

**A BAT SURVEY REPORT FOR
ST. MARY'S CHURCH
EDGEWORTH**

A report to:
The Bats in Churches Project,
The Diocese of Gloucester and
Edgeworth Parochial Church Council

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1.0 Introduction

- 1.1. Link Ecology Ltd. was commissioned by the Bats in Churches Project to carry out bat survey work and provide expert ecological advice required at St Mary's church, Edgeworth, Gloucestershire, as detailed in the Church Project Plan.
- 1.2. The intention was to help facilitate the planning of approaches to solve the conflict between bats and people, with a view to involving local bat conservationists (principally Gloucestershire Bat Group), so that contact could be secured for a route for future advice and monitoring support.
- 1.3. A "Light Touch Survey" comprising of a daytime inspection and interview with the Church warden was carried out in August 2017 by John Daw of RSK. This identified where signs of bats were located at the time and a number of features on the interior and exterior of the church that could be used by roosting bats.
- 1.4. Link Ecology carried out an update daytime inspection and a series of emergence and re-entry surveys over the bat season in 2019 in the expectation of gaining sufficient information on the numbers and species present and the way they are using the church, in order to be able to provide practical advice on the potential of either manipulating the way bats use the church interior to restrict the impact they have on the community and church heritage, or to exclude the bats from the interior altogether. Which solution should be developed needed to consider the Parochial Church Council (PCC) desires, the cost effectiveness (there are no additional funds within the project to support future works, so it will rely on church fundraising) and what is practically possible within the bat licencing options available.
- 1.5. The work included:
 - Bat surveys necessary to be compliant with the requirements of applying for a European Protected Species (EPS) licence or registration under the Bats in Churches Class Licence;
 - Liaison as appropriate with the church PCC, Diocesan Advisory Committee (DAC) representatives, architects and builders contracted by the PCC to help develop their plans;
 - Provision of a written report of findings including advice on possible options and licencing requirements, including estimated ecologist costs associated with options.
- 1.6. The output of this work is presented in this report, which details:
 - Surveys undertaken;
 - Findings of surveys;
 - Management recommendations for the church, taking into account:
 - Church future requirements/needs;
 - Further bat survey or licencing requirements;

2.0 Summary

- 2.1. One comprehensive daytime inspection for bats in the church, and several rapid inspections were carried out between May and October 2019. Three evening emergence surveys and one dawn survey were carried out. A static detector was placed inside the church and successfully recorded bat activity over 44 nights, between May and October 2019. These confirmed the presence of serotine, brown long-eared, and one of the *Myotis* species. These findings are broadly consistent with those of the Light Touch Survey carried out in 2017 by RSK, although it is not thought likely that bats other than a low number of *Myotis* are ever present roosting during the day. The evidence for this suggests that day roosting does not occur very often. Instead, bats enter the church some time after dusk and are gone before dawn, presumably day roosting somewhere else. Further attempts to identify the species of *Myotis* bat found roosting are considered necessary to inform a site registration under the Bats in Churches Class Licence (BiCCL).
- 2.2. The surveys were constrained by the limitations of the equipment used (principally the number of available nightshot video cameras, the duration of recording and the visibility splay of the cameras) and the time spent on site by surveyors undertaking emergence and dawn surveys. The expectation throughout the survey period had been that bats would be day roosting frequently enough that they would be detected during “conventionally” timed surveys i.e. from 15 minutes before dusk to 1.5-2 hours after dusk and from 1.5 hours before dawn until 15 minutes after dawn. It was only once the last survey was completed that entry into the church by bats (as opposed to emergence from it) was confirmed by incidental observation whilst the lead surveyor was packing up equipment. As a consequence of this sequence of events, the exact means of access into the church was not determined. This in turn meant that the provision of detailed advice on managing the bats could not be finalised. Further survey in 2020 is suggested in order to better inform next steps, including (if considered desirable) confinement and/or permanent exclusion. Additional techniques, specific equipment needs and novel timings of surveys are suggested as a means of gaining enough information to inform next steps, leading if necessary to licensable works to contain or exclude bats from the church. It is considered unlikely that such licensable works could be achieved before autumn 2020 at the earliest.

3.0 Methodology

Daytime Inspection for Bats

- 3.1. A daytime inspection of the church was carried out to confirm the location and extent of bat evidence/damage to artefacts, as well as the continued presence of features of actual or potential suitability for roosting bats that had been noted during the Light Touch Survey. Any additional features found were also noted. This survey was carried out on 17th May 2019 by Eric Palmer CEnv MCIEEM, a Natural England licensed bat worker (Class Licence registration numbers 2015-11659-CLS-CLS and 2015-11660-CLS-CLS).
- 3.2. An external inspection was undertaken using a powerful torch, binoculars, a three-section ladder and an endoscope to inspect potential points of access into the roof and walls and/or other exterior features considered potentially suitable for roosting by bats.
- 3.3. An inspection of all accessible features of interest within the church was undertaken using a powerful torch and an endoscope (where appropriate) to identify any evidence of roosting bats such as the presence of bat droppings, live or dead bats or feeding remains.

Additional daytime inspection of the Church Warden's house

- 3.4. The warden reported the presence of a bat roost in his house and this was investigated to provide context to the survey of the church itself. A brief inspection of the loft of the property was carried out in order to confirm the species concerned and the likely status of the roost. No further more detailed investigations were entered into.

Bat activity surveys

- 3.5. Four activity surveys were carried out to determine whether or not bats emerged from (at dusk) or returned to (at dawn) features on the interior and/or exterior of the church.
- 3.6. Each dusk emergence survey was carried out by five surveyors, with four stationed outside and one stationed inside the church. Equipment used included Pettersson D240x¹ and Tranquility Transect² time expansion bat detectors, EM2 Touch Pro and EM3+ detectors³, Anabat SD1 and SD2 frequency division detectors⁴ and up to five nightshot video cameras with external infra-red flood lights.
- 3.7. All bat calls recorded were analysed using BatSound⁵ and Analook⁶ software.
- 3.8. Survey timings and weather conditions, positions of surveyors and results of surveys are presented in the Results section and Appendix II of this report.
- 3.9. The survey team included the following personnel:

Eric Palmer CEnv. MCIEEM (licensed bat worker)

¹ <https://batsound.com/product/d240x-ultrasound-detector/>

² <http://www.users.globalnet.co.uk/~courtpan/>

³ <https://www.wildlifeacoustics.com/>

⁴ <https://www.titley-scientific.com/>

⁵ <https://batsound.com/>

⁶ <https://www.titley-scientific.com/>

Colin Menendez (licensed bat worker)
Matthew Pickard (licensed bat worker)
Elin Pickard (trainee bat worker)
Kip Smith (trainee bat worker)
James Sweetman (licensed bat worker [Pending])
Gemma Waters (licensed bat worker)

Static monitoring

- 3.10. A single Anabat SD2 bat detector was stationed inside the church for four recording periods between May and October 2019. This was powered by an external 12v battery and was intended to record bat echolocation over a prolonged period in order to determine, as far as was possible, the species entering the church, the frequency with which bats entered, and the likely activity of bats inferred by time and type of call recordings (day roosting, night roosting, foraging and/or social behaviour) whilst inside the building.

Limitations

- 3.11. All of the surveys were carried out during the optimal period in the active season for bats so no timing limitations to the reliability of the survey findings were identified. The weather at the time of the bat activity surveys was considered to be suitable for bat activity. The bat survey methods and timings were fully compliant with the recommendations of the *Bat Survey Guidelines*.
- 3.12. Accessibility of features for detailed daytime inspection varied according to the position, elevation and complexity of the features identified. No attempt to access features on the interior or the exterior of the church was made beyond the reach of a triple extending ladder (approximately 6m elevation). This allowed access to eaves level but not to roof timbers, ridge lines or high wall tops within the building. The church has a Cotswold stone roof and as a consequence contains thousands of potential access points and roosting locations within the roof. It was not possible to access these for detailed inspection and time constraints meant that such an exhaustive inspection was impractical.
- 3.13. The static detector was deployed in August but it failed to record due to equipment failure. As a consequence, the fourth monitoring period began in September.

