

Tottergill lime kiln, RSPB Geltsdale, Cumbria.

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Introduction

Interest in Tottergill began as a mature sycamore tree was growing on top of the lime kiln and had been identified by RSPB site staff as having potential for damaging the structure. The tree was rooted in the top edge of the kiln and branches were overhanging the entrances to the draw arches. Due to the location of the kiln, at the head of a wooded valley, it was anticipated that the kiln may be used by bats at certain times of the year.

To ascertain bat use of the site prior to any work being carried out to fell the tree, an SM2+ bat detector was placed on the retaining wall immediately east of the kiln in October 2012. Over 4,900 bat call files were recorded during the night of 09-10/10/2012. Sound analysis identified *Myotis* species bats, common pipistrelle *Pipistrellus pipistrellus* and soprano pipistrelle *P. pygmaeus* flying around the kiln. Subsequently, *Myotis* species bats were observed flying within the lime kiln on 13/10/2012. Time expansion calls identified some of the *Myotis* species calls as Natterer's bat *M. nattereri*.

Due to the high level of bat activity in and around the kiln in October 2012 it was thought that this kiln may be a significant swarming site and potential hibernacula. A Natural England bat project licence was applied for and approval was sought from the RSPB Reserves Ecology Team to allow research to be undertaken in the swarming period using mist nets to catch and ring any *Myotis* species bats caught at the kiln. This short report summarises the bat research that has been undertaken at Tottergill lime kiln between 2013 and 2015.

Site description

Tottergill lime kiln is a small double arched kiln beside the Totter Gill towards the head of an open wooded valley on the western slope of Castle Carrock Fell, Cumbria. The valley contains secondary woodland with a diverse mix of semi-mature and mature conifers and broad leaved trees. Castle Carrock reservoir lies 500m to the west. The immediate surrounding area is unimproved limestone grassland and heather moorland, grazed by sheep.



Tottergill lime kiln is constructed from random stone blocks with an assumed rubble fill. The kiln has an unusual construction in that each draw arch has two draw eyes and the two draw tunnels go to the same pot. Each draw arch of the kiln is relatively small, with width of 2.1m, depth of 2.7m and a maximum height of 2.7m (www.solwaypast.co.uk).

The kiln is at 235m above sea level (asl) and is located within Ordnance Survey grid reference NY550544. The kiln is within the RSPB Geltsdale nature reserve and is owned and managed by the RSPB (see Figure 1).

