

## St Mary the Virgin Church, Bromfield

Bat Surveys and Bat Management Plan

**On behalf of Natural England** 

Project Code: EP2021019Av3

Bats in Churches HF Project HG-16-02183: BiC-2021-022

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#### 1 Summary

1.1 Summary of Bat Surveys and Management options

#### Natterer's Bats

- 1.1.1 A maximum of 13 Natterer's bats emerged inside the church on any one survey visit.
- 1.1.2 Therefore, the church provides suitable internal conditions for large summer day roost for Natterer's bats.

Brown long-eared Bats

- 1.1.3 A maximum of eight brown long-eared bats were recorded roosting inside the church on any visit.
- 1.1.4 Therefore, the church provides suitable internal conditions for a **maternity roost of brown long**eared bats<sup>1</sup>.

#### Common pipistrelle bats

- 1.1.5 A maximum of four common pipistrelle bats emerged internally and a maximum of three emerged externally. One common pipistrelle bat flew into the 'Remains of Fox House' and appeared to use this for night roosting.
- 1.1.6 Therefore, the church provides suitable internal conditions for summer day roost for common pipistrelle bats and Remains of Fox House provides a night roost. External features support summer day roosts for common pipistrelle bats.

#### Soprano pipistrelle bats

- 1.1.7 A maximum of six soprano pipistrelles emerged from external features of the church.
- 1.1.8 Therefore, external features support summer day roosts for soprano pipistrelle bats.
- 1.1.9 Bat Management
- 1.1.10 Methods to reduce damage from bat droppings/urine in the church comprise: droppings catchers under the main roost areas; covers; protection for the lectern, pulpit and wall memorials; cleaning support; bat engagement to raise funds for a professional clean in the autumn. Some of these ideas are elaborated on below:

<sup>&</sup>lt;sup>1</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A & C Black Publishers Ltd.

- 1.1.11 Weekly cleaning with DEFRA approved disinfectant (e.g. https://www.safe4disinfectant.com/store/disinfectant-products/disinfectant-cleaner-25l) immediately before services will ensure surfaces are clean of pathogens and thus suitable for public use.
- 1.1.12 Sensitive features (such as the pulpit/lectern) could be covered by polythene transparent sheeting (especially overnight when bats are active) these protective sheets could be removed prior to services in the church.
- 1.1.13 Wall memorials could be fitted with transparent plastic deflectors/trays above them to prevent droppings/urine landing on them.
- 1.1.14 Deflectors or trays could be used over/on the window sills of the east end of the north aisle, which would catch some of the droppings and over the boards of Lord's Prayer, Creed and Commandments at the west end of the nave.
- 1.1.15 Smaller and flatter wall mounted monuments, such as the brass plaque, could be framed and glazed for protection.
- 1.1.16 These methods of protecting the church and its artefacts from bat damage would not require a bat mitigation licence.
- 1.1.17 External roosting opportunities could be provided for bats in the form of wall-mounted bat boxes, By installing bat boxes on the exterior of the church, these may encourage certain species such as common pipistrelle bats to use these features rather than roosting in the church. However, brown long-eared bats, in particular tend to prefer roosting in roof voids (such as the spaces found in the church) although individual bats can use bat boxes.

#### 2 Introduction

#### 2.1 **Scope**

- 2.1.1 Wild Service was commissioned by Natural England as part of the Bats in Churches Project to carry out three dusk emergence surveys, one dawn re-entry survey and a bat walk at St Mary the Virgin, Bromfield, Shropshire, SY8 2JP (hereafter referred to as the 'Site'). The dusk emergence and dawn re-entry surveys were required in order to inform a bat mitigation plan and bat licence application.
- 2.1.2 The bat surveys were requested in order to inform a bat management plan for the church, commissioned as part of the Bats in Churches project, led by Natural England and involving Church of England, the Bat Conservation Trust, the Churches Conservation Trust and Historic England.

#### 2.2 Site Description

- 2.2.1 St Mary the Virgin is located on the outskirts of the village of Bromfield in rural Shropshire. The churchyard surrounding the building includes patches of well-maintained amenity grassland and patches of tall herb/grass. The edges of the church yard are bordered by trees and shrubs, which provide good bat foraging habitat.
- 2.2.2 The landscape surrounding the church includes the River Onny, which passes the church to the north and the River Teme Site of Special Scientific Interest (SSSI), which passes the church to the south, with both rivers converging approximately 350m to the east of the church. The rivers are lined by trees, and there is woodland habitat to the south of the River Teme. The village of Bromfield is located to the north of the Site, and the wider landscape is largely comprised of agricultural fields and boundary hedgerows.

#### 2.3 Background Information

#### 2.3.1 Heritage Considerations

2.3.2 The church of St Mary the Virgin, Bromfield, is a Grade I listed building, with the majority of the building dating from the twelfth, thirteenth and sixteenth centuries (Statement of Significance 2021). Aside from the large amount of surviving building material and structure from the twelfth century, the church has many outstanding interior features, including a seventeenth-century, painted, barrel-vaulted ceiling, wall painting of the Royal Arms, sixteenth-century Flemish glass

'roundels' and nineteenth-century C.E. Kempe & Co stained glass (Statement of Significance 2021). The large amount of bat droppings and urine disrupt the church badly (Statement of Significance 2021). There are several areas where large accumulations of droppings gather and a general spread of droppings throughout the church. There is staining on most furnishings and monuments.

2.3.3 The principal concerns for the church representatives revolve around damage to important artefacts and cleaning (Lewns 2017). The church manages the issue with plastic sheeting, but still find the burden of the amount of cleaning required to remove evidence of roosting bats onerous (Lewns 2017). The areas where bat droppings/urine are most prevalent are the Nave and North Aisle. Bats are reported to have damaged the fabric of church to some degree plus some of the monuments, fixtures and fittings (Lewns 2017). The chancel, wall mounted monuments and woodwork, especially the east end of the north aisle and the pulpit/lectern are considered the main features that need protection from bat droppings/urine (R. Arnold, pers. comm).

#### 2.3.4 Previous Bat Survey Findings

- 2.3.5 Previous bat assessments have been undertaken at the Site and include a bat roost visit in July and August 2017 (Lewns 2017). The 2017 daytime assessment recorded several Natterer's bat *Myotis nattereri* droppings throughout the nave & north aisle, with significant concentrations at the east and west ends of the north aisle and west end of the nave. Lesser concentrations were recorded around potential exit points on the north elevation of the north aisle and on southern/south-eastern, northern and western aspects of the nave. More than 20 adult and juvenile Natterer's bats were also seen in the roof apex at the west end of the north aisle. The report also recorded >50 brown long-eared bat *Plecotus auritus* droppings on the walls and floor around the pulpit and ten fresh droppings below the roof truss at the east end of the nave. Fresh *Plecotus auritus* droppings & feeding remains were also recorded on the ground inside the church. Fresh *Pipistrellus* species droppings were recorded on the wall in the nave and on pews below the roof truss in the nave. The 2017 bat roost visit form also references a 2016 survey in which Natterer's bats were recorded roosting inside the church, though detailed information was not provided.
- 2.3.6 This report presents the findings of the bat emergence/re-entry surveys and bat walk undertaken by Wild Service in 2021. It also proposes mitigation measures to lessen the damage caused by bat droppings/urine.
- 2.3.7 The central Ordnance Survey Grid Reference for the Site is SO 48200 76810.

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#### 2.4 Legislation

- 2.4.1 This report has been prepared in accordance with relevant legislation and policy. Further detail is provided in Appendix 1, however the following primary documents are of relevance:
  - The Wildlife and Countryside Act 1981 (as amended) (WCA 1981);
  - The Countryside and Rights of Way Act (CRoW Act), 2000 (as amended);
  - The Natural Environment and Rural Communities Act (NERC Act), 2006; and
  - The Conservation of Habitats and Species Regulations 2017 (as amended) (CHS 2017).
- 2.4.2 No part of this report should be considered as legal advice and when dealing with individual cases, the client is advised to consult the full texts of the relevant legislation and obtain further legal advice.

#### 3 Methods

#### 3.1 **Preliminary Roost Assessment**

- 3.1.1 The church building was evaluated for evidence of bats and to determine where bats may be roosting within the building by way of an interal and external building inspection undertaken by Elizabeth Pimley (Natural England licence number: 2015-13418-CLS-CLS, WML CL18 (Bat Survey Level 2) on 23<sup>rd</sup> April 2021. The survey was undertaken in accordance with best practice guidelines (based on Collins, 2016).
- 3.1.2 The buildings' exterior was observed from ground level using binoculars and a high-powered torch, paying attention to potential roosting and access points for bats. Internal areas were also accessed where possible. Areas of particular suitability include crevices in stonework, gaps beneath roof tiles and any dark loft spaces. Any suitable areas were searched thoroughly for evidence of use by bats. Signs of bats include live animals, corpses, droppings, urine staining, feeding remains (e.g. moth and butterfly wings) and scratches.

#### 3.2 Dusk Emergence & Dawn Re-entry Surveys

- 3.2.1 Surveyors were positioned around and within the church building so that potential roosting features could be viewed. Surveyors had a radio to facilitate communication between surveyors regarding bat roosting and foraging behaviour and for health and safety reasons. The dusk surveys began approximately 15 minutes prior to sunset and ended between approximately 90–120 minutes after sunset. The dawn survey began 90 minutes before sunrise and ended at sunrise.
- 3.2.2 The survey team comprised Elizabeth Pimley (Natural England licence number: 2015-13418-CLS-CLS, WML CL18 (Bat Survey Level 2)), Julia Morrison, Michelle Newman, Rebecca McKie, Joshua Evans (Natural England licence number: 2015-16640-CLS-CLS, WML CL18), Phil Ward and Karen Evans. Following the guidance of the Bats in Churches Project, volunteers from the local community were also present. The objective of engaging community volunteers is to produce a sustainable network of skilled volunteers able to support churches in order to ensure a future legacy beyond the funded Bats in Churches project. As experienced bat surveyors, member of the Wild Service team was positioned to view features of the building where bats were most likely to be roosting, based on previous assessments and the Preliminary Roost Assessment, and these positions are mapped in Figure 1a. Volunteer positions are mapped where they recorded an emergence/re-entry result.