4.0 Results

Daytime inspection of the Church

- 4.1. Architectural and historical details of St. Mary's can be found in the Light Touch Survey report and the Church Plan. In brief summary, the church dates from c1100, with 12th and 14th Century additions.
- 4.2. The roof of the church is composed of loosely fitting Cotswold stone tiles. The south side of the Chancel was re-roofed in 2017. The walls of the church are composed largely of local limestone.
- 4.3. The habitat immediately around the church is composed of a church yard and scattered trees. To the north, the church yard looks out to a valley composed of small pasture fields and large areas of woodland. To the east are buildings associated with the adjacent Manor. To the south are more fields and gardens, whilst to the west is the house and garden of the church warden.
- 4.4. All features of note are shown on the plan in Appendix I. In summary, the following signs of bats were found:
 - 25 serotine droppings on the floor between the font and the tower entrance at the west end of the Nave. On 3rd July (before the start of the second emergence survey), only two droppings were present in this location but a further three droppings were found on a pew in the corner of the Nave at this end of the building.
 - Approximately 20 serotine and brown long-eared bat droppings on the Chancel screen "loft" above the pulpit and below the Chancel arch wall. By July the number of serotine droppings had increased to 30. By August this was 60 droppings.
 - 14 mixed species bat droppings on window-sill on the east gable end of the Chancel, above the altar.
- 4.5. Possible roosting locations on the inside of the church were noted on wall tops, principally the Chancel arch and the Nave west end wall, but these features were too high up and inaccessible for detailed inspection to be possible.
- 4.6. The most likely means of access into the church that could be found from the interior was at eaves level on the south side of the Chancel. Here, daylight could be seen through crevices between the wall top and the roof. Elsewhere in the church, the eaves had been blocked with rockwool insulation.
- 4.7. In addition to the above, it was thought possible that bats could enter the church through the thousands of gaps between Cotswold stone tiles on the roof pitches. Routes to the interior, through the underlying bitumen felt and the boarding between the rafters were thought possible but none were found.
- 4.8. Possible roosting locations on the exterior of the church were noted, including gaps between timbers, between timbers and walls and between loose roof materials such as exposed underfelt.
- 4.9. Urine damage to the lectern and to the organ was noted.
- 4.10. These findings correspond with those of the Light Touch Survey in the following ways:
 - Likely roosting locations on the interior of the church were the same, although the confidence with

which roosts could be identified was lower in 2019. The 2017 survey indicated that there were 3 roosts inside the church, on the west end of the Nave, the Chancel arch and the east end of the Chancel.

- The RSK surveyor considered that the number of serotine bat droppings found at that time could indicate the presence of a maternity roost. This was not consistent with the findings of the 2019 survey, although droppings did accumulate on the Chancel screen “loft” through the season.
- Likely points of entry into the church identified in 2017 and 2019 were broadly the same.
- Brown long-eared bat droppings were not noted in 2017.

Additional daytime inspection of the Church Warden’s house

- 4.11. The presence of a maternity colony of brown long-eared bats was confirmed by observation of a cluster of approximately 20 animals in the loft.

Bat activity surveys

- 4.12. The positions of surveyors and static nightshot cameras during the surveys are shown on Plans 1-4 in Appendix II. The surveyors on the outside of the church remained in place for the duration of the surveys. The surveyor inside the church roved between the cameras, making intermittent observations using a red-filtered torch.

Bat activity survey 1 – 20th May 2019

- 4.13. This was an emergence survey. A single brown long-eared bat was seen flying inside the church 1 hour and 20 minutes after dusk. This animal was not seen to emerge and was thought likely to have entered the building from outside, having day roosted elsewhere (probably in the Warden’s house). The bat was recorded by camera 3 (see Plan 1, Appendix II) alighting on the Nave West wall and then flying away five times within a three minute period. Had it been roosting in this area it would have been recorded by the camera. The bat continued to fly around inside the church for the remainder of the survey.
- 4.14. Serotine, common pipistrelle, soprano pipistrelle and a species of *Myotis* bat (call parameters suggested Natterer’s, *M. nattereri*) were noted flying around the church during the survey. Common pipistrelles were recorded social calling.

Bat activity survey 2 – 15th June 2019

- 4.15. This was a dawn survey. No bats were recorded inside the church.
- 4.16. Common and soprano pipistrelle bats were noted flying around the church during the survey. Very few animals, perhaps only single animals of each species, were present.

Bat activity survey 3 – 3rd July 2019

- 4.17. This was an emergence survey. No bats were recorded inside the church.
- 4.18. Common and soprano pipistrelle, serotine, brown long-eared and a *Myotis* bat were noted flying around the church during the survey. Very few animals, perhaps only single animals of each species,

were present.

Bat activity survey 4 – 21st August 2019

- 4.19. This was an emergence survey. No bats were recorded inside the church for the duration of the survey. However, the lead surveyor remained inside the church for two hours after the end of the emergence survey in order to determine, as had been suspected, whether or not bats entered the building during the night. 35 minutes after the end of the survey (which ended 2 hours after dusk), a serotine bat was noted on the Chancel arch wall on the Nave side, above where the accumulations of droppings noted during the daytime inspections were located. This animal remained in place for nearly an hour and then flew to the opposite wall at the west end of the Nave, where it alighted again and remained in place until the surveyor left the building.
- 4.20. Two brown long-eared bats were noted flying in the Chancel 1 hour and 15 minutes after the end of the survey. These were flying high in the roof, up to the gable end wall and away, never actually alighting on any surfaces. These animals then flew in a manner that at the time was described as “sparring” i.e. the animals were chasing each other, social-calling very loudly. Additional noise heard suggested that the bats were either slapping their wings against each other or against the roof timbers. One of the bats briefly hung on a roof timber and then settled on the Chancel arch on the Nave side, where the serotine bat had previously been night roosting.
- 4.21. On the exterior of the church, two common pipistrelle bats and three *Myotis* bats emerged from under ridge and roof tiles. A further two bats were noted possibly emerging – a common pipistrelle from the tower and a serotine from the ridge line of the Nave.
- 4.22. Common and soprano pipistrelle, noctule (*Nyctalus noctula*), serotine, brown long-eared and *Myotis* bats were noted flying around the church during the survey.

Photo 4.1 – serotine bat night roosting on the west end wall of the Nave.



Static monitoring

4.23. The static bat detector was stationed on the Chancel screen loft as shown on Photo 4.2. Tables showing the full results of static monitoring are presented in Appendix III. A summary table, a chart and interpretation of the data are given in this section of the report. Serotine, brown long-eared and a species of *Myotis* bat were noted to be present during the recording periods. Calls that could not be attributed to a single species were also recorded.

4.24. Static monitoring was achieved over 44 nights between May and October, as shown in Table 4.1 below. This shows that bats were present on 23 nights (52% of all recording periods combined). Perhaps surprisingly, given the amount of droppings found during daytime inspections, serotine was only definitely present on 3 nights (7% of the recording periods combined). Confirmed *Myotis* bats were most frequent, although these only occurred on 17 nights (39% of the recording periods combined). It should be noted, however, that calls from bats that could not be identified were recorded on 15 nights (34% of the recording periods combined). The majority of the recordings were of unassignable social calls and these could have been from any of the species listed.

