat was also tracked for several nights when she predominantly foraged over meadows, along mature hedgerows and a 'green lane', but also made regular forays to two small copses of broadleaf trees and over a small sewage farm.



In August, the site that straddles the Nottinghamshire - Derbyshire border was surveyed again to try and understand more about the barbastelle activity there. This was the site where the two adult male barbastelle had been caught and sampled by Dr Orly Razgour in 2016. Interestingly, a year on from Orly's visit, one of these bats was recaptured in the same location. This recapture was apparent as a tiny scar remained on the wing membrane of this healthy-looking male bat, as shown by the arrow, where the tissue sample had been taken.

To conclude, the above findings have undoubtedly furthered our knowledge of the distribution and conservation status of the barbastelle in Nottinghamshire and the surrounding area, and the maps below provide a spatial context to this; the left-hand map shows the number of site records in the NBG database in early 2015, prior to the initiation of the NBP and the ELP, whereas the right-hand map shows the increased number of site records in the database now. These site records include detailed accounts of 33 different barbastelle captured on the NBP, all since 2015.



The number of site records for barbastelle in the NBG database in early 2015, prior to the NBP and ELP, is shown on the left-hand map above; the number of site records in the database in 2018 is shown on the right-hand map. Note that the 2018 map includes two site records from 2016 not strictly acquired within the scope of either project - one of a grounded individual and two bats found in a bat box.

However, the NBP has also provided thousands of new bat detector records of non-target species for NBG, as well as 670 detailed records of non-target captured bats identified to species level. These records have provided an invaluable insight into the bat assemblages present at some of the sites surveyed most often, and has directly enabled NBG to nominate some as Local Wildlife Sites (LWS) for bats. In 2018, all of the records acquired on the NBP will also be mapped in detail on a 'Bat Atlas' for the county, to be produced as part of the report for the overarching ELP.

Going forward, it is hoped that suitable habitat management and sympathetic highways lighting regimes can be implemented at these LWS and other sites of demonstrable importance for bats, especially where the rare barbastelle is present. However, this will only be possible with support from the most influential conservation organisations in the county, and the other key stakeholders. In the long-term, with support from Natural England, the ultimate goal is then statutory protection for the sites of most importance to barbastelle colonies in and bordering Nottinghamshire, where this national conservation priority species is at the northern limits of its current UK range.

NBG would like to thank everyone who has supported the NBP to date, either directly or indirectly. Special thanks are due to: the Heritage Lottery Fund; the landowners that have accommodated surveys, especially Hill Holt Wood (Oliver Woodman), the Flintham Estate (Sir Robert Hildyard) and the Creswell Crags Heritage Trust (Paul Kaye); Dr Jon Russ and Lois Browne (Warwickshire Bat Group) for technical guidance and the project idea respectively; Nottingham Trent University (Dr Sam Bremner-Harrison) for equipment loans, and RSK Environment Ltd for equipment loans, mapping and technical review. However, the help with fieldwork from over 70 volunteers since 2015, from most Midlands bat groups, has been especially appreciated, particularly the regular assistance from a small but very dedicated team from NBG.

If you would like further information on the NBP please contact Matt Cook, project lead, via [mattcook \(at\) hotmail.co.uk](mailto:mattcook@hotmail.co.uk). For general info on NBG please visit www.nottsbatgroup.org.uk, or follow them on Facebook (<https://www.facebook.com/NottinghamshireBatGroup/>) or Twitter (@nottsbatgroup).

References:

- Andreas, M., Reiter, A. and Benda, P. (2012). *Prey selection and seasonal diet change in the Western Barbastelle Bat (Barbastella barbastellus)*. Acta Chiropterologica 14(1): 81-92.
- Davidson-Watts, I. (2014) *Barbastelle bat surveys and tracking at Nocton wood, Lincolnshire*. Davidson-Watts Ecology Limited. Unpublished report, available from the author at: <http://www.dwecology.co.uk>
- Goerlitz, H.R., Ter Hofstede, H.M., Zeale, M.R.K., Jones, G. and Holderied, M.W. (2010) *An aerial-hawking bat uses stealth echolocation to counter moth hearing*. Current Biology 20:1588-1572.
- Greenaway, F. (2004) *Advice for the management of flightlines and foraging habitats of the barbastelle bat Barbastella barbastellus*. English Nature Research Report No. 657. English Nature, Peterborough, UK.
- Greenaway, F. and Hill, D. (2004) *Woodland management advice for Bechstein's bat and barbastelle bat*. English Nature Research Report No. 658, English Nature, Peterborough.
- Greenaway, F. (2008). *Barbastelle bats in the Sussex West Weald: 1997-2008*. A report for the Sussex Wildlife Trust and the West Weald Landscape Project, Sussex, UK.
- Kenward, R.E. (2001). *A manual for wildlife radio tagging*. Academic Press, London, United Kingdom.
- Piraccini, R. 2016. *Barbastella barbastellus*. The IUCN Red List of Threatened Species 2016: e.T2553A22029285. <http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T2553A22029285.en>. Downloaded on 18 January 2018.
- White, G.C. & Garrott, R.A. (1990) *Analysis of Wildlife Radio-Tracking Data*. Academic Press Limited, London.
- Zeale, M.R.K. (2011) *Conservation biology of the barbastelle (Barbastella barbastellus): applications of spatial modelling, ecology and molecular analysis of diet*. PhD thesis, University of Bristol, Bristol.
- Zeale, M.R.K., Butlin, R.K, Barker, G.L.A., Lees, D.C., Jones, G. (2011). *Taxon-specific PCR for DNA barcoding arthropod prey in bat faeces*. Molecular Ecology Resources 11:236-244.
- Zeale, M.R.K., Davidson-Watts, I. and Jones, G. (2012) *Home range use and habitat selection by barbastelle bats (Barbastella barbastellus): implications for conservation*. Journal of Mammalogy, 93: 1110–1118.