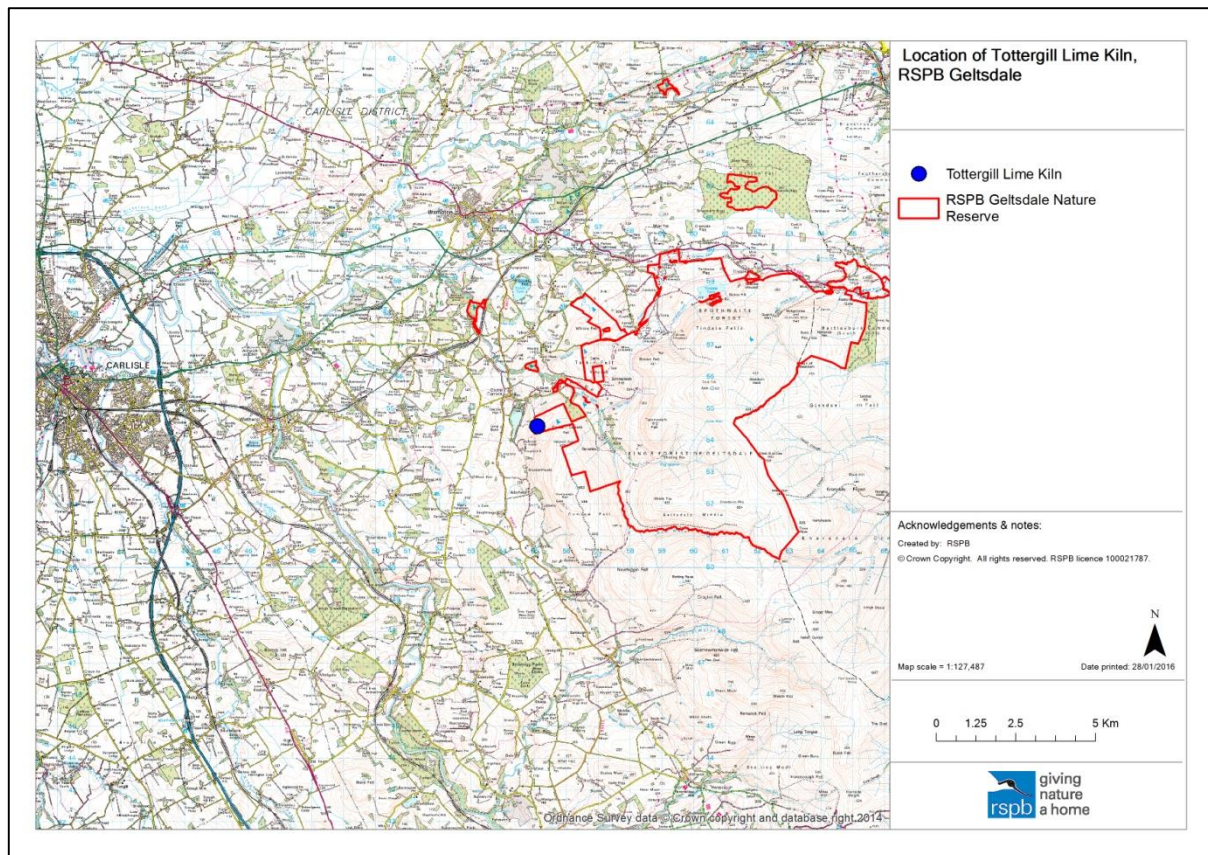


Figure 1 Location of Tottergill lime kiln, RSPB Geltsdale.

Methodology

As the mature sycamore needed to be removed to limit future structural damage to the kiln and due to the bat interest at the site, works have been phased to maintain the microclimate around the kiln during and after the works. The majority of the sycamore was removed in September 2013; the lower limb that hangs down over the draw arches was preserved to help maintain some climatic stability at the site. An SM2+ bat detector was placed at the kiln before, during and after the works to monitor the bat activity levels around the kiln during the tree works.

Subsequently, eleven swarming surveys have been undertaken at the site between 2013 and 2015, in August, September and October (see Table 1). The nets were set before sunset and remained in place until bat activity had effectively stopped. Over the three years of the project, the earliest catching survey was on 16th August and the latest was on 4th October. Previous studies have shown that swarming occurs between August and October with a peak in activity between mid-August to mid-September (Parsons et. al., 2003a, b). As mist nets were used to catch bats, trapping could only take place on still nights, and as Tottergill is at 235m asl, finding suitable nights for trapping proved challenging.

Date	Sunset	Start time	End time	Trapping hours	Minimum temperature
14/09/2013	19:27	19:00	01:30	6.5	-
20/09/2013	19:11	19:00	00:00	5	-
04/10/2013	18:36	18:00	23:00	5	-
31/08/2014	20:02	19:30	01:00	5.5	13.25°C
04/09/2014	19:52	19:30	03:30	8	14.5°C
17/09/2014	19:19	19:00	04:00	9	16.25°C
29/09/2014	18:48	18:30	03:00	8.5	12.0°C
16/08/2015	20:38	20:30	03:30	7	9.0°C
31/08/2015	20:02	19:45	03:15	7.5	9.75°C
08/09/2015	19:42	19:30	01:00	5.5	10.0°C
26/09/2015	18:56	18:15	00:45	6.5	8.25°C

Table 1 Swarming survey dates.

All bats caught were identified and their biometrics taken. The data recorded were the species, sex, age, reproductive status, forearm length and weight of each individual. All *Myotis* species bats were ringed on the right forearm with individually numbered rings as supplied by the Bat Conservation Trust. Fur clippings were taken, under licence, from selected small *Myotis* species to allow DNA analysis for species confirmation.