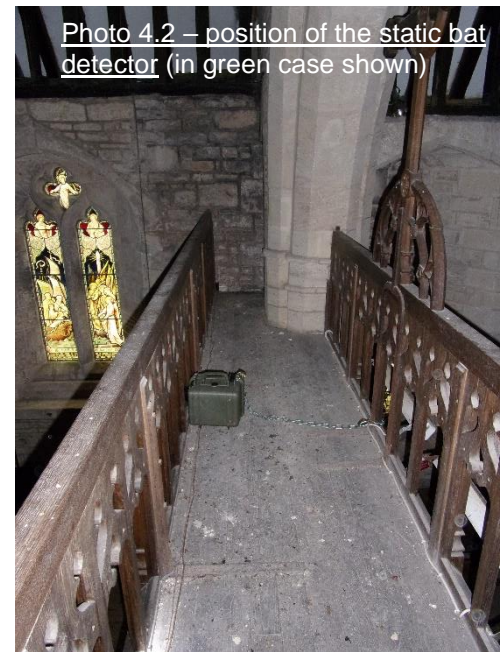
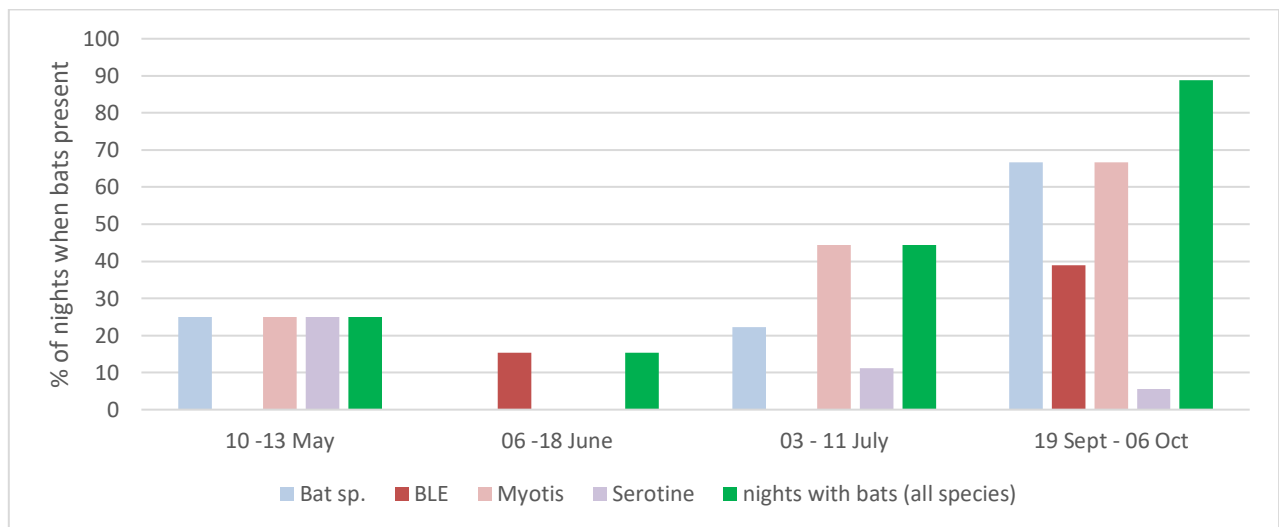


Table 4.1 – monitoring periods and numbers of bat calls recorded

Number of nights when bats were present					nights with bats (all species)	nights with no bats	total nights
Monitoring period	Bat sp.	BLE	<i>Myotis</i>	Serotine			
10 -13 May	1	0	1	1	1	3	4
06 -18 June	0	2	0	0	2	11	13
03 - 11 July	2	0	4	1	4	5	9
19 Sept - 06 Oct	12	7	12	1	16	2	18
Total nights present (all monitoring periods combined)	15	9	17	3	23	21	44
% of monitoring periods in which bats present					nights with bats (all species)	nights with no bats	
Monitoring period	Bat sp.	BLE	<i>Myotis</i>	Serotine			
10 -13 May	25	0	25	25	25	75	
06 -18 June	0	15	0	0	15	85	
03 - 11 July	22	0	44	11	44	56	
19 Sept - 06 Oct	67	39	67	6	89	11	
Total nights present (all monitoring periods combined)	34	20	39	7	52	48	

4.25. It can be seen from the figures presented in this table, in Chart 4.1 below and in the tables in Appendix III, that use of the church by bats was most consistent (i.e. there were fewer nights when bats were absent) during the autumn (September to October) period. This pattern of use is consistent with the limited observations on 21st August of social behaviour by brown long-eared bats that suggest the church is mainly used as a minor swarming/ mating site. The relatively high number of calls from *Myotis* bats in May is unlikely to be indicative of this behaviour, but those in July might be, particularly if the species concerned are whiskered (*M. mystacinus*) and/or Brandt's (*M. brandtii*), two species known to start swarming behaviour earlier than other species (see Table 1 in Appendix III for data from both periods).

Chart 4.1 – percentage of nights when bats were present



4.26. First and last calls of the nights recorded (see Table 2 in Appendix III) suggested that bats were only potentially present roosting during the day on 4 dates out of 44 (9% of dates), as follows:

4.27. A brown long-eared bat was recorded 33 minutes before sunrise on 17th June. This indicates that it may have gone to roost inside the church. The median (mid-point) return time for this species is around 1 hour before dawn (Entwistle et. al. 1996).

4.28. *Myotis* bats were recorded 32 minutes after sunset on 4th July, 29 minutes after sunset on 5th July and 33 minutes after sunset on 29th September. These timings suggest that the bat(s) had emerged from day roost(s) inside the church. Whiskered and Brandt's bats emerge between approximately 30 minutes and 45 minutes after sunset (Berge 2007). Daubenton's bats (*M. daubentonii*) emerge between 24 and 51 minutes after sunset (Shirley et. al. 2001), so these three species at least are possibly present. Median emergence of Natterer's bats (*M. nattereri*) is 75 minutes after dusk (Jones and Rydell, 1994), although there is likely to be sufficient variation in this behaviour that the presence of this species cannot be ruled out. The final two *Myotis* species, Bechstein's bat (*M. bechsteini*) and Alcaho's bat (*M. alcaho*), if present (this is a very rare species in the UK), are highly unlikely to be present because of their rarity and their preference for roosting in trees.

The presence of a serotine bat day roost can be ruled out from these results because the expected emergence time would have been within a few minutes of sunset (see Catto, Racey and Stephenson 1995).

5.0 Conclusion

- 5.1. The species found using the church interior are serotine, brown long-eared and one or more species of the genus *Myotis*. Identification of the first two species was by direct observation, examination of droppings and analysis of echolocation recordings. The *Myotis* species could not be determined because the only evidence for its presence was echolocation recordings from the static bat detector. Echolocation calls of these species are too similar to allow for identification from sonograms alone.
- 5.2. The observations during activity surveys, those made after emergence surveys were completed and the recordings from static detectors suggest strongly that the interior of St. Mary's Church is seldom, if ever, a day roost for any species of bat. Instead, the evidence suggests that bats enter the church some time after dusk, having roosted elsewhere during the day.
- 5.3. The observation of "sparring" brown long-eared bats made on 21st August and the large numbers of social calls recorded by the static detector indicate that the church is used by this species for finding a mate, or asserting ownership/ dominance of the area against other individuals of the same species. Exact uses by serotine and *Myotis* bats were not adequately characterised but it is likely that individuals entered the church to feed on insect prey inside, or to consume prey caught outside.
- 5.4. The exact means of access for bats was not determined because bats entered the church late at night and were gone before the beginning of any dawn survey that was attempted.
- 5.5. In view of the uncertainties outlined above, it is considered that not enough is known about which species use the church and where access points for bats are for site registration under the Bats in Churches Class Licence (BiCCL) to be successful.
- 5.6. Up to seven bats (three common pipistrelle, three *Myotis* bats and one serotine) were noted roosting on the exterior of the church. The presence of these animals is not considered material to the concerns regarding damage to artefacts and inconvenience to parishioners that have been expressed but they should be noted because any re-roofing or other repair works could affect these roosts. To remain lawful, such works should be carried out under a Bat Mitigation Licence (A13).

6.0 Recommendations

Further survey

- 6.1. Further survey is recommended before consideration can be given to the effectiveness of measures taken under the Bats in Churches Class Licence (BiCCL). Suggested elements of this are given below. Ideally, a combination of all techniques would be employed.

