A Lesser Horseshoe Bat Hibernation Roost takes on New Technology

Mike Averill

If you were asked to design a bat hibernation house, an old canal tunnel would fit the bill very nicely, especially if there was no longer any boat activity. Such a tunnel exists at Newnham Bridge where the Leominster to Stourport Canal once ran 225 years ago. The canal and the walks along it are one of the best kept secrets in Herefordshire and Worcestershire and are a relic of a short dabble with coal transport using the wonder of the day, a canal. Now, there are still traces of canal bed, a handful of tunnels remain and two old derelict aqueducts.

One of the tunnels is at Newnham Bridge, and I have been lucky enough to be able to monitor it for bats since 1989. Nowadays the approach canal bed has filled in with soil, so only the top part of the arch is still above ground level (Figure 1), meaning you have to climb down a steep slope to enter. This has been problematic over the years as it is easy for weeds like nettles to obscure the entrance. For many years the entrance was partly obscured by a large rock that had to be rolled back but thanks to the owner at the time, a small group were given permission to fit a permanent grill. This pleased the farmer as it prevented his lambs from getting in, not to mention making it safe, preventing access by children.

Once inside there are no features other than the brick walls which have a few misplaced bricks, but generally the tunnel is in good condition. The tunnel is 100 yards long, the interior walls are mainly intact and show a rather rustic look as they twist along the length. The walls are smooth other than a small number of recesses which must have been the post holes that took the wooden supports during the building stage. Only one entrance is open with the far end completely closed off with soil and the remains of a 1950's rubbish dump. The fact that the tunnel is closed at one end means the internal temperature never varies outside 10 to 11 degrees centigrade, making it ideal for a stable hibernating environment. What the bats like to use, and hang onto, are the slightly irregular bricks near the ceiling and in particular a couple of places where two or three bricks have dropped out leaving the bedrock exposed. The atmosphere, apart from having a very stable temperature, is quite humid due to there always being some water in the tunnel. Water levels can be up to waist height, depending on the rainfall in previous months.

In the 1980s the numbers of hibernating bats were low, usually less than 10, but since a grill was installed, the numbers have crept up to around of 35-45 over the last few years (Figure 2).



Figure 1. Entrance to Newnham Bridge canal tunnel, Mike Averill

Most bats hang in the first 50 yards with the odd one further on towards the end of the tunnel. The bats using the tunnel have all been Lesser Horseshoe *Rhinolophus hipposideros* except for a lone Natterer's Bat *Myotis nattereri* which was seen only once.

Lesser Horseshoe bats like a big open space to fly around in preparation for going outside (Figure 3) so that they can investigate the temperature at the entrance to see if it is worth going out when they start to awake from deep hibernation. Normally the Bat Conservation Trust (BCT) Hibernation Survey requires two visits a year, one in January and one in February when the bats are usually asleep with their wings wrapped around themselves looking like small plums (Figure 4). If it is mild a few may be half awake and at that stage their nose may be sticking out of their folded wings and may give a slight twitch as you walk below them.

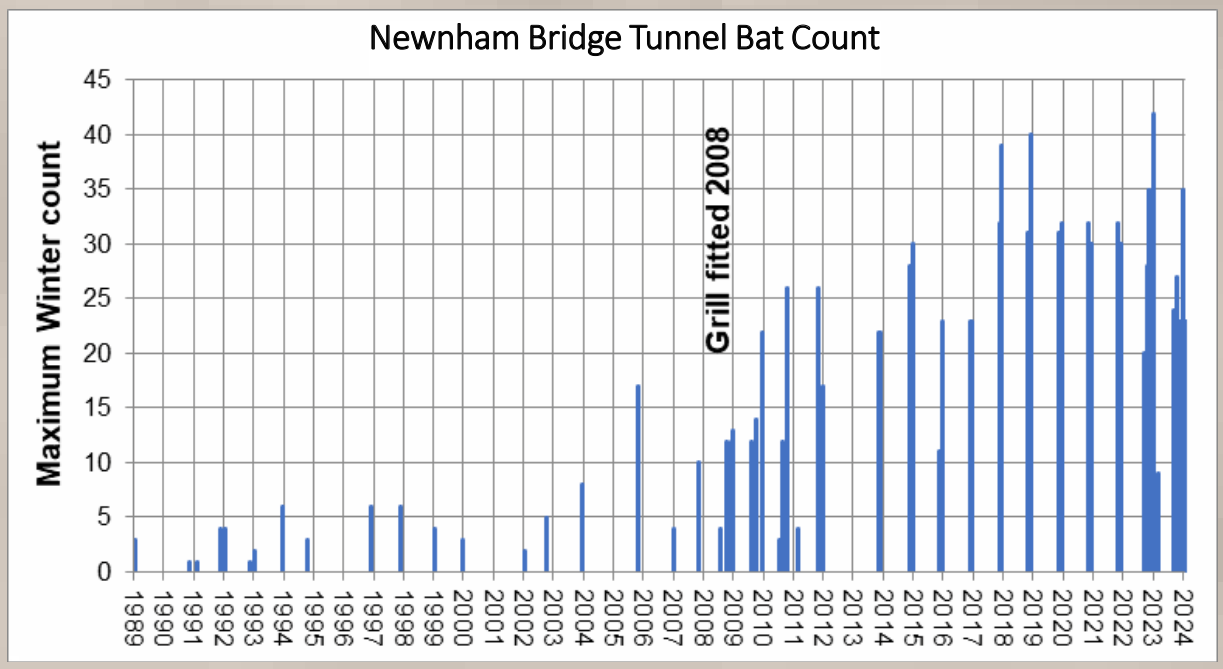


Figure 2. Number of hibernating bats in Newnham Canal Tunnel 1989 - 2024.

