



AEWC Ltd

Animal Ecology & Wildlife Consultants

Lesser Horseshoe Roost Monitoring

Northern Quarter

Cinderford

Daniel Whitby
March 2023

AEWC Ltd Birch Walk, Lower Street, Fittleworth, West Sussex, RH20 1JE
Tel: 08452 505585, info@aewc.co.uk, www.aewc.co.uk

Registered in England and Wales No. 06527840

This report has been prepared by AECW Limited, with all reasonable skill, care and diligence within the terms of the Contract with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.

The information and data which has been prepared and provided is true and has been prepared and provided in accordance with the Professional Guidance and 'Code of Professional Conduct' issued by the Chartered Institute of Ecology and Environmental Management (CIEEM). We confirm that the opinions expressed are our true and professional bona fide opinions.

1 Introduction

- 1.1 AEWCLtd. was commissioned by the Forest of Dean Council to conduct monthly monitoring surveys of all buildings present at the Northern Quarter site from January 2022 through to December 2022.
- 1.2 These surveys are a continuation of monthly surveys conducted at the site by AEWCLtd since July 2013 and by other surveyors prior to this.
- 1.3 This report provides the results of the surveys conducted at the site by AEWCLtd from January 2022 to December 2022. The results of this monitoring are intended to be used to provide monitoring of the lesser horseshoe population on site, notably the use of two new artificial roosts and to inform for any proposed development of the site and any licence applications for this site.

2 Method

- 2.1 There are five existing historical structures that are surveyed each month by licenced ecologists, the bath house, canteen building, office building, woodland shed and artificial roost. The same survey methodology has been used by AEWCLtd surveys since July 2013 to ensure consistency of data gathered where possible and required.
- 2.2 Surveys are conducted once each month with all buildings surveyed on the same day to ensure accuracy of surveys and that bats moving between buildings are not re-counted.
- 2.3 Each month internal surveys are conducted on the bath house, canteen building, office building and woodland shed. The artificial roost is only surveyed internally during colder months from October to April due to the high levels of disturbance this would cause to the main maternity roost colony during summer months, and the inaccuracy of using this survey method with high numbers of active bats present.
- 2.4 During summer months from April to October emergence surveys were conducted on the artificial roost using night vision cameras and IR illuminators. This enables the visual identification of bats emerging from the building in low light and dark conditions, which would otherwise make it impossible to count the bats present.
- 2.5 Following on from years of data collected at the bath house and office building, where repeated low counts were identified using these buildings, these two buildings were counted during daytime internal surveys. The artificial roost was counted by emergence survey, if in the event numbers were identified to increase in the office or bath house and an internal survey could not get an accurate counts, then these would also have emergence surveys conducted.
- 2.6 Since June 2017 the two new replacement roosts, Nelson and Birchwood have also been surveyed monthly to internally count the number of bats present, check and monitor the building and identify any new notable evidence of use by bats. During

the summer of 2022, following modifications to the roost, Birch wood artificial roost had a notable increase in numbers of bats present, as a result emergence surveys were conducted on this roost as it became less suitable and accurate to count the bats present in this building internally.

3 Results

- 3.1 During 2017 there were a number of changes at the artificial roost in both repairing heaters, and roost modification creating additional access point for the larger colony and to provide an alternate access to reduce risk to the colony from the single access available. The counts during this time were variable, some months recording the highest recorded by a notable number, and other months lower than the previous year.
- 3.2 Trapping surveys at the roost sites in 2013 did identify that there were unusually high proportions of male bats present using the roost sites, and how the males may move between this and other sites is unknown. The surveys conducted cannot identify the sex of bats present to determine if this has continued into recent years, or if the proportion of the sexes changes throughout the year.
- 3.3 The 2022 survey data provides additional information following these changes to the roost to identify if activity and use by bats has remained consistent and to identify any changes in use by bats at the site in any of the building.
- 3.4 There were some notable changes during 2022, with some improvements and modifications on some of the roosts on the site. It had been previously identified that the Birchwood and Nelson roost hotboxes were not constructed correctly, these were not suitable and the solar PV system was substandard for the requirements of the building. Prior to the summer period in 2022, modifications were made to this in improving the Solar PV system to ensure that the heater was functional. At the end of July the hot box (which was unsuitable and incorrectly built) was dismantled and reconstructed correctly.

Monthly observations

13th January 2022

With the onset of some colder weather, the numbers of bats present on the site had dropped from the December count, however there were still very high numbers of bats present for a winter survey. The previous highest January count was 67 in 2019, and this month there were 181, a significant new peak.

All but 2 of these bats were found in the artificial roost, with two bats found in Birchwood basement. No other buildings were found to have any bats present.