Determining which Myotis species use the church

- 6.2. As for all bat licensing, NE should not issue a BiCCL for “all *Myotis*” species because an assessment of the effect of the work on the Favourable Conservation Status (FCS) of the species cannot be made unless the species concerned has been identified. The six species currently known to occur regularly in the UK have very different population sizes and therefore have different conservation needs. In order to determine with some degree of accuracy which *Myotis* species is/ are present, the following could be done:

- Additional static monitoring using time expansion detectors. This might provide sufficient detail on call parameters recorded to allow for more accurate identification of some calls. Whether or not this provides enough information to inform licensing depends on how frequently *Myotis* bats are recorded and the amount of successful monitoring time that is achieved. Time expansion files take up much larger amounts of memory on storage devices (e.g. SD cards) than the frequency division files generated during static monitoring in 2019 so more frequent visits would be required to download devices before they are filled and consequently stop recording bat calls altogether. In addition to this, analysis of calls could take a considerably longer than for frequency division analysis.
- Gathering droppings for DNA analysis. This could be problematic because no droppings that could be reliably attributed to *Myotis* species were found and although the larger *Myotis* species can have droppings similar to those of brown long-eared bat, there were very few of these. Unless accumulations of droppings can be found in the 2020 season, each sample of droppings is likely to be small and therefore may return unreliable results (due, for example, to inadvertent mixing of droppings from more than one species), or the laboratory analysis could fail (due, for example, to having to use old droppings with degraded DNA). This could result in the necessity to gather several samples across the season with no guarantee of success.
- Capture and identification of bats in the hand. Capture for identification inside the church is possible, using a harp trap and an acoustic lure. Given that use of the church by *Myotis* bats is intermittent, the success of such a technique cannot be guaranteed. Any such technique would have to be applied over all or much of the night, at least until a *Myotis* bat was caught and identified.

Further investigation of how bats enter the church

- 6.3. As noted above, the exact means of entry into the church for bats was not determined in 2019. The most likely entry point noted during the daytime inspection is via gaps at the wall top of the Chancel on the south elevation. This could be monitored using nightshot video cameras instead of a surveyor (as was the case in 2019), with the monitoring period extending through the night rather than for 2 hours at dusk or dawn. All-night monitoring could also be attempted for other parts of the church,

including the north elevation of the Chancel.

Additional survey on the interior of the church

- 6.4. The all-night monitoring recommended for the exterior of the church should be accompanied by a similar level of effort inside it. Nightshot cameras should be used to monitor the east Chancel wall and eaves, and the top of the Chancel arch wall, as these could be either a means of entry for bats or a night-roosting location. Accumulated serotine bat droppings on the "loft" above the Chancel screen could be from animal(s) hanging on the wall itself, as was observed at the opposite end of the nave, or from animal(s) emerging from a roost or access point from the outside that may be located between the wall top and the roof materials. Prior to planning such monitoring, the feasibility of creating a means of safe access (scaffolding) for daytime inspection with an endoscope should be considered.

Likely nature of works under a BiCCL and their effect on bats

- 6.5. Once additional information on bat species and entry points has been gathered to adequately inform a site registration under a BiCCL, consideration will need to be given to an effective means of preventing damage to the interior of the church by bats. Given the practical and resource constraints associated with managing the deposition of droppings and urine on artefacts and fixtures, it would seem likely that the only effective solution would be to prevent bats from accessing the main body of the church. If successful, this is likely to fundamentally alter the function of the building for bats. As outlined in the Results section of this report, bats appear to use the large void presented by the church interior as a flying space for expressing social behaviour and probably for catching some prey items. If prevented from flying inside the main body of the church, the bats are unlikely to continue to use it in this manner. If a smaller void were to be provided (e.g. by boxing-in the eaves of the Chancel) this is unlikely to provide a volume of enclosed space that is large enough to allow the behaviour observed in 2019 to be expressed. However, a new feature such as this might be used for other purposes, such as day roosting. The "ecological function" of the building for bats would therefore change. Whether or not this would disrupt the life cycle of the bats concerned so much that their survival could be compromised is likely to remain unknown. It is possible that flying space outside of the church serves the same or a similar function, but this would need to be tested by the additional surveys recommended above.

7.0 References

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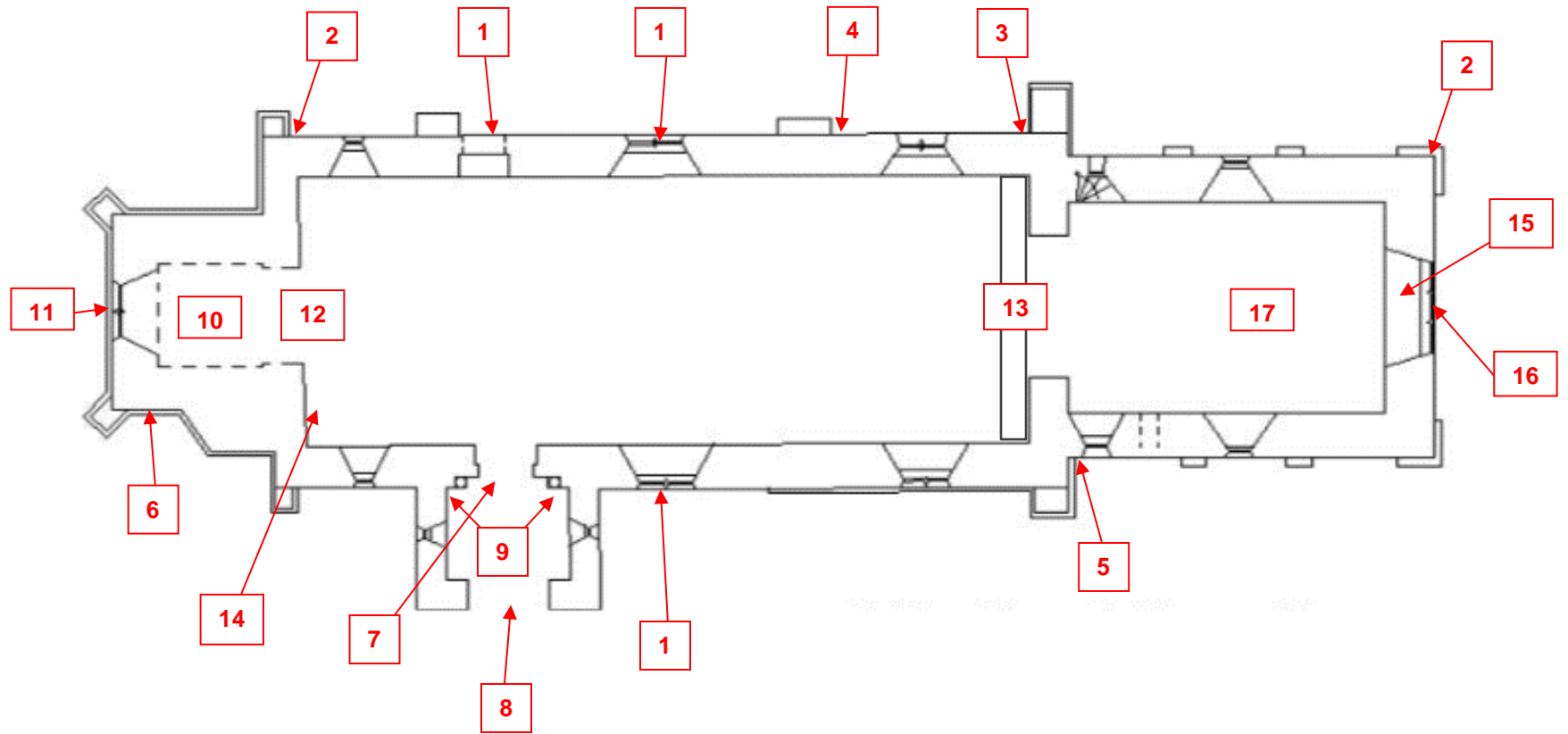
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Appendix I – Bat daytime inspection survey results plan



Key

1

Denotes Target Note (See overleaf for Target Note text)

Target notes

Exterior

1. Gaps between wall plate timbers could allow bats to enter exterior crevices and/or provide a means of access into the interior of the church. However, no corresponding gaps were noted inside the building.



2. Gaps in the corners next to parapet walls of the Nave and Chancel.



3. Gap between lead and slates at the corner of the Nave.
4. A rot hoe in a wall plate.



5. Gap between buttress wall of the Nave and the lead detail against the Chancel roof
6. A possible gap behind the sundial.

