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## **The Cotswold Water Park Bat initiative**

### **The Bat Assemblage of the Cotswold Water Park**

**An analysis of data collected 2005 to 2013**

**A project of the Cotswold Water Park  
Biodiversity Action Plan (2007-2016)**

**May 2014**

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Cotswold Water Park Bat Initiative**

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## 1. Introduction

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### 1.1. About this report

This report provides an analysis of the first nine years of the Cotswold Water Park Bat initiative (CWPBI). As such it may be considered to be a “mini-atlas” of bats in the CWP combined with an interim report of work to date; it is very much a work in progress. For each species recorded in the CWP, we provide a species account, a series of maps, a statement of our current knowledge and recommendations for further survey and conservation work. We do not presume that the project has completed its original aims but what we have achieved so far provides an excellent baseline upon which to base further work and to prioritise future conservation action.

### 1.2. The Cotswold Water Park

The Cotswold Water Park (CWP) comprises 40 square miles of wetlands and farmland at the head of the Thames Valley. Straddling four county boundaries, the CWP lies mainly in Gloucestershire and Wiltshire, but also in Oxfordshire and Swindon Borough.

Large deposits of minerals were deposited as ice sheets retreated during previous Ice Ages; much of the resulting sand & gravel was carried by a once-larger river (today’s River Thames), depositing this material throughout the Thames Valley in a series of exploitable terraces. Gravel extraction over the past 50 years has created 154 lakes of varying sizes so far. A further 30-50 years’ worth of extraction may remain, ensuring that extensive areas of new wetlands will be created in the future. The CWP is already 50% larger than the Norfolk Broads and is set to become one of the largest areas of man-made wetland in Europe.

The high invertebrate abundance in the lakes and other wetland habitats, coupled with the rich aquatic plant assemblage indicates high water quality. Indeed, the crystal-clear lime-rich marl waters support a rich aquatic plant assemblage considered to be of European Importance, in particular for the assemblage of Stoneworts and *Potamogeton* pondweed species. Ten lakes have been designated as Sites of Special Scientific Interest (SSSI) for their aquatic plant interest. The newly-created wetlands have attracted an ever-increasing number of other species dependent on the high quality water environment. The area attracts 35-40,000 wintering waterbirds and is internationally important for Lesser Black-backed Gull, nationally important for several species including Pochard, Tufted Duck, Gadwall, Shoveler, Coot, Great Crested Grebe and Smew. Furthermore, surveys in 2007 suggest the area supports a summer waterbird population of 6,568 – 7,704 birds, including nationally important breeding populations of six species of waterbird (Coot, Great Crested Grebe, Mute Swan, Tufted Duck, Red Crested Pochard and Gadwall)<sup>1</sup>.

The CWP supports a wide diversity of wildlife, including significant populations which existed prior to mineral extraction. In addition to bats, which are the subject of this review, the CWP supports important farmland bird populations such as Tree Sparrow, Lapwing, Yellow Wagtail and Barn Owl, mammals such as Otter and Water Vole. Following intensive control of American Mink in recent years, remnant water vole populations are flourishing once more and recovering their range across the CWP. Similarly Otter populations continue to thrive following a recent recovery and may be recorded using all of the watercourses across the area.

Traditional hay meadows support many thousands of green-winged orchids and snakes-head fritillaries. Six neutral grasslands have been designated SSSI’s, including some of the finest hay meadows remaining in Europe, such as the internationally-renowned Special Area of Conservation,

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<sup>1</sup> Adams N, Harris G 2008. Breeding Waterbird Surveys of the Cotswold Water Park 2007. Part of the CWP BAP Implementation Project. Cotswold Water Park Society & Royal Society for the Protection of Birds

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Clattinger Farm (owned and managed by Wiltshire Wildlife Trust) & North Meadow National Nature Reserve SSSI (managed by Natural England).

### **1.3. Indications of potential importance for bats**

Many of the lakes are relatively new and are yet to develop a mature fringe of vegetation; such lakes may be devoid of dense stands of vegetation and adjacent tree growth and are consequently exposed to the elements and frequently less attractive to foraging bats except on all but the calmest of evenings. Many of the lakes however have developed a rich assemblage of aquatic plants, submerged in the lake or growing around or on the margins. Such vegetation supports a diverse abundance of insects.

Many of the lakes yield a super-abundance of invertebrates such as damselflies, caddis flies and mayflies during mass emergences from the lakes noted throughout May and into June. With luck, a nocturnal visit to the CWP may coincide with such a mass emergence and it is often possible to witness what appears to be hundreds of bats of a range of species feeding on the hapless emerging invertebrates!