During 2015 an Anabat Express detector has been left by the kiln at intervals during the bat activity season. The detector was first deployed on 15/05/2015 and was brought in for winter after the heavy rains on 05/12/2015. On each occasion, when the detector batteries were changed the kiln was inspected visually for the presence of roosting bats.

Results

The majority of the mature sycamore was removed in heavy rain on 05/09/2013, the branch that hangs down to the south west over the south face of the kiln was retained. Heavy rain started to fall before dawn on 05/09/2013 and continued until during the night of 06-07/09/2013; the minimum night time temperature also fell more than 6°C during this period.

The remote detector at the kiln recorded Daubenton's bat *Myotis daubentonii*, Natterer's bat, *Myotis* species bat, noctule



Nyctalus noctula, common pipistrelle, soprano pipistrelle and brown long-eared bat *Plecotus auritus* around the kiln. The number of bat calls fell after the tree works with the lowest number of bat sound files recorded the second night after the tree was removed but bat activity recovered to above previous levels within three nights (see Figure 2). The fall in bat activity is likely to be related to both the disturbance caused by the tree works and the wet and cool weather.

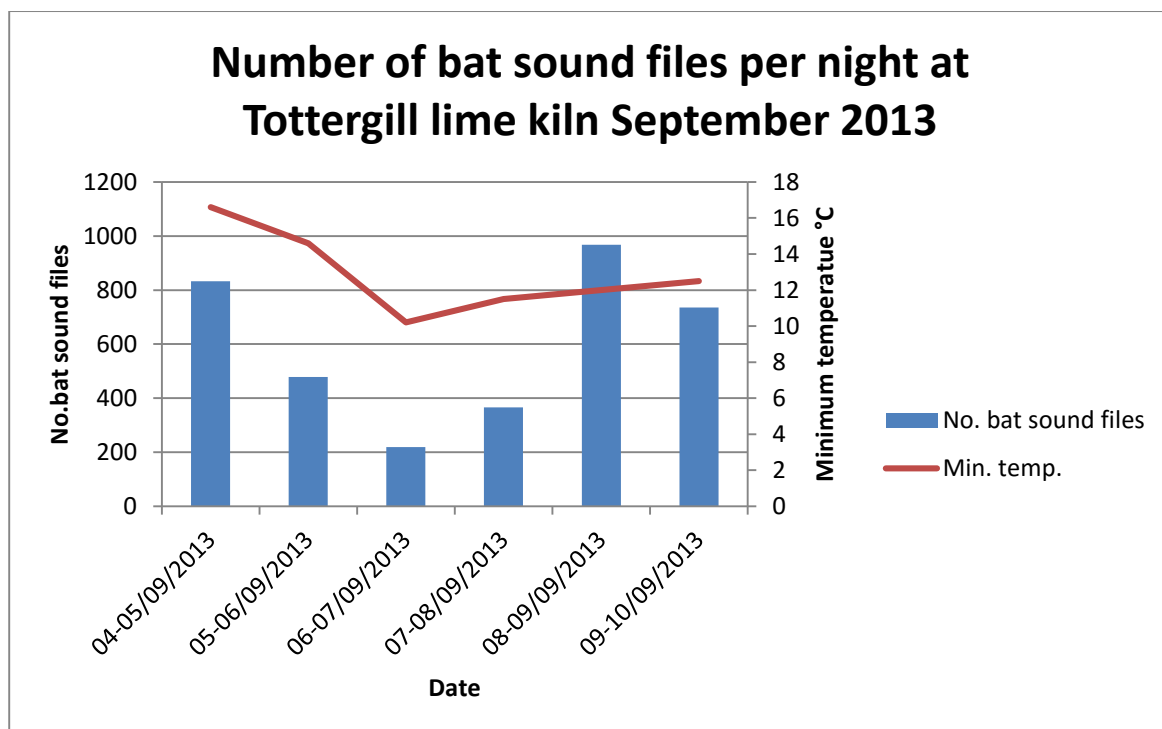


Figure 2 Number of bat sound files per night at Tottergill lime kiln September 2013.

