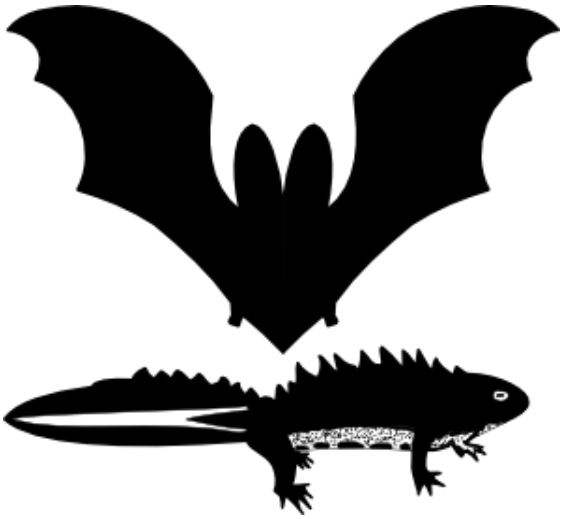

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Lesser Horseshoe Juvenile Monitoring and Breeding Success

Northern Quarter

Cinderford

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1 Introduction

1.1 AEWC Ltd. was commissioned by the Forest of Dean Council to conduct monitoring of the Lesser Horseshoe colony at the Northern Quarter site and undertake and 'in practice' review of the survey strategy for monitoring breeding success of the colony in the summer of 2016.

1.2 These surveys were conducted alongside the monthly surveys conducted at the site by AEWC Ltd during 2016

1.3 The breeding success surveys were conducted following recommendations by Leeds University to monitor the breeding success of the colony present.

1.4 This report provides the results of the surveys conducted from Mid-July to Mid-August 2016 to identify he population present and the breeding success of the colony. The results of this monitoring are intended to be used to review the appropriateness of the survey methodology, support assessments in relation to any proposed development of the surrounding area and to inform for future long term population monitoring of the colony present.

2 Background

2.1 The population of Lesser horseshoe bats at Northern Quarter has been monitored for many years with surveys results reported since 2003. Since this time there have been several changes at the site including the erection of a new Artificial Roost, and later addition of a heat supply at the artificial roost, which is now the main roost site for the colony.

2.2 The Northern united site has been intensively monitored with monthly counts of all buildings, including emergence counts using night vision cameras since July 2013; with a fixed and consistent survey methodology set up by AEWC Ltd.

2.3 Monitoring of the site has identified a number of uses of the buildings by a range of bat species and observed a notable peak population growth at the site from 355 in 2013 to 614 individuals in 2016. (For further detail see AEWC report – Lesser Horseshoe Colony Historical Review and Status)

2.4 Additional surveys at the site included trapping surveys in 2013 as part of further surveys across the site and radiotracking surveys. These surveys identified that the Artificial roost was used by an unusually high number of male lesser horseshoe bats. A typical horseshoe colony does have males present, which usually make up 10-15% of the colony population. However, trapping at the artificial roost caught notably more males than females, out of 64 adults caught 41 were males, almost 2/3rds and already over 10% the population with a limited sample selection.

2.5 In October 2015, a Cinderford Northern Quarter Bat Monitoring Strategy was produced by Dr Anna Berthinussen & Professor John Altringham which included additional monitoring of the Lesser horseshoe colony to include monitoring

productivity of the colony by calculating the reproductive success, this was recommended as a quicker way to identifying if there may be an impact on a colony.

2.6 This was recommended to be achieved by conducting weekly emergence counts from Mid-July to Mid-August and estimating the number of juveniles during first flight emergence from the roost to give a basic estimate of the productivity of the maternity colony. This can be calculated by estimating the number of juveniles from pre-Volant (May-June) and post-volant (July and August) emergence surveys and dividing the estimated number of juveniles by the pre-volant colony count.

2.7 The report suggested that a decline of >10% in two consecutive years is cause for concern and could indicate a negative impact on the LHB bat colony.