10th February 2022

Following on from January, February had a record count of 188 LHB bats present, with the previous record being 77 last year. All but 5 were in the artificial roost.

The bath house had 2 LHB present, one in each the asbestos room and the paint peeling room. In addition, a single Natterers was found in the canteen building.

12th March 2022

The number of bats present in March had increased slightly to 203, a new record count for March. All but 12 bats were in the artificial roost with most in the downstairs rooms, only three bats in the loft areas.

The bath house had 4 LHB present, one in the toilet block, east cupboard and two in the asbestos room. Six bats were in the office and two in Birchwood, one in each of the ground floor and basement areas.

12th April 2022

With a warm April numbers increased notably, following on from the peak in March, April had 389 bats on site, with all but 10 in the artificial roost. A notable jump from last year's April peak of 265. The warmer weather also had a notable change in roost usage, normally in April most bats are still on the ground floor, however this time they were 177 bats in the warm loft roosting areas, likely due to the warmer weather and better foraging than the previous colder year.

The Office and Bath house were the only other buildings with bats present, only a single bat in the Bath House in the toilet block, and most bats in the office in the drying room.

No bats were present in the new Nelson or Birchwood roosts. There had been bats present during the winter, but with warm weather they had moved to preferred warmer roosts.

19th May 2022

The number of bats had again jumped on site to a new May peak of 464. Most of these were the artificial roost with 427.

Following the tree clearance that had been conducted in the area, but notably on the east side of the roost, the number of bats using the new access point has dropped significantly to the lowest seen for 4 years indicating that the tree clearance works had an impact on behaviour.

There were 14 bats in the office and one in the store room.

There was an increase in bats using the Birchwood roost. Around 15 active bats were present in the roost loft area and 5 on the ground floor, with one in the side room. A single LHB was in the Nelson roost.

16th June 2022

The number of bats roosting outside the main artificial roost increased this month as is typical with increasing temperatures (when the bats don't need the artificial heat provided by this roost as much). 41 bats were in the office, mostly in the rear roof with 34 and unusually for the time of year, one bat up the chimney. There were the now typically low two LHB in the Bath House and an increased 28 in Birchwood. 24 were in the loft area, but most using the loft area and not the hot boxes. Only a single LHB was present in Nelson.

The canteen had a single bat, the regular Natterers in the roof and the bath house had an increased four Greater Horseshoe bats, the highest number of GHB ever recorded on the site.

The artificial roost had an emergence survey conducted which had a count of 477, the highest count recorded in June, 10 more than 2016. The total for the site was 535 the highest pre parturition ever recorded on the site.

15th July 2022

With the warm spring, pups were born much earlier this year, and the first pup count was conducted with a peak of 157 connected across the site, all but 4 were in the main artificial roost.

This high pup count and high number of adults present on the site resulted in the highest count to date of 811 individuals in total. 719 in the artificial roost and 62 in the office. The new roosts had one in Nelson and 29 in Birchwood.

The office had an increased number of bats present as is typical in warmer weather with a total of 62 LHB and a single Brown long eared. 23 in the main roof, 39 in the rear roof.

The Bath house had only a single bat, a GHB, however, the building had been broken into and people were present inside at the time of the survey with a small fire.

The nelson roost had a single LHB present, along with fresh BLEB droppings in the loft area. Birchwood had an emergence survey conducted due to the higher number of bats present which identified 29 bats emerge,

17th August 2022

With the early breeding and bats flying much earlier this year by Mid-August numbers were already decreasing and had dropped to 680 on the site. There were no pups left in the roost at the end of the survey, compared to over 60 the same time the previous year.

There were 517 bats in the artificial roost, a reduction of 200 on the previous month which were all active, 64 bats were present in the office with no bats in the canteen or bath house.

Two bats were present in Nelson roost, however following the modifications to the Birchwood roost the previous month the number of bats in this roost had jumped notably to 97, by far the highest number ever recorded in this roost and over 14% of the total population. This is the highest number of bats found roosting outside the main artificial roost for 5 years.

17th September 2022

As we go into September numbers continue to drop down to 537 on the site. The artificial roost had 444 with 32 in the Office, around half the previous month and a single individual was in the Bath House.

The Nelson roost had 4 individuals, with some obviously juveniles of the year, which is the highest number recorded in this roost to date. The Birchwood roost had 56 bats present.

19th October 2022

A high number of bats were still present on the site with a peak of 520, notably more than the previous year's October count of 383. The artificial roost had 446, however compared to the previous month, many bats were in the hot box and warm roof area. With 154 bats in the cooler ground floor there were 143 in the hot box, compared to none the previous month and 112 in the warm rear of hot box area compared to 6 the previous month.