Interior

7. Gap between a rafter and the end wall of the porch.



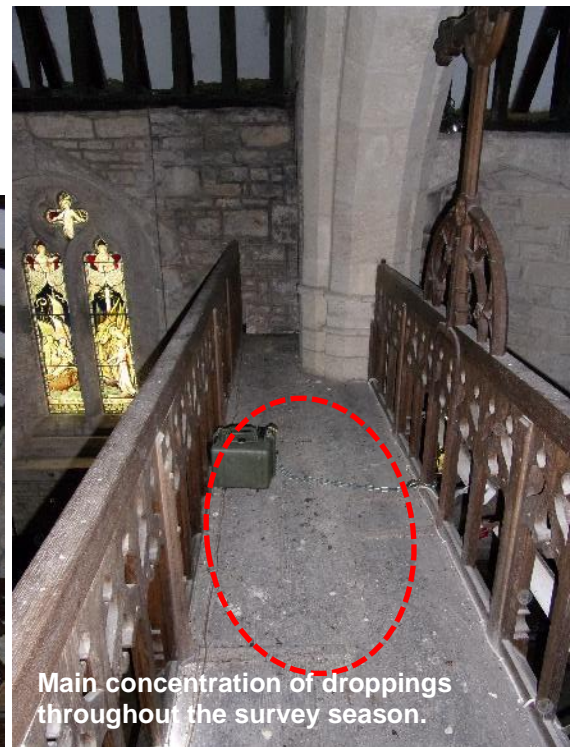
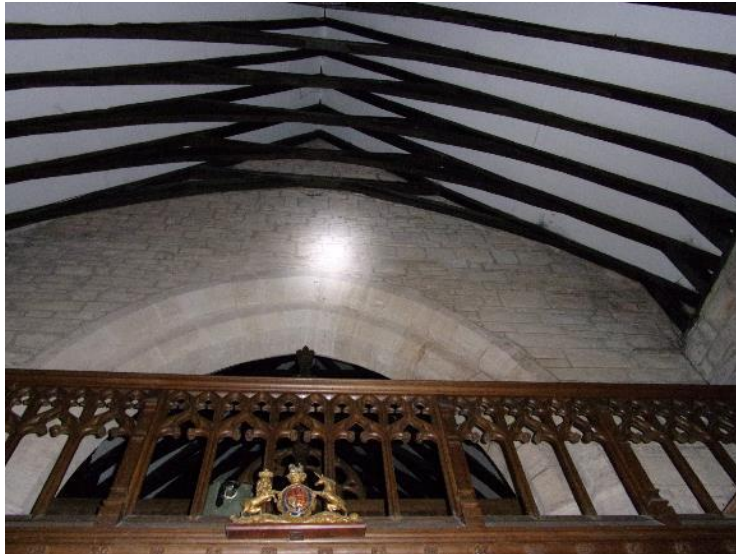
8. Gap next to ridge beam in the porch.
 9. Gaps behind and to the sides of the stone pillars in the porch.
 10. The tower has potential for bat roosting and there are crevices at the tops of windows on the floor below the bells. Bats could enter the tower via gaps around the mesh in the louvred windows of the bell housing but there were no signs and this feature was particularly draughty.



11. Gaps between the floor joists and the outer stone walls of the tower.
 12. 25 serotine and some possible long-eared bat droppings were found in this location in front of the curtained-off area of the tower, on the floor. A further three droppings were noted on the wall. There is a gap between the plaster/ lath of the ceiling and the wall, between the eaves and the ridge line. This could be a bat roost location.
 13. Wall top between Nave and Chancel has a gap more or less all the way from the eaves to the ridge, but unlike the feature observed at Target Note 12, there is no exposed felt. White plasterboard is present throughout.

20 bat droppings found on the Chancel screen "loft" (a balcony – see photos below) above the pulpit and below the Chancel Arch wall, 11 of which were serotine droppings, and the remainder were possible long-eared bat droppings. The number of droppings on this feature gradually built up through the active season, with numbers of serotine droppings increasing at least threefold.

On the Chancel side, the gap between the plasterboard and wall is more evident and this was considered likely to lead to felt. There were no obvious signs of bats in association with this.



Main concentration of droppings throughout the survey season.

14. Approximately 100 serotine droppings were noted in this location, on pews at the back of the Nave, on 21st August, before the emergence survey.
15. 14 probable long-eared bat droppings on sloping sill above altar.
16. The gable end was generally well sealed with mortar but there was a possible gap to the left hand side of the ridge board where a small piece of underfelt could be seen hanging down.
17. Plasterboarding did not meet at the ridge and felt can be seen along ridge line. It was unclear from ground level whether or not any crevices were present, however this was considered unlikely.

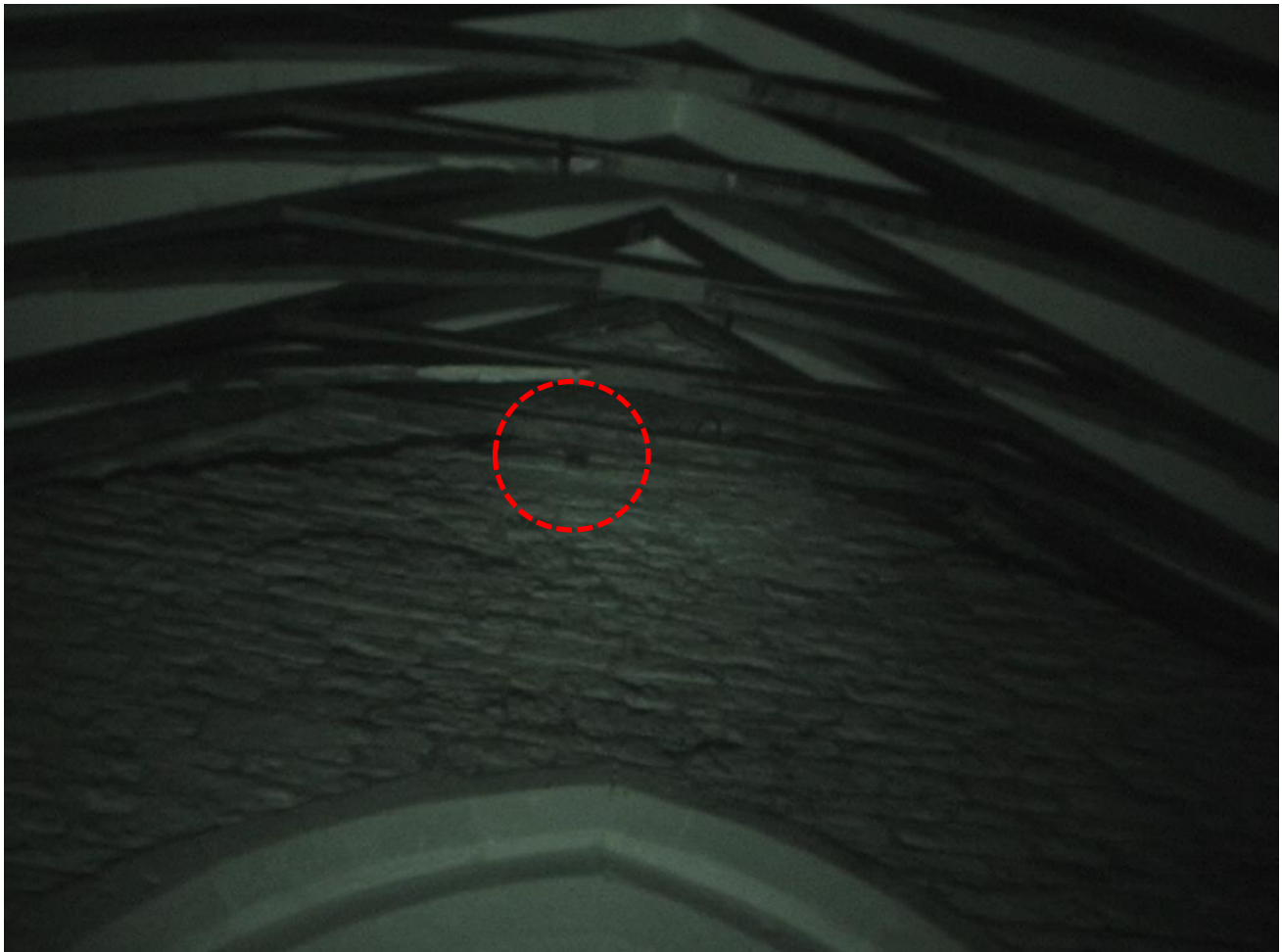
Appendix II – Bat activity survey results plans