2.8 There were a number of concerns raised with conducting weekly counts and working out the first flight numbers of a way of estimating the number of juveniles within a Lesser horseshoe colony by people working with this species. Previous surveys have clearly shown the that emergence counts fluctuate regularly making counts inconsistent, it was therefore decided to also conduct pup counts at the same time as a comparator survey method.

3 Method

3.1 Juvenile monitoring surveys were conducted once per week from Mid-July to Mid-August 2016, a total of 5 surveys. Existing monthly population monitoring surveys across the Northern United buildings were conducted once per month throughout 2016

3.2 Each Juvenile survey included a daytime internal count of the Office building to gain a count of the number of adult bats present and an emergence survey of the Artificial roost. All emergence surveys were conducted using night vision cameras and infra-red illuminators. Recordings were watched back to enable accurate counts of the number of bats present. Counts of the Bath House were not included as access was limited to this building.

3.3 Following each emergence count the Office building and Artificial roost were surveyed internally to count any Adults remaining present, and pups and juveniles.

4 Results

4.1 Specific Juvenile monitoring surveys were conducted on the 15th July, 23rd July, 29th July, 6th August and 15th August.

4.2 Additional Pre-volant surveys as part of the site monitoring were conducted on the 11th May and 20th June. The first summer survey in May identified a population of 248, and in June 477 individuals.

4.3 The later summer counts of the Artificial roost and Office building only had a count of 498 on the 15th July, which was considered a maximum pre-volant count, especially given the poor and late breeding year. Notably the count on the 23rd July, one week later had dropped to 402 individuals.

4.4 The maximum count of the Office and Artificial roost only was 599 on the 15th August. See Table 1

Table 1

Adult and Juvenile counts 2016

	15th July	23rd July	29th July	6th August	15th August
Office - adult day count	18	28	43	29	48
Artifical roost - emergence count	498	402	492	563	551
Total adults	516	430	535	592	599
Post emergence pup count - office	2	3	2	0	0
Post emergence pup count - Artifical roost	88	96	93	11	0
Total Pups	90	99	95	11	0

N.B. counts of the Bath house and other buildings are not included within these results.

4.5 Using the first flight calculations to work out the % reproductive success by the following calculation -
a) Maximum total colony count recorded during pre-volant period (May to mid-July)
b) Maximum total colony count recorded during post-volant period (mid-July to mid-August)
c) Estimated number of juveniles = (b – a)
d) Reproductive success (%) = (c / a) x 100

4.6 Where the maximum pre-volant count is 516 and post-volant count is 599 this gives an estimated juvenile count of 83 and a calculated reproductive success of 16.1%.

4.7 The pup counts identified a peak count of 99 individuals on the 23rd July. This can be used as a minimum count, or, used to calculate the reproductive success. This can either be done with the maximum pre-volant count giving 19.2%, or, the count conducted on that day giving a reproductive success of 23%.

4.8 As there were good pup counts conducted on three occasions these can be used to create three calculations for reproductive success.

15th July – 17.4%
23rd July – 23.0%
29th July – 17.8% Average – 19.4%

5 Constraints/Limitations

5.1 Previous surveys have already identified that bat numbers on the site fluctuate notably, not only yearly, seasonally, but from one month to the next, and, it is believed from one day 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 other sites.

6 Discussion

6.1 The pre-volant counts vary notably, ranging from 248 to 516, more than 100% increase. This indicates how notably the population present at the site can fluctuate. This was more notably demonstrated with the counts on the 15th July and 23rd July where over 1 week the counts reduced by 86 individuals.

6.2 The colony counts have always known to fluctuate notably, which may be due to the high proportion of male bats identified within the colony during the 2013 surveys. Male and non-breeding female bats are less roost faithful and may switch roost more regularly depending on factors including weather conditions than breeding females with young.