In addition, for the first time recorded, there was a single BLEB present in the hot box.

The office had 12 LHB, mostly in the drying room with 10 present, and two bats in this roost were ringed. A single Soprano Pipistrelle was present in the door frame.

No other LHB were found in any Northern united buildings, but the Natterers was again present in the roof of the canteen.

The Nelson roost had one bat present. However, the Birchwood roost had 61 bats still present, 31 in the roof areas, mostly in the new hot box and no other hot boxes used. 23 were on the ground floor and 6 in the basement.

14th November 2022

With continued mild weather, and likely intermittent foraging suitability continuing into November, numbers remained relatively high with a total count of 395.

The artificial roost had a total of 331, most bats were in the large ground floor room, with 165, but there were 136 bats still using the hot box and rear of hot box warmer area.

The office had 13 LHB with one ringed bat present. Three LHB were in the Bath House, with one in each of the toilet block, east cupboard and paint peeling room, which is very rarely used. In addition, there was a single GHB in the main cupboard and a Nin the canteen.

The Nelson roost had 3 LHB present, which is high for this roost. Birchwood had 45 bats present, the highest ever recorded for this time of year comparing to 13 the previous year. Most of these bats were in the hot box with 24 and 11 roosting in the roof, mostly near the hot box. 2 bats in the basement and 8 on the ground floor with 3 in poly boxes and 2 in wall boxes.

14th December 2022

While November and the start of December had remained mild, a prolonged cold snap with continuous sub-zero temperatures had caused a shift in bats using the building and a considerable drop in numbers.

The sub-zero temperatures are likely to have resulted in most of the ground floor areas of the artificial roost being too cold for hibernating bats. The previous month had 165 present in the main large ground floor room, and the previous December had 173 present, however this month had only two individuals, the previous lowest count in this area had been seven in December 2017. (Which was still the majority of bats present with a peak of only 12 using the building at that time.)

There were 111 individuals in the roof area, which were mostly roosting near and along the sides of the incubator using some of the residual heat from this to avoid the cold, while still not roosting in the warm areas.

With the cold weather and frozen conditions there were no bats in the Office, Wood shed, and Bath house. The Canteen had a single natterer in the ceiling and a Brown long eared behind plaster.

There were no bats in the Nelson roost, however the Birchwood roost had a notably higher count following modifications and enhancements made to this building over the last year. The previous peak December count was one, and highest winter count was two in January 2022. This survey identified 23 individuals, all found in the basement and half of these were roosting in installed roost boxes.

12th January 2023

Since the last survey there had been a rise in the temperature and there has been a period of much milder, but very wet weather. The ground water was high and as a result the water level had risen inside the artificial roost, with surface water inside the building.

There had been a shift in bat behaviour over the last two months in the artificial roost. December saw the lowest number of bats ever using the ground floor areas during the period of freezing temperatures, bats clustered roosting around, but not inside the incubator. Indicating that they were using the heat lost from this to avoid freezing, but not roosting in warm areas. In the milder weather of January, behaviour had returned to normal with 133 found in the main ground floor room, and 158 in the building in total. The 111 found in the roof area around the incubator area the previous month, had dropped to 14.

There were no bats found in the Office, woodland shed and only a single bat in each the bath house, in the east cupboard, and canteen storeroom. There was again evidence that these buildings had been broken into/accessed.

No bats were found in Nelson roost, however Birchwood roost had a peak of 15 LHB with most bats again found using the polystyrene boxes, although down on the previous month this is the highest January count to date.

Table 1+2 – Showing the counts observed in the original roost buildings and new Birchwood and Nelson roosts.

Building	Area	January 13th	February 10th	March 12th	April 12th	May 19th	June 16th	July 15th	August 17th	September 17th	October 16th	November 14th	December 14th
Artificial roost	small room+stairs	6+8	6+6	7+3	4	NA	NA	NA	NA	4	6	7	0
	large ground	158	162	178	198	NA	NA	NA	NA	429	148	165	2
	upstairs	7	9	3	177	NA	NA	NA	NA	11	292	159	111
Shed opposite Artificial roosts		0	0	0	0	0	0	0	0	0	0	0	0
Office	main roof	0	0	0	0	6	5	23	6	1	1pip	1	0
	second roof	0	0	2	2	2	35	39+BLEB	39	12+BLEB	2	4	0
	storage room	0	1	4	7	6	1	0	19	19	10	8	0
Canteen		0	M.n	0	0	1	M.n	0	0	M.n	M.n	M.n	M.n+BLEB
Bath house		0	2	4	1	0	2+4GHB	GHB	0	1	0	3+GHB	0
Total		179	186	201	389	NA	NA	NA	NA		458	344	113