- 3.2.3 Bat detectors were used to record bat echolocation calls in order to identify the species present. Detectors used comprised Echometer Touch 2 Pro, Pettersson detectors (M500-384 USB Pettersson detectors) and an EM3 detector, all set to time expansion mode. A heterodyne Batbox Duet was also used.
- 3.2.4 Bat surveyors used a red light to inspect the interior of buildings for any bats at intervals during the survey to gain a more detailed understanding of where bats are roosting/feeding.
- 3.2.5 Each surveyor is trained and has prior experience in carrying out dusk emergence/dawn re-entry surveys and the use of bat detectors.

#### 3.3 **DNA Analysis**

3.3.1 Two samples of bat droppings were collected from the chancel and nave during the Preliminary Roost Assessment and sent to the University of Warwick for DNA analysis to confirm the species present.

#### 3.4 Bat Walk

3.4.1 A bat walk led by Elizabeth Pimley was held on 25<sup>th</sup> August 2021 at dusk, arranged in collaboration with the project Engagement Officer representing the church, and the Parochial Church Council (PCC). Where bats were recorded emerging from the building during the bat walk event, these results are included in this report, along with a list of species recorded during the event.

#### 3.5 Limitations and Constraints

3.5.1 While every attempt has been made to collect accurate baseline data, all ecological surveys represent a 'snapshot' of activity. Ecological features are dynamic and often transient, and it is not possible to confirm the absence of a species through survey. It may be necessary to update the ecological surveys if sufficient time elapses since the surveys and data collection presented in this report were carried out.

### 4 Results and Plans of bat access points and roosts

#### 4.1.1 Preliminary Roost Assessment & Dusk/dawn emergence/re-entry surveys

- 4.1.2 The church consists of a nave, north aisle, chancel, and northwest tower. The church building dates back to 1155 and is constructed of sandstone, with clay-tiled roofs. The roof is lined with timber sarking to the underside of the nave, vestry and north aisle roof and there is a plaster barrel ceiling to chancel roof (Lewns 2017) On the south elevation are the 'Remains of Fox house' i.e. a formerly converted section of the church which has now been damaged, with some external walls remaining.<sup>2</sup> There are roosting opportunities for bats externally in the ridges or between tiles/lining, and there is an enclosed loft above the chancel. Internal roosting habitat is provided in the form of gaps between roof timbers, with the roof apex within the north aisle and the nave providing particularly good roosting areas as evidenced by the droppings below.
- 4.1.3 Survey weather data is recorded in Table 1. The results of the dusk emergence survey are summarised below, and full survey results are provided in Tables 2.1., 2.2., 2.3. and 2.4., and surveyor positions are labelled on Figure 1. Reference should be made to the photographs provided in Appendix 2. Bat emergence and re-entry points (i.e. access points) are shown in Figure 1a (pg 11) and bat roosting locations are shown in Figure 1b (pg 12).
- 4.1.4 During the first dusk emergence survey, a total of six Natterer's bats emerged inside the church: two from the apex on the eastern wall of the nave, adjoining the chancel, and four from the apex on the south-east corner wall of the nave. Internally, three brown long-eared bats emerged from the apex on the south-east corner wall of the nave. Four common pipistrelle *Pipistrellus pipisrellus* bats emerged internally: three from the apex on the eastern wall of the nave. Two Natterer's bats were recorded emerging from external features: one from under the eaves of the roof on the south-facing wall of the chancel, and one from under the eaves of the roof between the 'Remains of Fox House' and the chancel. Three common pipistrelle bats emerged from external features of the roof between the 'Remains of the chancel, and the other from under the eaves of the roof between the 'Remains of the chancel, and the other from under the eaves of the roof between the 'Remains of the chancel, and the other from under the eaves of the roof on the south-facing wall of the chancel. Three common pipistrelle bats emerged from external features of the chancel, and the other from under the eaves of the roof between the 'Remains of Fox House' and the other from under the eaves of the roof between the 'Remains of Fox House' and the other from under the eaves of the roof on the south-facing wall of the chancel, and the other from under the eaves of the roof on the south-facing wall of the chancel.

<sup>&</sup>lt;sup>2</sup> https://en.wikipedia.org/wiki/St\_Mary\_the\_Virgin%27s\_Church,\_Bromfield

https://historicengland.org.uk/listing/the-list/list-entry/1291888

*pygmaeus* emerged from under the eaves of the roof between the 'Remains of Fox House' and the chancel.

- 4.1.5 During the second dusk emergence survey, a total of eight brown long-eared bats emerged were recorded roosting inside the church at the start of the survey. These bats were seen roosting in the north aisle, on the west side under a wood rafter on the ceiling and stayed there throughout the survey. Two Natterer's bats emerged internally, from the eastern wall of the nave, adjoining the chancel. Three common pipistrelle bats were recorded emerging from external features, one from under eaves in the corner of the 'Remains of Fox House' and the nave, and two from the north-west corner at the top of the tower. Six soprano pipistrelles emerged from external features: four from a gap under the eaves of the external chancel roof on the south elevation, and two from an undetermined location on the south elevation wall of the nave. One bat was seen roosting on the ceiling along the central beam in the nave, and resembled a brown long-eared bat.
- 4.1.6 During the dawn re-entry survey, a total of seven brown long-eared bats were recorded re-entering the church. One brown long-eared bat returned to the apex of the tower window on the northern side of the church tower. Six brown long-eared bats returned to the lintel above the door of the southern side of the church within the alcove (Remains of Fox House). Three common pipistrelle bats re-entered the church building: two returned to the eastern end of the nave/chancel end, and one returned to the west-facing side of the tower.
- 4.1.7 During the third dusk emergence survey, a total of twelve Natterer's bats emerged from an external feature of the church, all from the corner of the chancel and 'Remains of Fox House'. Four soprano pipistrelle bats emerged externally from the 'Remains of Fox House'. One common pipistrelle bat flew into the 'Remains of Fox House' near the beginning of the survey and was not seen flying out again. Internally, one brown long-eared bat emerged from the apex on the eastern wall of the nave, adjoining the chancel. Seven Natterer's bats emerged from the apex on the eastern wall of the nave, adjoining the chancel, and five emerged from the apex on the south-east corner wall of the nave. One Natterer's bat emerged from apex of North Aisle. Bats flew back and forth within roof void of church.
- 4.1.8 Figures 1a and 1b should be referenced for bat emergence points and roost locations.

#### 4.2 DNA Analysis

4.2.1 The two samples of bat droppings collected from inside the church were both identified as Natterer's *Myotis nattereri*. The full DNA analysis results can be found in Appendix 4.

#### 4.3 Bat Walk

4.3.1 During the walk the following species were recorded: common pipistrelle, soprano pipistrelle, Daubenton's *Myotis daubentonii* (by the river), Brandt's *M. brandtii* (by the church), noctule *Nyctalus noctula*; and Natterer's (within the church). Three common pipistrelles emerged from the roof, and the church warden reported having seen baby bats and droppings on the ledge at the eastern end of the north aisle earlier in the summer of 2021.

4.3.2 Figure 1a. Plan of St. Mary the Virgin, Bromfield (provided by client) including Bat Emergence/Re-entry Points (i.e. bat access points) (CP = Common pipistrelle, SP = Soprano pipistrelle, BLE = Brown long-eared bat, MN = Natterer's bat)



## Figure 1b. Plan of St. Mary the Virgin, Bromfield (provided by client) showing current roosts in pale blue and historic roost in dark blue



Historic roost locations are indicated by pale blue spots.

Survey date	Sunset/ sunrise time	Start/end of survey	Temperature outside (°C)	Temperature inside (°C)	Wind (beaufort scale)	Rain
25/05/2021	21:15	Start 21:00	10.6	Not recorded	0	Light rain for first 10 minutes of survey.
Dusk survey		End 22:58	9.0	Not recorded	1-2	None.
15/06/2021	21.25	Start 21:10	16.8	20.3	0	None.
Dusk survey	21:35	End 23:05	13.2	20.7	0	None.
16/07/2021	05.00	Start 03:00	20.3	Not accessible	0	None.
Dawn survey	05:08	End 05:15	18.0	Not accessible	0	None.
10/08/2021	20:46	Start 20:31	15.3	Not recorded	1	None.
Dusk survey	20:40	End 22:25	14.2	Not recorded	0	None.

#### Table 1: Survey Conditions

Activity		Details					
Time	Туре	Species	No. of bats	Surveyor No.	Location/Behaviour		
20:50	Internal inspection	P. auritus	-	3	Several fresh brown long-eared bat droppings seen on radiator inside church. Fresh droppings also seen on stairs to alter. Natterer's bat droppings were seen by alter steps and possible brown long-eared droppings were seen on radiator on the west side of the church near the font.		
20:58	Emergence - Internal	P. pipistrellus	1	3	One bat emerged from apex on the eastern wall of the nave, adjoining the chancel.		
21:02	Commuting	P. pipistrellus	1	2	One bat seen flying close to chancel area on south elevation of church.		
21:14	Commuting	Unidentified	1	1	One bat flew from west to east toward the trees to the east of the church.		
21:14	Pass	M. nattereri	1	3	Echolocation call detected from outside church.		
21:15	Passes	N. noctula and P. pipistrellus	1 of each	4	Echolocation calls detected. Bats not seen.		
21:20	Pass	Pipistrellus species	1	4	Echolocation call detected. Bat not seen.		
21:20- 21:40	Commuting /foraging	N. noctula	1	4	One bat seen flying around building several times, usually flying from south to north.		
21:20- 21:40	Commuting /foraging	Pipistrellus sp.	Up to 3	4	Up to three bats seen flying around building several times, usually flying from south to north.		
21:24- 21:27	Emergence – External	P. pipistrellus	1	1	One bat emerged from the church, and then foraged above grass in front of church. Exact emergence point was not observed, but likely to be from under eaves of roof, between the 'remains of Fox House', and the chancel.		
21:26	Foraging	P. pipistrellus	2	1	Two bats foraging in grass to the south of the church.		