6.3 Using the pre-volant and post-volant emergence counts to estimate the number of juveniles to be 83 and has given a breeding success of 16.1%. This is considered to be low. While this may be due to the number of males present the notable fluctuations in population present can very easily skew these results, as shown by the 15th July and 23rd July colony counts. If the reproductive success is calculated using the lower, and later 23rd July counts it gives a reproductive success of 19.3%.

6.4 The internal post emergence pup counts identified a minimum count of 99 pups with 90% flying and emerging within 2 weeks and all within three weeks. These counts can be used as a minimum juvenile population count. This can be used with the maximum pre-volant count to calculate a breeding success of 19.2%, However, if used with the unusually lower count from that day it gives 23%.

6.5 The average of the breeding success from the three pup counts and emergence counts for the first three surveys was 19.4%, which is very similar to the breeding success calculated from the maximum pup count and maximum pre-volant emergence count giving 19.2%

6.6 Because of the apparent high male proportion of the colony it is not felt that this colony breeding success can be compared to other lesser horseshoe bats colony's breeding success. Breeding success should be calculated as a proportion of the number of adult females, not colony population including males. As Lesser horseshoe bats are known to have a good proportion of the colony made up of males calculating reproductive success is less reliable for this species.

6.7 The juvenile first flight survey method was not considered to be an accurate way to calculate this colony breeding success as it was known that there are such a high proportion of males within the colony and the emergence counts fluctuate notably.

6.8 The counts on the 15th and 23rd July only 8 days apart showed a colony reduction of 16.7%, if this had occurred when juveniles started flying it would have shown a net negative calculation in the colony breeding success which is incorrect and misleading.

6.9 The post emergence pup counts are a recommended and considered to be more accurate survey technique, and can be conducted at the same time as emergence surveys so don't rely on the previous pre-volant counts, which are known to be highly variable and can use the emergence counts form the same night. Additionally, this can be achieved by conducting fewer counts when juveniles are volant.

6.10 Breeding success can be affected by many factors, most notably weather conditions especially in the early spring, in poor spring years breeding success is known to be much lower. Given that this, and other factors can heavily affect the breeding success it is still considered that using the breeding success of a colony can still take many years to show any trend and identify if there is a negative impact.

6.11 Using a 10% reduction in breeding success, even over two years as a sign of possible negative impact is not considered to be reliable, especially for this species and colony. Breeding success can fluctuate by well over 10% annually, for one studied colony over 14 years the breeding success has ranged from 21% to 81% (Vincent Wildlife Trust) and was notably affected by weather conditions. Given breeding success can be so affected by weather it may take many years to work out the average breeding success and then good years may still show an increased breeding success even with a reduced colony population, and vice versa.

6.12 Additionally, the very low % breeding success calculated by this colony, believed to be affected by the high may proportion of the colony, would mean that only a slight reduction in the counts could notably affect the breeding success calculation. Using the first flight juvenile estimate a count of only 9 fewer individuals from the August count of 599, only 1.5%, would equate to a more than 10% reduction in breeding success.

6.13 For this reason, caution is advised in using a 10% reduction in breeding success may not be a good reliable way of identifying negative impacts for this colony and due to the high natural variation in a colony breeding success using the results from the year before construction as a baseline is unadvisable and should use many years as an average.

6.14 However what is important is measuring trends over extended periods of time both in terms of colony size and birth rate. In considering population dynamics at any given point it will be necessary to take in to consideration the context of the results in relation to local and national factors. A degree of professional judgement is likely to be needed to be applied.

6.15 It is recommended that reproductive success could be calculated more accurately by conducting post emergence pup counts and colony counts from the same day, and this would not require as many surveys to give more accurate results.

7 Recommendations

• One extra survey is conducted between the Mid-July and Mid-August monthly surveys.

• Three surveys from Mid-July to Mid-August include a post emergence pup count to monitor breeding success to work out the maximum juvenile population.

• Breeding success is worked out using both the monthly counts and the peak counts (pup count and pre-birth emergence) and the data and monitoring method is revisited after the summer of 2017 to evaluate effectiveness.