Bat activity survey 1

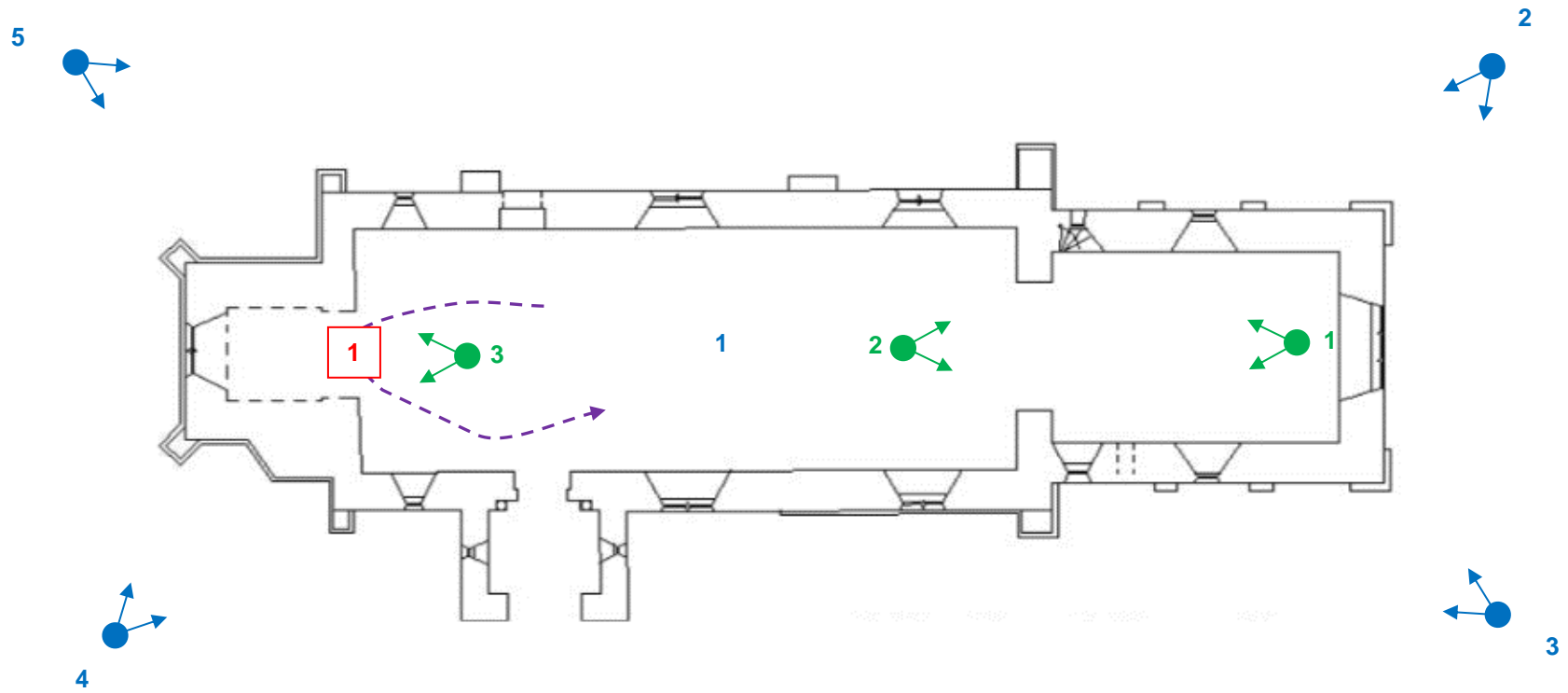
Date	20th May 2019		Sunset/sunrise	20:52
Survey start	20:45		Survey end	22:50
	Start	Middle	End	Detectors used
Temp (°C)	14	13	12	Surveyor 1: Eric Palmer - Pettersson D240x
Rain	Dry	Dry	Dry	Surveyor 2: Matt Pickard – Pettersson D240x
Wind (Bf)	3		4-5	Surveyor 3: Elin Pickard – Anabat SD1
Cloud (%)	90		95	Surveyor 4: Kip Smith – EM3+
				Surveyor 5: Gemma Waters – EM3+

Target Note (see plan overleaf)





1. Brown long-eared bat seen flying inside the church 1 hour and 20 minutes after dusk, alighting on the Nave west end wall five times in 3 minutes.



Bat activity survey 1 – 20th May 2019



Key

-  Position of surveyor with indicative field of view shown by arrows
-  Position of nightshot camera with indicative field of view shown by arrows
-  Target Note
-  Indicative flight line

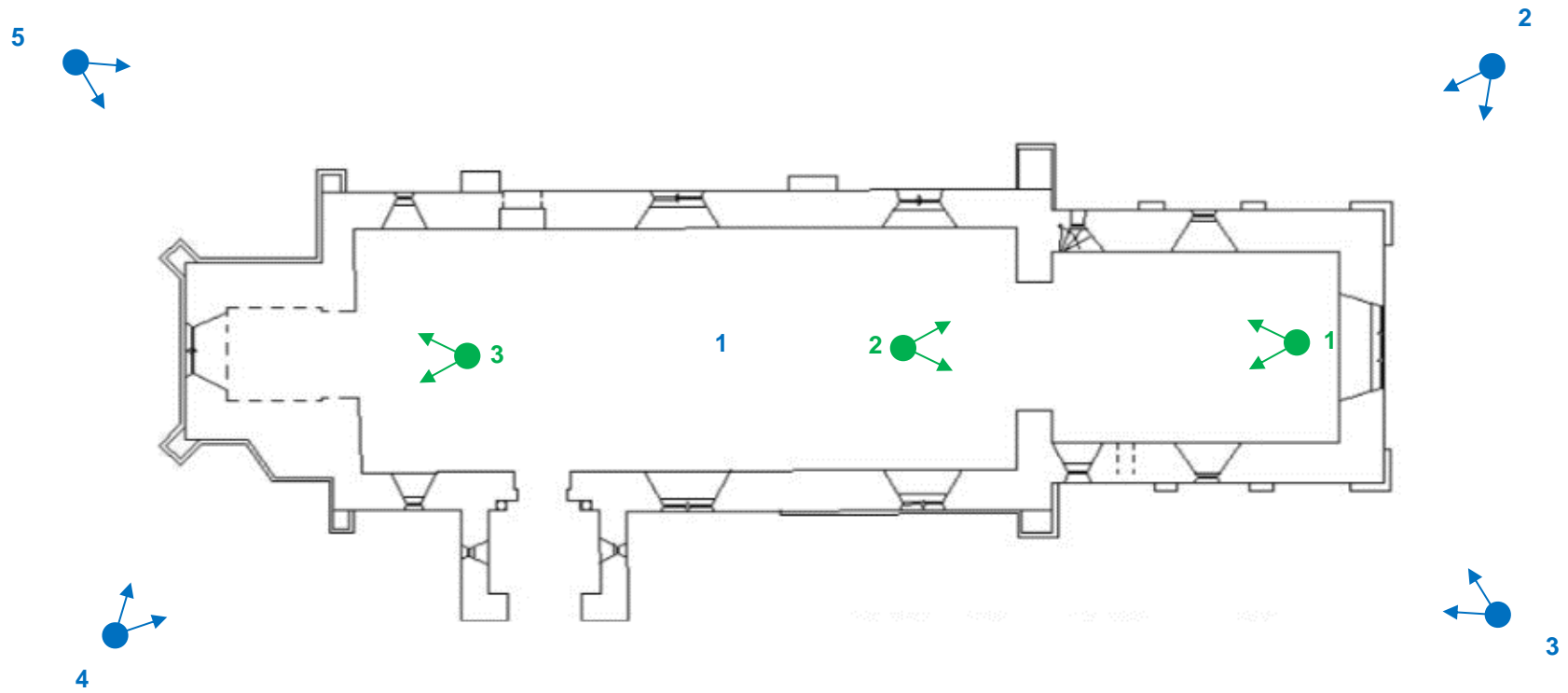
Bat activity survey 2

Date	15th June 2019		Sunset/sunrise	04:49
Survey start	03:20		Survey end	05:00
	Start	Middle	End	Detectors used
Temp (°C)	9	9	10	Surveyor 1: Eric Palmer - Pettersson D240x
Rain	Dry	Dry	Dry	Surveyor 2: Matt Pickard – Pettersson D240x
Wind (Bf)	4	4	4	Surveyor 3: Elin Pickard – Anabat SD1
Cloud (%)	95	50	30	Surveyor 4: James Sweetman – EM3+
				Surveyor 5: Gemma Waters – EM3+