## Table 2.1. Dusk Emergence Survey Results – 25th May 2021. Sunset 21:15

21:28	Foraging	M. nattereri	1	1	One bat seen foraging in grass to the south of the church.
21:31	Foraging	Unidentified	1	1	One bat seen foraging in grass to the south of the church.
21:32	Foraging	P. pipistrellus	1	1	One bat seen foraging in grass to the south of the church.
21:32	Pass	N. noctula	1	2	Echolocation call detected. Bat not seen.
21:33	Emergence - Internal	P. pipistrellus	2	3	Two bats emerged from apex on the eastern wall of the nave, adjoining the chancel.
21:34	Pass	N. noctula	1	3	Echolocation call detected from outside church.
21:36	Passes	N. noctula	1	1	Echolocation call detected. Bat not seen.
21:38	Pass	N. noctula	1	1	Echolocation call detected. Bat not seen.
21:38	Pass	P. pygmaeus	1	2	Echolocation call detected. Bat not seen.
21:39	Passes	N. noctula	1	1	Echolocation call detected. Bat not seen.
21:40- 21:56	Passes	N. noctula	1	4	Echolocation calls detected. Bats not seen.
21:40- 21:42	Passes	N. noctula	1	1	Echolocation call detected. Bat not seen.
21:40- 44	Commuting /foraging	P. pipistrellus	1	1	One bat flew from south to north past the east gable end of the church.
21:41	Passes	N. noctula	1	2	Echolocation call detected. Bat not seen.
21:44	Commuting /foraging	P. pipistrellus	1	1	One bat flew from south to north past the east gable end of the church.
21:46	Pass	N. noctula	1	1	Echolocation call detected. Bat not seen.
21:46	Passes	N. noctula and P. pipistrellus	1 of each	1	Echolocation calls detected. Bats not seen.
21:48	Pass	P. pygmaeus	1	2	Echolocation call detected. Bat not seen.
21:48- 22:15	Passes	<i>N. noctula</i> and <i>Nyctalus leisleri</i>	1 of each	1	Faint and constant echolocation calls detected. Bats not seen.
21:50- 22:05	Passes	N. noctula	1	4	Echolocation calls detected. Bats not seen.
21:50- 22:05	Passes	<i>Pipistrellus</i> species	1	4	Echolocation calls detected. Bats not seen.
21:51	Foraging	N. noctula	1	2	One bat heard foraging near surveyor.

21:52	Pass	M. nattereri	1	1	Echolocation call detected. Bat not seen.
21:52	Commuting	M. nattereri	1	2	Echolocation calls detected for several minutes. Bats not seen but likely to be passing along river to the south of the building and surveyor.
21:53	Commuting	N. noctula	1	2	One bat seen flying down the river south of the church, from west to east.
21:55	Pass	M. nattereri	1	1	Echolocation call detected. Bat not seen.
21:56	Commuting	M. nattereri	1	1	One large bat flew low from south to north past the east gable end of the church.
21:59	Commuting	N. leisleri	2	1	Two bats flew over east gable end of building, close to roof.
21:59	Emergence - Internal	M. nattereri	1	3	One bat emerged from apex on the eastern wall of the nave, adjoining the chancel.
22:00- 22:35	Commuting /foraging	P. pygmaeus	1	2	Echolocation calls detected throughout this period. Bat not seen but assumed to be foraging nearby.
22:01- 22:11	Foraging	P. pipistrellus	1	1	One bat seen foraging in grass to the south of the church.
22:01- 22:35	Commuting /foraging	P. pipistrellus	1	2	Echolocation calls detected throughout this period. Bat not seen but assumed to be foraging nearby.
22:05	Foraging	N. noctula	1	2	One bat seen flying down the river south of the church, from west to east and foraging for several minutes.
22:05	Pass	N. noctula	1	3	Echolocation call detected from outside church.
22:06	Pass	M. nattereri	1	1	Echolocation call detected. Bat not seen.
22:06	Foraging	M. nattereri	1	2	One bat seen foraging for several minutes.
22:07	Pass	Rhinolophus hipposideros	1	2	Echolocation call detected. Bat not seen.
22:08	Pass	M. nattereri	1	1	Echolocation call detected. Bat not seen.
22:13	Pass	P. pygmaeus	1	1	Echolocation call detected. Bat not seen.
22:14	Pass	M. nattereri	1	1	Echolocation call detected. Bat not seen.

	Emorgonco				One bat emerged from apex on
22:14	Intergence	M. nattereri	1	3	the eastern wall of the nave,
	- mternai				adjoining the chancel.
	Communities				Flew from north to south over
22:15	Commuting	P. pygmaeus	1	1	surveyor, then foraging in grass to
	/foraging				the south of the church.
	_		_	_	Echolocation call detected. Bat
22:15	Pass	P. auritus	1	2	not seen.
					Flew from north to south over
22:17-	Commuting	P. pvamaeus	1	1	surveyor, then foraging in grass to
22:18	/foraging	, , , , , , , , , , , , , , , , , , ,			the south of the church.
					Two bats emerged from apex on
22:17-	Emergence	M. nattereri	2	3	south-east corner wall of the
22:18	- Internal				nave.
					Flew from north to south over
22:19	Commuting	P. pipistrellus	1	1	survevor, then foraging in grass to
	/foraging				the south of the church.
22:20-					Two bats seen foraging in grass to
22:21	Foraging	P. pygmaeus	2	1	the south of the church
					One bat emerged from anex on
22.22	Emergence	M nattereri	1	3	south-east corner wall of the
<i>LL.LL</i>	- Internal	w. nutteren	1	5	
					One bat flow from parth to south
22:23	Commuting	P. pygmaeus	1	1	over surveyor
22:25	Commuting	P. pygmaeus	1	1	One bat flew from west to east
	_				over church.
22:25	Foraging	P. pipistrellus	1	1	One bat seen foraging in grass to
					the south of the church.
22.25	Pass	M nattereri	1	1	Echolocation call detected. Bat
22.25	1 435		-	-	not seen.
22.26	Dace	M nattorari	1	2	Echolocation call detected. Bat
22.20	Fass	w. nulleren	1	5	not seen.
22:26-	_ ·	_			One bat seen foraging in grass to
22:27	Foraging	P. pygmaeus	1	1	the south of the church.
	_				One bat emerged from apex on
22:27	Emergence	P. auritus	1	3	south-east corner wall of the
	- Internal				nave.
					One bat seen foraging in grass to
22:29	Foraging	P. pipistrellus	1	1	the south of the church.
					Two bats emerged from apex on
22:29	Emergence	P. auritus	2	3	south-east corner wall of the
	- Internal		-	•	nave.
		P ninistrellus and	1 of		Echolocation calls detected Bats
22:30	Passes	Myntis sn	each	1	not seen
			cuen		One bat emerged from anex on
	Emergence				south-past corpor wall of the
22:30	- Internal	M. nattereri	1	3	nave and flow into wooden has
	- interridi				by pulpit
					ny haihir

22:32	Pass	P. pipistrellus	1	1	Echolocation call detected. Bat not seen.	
22:32- 22:40	Emergence - External	P. pipistrellus, M. nattereri and P. pygmaeus	1 of each	1	Bats emerged from under eaves of roof, between the 'remains of Fox House' and the chancel.	
22:33	Pass	M. nattereri	1	2	Echolocation call detected. Bat not seen.	
22:35	Passes	M. nattereri	1	3	Echolocation call detected. Bat not seen.	
22:36	Pass	P. auritus	1	2	Echolocation call detected. Bat not seen.	
22:38	Re-entry	Unidentified	1	1	One bat attempted to re-enter under eaves but did not (uncertain which species).	
22:40	Passes	<i>M. nattereri</i> and <i>N. pipistrellus</i>	1 of each	3	Echolocation calls detected. Bat not seen. Nathusius's pipistrelle call could have been detected from outside of church.	
22:42	Foraging	P. pygmaeus	1	1	One bat seen foraging in grass to the south of the church.	
22:43	Emergence - External	P. pipistrellus	1	1	Bat emerged from under eaves of roof on south facing wall of the chancel.	
22:45	Emergence - External	M. nattereri	1	1	Bat emerged from under eaves of roof on south facing wall of the chancel.	
22:45	Foraging	P. pipistrellus	1	1	One bat seen foraging in grass to the south of the church.	
22:58	Emergence - Internal	P. pipistrellus	1	3	One bat emerged from apex on south-east corner wall of the nave and flew inside along ceiling.	
22:58	Survey terminated.					

Activity		Details				
Time	Туре	Species	No. of bats	Surveyor No.	Location/Behaviour	
20:50	Internal inspection	-	_	3	Fresh brown long-eared droppings found in west end of the north aisle (staining also seen on wall here), on a radiator on the west wall of the nave, in the south-east corner of the nave, and in the south-east corner of the chancel. Possible Pipistrellus species droppings seen on the east side of the north aisle, and on the floor in the south-east corner of the nave.	
21:35- End	Roosting	P. auritus	8	3	Eight bats seen roosting in the north aisle, on the west side under a wood rafter on the ceiling and stayed there throughout the survey.	
21:44	Emergence	P. pipistrellus	1	1	One bat emerged form under eaves in the corner of the remains of fox house, and the nave.	
21:50	Pass	P. pipistrellus	1	4	Echolocation call detected. Bat not seen.	
21:50	Pass	P. pygmaeus	1	4	Echolocation call detected. Bat not seen.	
21:51	Pass	P. pipistrellus	1	1	Echolocation call detected. Bat not seen.	
21:51	Commuting	P. pygmaeus	1	4	One bat seen flying to north of surveyor.	
21:53	Commuting	P. pygmaeus	1	4	One bat seen flying to west of surveyor.	
21:54	Emergence - External	P. pipistrellus	1	5	One bat emerged from the north- west corner at the top of the tower.	
21:56	Commuting	P. auritus	2	1	Two bats flew from east to west over the church roof.	
21:57	Emergence	P. pygmaeus	3	1	Three bats emerged from a gap under the eaves of the external chancel roof on the south elevation.	
21:59	Emergence	P. pygmaeus	1	1	One bat emerged from a gap under the eaves of the external	