Total bats found in Birchwood and Nelson

Building	Area	January	February	March	April	May	June	July	August	September	October	November	December
Birchwood	Loft	0	0	0	0	15?	24	NA	NA	13	31	35	0
	Ground Floor	0	1	1	0	5	4	NA	NA	41	23	8	0
	Basement	2	1	1	0	0	0	NA	NA	1	6	2	23
	Small room	0	0	0	0	1	0	0	NA	1	1	0	0
	South Box	0	0	0	0	0	0	0	3pip	0	4pip	0	0
	East Box	0	0	0	0	0	0	0	0	0	0	0	0
Nelson	Loft	0	0	0	0	0	1	0	1	2	0	1	0
	Ground Floor	0	0	0	0	1	0	1	1	2	1	2	0
	Bat Boxes	0	0	0	0	0	0	0	0	0	0	0	0

BLEB - Brown long-eared bats, Mn – Natterers bat, GHB – Greater Horseshoe bat, LHB – Lesser horseshoe bat, Pip – Pipistrelle bat

- 3.5 During 2022 the emergence surveys were conducted from May to September inclusive as there were a high active number of active bats present during this time and an internal count was not accurate.
- 3.6 During 2022 emergence surveys were not conducted of the bath house or office, the surveys during the previous years had consistently identified low numbers of bats present within the bath house and as such the internal counts were considered accurate, and more accurate to count the bats during the daytime than emergence surveys when not all emergence points were visible.
- 3.7 The total peak counts of lesser horseshoe bats using each building and the total for the site is shown in Table 3. Generally, the number of bats present using the Northern United buildings is low, especially during the hibernation period where there are only the very odd individuals present and typically only higher numbers are found present during warmer, drier weather conditions from June to September.
- 3.8 The Birchwood roost, due to construction layout is not possible to count as soon as there are more than a few bats present. As a result, emergence surveys were conducted during June to September. This roost was modified with both rebuilding the hot box and installing increased hibernation roost suitability in July 2022, which resulted in a spike in numbers present.
- 3.9 The bottom of Table 3 shows the percentages of the number of bats identified each month using the two main buildings on the Northern United site, the office and the bath house, and the two new artificial roosts, Nelson and Birchwood.

Table 3 - Total lesser horseshoe only counts for each building 2022 (including pups/juveniles)

	January	February	March	April	May	June	July	August	September	October	November	December
Artificial roost	43	77	103	240	321	477	511	601	442	336	340	257
Shed opposite	0	0	0	0	0	0	0	0	0	0	0	0
Office	0	0	9	16	11	42	36	67	33	14	11	2
Canteen	0	0	0	3	1	0	0	0	1	1	0	0
Bath House	1	0	2	5	5	1	0	0	5	0	1	0
Nelson	0	0	0	0	0	1	0	0	1	3	2	0
Birchwood	0	0	0	1	3	14	15	26	20	29	13	1
Peak Total	44	77	114	265	341	535	562	694	502	383	367	260
% LHB in Bath House	2.3%	0.0%	1.8%	1.9%	1.5%	0.2%	0.0%	0.0%	1.0%	0.0%	0.3%	0.0%
% LHB in Office	0.0%	0.0%	7.9%	6.0%	3.2%	7.9%	6.4%	9.7%	6.6%	3.7%	3.0%	0.8%
% LHB in Nelson	0.00%	0.00%	0.00%	0.00%	0.00%	0.19%	0.00%	0.00%	0.20%	0.78%	0.54%	0.00%
% LHB in Birchwood	0.00%	0.00%	0.00%	0.38%	0.88%	2.62%	2.67%	3.75%	3.98%	7.57%	3.54%	0.38%

4 Juvenile monitoring surveys

- 4.1 During 2016 - 2018 surveys were conducted to test methods to monitor juvenile populations and breeding success, by conducting pup/juvenile counts, and juvenile first flight monitoring recommended by Leeds University. However, the methods recommended by Leeds were untested, not used by researchers and not believed to work by many bat workers.
- 4.2 Monitoring over three years consistently identified that the Leeds University first flight method of monitoring does not work and is ineffective in suitably monitoring either the juvenile population or breeding success being significantly lower than the pup counts, and even showing negative breeding rates opposed to the true rates. Following this pup counts only have been adopted for monitoring breeding success as the most reliable, accurate and consistent method.
- 4.3 Pup counts were conducted on four dates approximately one week apart during July and early August 2022. Dates are not consistent each year, but vary according to that year's birthing period. Counts are conducted inside the office and Hawkwell artificial roost from the Northern United only, for consistency, as the two main roosts. Due to increased numbers this was also conducted in Birchwood during 2022.
- 4.4 The 2022 surveys have identified a peak of 157 pups and juveniles on the 15th July, the highest recorded to date.
- 4.5 The survey on the 23rd July was when the first juveniles were becoming volant and had the highest overall count ever recorded on the site of 851 individuals.
- 4.6 By the 30th July, although still early all bats were volant and no pups remained so no further pup counts were conducted.