Eleven swarming surveys have been undertaken at the kiln and 105 bats of seven species have been caught under licence between 2013 and 2015 (see Figure 3).

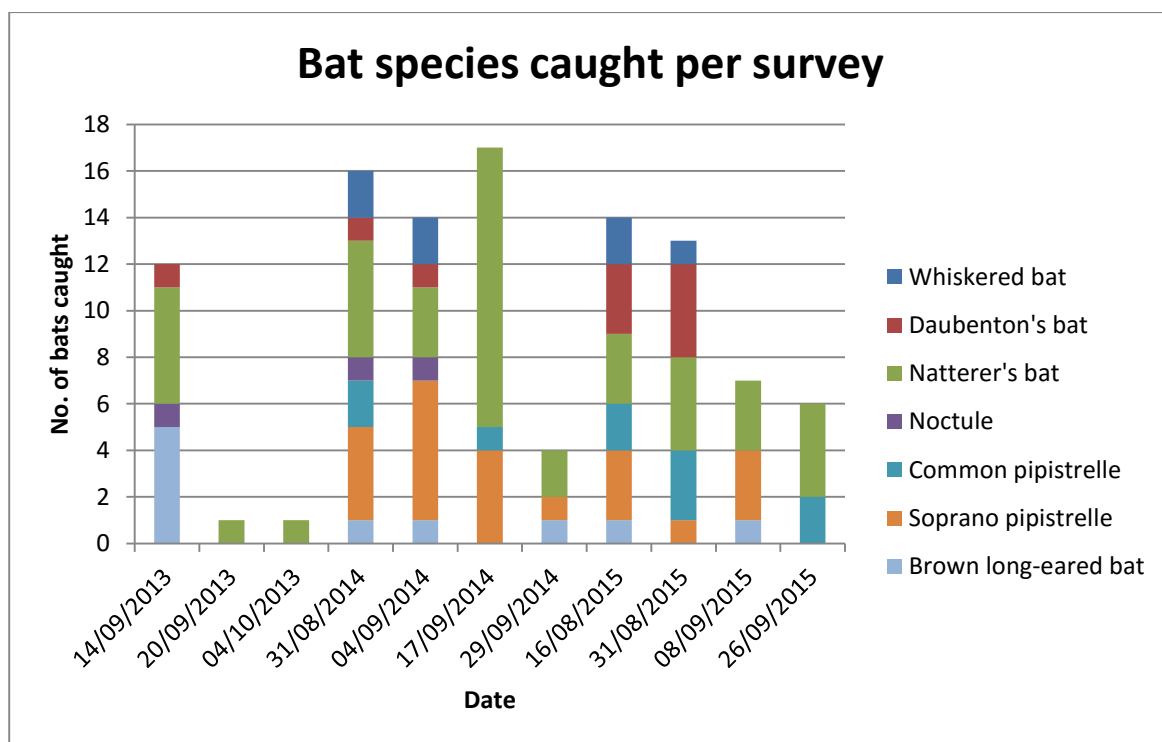


Figure 3 Bat species caught per survey.

Four of the five resident swarming species have been caught at the kiln. Noctule, common pipistrelle and soprano pipistrelle have also been caught at this site, with both common and soprano pipistrelle caught whilst trying to enter the kiln.

Natterer's bats were the most numerous bats encountered, with 43 bats caught, accounting for 41% of bats caught. Thirty six Natterer's bats have been ringed, four individuals have been recaptured and two bats were not ringed due to old injuries along their forearms. Soprano pipistrelle was the next most frequently caught bat at 22, 21% of all bats caught. Ten Daubenton's bats, ten common pipistrelle and ten brown long-eared bats have been trapped (9% each), seven whiskered bats *M. mystacinus* and three noctules have been caught, 7% and 3% respectively. Whiskered bats were first caught in 2014; three of these bats were fur clipped for DNA analysis, the results confirming the species identification in the field. Two more individuals were subject to DNA analysis in 2015, again confirming whiskered bat.