## Table 2.2. Dusk Emergence Survey Results – 15<sup>th</sup> June 2021. Sunset 21:35

					chancel roof on the south
					elevation.
21:59- 22:10	Foraging	P. pygmaeus	3	1	Three bats foraging over grass to the south of the church.
22:01	Emergence - External	P. pipistrellus	1	5	One bat emerged from the north- west corner at the top of the tower.
22:13	Foraging	Rhinolophus hipposideros	1	4	One bat seen foraging to west of surveyor.
22:14	Commuting	M. nattereri	1	4	One bat seen flying to west of surveyor.
22:17- 22:21	Foraging/soc ial behaviour	P. pygmaeus	2-3	1	Two to three bats foraging over grass to the south of the church. Often two bats were seen chasing each other.
22:21	Pass	P. auritus	1	1	Echolocation call detected. Bat not seen.
22:22	Pass	M. nattereri	1	1	Echolocation call detected. Bat not seen.
22:22	Emergence - Internal	M. nattereri	2	3	Two bats emerged from eastern wall of the nave, adjoining the chancel.
22:22	Commuting	M. nattereri	1	5	Bat flying to north of surveyor.
	Emergence -				Two bats emerged from building
22:24	External/ social calls	P. pygmaeus	2	1	but exact location could not be seen.
22:24 22:25	External/ social calls Roosting	P. pygmaeus Unidentified	2	1 3	but exact location could not be seen. One bat seen roosting on the ceiling along the central beam in the nave. No echolocation call detected.
<b>22:24 22:25</b> 22:25	External/ social calls Roosting Commuting	P. pygmaeus Unidentified N. noctula	2 1 1	<b>1</b> <b>3</b> 5	but exact location could not be seen. One bat seen roosting on the ceiling along the central beam in the nave. No echolocation call detected. One bat flew from north to west.
<b>22:24</b> <b>22:25</b> 22:25 22:26	External/ social calls Roosting Commuting Pass	P. pygmaeus Unidentified N. noctula E. serotinus	2 1 1	1 3 5 1	but exact location could not be seen.         One bat seen roosting on the ceiling along the central beam in the nave. No echolocation call detected.         One bat flew from north to west.         Echolocation call detected. Bat not seen.
<b>22:24</b> <b>22:25</b> 22:25 22:26 22:26- 22:41	External/ social calls Roosting Commuting Pass Foraging	P. pygmaeusUnidentifiedN. noctulaE. serotinusP. pygmaeus	2 1 1 2	1 3 5 1 5	but exact location could not be seen.         One bat seen roosting on the ceiling along the central beam in the nave. No echolocation call detected.         One bat flew from north to west.         Echolocation call detected. Bat not seen.         One bat seen foraging over graveyard to the west of the church.
<b>22:24</b> <b>22:25</b> 22:25 22:26 22:26 22:41 22:27- 22:36	External/ social calls Roosting Commuting Pass Foraging Passes	P. pygmaeusUnidentifiedN. noctulaE. serotinusP. pygmaeusP. pygmaeus	2 1 1 2 2	1 3 5 1 5 1	but exact location could not be seen.         One bat seen roosting on the ceiling along the central beam in the nave. No echolocation call detected.         One bat flew from north to west.         Echolocation call detected. Bat not seen.         One bat seen foraging over graveyard to the west of the church.         Echolocation call detected. Bat not seen.
22:24 22:25 22:25 22:26 22:26 22:41 22:27- 22:36 22:30- 22:33	External/ social calls Roosting Commuting Pass Foraging Passes Foraging	P. pygmaeusUnidentifiedN. noctulaE. serotinusP. pygmaeusP. pygmaeusP. pygmaeusand M. nattereri	2 1 1 2 2 1 of each	1 3 5 1 5 1 1 1	but exact location could not be seen.One bat seen roosting on the ceiling along the central beam in the nave. No echolocation call detected.One bat flew from north to west.Echolocation call detected. Bat not seen.One bat seen foraging over graveyard to the west of the church.Echolocation call detected. Bat not seen.Bats seen foraging continuously in grass to the south of the church.
22:24 22:25 22:25 22:26 22:26 22:41 22:27- 22:36 22:30- 22:33 22:30- 22:33	External/ social calls Roosting Commuting Pass Foraging Passes Foraging Passes	<ul> <li>P. pygmaeus</li> <li>Unidentified</li> <li>N. noctula</li> <li>E. serotinus</li> <li>P. pygmaeus</li> <li>P. pygmaeus</li> <li>P. pygmaeus</li> <li>and M. nattereri</li> <li>N. noctula</li> </ul>	2 1 1 2 2 1 of each 1	1 3 5 1 5 1 1 1 1 1	<ul> <li>but exact location could not be seen.</li> <li>One bat seen roosting on the ceiling along the central beam in the nave. No echolocation call detected.</li> <li>One bat flew from north to west.</li> <li>Echolocation call detected. Bat not seen.</li> <li>One bat seen foraging over graveyard to the west of the church.</li> <li>Echolocation call detected. Bat not seen.</li> <li>Bats seen foraging continuously in grass to the south of the church.</li> <li>Occasional echolocation calls detected. Bat not seen.</li> </ul>
22:24 22:25 22:25 22:26 22:26 22:41 22:27- 22:36 22:30- 22:33 22:30- 22:33 22:34- 22:44	External/ social calls Roosting Commuting Pass Foraging Passes Foraging Passes Foraging Passes	<ul> <li>P. pygmaeus</li> <li>Unidentified</li> <li>N. noctula</li> <li>E. serotinus</li> <li>P. pygmaeus</li> <li>P. pygmaeus</li> <li>P. pygmaeus</li> <li>and M. nattereri</li> <li>N. noctula</li> <li>P. pygmaeus</li> </ul>	2 1 1 2 2 1 of each 1 1-2	1 3 5 1 5 1 1 1 1 1 1	<ul> <li>but exact location could not be seen.</li> <li>One bat seen roosting on the ceiling along the central beam in the nave. No echolocation call detected.</li> <li>One bat flew from north to west.</li> <li>Echolocation call detected. Bat not seen.</li> <li>One bat seen foraging over graveyard to the west of the church.</li> <li>Echolocation call detected. Bat not seen.</li> <li>Bats seen foraging continuously in grass to the south of the church.</li> <li>Bats seen foraging continuously in grass to the south of the church.</li> <li>Bats seen foraging continuously in grass to the south of the church.</li> </ul>

22:42	Passes	<i>N. noctula</i> and <i>M. nattereri</i>	1 of each	1	Echolocation calls detected. Bats not seen.	
22:42	Pass	N. noctula	1	1	Echolocation call detected. Bat not seen.	
22:44	Foraging	R. hipposideros	1	5	One bat seen foraging by trees to the north of the church.	
22:46	Foraging/ social behaviour	P. pygmaeus	2	1	Two bats seen foraging and flying together in grass to the south of the church.	
22:46	Pass	N. noctula	1	1	Echolocation call detected. Bat not seen.	
22:47- 23:00	Foraging	P. pygmaeus	1	5	One bat seen foraging over graveyard to the west of the church.	
22:49- 22:56	Social behaviour	P. pygmaeus and M. nattereri	4 bats seen	1	Four bats seen flying in circles together in front of the church building.	
22:50	Pass	N. noctula	1	1	Echolocation call detected. Bat not seen.	
22:50	Foraging	P. pipistrellus	1	5	One bat seen foraging by trees to the north of the church.	
22:52	Foraging	P. pygmaeus and M. nattereri	3-4	1	Four bats seen foraging and flying together in grass to the south of the church.	
22:53	Foraging	P. pygmaeus	1-2	1	Two bats seen foraging and flying together in grass to the south of the church.	
22:55	Pass	N. noctula	1	1	Echolocation call detected. Bat not seen.	
23:05	Survey terminated.					

Activity		Details				
Time	Туре	Species	No. of bats	Surveyor No.	Location/Behaviour	
03:05- 03:33	Foraging	P. pipistrellus	1-2	1,4&5	One common pipistrelle seen foraging around the Site, but especially along the trees of the northern side of the church.	
03:12- 03:45	Foraging	P. pygmaeus	1	4 & 5	Regular foraging along the tree edge on the northern side of the church.	
03:20, 04:06- 04:16	Foraging	P. auritus	5	1,4&5	BLEs foraging mostly on the southern side of church and occasionally on the northern side.	
03:44- 03:58	Foraging	M. nattereri	1	5	Myotis foraging along the northern side of the church.	
03:52	Commuting	R. hipposideros	1	5	Bat briefly passed along the northern side of the church.	
04:08	Re-entry	P. auritus	1	5	One brown long-eared bat returned to the apex of the tower window on the northern side of the church tower.	
04:18- 04:26	Re-entry	P. auritus	6	1	Six brown long-eared bats returned to the lintel above the door of the southern side of the church within the alcove.	
04:37- 04:39	Re-entry	P. pipistrellus	2	4	Two common pipistrelle bats returned to the eastern end of the nave/chancel end.	
04:49	Re-entry	P. pipistrellus	1	5	Common pip returned to the west-facing side of the tower.	
03:05- 03:33	Foraging	P. pipistrellus	1-2	1,4&5	One common pipistrelle seen foraging around the Site, but especially along the trees of the northern side of the church.	
03:12- 03:45	Foraging	P. pygmaeus	1	4 & 5	Regular foraging along the tree edge on the northern side of the church.	
03:20, 04:06- 04:16	Foraging	P. auritus	5	1, 4 & 5	Foraging mostly on the southern side of church and occasionally on the northern side.	
03:44- 03:58	Foraging	M. nattereri	1	5	Myotis foraging along the northern side of the church.	
03:52	Commuting	R. hipposideros	1	5	Bat briefly passed along the northern side of the church.	
04:08	Re-entry	P. auritus	1	5	One brown long-eared bat returned to the apex of the	

## Table 2.3. Dawn Re-entry Survey Results – 16<sup>th</sup> July 2021. Sunrise 05:08

					tower window on the northern side of the church tower.
04:18- 04:26	Re-entry	P. auritus	6	1	Six brown long-eared bats returned to the lintel above the door of the southern side of the church within the alcove.
04:37- 04:39	Re-entry	P. pipistrellus	2	4	Two common pipistrelle bats returned to the eastern end of the nave/chancel end.
04:49	Re-entry	P. pipistrellus	1	5	Common pip returned to the west-facing side of the tower.
05:15	Survey termina	ated.			