The 154 lakes lie within a network of rivers & streams. The Thames and its tributaries amount to over 200km of waterway, with even more if the extensive network of ditches and drains is included. All of these river corridors support varying numbers of mature trees, including large willow pollards, offering roosting sites for bats and extensive foraging habitat. Furthermore, they offer a complex network of commuting routes.

Nestled amongst the lakes and rivers there are a large number of smaller ponds, reedbeds, fen and marsh, willow carr and other wetland habitats, as well as copses of broad-leaved woodland and a network of species-rich hedgerows; all of these offer additional foraging sites and commuting routes, and additional roosting sites in trees and built structures.

Perhaps most importantly for the CWP's bats, the area is characterised by a long history of human settlement; villages and small towns have been established for many hundreds of years, for example South Cerney, Ashton Keynes, Somerford Keynes, Kempsford, Fairford and Lechlade. Many of these villages retain their old Cotswold stone buildings and cottages, churches and stone bridges. All of these offer a range of roosting sites for bats, whilst the gardens offer additional foraging areas and commuting routes giving access to the nearby lakes and wetlands.

The combination of natural and man-made features and habitats within the CWP suggest a landscape rich in potential for bats of a variety of species. Whilst this was recognised, prior to the CWPBI there appears to have been only one coordinated effort to understand the importance of this area for bats. In 2000 the Cotswold Water Park Society brought together a number of bat workers from Gloucestershire and Wiltshire to undertake the first cross-boundary bat survey, assessing a number of bridges for roosting Daubenton's bats *Myotis daubentonii*. A number of roosts discovered at this time are still monitored today.

### **1.4. The Cotswold Water Park Bat Initiative**

In 2005 the CWP Nature Conservation Forum (NCF) and the Cotswold Water Park Society began work on the review and re-launch of the CWP Biodiversity Action Plan. The new edition of the BAP included a new Species Action Plan for Bats, recognising the potential and probable importance of this area for bats, and recommending detailed survey work and conservation effort. The Species Action Plan for Bats was drafted by Jenny Ford, the then Wiltshire County Ecologist. Research for this document highlighted the lack of data on bats in the CWP. The CWP BAP was finally re-launched in

2008. Today, the Bat Species Action Plan remains a superb example of BAP delivery by a dedicated team of volunteers and the wider community<sup>2</sup>.

In 2005, the Cotswold Water Park Society (now Trust) drew together a new partnership to launch the CWP Bat Initiative (CWPBI), a project to promote and coordinate bat conservation and study in the CWP. This partnership included the then Biodiversity Officer, Gareth Harris, Wiltshire Bat Group member, Will Ponting and Wiltshire County Ecologist, Jenny Ford.

The project was originally launched with the following aims, each highlighting clearly the urgent need for high quality bat data and records for the CWP in order to inform the local planning authorities;

- To provide a direct input to the CWP Nature Conservation Forum and CWP Biodiversity Action Plan to promote all forms of bat conservation in the CWP.
- To gather information of sufficient quality to inform and influence development control, forward planning and mineral planning processes.
- To gather high quality data on the Bats of the CWP through co-ordinated field work.

The CWP BI began a systematic survey of the CWP and wider area, employing a variety of survey methods in order to maximise records of a variety of species throughout the year. At the same time, the project worked with Purgle Linham of the Wiltshire & Swindon Biological Records Centre (WSBRC) to develop an effective and efficient simple database to hold all of these records, constructed in such a way as to enable simple data exchange with WSBRC and the Gloucestershire Centre for Environmental Records (GCER); this database remains in place and has evolved through a series of enhancement to improve data quality and data flow. Annual data submission to WSBRC and GCER is maintained, ensuring the data is freely available to the local records centres and therefore to the local planning authorities.

To date, over 100 volunteers have been involved in the project undertaking surveys across the CWP. Over 300 bat boxes have been erected and are checked several times each year. Many surveys are undertaken each year of known and new bat roosts. Surveys undertaken for local landowners are contributing to local Environmental Stewardship schemes. So far, 14 species of bats have been recorded in the CWP (of the 18 species found in the UK), and most areas within the CWP support extremely high bat activity. Key populations of Lesser Horseshoe and Bechstein's bats have been discovered and are the subject of study. All of the Annex II species (Greater Horseshoe, Lesser Horseshoe, Bechstein's and Barbastelle bat) have been recorded in the CWP, as well as the Nathusius' Pipistrelle bat.