Target Notes (see plan overleaf)

(None)

Bat activity survey 2 – 15th June 2019



Key

-  Position of surveyor with indicative field of view shown by arrows
-  Position of nightshot camera with indicative field of view shown by arrows
-  Target Note
-  Indicative flight line

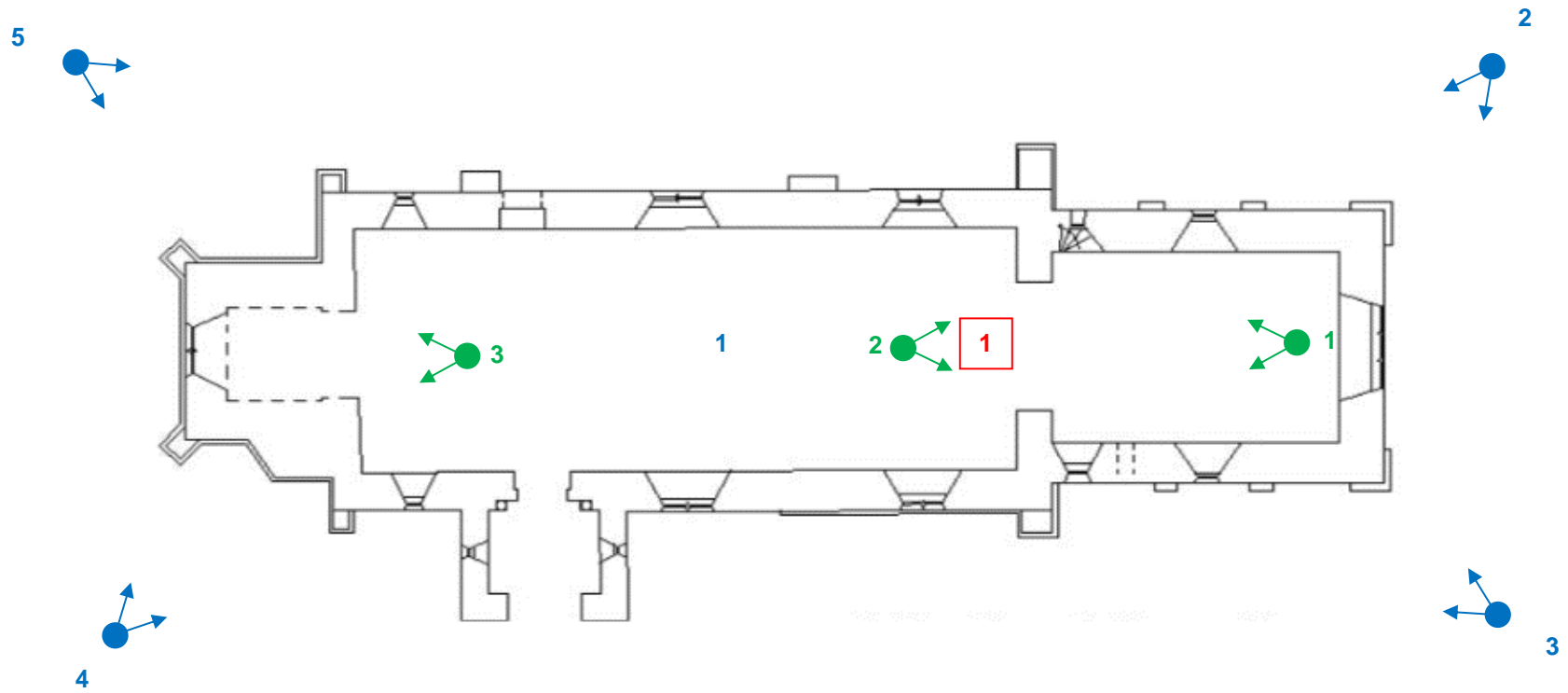
Bat activity survey 3

Date	3rd July 2019		Sunset/sunrise	
Survey start			Survey end	
	Start	Middle	End	Detectors used
Temp (°C)	17	16	15	Surveyor 1: Eric Palmer - Pettersson D240x
Rain	Dry	Dry	Dry	Surveyor 2: Matt Pickard – Pettersson D240x
Wind (Bf)	2	2	3-4	Surveyor 3: Colin Menendez – Anabat SD1
Cloud (%)	0	0	0	Surveyor 4: James Sweetman – EM3+
				Surveyor 5: Gemma Waters – EM3+





Target Notes (see plan overleaf)

1. A common pipistrelle bat may have emerged from the ridge line of the Nave adjacent to the Chancel.

Bat activity survey 3 – 3rd July 2019



Key

-  Position of surveyor with indicative field of view shown by arrows
-  Position of nightshot camera with indicative field of view shown by arrows
-  Target Note
-  Indicative flight line

Bat activity survey 4

Date	21st August 2019		Sunset/sunrise	
Survey start			Survey end	
	Start	Middle	End	Detectors used
Temp (°C)	17	17	16	Surveyor 1: Eric Palmer - Pettersson D240x
Rain	Dry	Dry	Dry	Surveyor 2: Matt Pickard – Pettersson D240x
Wind (Bf)	2	2	2	Surveyor 3: Colin Menendez – Anabat SD1
Cloud (%)	95	90	30	Surveyor 4: James Sweetman – EM3+
				Surveyor 5: Gemma Waters – EM3+

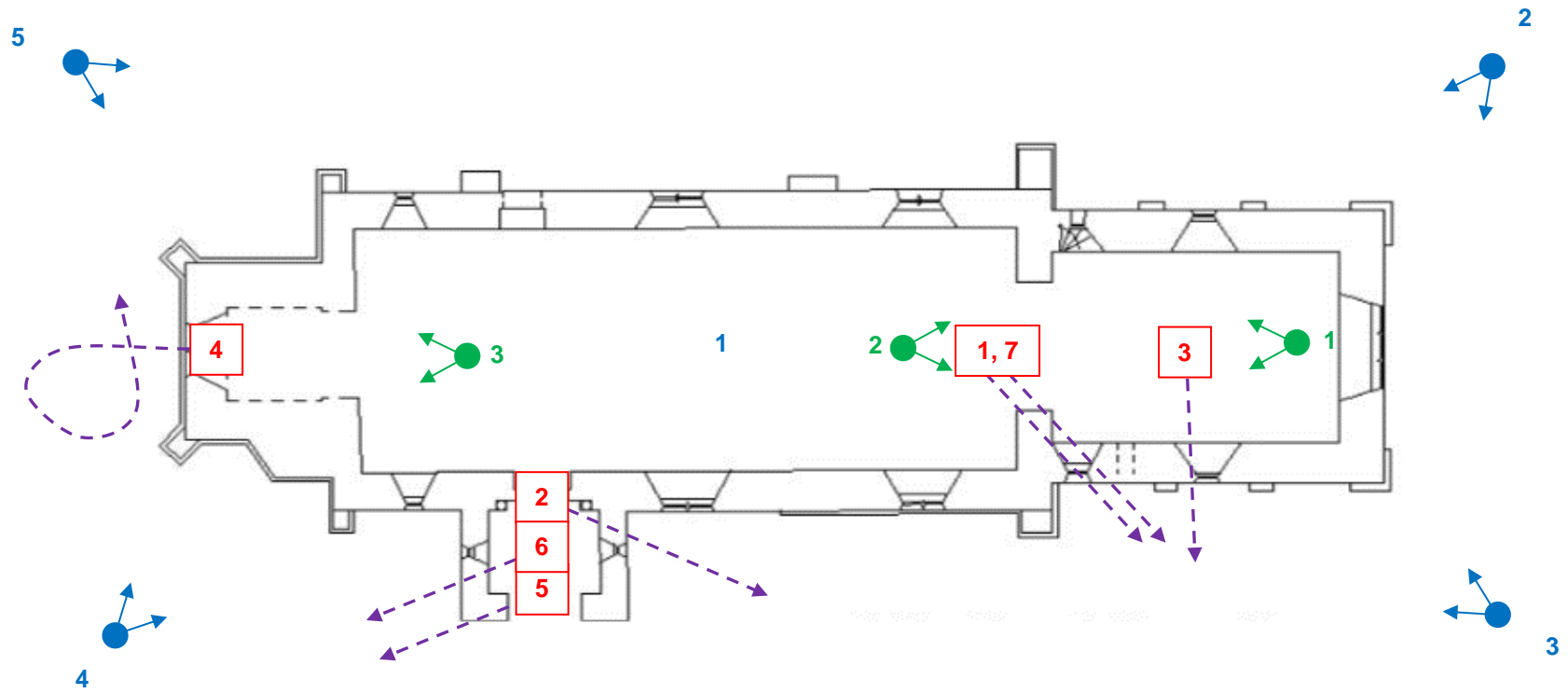
Target Notes (see plan overleaf)

1. A common pipistrelle bat emerged from the ridge line of the Nave adjacent to the Chancel.
2. A *Myotis* bat emerged from a location in this part of the building – either the ridge line of the porch or at eaves level on the Nave above.