Activity		Details				
Time	Туре	Species	No. of bats	Surveyor No.	Location/Behaviour	
20:51	Entry	P. pipistrellus	1	1	One bat flew from east to west into the 'Remains of Fox House'	
20:57	Emergence - External	P. pygmaeus	1	1	One bat emerged from the 'Remains of Fox House'	
21:01	Pass	P. pygmaeus	1	1	Echolocation call detected. Bat not seen.	
21:02	Emergence - External	P. pygmaeus	1	1	One bat emerged from the 'Remains of Fox House', then seen flying over grass in churchyard.	
21:04	Emergence - External	P. pygmaeus	1	1	One bat emerged from the 'Remains of Fox House', then seen flying over grass in churchyard.	
21:08	Emergence - External	P. pygmaeus	1	1	One bat emerged from the 'Remains of Fox House' and two bats seen chasing each other over grass in churchyard.	
21:08	Emergence - Internal	M. nattereri	1	3	One bat emerged from apex on the eastern wall of the nave, adjoining the chancel.	
21:08- 21:38	Foraging	P. pygmaeus	3	1	Three bats seen foraging continuously over grass in churchyard.	
21:11	Pass	P. pygmaeus	1	2	Echolocation call detected. Bat not seen.	
21:11	Pass	M. nattereri	1	3	Echolocation call detected. Bat not seen.	
21:14	Foraging	P. pygmaeus	1	2	One bat seen foraging around the churchyard.	
21:15	Commuting	P. pygmaeus	1	2	One bat flew past surveyor.	
21:15	Emergence - Internal	M. nattereri	1	3	One bat emerged from apex on the eastern wall of the nave, adjoining the chancel.	
21:16	Pass	N. noctula	1	1	Echolocation call detected. Bat not seen.	
21:16	Commuting	N. noctula	1	5	One bat flew from south to north past the church.	
21:16- 22:18	Regular passes	P. pygmaeus	1	2	Soprano pipistrelle calls were detected throughout the survey almost every minute, though the bats were not often seen.	

## Table 2.4. Dusk Emergence Survey Results – 10<sup>th</sup> August 2021. Sunset 20:46

					Occasionally more that one bat was heard at a time and it is possible the calls detected were from the bats seen by surveyor 1, or from bats commuting along the river to the south of the church behind surveyor 2.
21:17	Commuting	P. pygmaeus	1	2	One bat flew past surveyor.
21:17	Pass	N. noctula	1	2	Echolocation call detected. Bat not seen.
21:18	Pass	M. nattereri	1	3	Echolocation call detected. Bat not seen.
21:23- 25	Passes	M. nattereri	2	3	Echolocation call detected. Bat not seen.
21:25	Passes	P. pipistrellus	1	5	Echolocation call detected. Bat not seen.
21:27- 49	Foraging	P. pygmaeus	1	5	Echolocation call detected. Bat not seen. Likely foraging near surveyor.
21:28	Emergence - Internal	P. auritus	1	3	One bat emerged from apex on the eastern wall of the nave, adjoining the chancel.
21:30	Pass	M. nattereri	1	3	Echolocation call detected. Bat not seen.
21:31	Roosting	M. nattereri	2	3	Two bats seen flying around the nave inside the church.
21:32	Roosting	M. nattereri	1	1	One bat seen roosting in the corner of the external roof between the chancel and 'Remains of Fox House'.
21:32	Commuting	P. pygmaeus	1	2	One bat flew past surveyor.
21:32	Emergence - Internal	M. nattereri	1	3	One bat emerged from the corner of the chancel.
21:34	Emergence - External	M. nattereri	1	1	One bat emerged from corner of chancel and 'Remains of Fox House'.
21:34	Pass	M. nattereri	1	3	Echolocation call detected. Bat not seen.
21:35	Rentry - Internal	M. nattereri	2	3	Two bats went back into the corner of the chancel, near the pulpit.
21:36	Emergence - Internal	M. nattereri	1	3	One bat emerged from apex on the eastern wall of the nave, adjoining the chancel.
21:36- 50	Foraging	M. nattereri	1	5	Echolocation call detected. Bat not seen. Likely foraging near surveyor.

21:37	Pass	M. nattereri	1	1	Echolocation call detected. Bat not seen.
21:38	Commuting	M. nattereri	1	1	One bat flew past surveyor from
21:38	Emergence - Internal	M. nattereri	1	3	One bat emerged from apex on the eastern wall of the nave, adjoining the chancel.
21:39	Foraging	P. pygmaeus	1	2	One bat seen foraging around the churchyard.
21:39	Emergence & Re-entry - Internal	M. nattereri	1	3	One bat emerged from the apex in the chancel and then flew into the corner of the chancel above the pulpit.
21:40	Foraging	M. nattereri	1	1	Bat heard/seen foraging in churchyard in front of surveyor.
21:40	Pass	M. nattereri	1	2	Echolocation call detected. Bat not seen.
21:40	Commuting	P. pygmaeus	1	2	One bat flew past surveyor.
21:40	Emergence - Internal	M. nattereri	2	3	Two bats emerged from between the apex and corner roosting of the chancel from behind the wooden beam.
21:42	Foraging	M. nattereri & P. pygmaeus	1 of each	1	Bats heard/seen foraging in churchyard in front of surveyor.
21:42	Roosting	M. nattereri	2	3	Two bats seen flying around the nave inside the church.
21:43	Passes	M. nattereri & P. pygmaeus	1 of each	1	Echolocation calls detected. Bats not seen.
21:43	Roosting	M. nattereri	2	3	Two bats seen flying around the corner roost in the chancel.
21:44	Commuting	N. noctula	1	5	Echolocation call detected. Bat not seen.
21:45	Passes	P. pygmaeus N. noctula	1 of each	1	Echolocation calls detected. Bats not seen.
21:46	Pass	M. nattereri	1	3	Echolocation call detected. Bat not seen.
21:47	Roosting	M. nattereri	2	3	Two bats seen flying around the corner roost in the chancel.
21:48	Passes	P. pipistrellus & M. nattereri	1 of each	1	Echolocation calls detected. Bats not seen.
21:48	Re-entry - Internal	M. nattereri	1	3	One bat flew into the apex of the chancel.
21:48	Emergence - Internal	M. nattereri	2	3	Two bats flew out of the apex of the chancel.

21:49	Pass	M. nattereri	1	1	Echolocation call detected. Bat not seen.
21:49	Emergence - External	M. nattereri	1	1	One bat emerged from corner of chancel and 'Remains of Fox House'.
21:49	Emergence - Internal	M. nattereri	3	3	Three bats emerged from the corner of the chancel and the wooden beam between the corner and apex of the chancel.
21:49	Foraging	P. pipistrellus	1	5	Echolocation call detected. Bat not seen. Likely foraging near surveyor.
21:50	Foraging	M. nattereri	2-3	1	Bats heard/seen foraging in churchyard in front of surveyor.
21:50	Roosting/em ergence	M. nattereri	3	3	Three bats seen circling between the corner roost and apex roost and appeared to have emerged from apex roost then flying to the corner, then flying behind the wooden beam.
21:50	Foraging	M. nattereri	1	5	Echolocation call detected. Bat not seen. Likely foraging near surveyor.
21:52	Emergence - External	M. nattereri	1	1	One bat emerged from corner of chancel and 'Remains of Fox House'.
21:52	Roosting	M. nattereri	2	3	Two bats seen flying around the corner roost in the chancel, above pulpit area.
21:53	Emergence - External	M. nattereri	1	1	One bat emerged from corner of chancel and 'Remains of Fox House'.
21:53	Emergence & Re-entry - Internal	M. nattereri	1	3	One bat emerged from the corner of the chancel and appeared to fly back in.
21:54	Roosting	M. nattereri	2	3	Two bats seen flying around the corner roost in the chancel and up to the apex roost.
21:54	Commuting	N. noctula	1	5	Echolocation call detected. Bat not seen.
21:55	Roosting	M. nattereri	2	3	Two bats seen flying around the corner roost in the chancel and the apex.
21:56	Foraging	M. nattereri	1	5	Echolocation call detected. Bat not seen. Likely foraging near surveyor.
21:57	Roosting	M. nattereri	2	3	Two bats seen flying around the corner roost in the chancel.

	Emorgonco				One bat emerged from area in
21:58	Internal	M. nattereri	1	3	the north aisle of the church and
	interna				then flew around the north aisle.
21.28	Commuting	N poctula	1	5	Echolocation call detected. Bat
21.50	commuting	N. Hoctala	1	5	not seen.
22.00	Dace	D ninistrallus	1	1	Echolocation call detected. Bat
22:00	Pass	P. pipistrellus	T	T	not seen.
22.00	Dava		4	2	Echolocation call detected. Bat
22:00	Pass	M. nattereri	L	3	not seen.
				_	One bat flew across the nave of
22:02	Roosting	M. nattereri	1	3	the church.
					Echolocation call detected. Bat
22:02	Foraging	P. pygmaeus	1	5	not seen. Likely foraging near
					surveyor.
				_	Echolocation call detected. Bat
22:02	Commuting	P. auritus	1	5	not seen.
	_				Echolocation call detected. Bat
22:03	Pass	M. nattereri	1	1	not seen.
					Echolocation call detected. Bat
22:03	Foraging	P. pygmaeus	1	1	not seen. Feeding sounds heard.
					One bat flew across the apex
22:03	Roosting	M. nattereri	1	3	roost in the chancel
					One bat seen flying around the
22:06	Roosting	M. nattereri	1	3	roost at the font
22:07	Pass	M. nattereri	1	1	not soon
					Tobalasation call datasted Dat
22.07	Foraging	P. quritus	1	5	not soon. Likely foraging poor
22.07	FULAGING	P. uuntus	1	5	Suppore
					Two bats seen flying around the
22:07-	Roosting	M nattereri	2	3	aney of the corner roost of the
10	Noosting	W. Hatteren	2	5	chancel.
					Echolocation call detected Bat
22:08	Pass	N. noctula	1	1	not seen
					Echolocation call detected Bat
22:09	Pass	N. noctula	1	2	not seen
					One bat emerged from corner of
22.10	Emergence -	M nattereri	1	1	chancel and 'Remains of Fox
22.10	External	Wi. Hutteren	-	-	House'
					Two bats seen flying around
22:10-	Roosting	M. nattereri	2	3	with activity focussed on the
11			_	•	corner roost of the chancel.
					Echolocation call detected. Bat
22:11	Commuting	N. noctula	1	5	not seen.
					Echolocation call detected Bat
22:12	Pass	N. noctula	1	2	not seen.
					Five hats emerged from corner of
22:12-	Emergence -	M. nattereri	5	1	chancel and 'Remains of Fox
22:16	External			-	House'.
	1	1	I	I	