Previous studies have shown that during the swarming period the species composition changes from relative species evenness to a greater proportion of Natterer's bat in the catch (Glover and Altringham, 2008). The pattern of bats caught at Tottergill fits within this trend (see Figure 4).

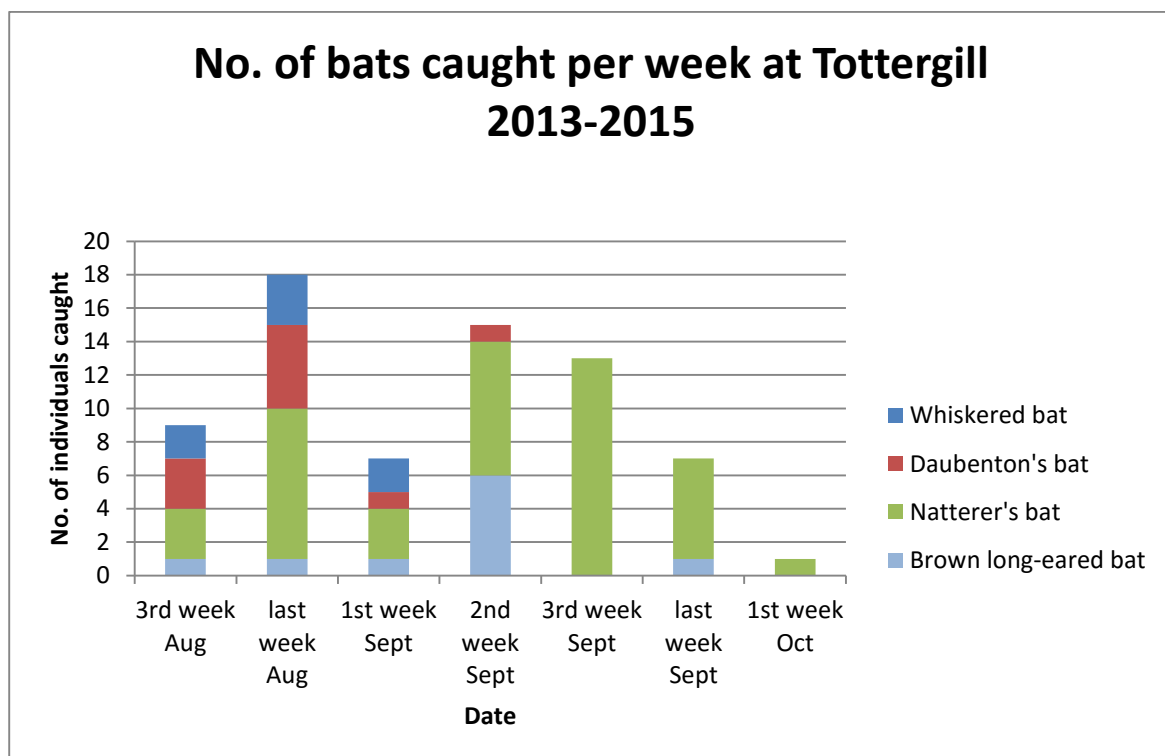


Figure 4 Number of bats caught per week at Tottergill 2013-2015.

The sex ratio of all bat species caught is strongly biased towards males, 84 males caught compared to 21 females. This is true, not only of the *Myotis* species and brown long-eared bats, the species that are known to visit swarming sites, but also of noctule and the *Pipistrellus* species bats caught at the kiln (see Figure 5). This skewed sex ratio corresponds to data from previous studies (Rivers et. al., 2006). Male bats are thought to visit swarming sites on several occasions during the swarming period to increase their chance of fathering offspring whereas a female bat only needs to mate on a single occasion.