Adult and Juvenile counts 2022

	15th July	23rd July	30th July
Office - adult day count	62	69	76
Artificial roost - Adult count/volant juvs	566	605	628
birchwood	29	30	33
Total adults	657	704	737
Day and Post emergence pup count - office	0	3	0
Post emergence pup count - Artificial roost	153	136	33
Birchwood	4	8	8
Total Pups	157	147	41

- 4.7 The juvenile and pup roost counts will always be a representative count of the number of juveniles present, and not a true complete number. Lesser horseshoe bats are known to regularly carry young to new roosts, and use nursery roosts, and it is accepted that a proportion of individuals will carry pups out of the roost during

emergence. However this method is still considered to be the most accurate and representative of the colony.

Constraints/Limitations

- 4.8 The bat numbers on the site fluctuate considerably , not only throughout the seasons but can change notably from as little as one week to the next. Each survey only acts as a snapshot in time and gives an indication of the numbers of bats using the site. However, numbers present may fluctuate daily with bats moving to, or between, other sites and can fluctuate between years, especially as a result of changing weather conditions.

5 Discussion

- 5.1 The counts in summer of 2022 are again high with a new peak of 811 on one of the monthly surveys and then 851 on one of the juvenile counts on 23rd July.
- 5.2 The juvenile counts also identified a peak juvenile and pup population of 157, however, the true number is expected to be higher than this. As birthing is spread out some juveniles could start being volant while others are still being born, additionally some mothers may carry the pups to nursery roosts.
- 6.1 The number of bats using all the Northern United buildings has remained on average low, and continued to decrease from previous years, with the typical increase in numbers during the warmer, drier weather from June to September.
- 6.2 The office had a higher number of bats present during the June-September dry summer period with a peak of 64 in August. The use of the bath house remained low throughout the year with a peak of only four in March. The bath house has continued to deteriorate, become increasingly damp and less suitable with timber boards rotting and increased water ingress. However, in 2022 that there was a continued increased use of this building by greater horseshoe bats with four individuals recorded in June, the highest number of GHB recorded on the site.
- 6.3 The peak use of the office was in August which represented 9.4% of the lesser horseshoe population on the site, only fractionally lower than last year, and an average of 3.7% occupancy throughout the year, down from 4.6% the previous year. The bath house had a peak of only 2% in March 2022 with only four bats present, and an average occupancy of 0.4% throughout the year.
- 6.4 Surveys of the Birchwood and Nelson new artificial roosts were conducted monthly throughout the year. Due to the layout of the building emergence surveys were conducted on Birchwood roost from June to September. Monitoring of these roosts over recent years had identified that the incorrect construction of the hot boxes was resulting in a failed uptake of use of these by the Horseshoe population and the

conditions of these were not suitable. As a result, overall number of bats using these new roosts remained low.

- 6.5 In July it was agreed that one of the hot boxes in the Birchwood roost could be removed and constructed properly and this was conducted by the AEWCL team. This remediation resulted in an immediate increase in numbers of bats using the roost, with almost all bats using the newly constructed hot box and a peak of 97 bats.
- 6.6 The Nelson roost has remained less suitable throughout 2022, the hot box present in this roost has now been removed and re-built and it is expected that uptake of this will increase in 2023
- 6.7 The increased peak of bats using the site is great for the local population. The increased peak of bats now using the Birchwood roost is a notable and important increase. During 2021 the highest proportion of bats using Birchwood was 7.5% in October 2021 and the average for the year was 2.1% of the colony using this building. In August 2022 following the roost modification this jumped to 14.2% of the colony and remained at over 10% for the following 5 months. The average for the year was 6.7% which is almost double the proportion using the Office and Bath house. This is the first time that the average proportion of the colony using the Birchwood roost is more than the Northern United buildings.
- 6.8 The surveys have shown that the population at Northern United is doing well. This appears to be still growing with another record peak count in 2022. The vast majority of the population still use the heated original artificial roost, however the modifications to the Birchwood roosts have shown a demonstrated increase in uptake which is hoped to increase during 2023, along with increase uptake of the Nelson roost following modifications there.