22:13	Pass	M. nattereri	1	3	Echolocation call detected. Bat not seen.
22:13	Foraging	M. nattereri	1	5	Echolocation call detected. Bat not seen. Likely foraging near surveyor.
22:13	Commuting	P. auritus	1	5	Echolocation call detected. Bat not seen.
22:13- 16	Roosting	M. nattereri	2	3	Two bats seen flying around the apex of the corner roost of the chancel.
22:15	Pass	M. nattereri	1	2	Echolocation call detected. Bat not seen.
22:15	Foraging	P. pygmaeus	1	5	Echolocation call detected. Bat not seen. Likely foraging near surveyor.
22:16	Emergence - External	M. nattereri	1	1	One bat emerged from corner of chancel and 'Remains of Fox House'.
22:16	Roosting	M. nattereri	2	3	Two bats seen flying around the apex of the corner roost of the chancel.
22:19	Pass	N. noctula	1	2	Echolocation call detected. Bat not seen.
22:19	Roosting	M. nattereri	2	3	Two bats seen flying around the nave/chancel border.
22:20	Emergence - External	M. nattereri	1	1	One bat emerged from corner of chancel and 'Remains of Fox House'.
22:23	Roosting	M. nattereri	1	3	One bat seen flying around in the nave/chancel.
22:25	Survey termina	ated.			

## 5 Discussion: Surveys Summary and Recommendations

#### 5.1 Summary of Bat Surveys

#### 5.1.1 <u>Natterer's Bats</u>

- 5.1.2 A maximum of 13 Natterer's bats emerged inside the church on any one survey visit (third dusk emergence survey).
- 5.1.3 Therefore, the church provides suitable internal conditions for a large summer day roost for Natterer's bats.

#### 5.1.4 Brown long-eared Bats

- 5.1.5 A maximum of eight brown long-eared bats were recorded roosting inside the church on any visit (second dusk survey). A maximum of seven brown long-eared bats were recorded re-entering the church (dawn survey).
- 5.1.6 Therefore, the church provides suitable internal conditions for a maternity roost of brown longeared bats.

#### 5.1.7 Common pipistrelle bats

- 5.1.8 A maximum of four common pipistrelle bats emerged internally (first dusk survey) and a maximum of three emerged from external features (first and second dusk survey). A maximum of three common pipistrelle bats re-entered the church building (dawn survey). One common pipistrelle bat flew into the 'Remains of Fox House' near the beginning of the survey and was not seen flying out again on the third dusk survey indicating that this functions as a night roost for this species.
- 5.1.9 Therefore, the church provides suitable internal conditions for summer day roost for common pipistrelle bats and the Remains of Fox House functions as a night roost. External features support summer day roosts for common pipistrelle bats.

#### 5.1.10 Soprano pipistrelle bats

- 5.1.11 A maximum of six soprano pipistrelles emerged from external features of the church (second dusk survey).
- 5.1.12 Therefore, external features support summer day roosts for soprano pipistrelle bats.

#### 5.2 Bat Management Recommendations

#### 5.2.1 Consideration of Options

- 5.2.2 A meeting was held 23/04/21 at the church with Rev Justin Parker (PCC rep), Lesley Lloyd (church architect), Dr Elizabeth Pimley (ecologist), Rachel Arnold (BiC Heritage Advisor), Rose Riddell (BiC Engagement Officer), to explore bat management options. Following the bat surveys an online meeting was held 08/09/21 between Rev Justin Parker (PCC rep), Lesley Lloyd (church architect), Dr Elizabeth Pimley (ecologist), Rachel Arnold (BiC Heritage Advisor), Rose Riddell (BiC Engagement Officer) to review bat management options.
- 5.2.3 Due to the high number of bats and variety of species using the church for roosting and the large number of access points, it was not considered appropriate to attempt to create alternative roosting provision in the form of a bat loft within the north aisle of the church with external bat access only and therefore enabling other access points into the church to be blocked under an EPS BiC mitigation licence. The blocking up of all possible access points into the church for bats was considered an impossible task and there are no funds available for constructing a suitable bat loft. Concerns were also raised around construction of a bat loft in terms of keeping sufficient ventilation necessary for preservation within an old church such as St Marys.

#### 5.2.4 Bat Management

- 5.2.5 As stated earlier, the chancel, wall mounted monuments and woodwork, especially the east end of the north aisle and the pulpit/lectern are considered the main features that need protection from bat droppings/urine (R. Arnold, pers. comm).
- 5.2.6 Several recommendations to reduce damage from bat droppings/urine in the church were discussed during a St Marys BiC meeting. These comprise: droppings catchers under the main roost areas; covers; protection for the lectern, pulpit and wall memorials; cleaning support; bat engagement to raise funds for a professional clean in the autumn. Some of these ideas are elaborated on below:
- 5.2.7 Weekly cleaning with DEFRA approved disinfectant (e.g. https://www.safe4disinfectant.com/store/disinfectant-products/disinfectant-cleaner-25I) immediately before services will ensure surfaces are clean of pathogens and thus suitable for public use. It is appreciated that additional cleaning support may be necessary to ensure that bat droppings

and urine are removed as soon as possible to avoid further damage to important features such as the lectern (which now needs conservation cleaning to restore it).

- 5.2.8 Sensitive features (such as the pulpit/lectern) could be covered by polythene transparent sheeting (especially overnight when bats are active) these protective sheets could be removed prior to services in the church. Wall memorials could be fitted with transparent plastic deflectors/trays above them to prevent droppings/urine landing on them. Deflectors or trays could be used in the window sills of the east end of the north aisle, which would catch some of the droppings and over the boards of Lord's Prayer, Creed and Commandments at the west end of the nave (Statement of Significance 2021). These would have to be carefully designed to ensure cleaning is easy to achieve and the view of these important windows is not obstructed. Smaller and flatter wall mounted monuments, such as the brass plaque, could be framed and glazed, which has been achieved at another project church (Statement of Significance 2021).
- 5.2.9 A suitable droppings catcher design has been proposed by E. Palmer for St Peters Church in 2020 and is included below. A transparent acrylic sheet would be used to minimise the visual impact. Installation of droppings catcher under roosting locations (see Figure 1b) would not require an EPS BiC mitigation licence providing that it did not obstruct bat access to a roost entrance. To ensure this, the contracted bat ecologist for the scheme should be involved in the precise locating of the droppings catcher within the church. It should be noted that the droppings catcher would need to be emptied on a regular basis and it would be advisable for the church warden/other suitable person to monitor the effectiveness of the droppings catcher.
- 5.2.10 The west end of the north aisle is used for storage and would benefit from sensitively designed cupboards being fitted (Statement of Significance 2021). These would offer protection to some items and make cleaning in that area easier.
- 5.2.11 External roosting opportunities could be provided for bats in the form of wall-mounted bat boxes, which should be placed a minimum heights of 4m and ideally by installed to face away from a north-westerly direction. These bat roosting features should not be illuminated. Further details are provided in Appendix 3. By installing bat boxes on the exterior of the church (for example, the Remains of Fox House), these may encourage certain species such as common pipistrelle bats to use these features rather than roosting in the church. However, brown long-eared bats in particular tend

to prefer roosting in roof voids (such as the spaces found in the church) although they will use bat boxes.



Figure 2. Proposed design for droppings catcher to be fitted under roosts (Palmer/Link Ecology 2020)

#### 5.2.12 Bat Lighting Considerations

- 5.2.13 It is our understanding that no new lighting is proposed for the church, which is strongly recommended as not only does the church provide exterior roosting features as well as interior ones, but the churchyard provides suitable habitat for foraging bats. Bats are deterred from roosting and foraging in illuminated areas. Should any lighting be required in the future, the following recommendations should be followed. Any proposed lighting should be designed sensitively to minimise light spill and potential impacts on bats in accordance with best practice. The following recommendations are based on Bats and Lighting in the UK (Stone, 2013):
  - All luminaires should lack UV elements when manufactured. Metal halide, fluorescent sources should not be used.
  - LED luminaires should be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability.
  - A warm white spectrum (ideally <2700Kelvin or >550nm) should be adopted to reduce blue light component, as redder light is preferable for bats.
  - <0.2 lux on horizontal plane good, hedgerow lighting tends to be <1 lux
  - Luminaires should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
  - Blue/white light should be avoided, or if mercury lamps are installed, these should be fitted with UV filters.
  - Internal luminaires can be recessed where installed in proximity to windows to reduce glare and light spill.
  - Accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it below horizontal plane.
  - The use of specialist bollard or low-level downward directional luminaires to retain darkness above can be considered.
  - Column heights should be carefully considered to minimise light spill.
  - Reducing the height of light units to keep the light as close to the ground as possible and reduce the volume of illuminated space.
  - Only luminaires with an upward light ratio of 0% should be used.

- Luminaires should always be mounted on the horizontal, i.e. no upward tilt. Ideally the angle of the luminaire should be less than 70 degrees to avoid upward light spill.
- Any external security lighting should be set on people-activated motion-sensors and short (1min) timers.

#### 5.2.14 Bat Habitat Enhancements

5.2.15 Planting additional flowering species (single flowering varieties) in the church yard will encourage insects and thus enhance the area for bats and other wildlife. Further details are provided in Appendix 3.