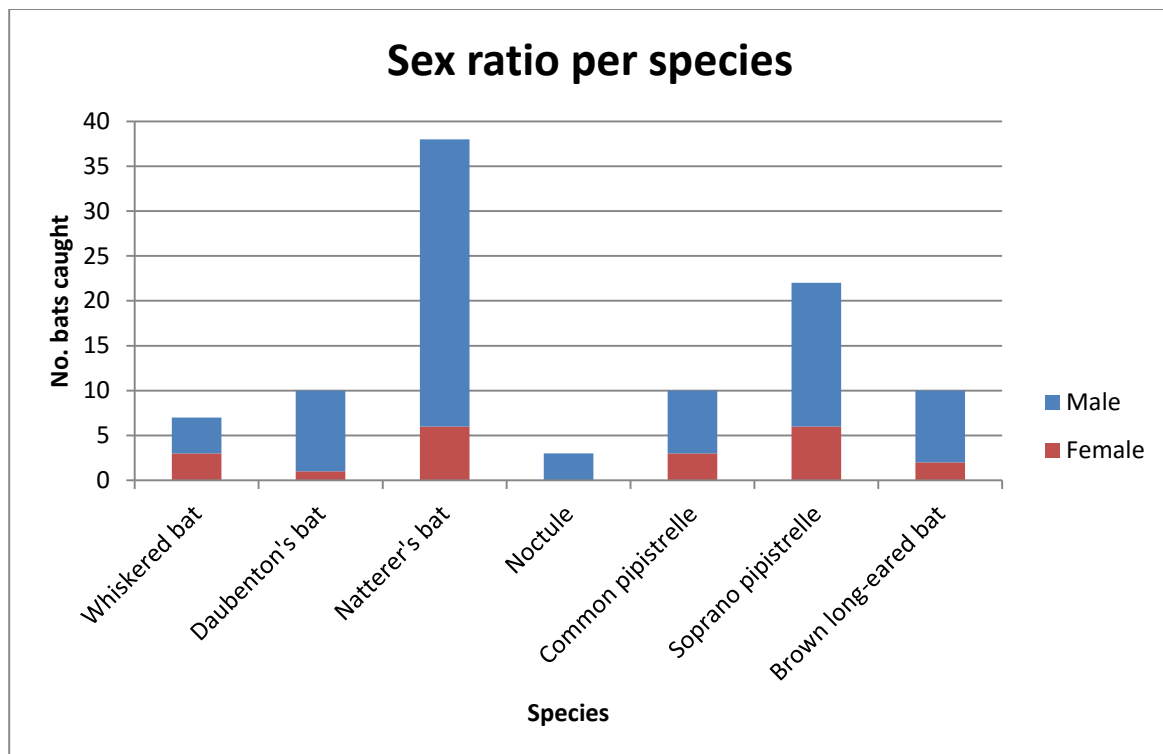


Figure 5 Sex ratio per species.

Glover and Altringham (2008) found that for Natterer's bat the ratio of females caught increases two to three-fold during the peak swarming season. The data for Tottergill fits this pattern although the sample size is small; six female Natterer's bats were caught during this study, all during September; one in the first week, two in the second and three in the third week.

Studies by Glover and Altringham (2008) have found that bats show high fidelity to single swarming sites with only two of 239 retrapped bats in their study moving between swarming sites.

At Tottergill lime kiln four individual ringed Natterer's bats have been retrapped, one twice. All four bats that have been retrapped were adult males. Y4927 was ringed on 14/09/2013 and then caught roosting in the kiln on 29/09/2014 and caught again on 26/09/2015, pictured right. Y4948 was ringed on 04/10/2013 and retrapped in the kiln on 31/08/2015. The two other recaptures have been same year retraps, Y4962 was caught on 31/08/2014 and again on 17/09/2014, roosting in the kiln on both occasions and H4970 was caught on 08/09/2015 and retrapped on 26/09/2015.



Retrapping bats that have been caught in the kiln, for example catching two bats within 17 and 18 days of original capture, illustrates that the disturbance does not cause them to leave

the site. Y4927 has been seen in all three years and Y4948 was not seen in 2014, this research will allow us to study these bats through many years.