3. A common pipistrelle bat emerged from the ridge line of the Chancel.
4. A common pipistrelle bat may have emerged from this louvre vent on the tower.
5. A *Myotis* bat emerged from the ridge line of the porch.
6. A second *Myotis* bat emerged from the ridge line of the porch but from a different location.
7. Possible emergence of a serotine bat from the Nave ridge line. The surveyor who noted this was some distance from the feature and the observation was made some time after dark.

Bat activity survey 4 – 21st August 2019



Key

-  Position of surveyor with indicative field of view shown by arrows
-  Position of nightshot camera with indicative field of view shown by arrows
-  Target Note
-  Indicative flight line

Appendix III – Results of static monitoring

General notes

A single Anabat SD2 bat detector was deployed on the Chancel screen "loft". Further details can be found in the Methods section of this report.

A zero in the total column for a night indicates that no bats were recorded on that night.

Abbreviations used:

Bat sp. Bat species unknown/ indeterminate

BLE Brown long-eared bat

Myotis Indeterminate Myotis species

Table 1 – numbers of bat calls recorded per night

Static monitoring period 1

Date	Bat sp.	BLE	Myotis	Serotine	Total
10/05/2019	0	0	0	0	0
11/05/2019	0	0	0	0	0
12/05/2019	11	0	83	7	101
13/05/2019	0	0	0	0	0
Grand Total	11	0	83	7	101

Static monitoring period 2

Date	Bat sp.	BLE	Myotis	Serotine	Total
06/06/2019	0	0	0	0	0
07/06/2019	0	0	0	0	0
08/06/2019	0	0	0	0	0
09/06/2019	0	0	0	0	0
10/06/2019	0	0	0	0	0
11/06/2019	0	0	0	0	0
12/06/2019	0	0	0	0	0
13/06/2019	0	0	0	0	0
14/06/2019	0	0	0	0	0
15/06/2019	0	0	0	0	0
16/06/2019	0	0	0	0	0
17/06/2019	0	5	0	0	5
18/06/2019	0	1	0	0	1
Grand Total	0	6	0	0	6

Static monitoring period 3

Date	Bat sp.	BLE	Myotis	Serotine	Total
03/07/2019	3	0	77	33	113
04/07/2019	0	0	101	0	101
05/07/2019	3	0	4	0	7
06/07/2019	0	0	3	0	3
07/07/2019	0	0	0	0	0
08/07/2019	0	0	0	0	0
09/07/2019	0	0	0	0	0
10/07/2019	0	0	0	0	0
11/07/2019	0	0	0	0	0
Grand Total	6	0	185	33	224

Static monitoring period 4

Date	Bat sp.	BLE	Myotis	Serotine	Total
19/09/2019	11	0	3	0	14
20/09/2019	12	2	0	0	14
21/09/2019	9	2	2	0	13
22/09/2019	0	0	4	0	4
23/09/2019	0	0	0	0	0
24/09/2019	2	1	9	0	12
25/09/2019	1	0	4	0	5
26/09/2019	10	8	4	1	23
27/09/2019	6	1	6	0	13
28/09/2019	0	0	4	0	4
29/09/2019	0	0	4	0	4
30/09/2019	0	0	4	0	4
01/10/2019	22	11	2	0	35
02/10/2019	10	0	0	0	10
03/10/2019	0	0	0	0	0
04/10/2019	5	0	0	0	5
05/10/2019	4	3	4	0	11
06/10/2019	2	0	0	0	2
Grand Total	94	28	50	1	173

Table 2 – first and last bat calls recorded per night

Date	Sunset	First bat recorded			Sunrise	Last bat recorded		
		Hs after sunset	Species	Time		Hs before sunrise	Species	Time
12/05/2019	20:50	03:15	Serotine	00:05	05:21	05:11	Serotine	00:10
		03:21	<i>Myotis</i>	00:11		01:19	<i>Myotis</i>	04:02
17/06/2019	21:30	06:43	BLE	04:13	04:49	00:33	BLE	04:16
18/06/2019	21:31	06:53	BLE	04:24	04:49			
03/07/2019	21:30	02:11	<i>Myotis</i>	23:41	04:55	01:32	<i>Myotis</i>	03:23
		02:11	Serotine	23:41		05:05	Serotine	23:50
04/07/2019	21:30	00:32	<i>Myotis</i>	22:02	04:56	01:22	<i>Myotis</i>	03:34
05/07/2019	21:29	00:29	<i>Myotis</i>	21:58	04:56	03:14	<i>Myotis</i>	01:42
06/07/2019	21:29	01:24	<i>Myotis</i>	22:53	04:57	01:33	<i>Myotis</i>	03:24
19/09/2019	19:15	03:10	BatSp.	22:25	06:49	06:21	BatSp.	00:28
		04:41	<i>Myotis</i>	23:56		06:39	<i>Myotis</i>	00:10
20/09/2019	19:12	04:27	BatSp.	23:39	06:51	03:48	BatSp.	03:03
		06:20	BLE	01:32		05:16	BLE	01:35
21/09/2019	19:10	02:22	BatSp.	21:32	06:52	02:48	BatSp.	04:04
		05:29	BLE	00:39		05:28	BLE	01:24
22/09/2019	19:08	01:31	<i>Myotis</i>	20:49	06:54	03:32	<i>Myotis</i>	03:22
24/09/2019	19:03	04:07	<i>Myotis</i>	23:10	06:57			
		04:08	BatSp.	23:11		04:28	BatSp.	02:29
		07:17	BLE	02:20				
25/09/2019	19:01	05:25	BatSp.	00:26	06:59			
		05:26	<i>Myotis</i>	00:27		05:11	<i>Myotis</i>	01:48
26/09/2019	18:58	04:41	BLE	23:39	07:00	06:58	BLE	00:02
		04:42	BatSp.	23:40		04:13	BatSp.	02:47
		04:43	Serotine	23:41				
27/09/2019	18:56	01:43	<i>Myotis</i>	20:39	07:02	03:56	<i>Myotis</i>	02:06
		03:41	BatSp.	22:37		10:12	BatSp.	22:49
		03:58	BLE	22:54				
28/09/2019	18:54	01:00	<i>Myotis</i>	19:54	07:04	08:08	<i>Myotis</i>	22:56
29/09/2019	18:51	00:33	<i>Myotis</i>	19:24	07:05	01:32	<i>Myotis</i>	05:33
30/09/2019	18:49	01:30	<i>Myotis</i>	20:19	07:07	10:07	<i>Myotis</i>	21:00
01/10/2019	18:47	07:24	<i>Myotis</i>	02:11	07:09	04:38	<i>Myotis</i>	02:31
		08:29	BLE	03:16		02:11	BLE	04:58
		08:30	BatSp.	03:17		01:57	BatSp.	05:12
02/10/2019	18:45	02:18	BatSp.	21:03	07:10	07:37	BatSp.	23:33
04/10/2019	18:40	01:22	BatSp.	20:02	07:14	07:34	BatSp.	23:40
05/10/2019	18:38	01:31	<i>Myotis</i>	20:09	07:15	08:01	<i>Myotis</i>	23:14
		02:29	BLE	21:07		09:59	BLE	21:16
		02:38	BatSp.	21:16		08:06	BatSp.	23:09
06/10/2019	18:35	05:37	BatSp.	00:12	07:17	05:59	BatSp.	00:18