## 6 Bat Management Costings

	Average
Work Type	Cost/£
	(pre VAT)
Deep cleaning of church and windows (including scaffolding, assume nearly	
twice as much as St Peter's church due to larger size of St Mary church)	6000.00
Safe4 Disinfectant	30.00
Bat box x2 to go up on Fox house walls (if Schwelger 1FF bat boxes used)	200.00
Install Protective Shelving/deflectors (under bats)	2160.00
Bat droppings collector (assume similar cost to shelving)	2160.00
Heritage covering (assume this means protective sheeting over key	
features that need protection)	1428.00
Total	11 978.00

The costs in bold are known costs, while the remaining costs are estimates based on the capital average costs provided by Judith Milne of Natural England and also from St Peter's church. We are awaiting more precise costs from local cleaning and building contacts of Justin Parker.

## 7 References

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Multi-Agency Geographical Information for the Countryside webOutbuilding <a href="http://magic.defra.gov.uk">http://magic.defra.gov.uk</a>

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### Appendix 1 – Policy and Legal Considerations

Statutory nature conservation sites and protected species are a 'material consideration' in the UK planning process (DCLG, March 2012). Where planning permission is not required, for example on proposals for external repair to structures, consideration of protected species remains necessary given their protection under UK law.

The **Conservation of Habitats and Species Regulations 2017** transpose the requirements of European Directives such as the Habitats Directive and Birds Directive<sup>3</sup> into UK law, enabling the designation of protected sites and species at a European level.

The **Wildlife and Countryside Act 1981** (as amended) forms the key piece of UK legislation relating to the protection of habitats and species. The **Countryside and Rights of Way Act 2000** provides additional support to the 1981 Act, for example, increasing the protection of certain reptile species. Specific protection for badger is provided by the **Protection of Badger Act 1992**. The **Wild Mammals (Protection) Act 1996** sets out the welfare framework with respect to wild mammals prohibiting a range of activities which may cause unnecessary suffering.

The Government has a duty to ensure that parties take reasonable practicable steps to further the conservation of habitats and species of Principal Importance for Conservation in England listed under Section 41 of the **Natural Environment and Rural Communities Bill 2006**<sup>4</sup>. In addition, the 2006 Act places a Biodiversity Duty on public authorities who 'must, in exercising [their] functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity' (Section 40 (1)). Criteria for selection of priority habitats and species include, for example, international threat (such that species may be protected in their strong holds) and marked national decline.

The **National Planning Policy Framework 2019** states that the planning system should minimise impacts on biodiversity, providing net gains in biodiversity, wherever possible. Section 15 states that when determining planning applications, local planning authorities should apply the following principles:

- a) if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;
- b) development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest;
- c) development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons<sup>5</sup> and a suitable compensation strategy exists; and
- d) development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to incorporate biodiversity improvements in and around developments should be encouraged, especially where this can secure measurable net gains for biodiversity.

<sup>&</sup>lt;sup>3</sup>Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, and Council Directive 79/409/EEC on the Conservation of Wild Birds, respectively.

<sup>&</sup>lt;sup>4</sup>**The NERC Act** refers to "species of principle importance for the conservation of biodiversity", which translates to BAP habitats and species occurring in England.

<sup>&</sup>lt;sup>5</sup> For example, infrastructure projects (including nationally significant infrastructure projects, orders under the Transport and Works Act and hybrid bills), where the public benefit would clearly outweigh the loss or deterioration of habitat.

## Appendix 2 – Photographs

No	Photo	Description
1	<image/>	Nave with yellow arrow indicating roosting area
2		Chancel with yellow arrows indicating roosting areas

No	Photo	Description
3		Radiator at western end of nave with bat droppings
4		Interior of church tower

#### Droppings on floor of nave



6

5



North Aisle, yellow arrow shows roost location

#### Church and churchyard



Complex roof line of church

8

7



9



Bats emergence from southeastern side of church as shown by yellow arrow 10



Western side of church

**Remains of Fox House** 

11



No	Photo	Description
12		Eastern side of church by wooded area

## **Appendix 3 – Ecological Enhancements**

#### **BAT ROOSTING FEATURES**

## Schwegler 1FF bat box





#### Schwegler 1WQ Summer & Winter bat





## **Planting for Wildlife**

Many wildlife species benefit greatly from considerate planting choices that still meet our practical and aesthetic needs. Plants and trees provide food for wildlife as well as places to nest and rest. Vegetation providing a variety of these functions creates an environment more beneficial for wildlife.

#### Non native species

Native species provide the best habitat for UK wildlife but there are also many non-native species, which are single flowering and/or provide fruits/nuts/seeds that can be used as food sources for insects, birds and small mammals. When using these non-native species in planting schemes, care should be taken to avoid invasive species such as Cotoneaster and Rhododendron. This is especially important when sites are adjacent to open countryside particularly nature reserves.



### **Uses of Wildlife Planting**

Wildlife value can be easily incorporated into visually pleasing and useful green areas and amenity spaces, such as borders, grass verges and tree screens.

Attractive Borders: Well selected decorative borders can be valuable for many insects and birds. Native plants can be mixed with single flowering ornamental species to add aesthetic interest and increase the flowering period of a planting scheme.

Shrubs and hedges: Native spiky species like blackthorn and hawthorn are effective barriers when used in hedges. They also provide an attractive feature at all times of year especially when in blossom and fruit. Bushy areas of foliage provide useful nesting and feeding areas for birds and small mammals, as well as foraging/commuting corridors for bats.

**Grasses mixes and verges:** Leaving uncut areas of suitable grasses provides great wildlife value and is economical to manage. Diverse grassy areas and verges also create an attractive human environment with different flowers and colours. There are a range of native grass and flower mixes for various soil types available on the market.





## **Selecting Suitable Species**

There are wildlife friendly species suitable for all situations, from fields, verges, shady corners or small gardens. Listed below are native wildlife friendly plant species organised by type and suitability for different locations.

#### Large Trees

Ash Fraxinus excelsior Beech Fagus sylvatica English Elm Ulmus procera Oak Quercus robur or Q. petraea Small-leaved lime Tilia cordata White willow Salix alba Wild cherry Prunus avium



#### Medium/small trees

Alder Alnus glutinosa Aspen Populus tremula Crab apple Malus sylvestris Field maple Acer campestre Holly Ilex aquifolium Rowan Sorbus aucuparia Silver birch Betula pendula Yew Taxus baccata



#### Native shrubs

Blackthorn Prunus spinosa Dogwood Cornus sanguinea Elder Sambucus nigra Guelder rose Viburnum opulus Hawthorn Crataegus monogyna Hazel Corylus avellana



#### Plants for shady areas

Archangel Lamiastrum galeobdolon Betony Stachys officinalis Bluebell Hyacinthoides nonscriptus Bugle Ajuga reptans Foxglove Digitalis purpurea Ground ivy Glechoma hederacea Lily of the valley Convallaria majalis Lords-and ladies/cuckoopint Arum maculatum Nettle-leaved bellflower Campanula trachelium Primrose Primula vulgaris Sweet violet Viola odorata Wild daffodil Narcissus pseudonarcissus

Plants for marshy areas & pond

edges

Bugle Ajuga reptans Hemp agrimony Eupatorium cannabinum Marsh marigold Caltha palustris Marsh woundwort Stachys palustris Meadowsweet Filipendula ulmaria Purple loosestrife Lythrum salicaria Ragged robin Lychnis flos-cuculi Water avens Geum rivale Water forget-me-not Myosotis scorpoides Water mint Mentha aquatica Water violet Hottonia palustris Yellow flag Iris pseudacorus

## Beneficial cultivated plants (generally non-natives)

Grecian windflower Anemone blanda

Angelica Angelica archangelica Aubretia Aubretia deltoidea California poppy Eschscholtzia californica

Candytuft Iberis sempervirens Christmas rose Helleborus niger Cosmos Cosmos bipinnatus Evening primrose Oenothera biennis

Fleabane Erigeron spp. Forget-me-not Myosotis spp. French marigold Tagetes patula Globe thistle Echinops ritro Grape hyacinth Muscari botryodes Hollyhock Althaea rosea Honesty Lunaria rediviva Ice plant Sedum spectabile Lenten rose Helleborus orientalis Tree mallow Lavatera spp.

Michaelmas daisy Aster novabelgii

Mint *Mentha x rotundifolia* Perennial cornflower *Centaurea montana* 

Perennial sunflower *Helianthus* decapetalus

Phlox Phlox paniculata Poached-egg plant Limnanthes douglasii

Red valerian *Centranthus ruber* Snapdragon *Antirrhinum majus* Spring crocus *Crocus chrysanthus* and hybrids

Sweet alyssum Lobularia maritima Sweet bergamot Monarda didyma

Sweet William Dianthus barbatus Tobacco plant Nicotiana affinis Wallflower Cheiranthus cheiri Alpine rock-cress Arabis alpina

Winter aconite *Eranthis hyemalis* Yellow alyssum *Alyssum saxatile* 

#### Native wildflowers for borders

Agrimony Agrimonia eupatoria Betony Stachys officinalis Bluebell Hyacinthoides nonscriptus Chicory Cichorium intybus Chives Allium schoenoprasum Common poppy Papaver rhoeas Corncockle Agrostemma githago Cornflower Centaurea cyanus Corn marigold Chrysanthemum segetum Cowslip Primula veris Cuckooflower Cardamine pratensis Dame's-violet Hesperis matronalis Devil's-bit scabious Succisa pratensis Field scabious Knautia arvensis Foxglove Digitalis purpurea Goldenrod Solidago virgaurea Great mullein Verbascum thapsus Greater knapweed Centaurea scabiosa Harebell Campanula rotundifolia Herb-robert Geranium robertianum Lady's bedstraw Galium verum Marjoram Origanum vulgare Meadow cranesbill Geranium pratense Common mallow Malva sylvestris Oxeye daisy Leucanthemum vulgare Primrose Primula vulgaris Red campion Silene dioica Snowdrop Galanthus nivalis Spiked speedwell Veronica spicata Tansy Tanacetum vulgare Teasel Dipsacus fullonum Toadflax Linaria vulgaris White campion Silene alba Wild thyme Thymus drucei Yellow loosestrife Lysimachia vulgaris



#### Appendix 4 – DNA Analysis Results





CeoWarwicker Ceological Forensies

17 August 21

Re: Identification Results for Elizabeth Pimley, Wild Service

Job number 16988, received 04 August 2021 Sample labelled: EP2021019 St Mary the Virgin Church, Pimley, 22/4/21 PCR amplification successful. DNA sequence: ATGACCAACATTCGAAATCTCACCCCCTAATGAAAATTATCAATAACTCCTTTATTGAC CTACCCGCTCCTCAAATATCTCTTCCTGATGGAATTTCCGGTCTCTTTTAGGAATCT

Phylogenetic analysis identification: Myotis nattereri

Confirmed by maximum likelihood, maximum parsimony, bootstrap 100%.