In 2024 there was the opportunity to take part in two projects run through the BCT, one using an experimental airborne environmental DNA (eDNA) technique, and one using ultrasonic static recording devices. The sound project produced hundreds of hours of data which is still being analysed and for which there are no results as yet.

The eDNA project was part of a larger project to see if airborne eDNA monitoring could be used to monitor bat hibernation sites. This was a project run by Joanne Littlefair of University College, London and a number of hibernation sites were picked for the project. The method involves sampling air which contains particles of skin, hair or faeces from animals, left as part of normal daily life, as they move through a location.

It was hoped that after some success using air monitoring in other parts of the world to detect animals, that applying airborne eDNA to confined spaces such as a hibernation site, would be useful.

A project summary can be viewed at YouTube - (https://www.youtube.com/watch?v=gNebd0cHmRc)

Altogether 12 sites in England were selected for monitoring, including Newnham Bridge Tunnel. Tables 1 and 2 shows the variety of species detected using all the sites (including Newnham Bridge). Having the Edible Dormouse on the list might be a surprise but the Wallaby shown was because one of the sites was at Whipsnade Zoo. DNA from humans and animals like dogs, cattle and sheep was found but ignored for this project.

Table 1. List of species identified by airbourne eDNA from all twelve Bat Conservation Trust project sites.

Animals detected from the several hibernation sites in the Project
Common Blackbird
Eurasian Wren
Rock Dove
Siberian Accentor
Song Thrush
Stock Dove
Wood Pigeon
Bank Vole, Brown Rat or Edible dormouse
Fallow Deer
Hare
Red Deer or Reeve's Muntjac
Red Fox
Red-necked Wallaby
Eastern Gray Squirrel
European Badger
Smooth Newt
Natterer's or Daubenton's Bat
Brown long-eared Bat

Table 2. List of species identified by airbourne eDNA from Newnham Bridge canal tunnel.

Latin name	Common name
Sciurus carolinensis	Eastern Gray Squirrel
Muntiacus reevesi	Reeves's Muntjac
Ecdyonurus dispar	Autumn dun
Ectopsocus meridionalis	A Barklouse
Halyomorpha halys	Brown Marmorated Stink Bug
Xestia xanthographa	Square-spot Rustic

The result for Newnham Bridge was rather disappointing. Lesser Horseshoe and Natterer's bats, were the only bats expected, but were not detected, although the American Gray Squirrel and Muntjac were, together with four invertebrates. Across the whole list of sites used across the country, only three bats could be detected by this method, not including Lesser Horseshoe and so some further work is needed to improve the technique.

This was an interesting project to take part in. It was experimental and can only be regarded as a trial. There are some problems to work out before it will be as straightforward as DNA sampling of water where the medium is more confined. One thing which might be concluded is that the low metabolic rate employed by bats during hibernation does not provide enough material to detect.

Normally the guiding principle of monitoring hibernating bats is 'minimal intervention'. Therefore taking part in the special projects requested by the BCT meant there was the chance to do something we would not normally do which was to visit once a month to see if the bats used the tunnel at other times of the year. This was something that had been suspected as quite a lot of droppings could occasionally be seen if the tunnel floor was dry.

The additional counts added to our knowledge of how the bats use the tunnel. Normally the BCT use a two-count method which usually shows that the bats will be more numerous in the February count. What 2023 and 2024 show is that the highest count was in March, so in future a third count will be made (Table 3). Also surprising was that bats were still present in April and even May in 2023. Unfortunately, grass had grown over the grill in June 2023, so that visit had no bats to count, and we don't know whether occupancy

Table 3. Bat numbers recorded during additional surveys of Newnham Bridge canal tunnel in 2023 and 2024.

Additional Bat Counts		
Date	Count	Outside temperature ^{o}C
26/11/2022	20	
04/01/2023	26	11
21/01/2023	35	1
12/02/2023	33	8
12/03/2023	42	12
11/04/2023	23	11
10/05/2023	9	17
14/06/2023	0	28
09/11/2023	24	8
15/12/2024	27	9
25/01/2024	23	9
17/02/2024	20	14
02/03/2024	35	3
07/04/2024	13	15

would extend all through the summer. What we are fairly sure of is that they do not use the tunnel as a maternity roost where females would have their young; it would be too cool for that. It could be where mating takes place though, which occurs in November.

Another interesting fact to emerge was that the bats would react to changes in temperature as the spring progressed and would be able to leave, and perhaps return, if it went cold. For example, in February 2024 the count had dropped as bats left the site during mild weather, only to return in March as the temperatures dropped.

We had hoped that the eDNA project might tell us whether the bats were all females, males or mixed, but unfortunately that proved to be not possible.

I thank Steve Horton for accompanying me and attending to various audio sampling techniques.

I would also like to thank Dr Littlefair, Boxian Wen, Phil Sanders and Nicola Thompson for allowing the, as yet unpublished, project to be mentioned.



Figure 3. Inside Newnham Bridge Canal Tunnel. Mike Averill



Figure 4. Lesser Horseshoe bat in Newnham Canal Tunnel. Mike Averill