Ten years after the original project launch the CWPBI has grown considerably; it continues to survey and monitor bats across the CWP, generating additional spin-off projects (such as the Braydon Forest Bechstein's Study), training new bat workers and ensuring a steady flow of data to the local records centres. It remains a great example of volunteer power.

### **1.5. The Braydon Forest**

Of relevance to this document is the Braydon Forest, an old Royal hunting forest to the south of the CWP in North Wiltshire. Lying between Malmesbury to the west and Swindon to the east, the Braydon Forest lies over a totally distinct geology to the CWP, being comprised almost entirely of heavy clays. Whilst the alluvial sands and gravels of the CWP were ideally suited to cultivation and pastoralism, the Braydon Forest's heavy clays enabled only grazing by livestock, mainly cattle. Today the Braydon Forest comprises something of a relict landscape, rich in species-rich meadows which have never been ploughed, semi-natural ancient woodlands and a rich network of dense hedgerows.

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<sup>2</sup> See Appendix

The forest supports several grassland and woodland Sites of Special Scientific Interest (SSSI) as well as innumerable local wildlife sites.

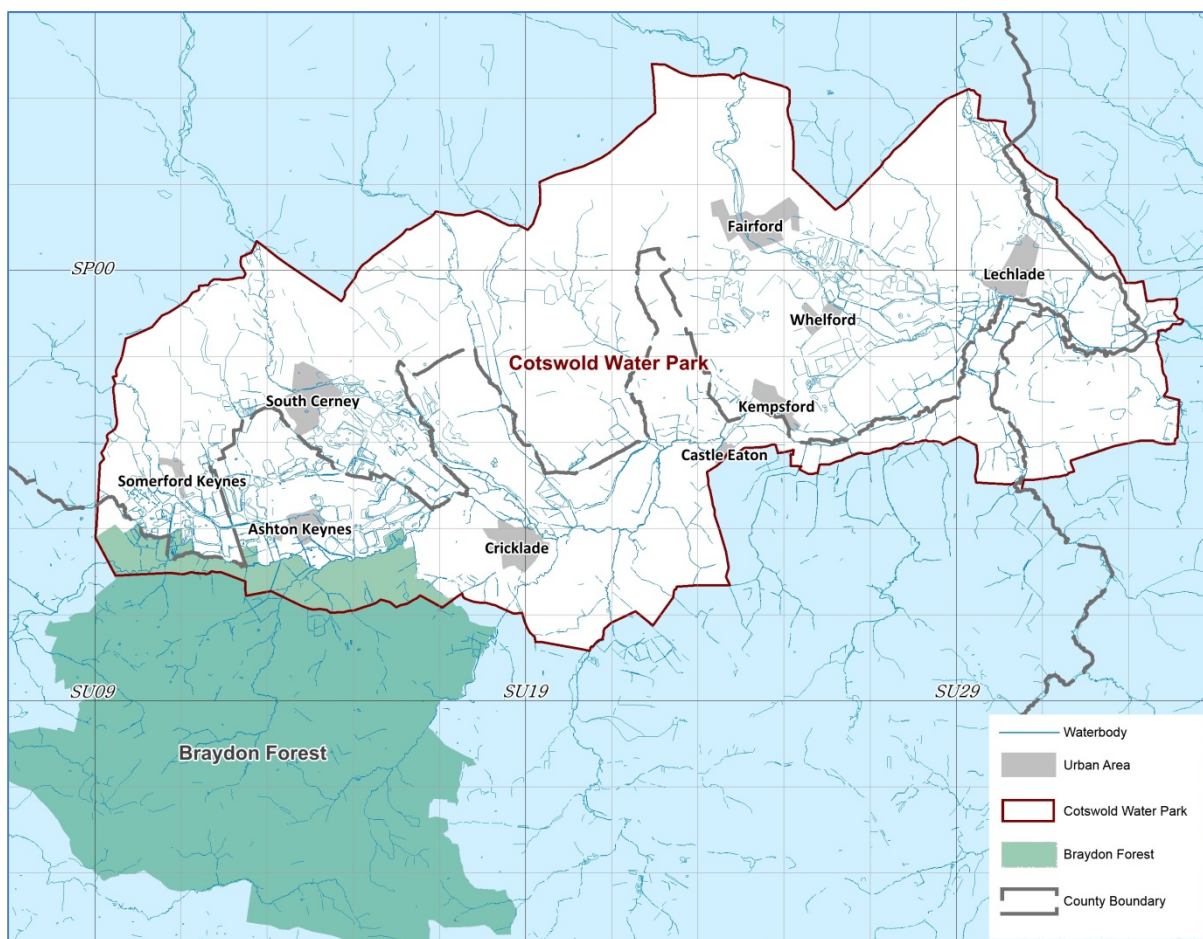
The discovery of a number of species of bat here comes as little surprise, but instead highlights what remains to be discovered even in areas so familiar. Although the Braydon Forest lies outside of the CWP, it becomes relevant to the unfolding story following the discovery of Bechstein's bats in the CWP.