Best regards,

Professor Robin Allaby

The results and conclusions in this report are based on an investigation of mtDNA sequence analysis. The results obtained have been reported with accuracy. The interpretation represents the most probable conclusion for the DNA sequence obtained rather than the sample provided given current levels of species data. It should be borne in mind that different circumstances might produce different results. Therefore, care must be taken with interpretation of the results especially if they are used as the basis for commercial recommendations.

#### Professor Robin Allaby

School of Life Sciences, Gibbet Hill Campus, University of Warwick, Coventry CV4 7AL Tel: 02476575059 Fax: 02476574500 Email: r.g.allaby@warwick.sc.uk





17 August 21

Re: Identification Results for Elizabeth Pimley, Wild Service

Job number 16987, received 04 August 2021 Sample labelled: EP2021019 St Mary the Virgin Church, Pimley, 25/5/21 PCR amplification successful. DNA sequence: TTCGAAATCTCACCCCCTAATGAAAATTATCAATAACTCCTTTATTGACCTACCCGCT CCATCAAATATCTCTTCCTGATGGAATTTCGGATCTCTTTTAGGAATCTGC

Phylogenetic analysis identification: Myotis nattereri

Confirmed by maximum likelihood, maximum parsimony, bootstrap 100%.

Best regards,

Professor Robin Allaby

The results and conclusions in this report are based on an investigation of mtDNA sequence analysis. The results obtained have been reported with accuracy. The interpretation represents the most probable conclusion for the DNA sequence obtained rather than the sample provided given current levels of species data. It should be borne in mind that different circumstances might produce different results. Therefore, care must be taken with interpretation of the results especially if they are used as the basis for commercial recommendations.

Professor Robin Allaby

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## **Appendix 5 – Ecological Experience**

#### Elizabeth Pimley: Head of Ecology & Principal Ecologist, BSc (Hons) PhD, CEnv MCIEEM

Elizabeth has worked in both the academic and consultancy ecology sectors since 2000 with a focus on mammalian ecology, particularly badgers, dormice, bats, water voles and otters. Elizabeth manages the Consultancy as well as being involved in project delivery. She has managed ecological projects, ranging in size and type, both in the UK and abroad. She regularly advises clients on the planning process in relation to Ecology. Elizabeth has expertise in a wide variety of ecological survey techniques including Preliminary Ecological Appraisals/Phase 1 habitat assessments and a variety of protected species surveys (e.g. the aforementioned mammal species as well as reptiles and great crested newts).

Elizabeth also devises ecological mitigation schemes, both as part of protected species mitigation licences (e.g. bats, great crested newts, badgers, dormice, water voles, otters) and for projects not requiring licensing (e.g. reptiles). She has produced a wide variety of preliminary ecological appraisals, BREEAM/CSH Ecology Assessments, mitigation licences for protected species (including Bat Mitigation Class Licences), Ecological Impact Assessments (EcIA), Construction Ecological Management plans, Habitat Regulations Assessments, Biodiversity Net Gain assessments, Biodiversity Enhancement Schemes, Ecological Design Strategies as well as writing for scientific journals, books and magazines. As a Building with Nature Assessor, Elizabeth also has expertise in providing green infrastructure advice to projects.

Elizabeth offers a scientific approach to projects with additional skills in radiotracking, bat call analysis, statistical analysis, home range and compositional habitat analysis and Geographical Information Systems (GIS) mapping. Elizabeth holds Natural England and Natural Resources Wales licences for bats and dormice as well as Natural England licences for great crested newts and water voles. She is also a Registered Consultant of the Bat Mitigation Class Licence (BMCL) and holds a CSCS card.

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#### Michelle Newman: Senior Ecologist, BSc (Hons) GradCIEEM

Michelle has worked in Ecological Consultancy for several years and has also volunteered for a number of nature conservation organisations over the years. She is experienced in undertaking Phase 1 habitat surveys and protected species surveys including those for bats, birds, otters, water voles, badgers, great crested newts and reptiles (including adder handling experience). She has also undertaken a variety of invertebrate surveys, specialising in bumble bee surveys. She holds a CSCS card and has worked as an Ecological Clerk of Works (ECoW) on a wide variety of sites. Michelle has prepared Preliminary Ecological Appraisals, Landscape and Ecological Mitigation Plans, Construction and Environmental Management Plans and Habitat Enhancement Schemes for a range of projects. In addition to project delivery, she is also involved with the management of Wild Service projects and advises clients on the ecological aspects of the planning process. She is experienced in analysing bat call data using a variety of software packages. Michelle holds a Natural England great crested newt licence. She is currently working towards her Natural England bat and white-clawed crayfish licences.

#### Julia Morrison: Ecologist, BSc (Hons) MSc

Julia has worked with Wild Service for several years and has recently gained her MSc in Applied Ecology from the University of Gloucestershire. Julia's dissertation project involved large-scale data analysis of biometric bird ringing data to assess biometric changes in UK wintering waterbirds. Julia has a keen interest in bat ecology and in addition to undertaking professional bat surveys and assessments, she has also studied bats in Ghana, West Africa. She is experienced in a range of ecological surveys including Phase 1 habitat assessments, protected species surveys, reptile surveys and translocations, great crested newt and dormouse surveys. Julia's additional skills include advanced data analysis and GIS mapping using various software packages including QGIS and ArcGIS. In addition to project delivery, she also assists with the management of Wild Service projects. Julia has also spent time volunteering on conservation projects with the Gloucestershire Bat Group and the Gloucestershire Wildlife Trust. Julia is a Qualifying member of CIEEM and holds a CSCS card. She is currently working towards her Natural England bat and great crested newt licences.

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#### Rebecca McKie: Graduate Ecologist, BSc (Hons)

Beccy joined Wild Service in 2020 having completed an Undergraduate Degree in Environmental Science. Beccy has professional experience of undertaking bat surveys and assessments, reptile surveys and translocations, great crested newt surveys, Ecological Clerk of Works (ECoW), as well as assisting in the preparation of ecological reports and production of maps in QGIS (including Phase 1 habitat maps).

During her BSc studies, Beccy gained knowledge and experience in GIS mapping using QGIS, and environmental law, as well as undertaking various fieldwork projects, such as studying the effect of climate change on invertebrates in hot springs in the Sierra Nevada. She has also completed Ecology Training UK's 'Certificate in Ecological Consultancy', during which she gained experience in Phase 1 Habitat and PEA Surveys, survey techniques for protected species, botany, wildlife law, hedgerow assessments and invasive species. Beccy has also carried out practical volunteering with the Wildlife Trusts, as well as being involved in hedgehog conservation through volunteering at Help a Hedgehog Hospital.

#### Gemma Waters – Associate Ecologist BSc (Hons) MCIEEM

Gemma has 15 years' experience in ecological consultancy with a focus on bat and bird ecology and surveying. She is also an experienced environmental educator. She worked on two Bats in Churches projects in Gloucestershire in 2019: undertaking dusk/dawn surveys for St Peter Church, Little Rissington and Church of St Mary, Edgeworth. Gemma has previously worked on Natural England's bat helpline where she provided advice to churches with bat concerns, liaised with volunteers and helped members of the public with bat issues. She has also been a bat warden for Natural England since 2006, providing surveys and advice for householders with bats. Gemma is a Natural England licence holder for bats (Licence number: 2015- 1560-CLS-CLS, WML CL18: Bat Survey Level 2) and is also a volunteer bat roost visitor (2015-10271-CLS-CLS). Gemma is experienced in providing EPS mitigation on a variety of projects, including cultural heritage projects for the National Trust and the Wye Valley AONB.

Gemma has undertaken voluntary research with Gloucestershire Bat Group (GBG) and Dr Roger Ransome, assisting in research of greater horseshoe, Bechstein's and barbastelle bats. With GBG, Gemma has also led bat walks and talks for the public. Gemma has over a decade of teaching experience; from primary students, up to University level.

#### Joshua Evans – Associate Ecologist BSc(HONS) MCIEEM

For the last 25 years Joshua has worked in both the conservation and consultancy sector. Many of these years were in woodland conservation and management. He is an experienced ecologist with good botanical skills and extensive experience in protected species' surveys. He has particular expertise in terrestrial invertebrates, amphibians, reptiles and bats and holds Natural England and Natural Resources Wales licences for bats, dormice, great crested newts, white-clawed crayfish and barn owls.



# Wild Service

MITIGATION

CONSERVATION

- We provide ecological surveys and assessments, mitigation, advice and guidance regarding wildlife, plants and habitats for both development and conservation projects throughout the UK.
- Wild Service is the Ecological Consultancy for Gloucestershire Wildlife Trust. As such, the company reinvests its profits into local conservation work.
- We are also part of a wider network of Wildlife Trust Consultancies enabling us to offer national delivery with local expertise.
- We offer the following types of service to clients:

Ecological Surveys Protected Species Licences Ecological Management Plans Biodiversity Net Gain Ecological Impact Assessments (EcIA) BREEAM Assessments Mitigation and Enhancement Arboricultural Surveys Landscape Consultancy Services Green Infrastructure Planning (Building with Nature)

Contact us at Wild Service, Conservation Centre Robinswood Hill Country Park Reservoir Road, Gloucester, GL4 6SX TEL: 01452 383 333; Email: info@wildservice.net Website: https://wildservice.net/

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