Natterer's bats use the kiln as a roost in autumn; ten Natterer's bats have been recorded roosting within the kiln on survey nights, with three bats present in the kiln on 17/09/2014.

Swarming sites are usually associated with hibernation sites. At Tottergill there are no known underground structures although a ringed bat was found deep in a crevice in the kiln on 10/11/2015. The last digit of the ring could be read, narrowing this bat down to one of three individuals, all male, two first caught in September 2014 and one in August 2015. This is the first bat that has been seen in daytime roosting within the kiln structure.



An Anabat Express detector has been deployed at the kiln at intervals during 2015. As yet this data has not been analysed, it is hoped that this data will provide an insight into the bat use of the kiln at other times of the year. In May 2013, an SM2+ bat detector recorded Natterer's bat, *Myotis* species bat, common pipistrelle, soprano pipistrelle and brown long-eared around the kiln on three nights, although the number of bat files was low, with 15, 53 and 180 bat files recorded respectively.

Discussion

Tottergill lime kiln is an important site for bats. All the resident swarming bat species have been caught at the kiln with the exception of Brandt's bat *M. brandtii*. As it is unclear if the study has overlooked this species or if the species is locally absent, a request was made to the Cumbria Biodiversity Data Centre (CBDC) for records of Brandt's bat. The closest record was for a female Brandt's bat found roosting in a bat box in Gelt Woods in May 1992; this is 4.9km north west of the site. As a result of the CBDC verification process this record has been reclassified as a whiskered/Brandt's bat. This is due to the greater understanding of species identification techniques within the twenty eight years since this bat was first recorded. This is the only Brandt's bat record within 20km of Tottergill.

The level of bat activity in autumn correlates with swarming studies undertaken elsewhere, however this site is not typical of other swarming sites as there are no underground chambers that bats could be investigating in terms of hibernation sites (Glover and Altringham, 2008). Typical swarming sites allow bats to fly freely both inside and outside of the cave/mine entrance and lead directly into the underground chambers where bats can hibernate. It is possible that there could be a void within the pot of this kiln, although bat access would involve the bat landing and crawling through rubble in the draw eyes. The draw arches themselves are small, again not typical of the structures used for swarming in other studies.

This study is a long term project and it is hoped that we will continue to retrap ringed bats at this site. Similar work at castle sites in the Scottish Borders has provided data on individual

bats using the same sites over a number of years with Natterer's bats being recaptured at the same site up to 11 years after they were first ringed (Stuart Smith, pers. comm.).

Acknowledgements

Thanks to the RSPB for supporting this study, for arranging access and for taking me to the site. Thanks also to Adam Moan for the photograph of the ringed bat in the kiln and to Stephen Westerberg for the photographs, graphs and for staying out long after his bed time!

References

Angell, R.L., Butlin, R.K., Altringham, J.D. (2013) Sexual Segregation and Flexible Mating Patterns in Temperate Bats. *PLoS ONE* 8(1): e54194. doi:10.1371/journal.pone.0054194.

Glover, A.M., Altringham, J.D. (2008) Cave selection and use by swarming bat species. *Biological Conservation* 141: 1493–1504.

Parsons, K.N., Jones, G., Davidson-Watts, I., Greenaway, F. (2003a) Swarming of bats at underground sites in Britain – implications for conservation. *Biological Conservation* 111, 63–70.

Parsons, K.N., Jones, G., Greenaway, F. (2003b) Swarming activity of temperate zone microchiropteran bats: effects of season, time of night and weather conditions. *Journal of Zoology (London)* 261, 257–264.

Rivers, N.M., Butlin, R.K., Altringham, J.D. (2006) Autumn swarming behaviour of Natterer's bats in the UK: population size, catchment area and dispersal. *Biological Conservation* 127, 215–226.

<http://www.solwaypast.co.uk/index.php/structures-in-stone/44-p-kilns#tot> accessed 07/01/2016.