### 1.6. The Study Area

At the outset of the CWP BI in 2005 the area of interest for the project was restricted to the CWP itself. The CWP BI adopted the project boundary of the CWP Biodiversity Action Plan (2007-2016); this boundary was based upon the original historic administrative boundary of the CWP (which was based upon parish boundaries) but was broadened to reflect more accurately the wetland habitats of the CWP. As such this remains the area of interest for the CWP BAP and its delivery projects.

The study area was further expanded following the discovery of Bechstein's bats in the CWP, which led to the study of maternity colonies in the Braydon Forest, to the south.

Figure 1.6 outlines the extent of the study area, centred upon the CWP and the extensive areas of wetland habitats (including riparian corridors, floodplain and lakes). The key settlements are labelled as is the Braydon Forest area to the south of the CWP.



**Figure 1.6 Study area of the CWP Bat Initiative**

### **1.7. Volunteers, surveyors, trainers and supporters**

Upon the launch of the project in spring 2005, further contact was made with the Gloucestershire and Wiltshire Bat Groups in order to promote the project and invite participation from bat group members. Existing volunteers of the Cotswold Water Park Society and other organisations in the CWP were also encouraged to get involved.

The result was an overwhelming wave of support and interest from local naturalists and local bat group members, many of whom travelled some distance to participate in and support survey events in the CWP. This interest may have reflected the considerable ambition evident in the range and volume of surveys being launched as part of the project, or indeed in the training opportunities that they generated; either way, this support and interest was and continues to be a source of energy for this project.

The project has always benefitted from a large contribution by volunteering ecological consultants (notably Cresswell Associates (latterly Hyder Consulting) and CSA Environmental) who can bring considerable knowledge and expertise, as well as equipment usually beyond the reach of small community projects.

Training events for project personnel and volunteers commenced early in the project. The project benefitted from a numerous friends and associates who provided training events such as BatSound Analysis (Dr Fiona Mathews), identification of bat droppings (Dr David Bullock & Dr Jude Smith) as well as small grants enabling a series of training events on Anabat & Analook analysis (Dr Sandie Sowler) and acoustic luring (Daniel Whitby & Daniel Hargreaves). Increasingly these training events were provided as a way of thanking and encouraging the volunteers for their efforts and time, spurring them on to contribute further time, expertise and energy.

### **1.8. Licensing**

In 2005 two of the three project coordinators were already licensed (Will Ponting & Jenny Ford); however in order to proceed with the ambitious trapping surveys in the CWP additional licensing was required. At this stage Steve Laurence (Wiltshire Bat Group) agreed to extend his personal bat license to cover the Gloucestershire section of the CWP (as well as the Wiltshire section); this was done with the specific agreement and support of the Gloucestershire Bat Group. This enabled the early trapping surveys to proceed with verve and energy, generating considerable numbers of the project's earliest records.

More recently Will Ponting and then Gareth Harris also became accredited agents upon the personal licence of Dr Fiona Mathews (then of Oxford University and more recently, Exeter University). Finally, in 2010, Will Ponting applied for a specific project licence for the CWP, adding a number of accredited agents to this licence including Gareth Harris and Lisa Wade.

Two points are salient here; firstly, from the very earliest days of the project, local bat groups and Natural England supported the study and conservation of bats in the CWP by licensing study methods such as mist netting, harp trapping, radio-tracking and ringing. This project is very much indebted to individuals such as Steve Laurence and Dr Fiona Mathews for their early and continued support.





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## 2. Methodology

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From 2005 a series of survey methods have been employed across the CWP. The key surveys and outcomes are outlined in paragraphs below. A variety of survey methods are employed at the majority of sites, each having its own benefits and shortcomings, but the sum of these efforts and surveys offers a greater insight into how bats may use the CWP and locations within it. Furthermore, a variety of survey methods offers a variety of training opportunities and experience for those involved.

### 2.1. Transect surveys

During 2005-2007 twenty-four transects were mapped and described across the CWP and volunteers were recruited to complete surveys on each. The aim of these transect surveys was simply to cover a wide area of the CWP with some basic survey effort to begin identifying areas of interest for further survey. Surveyors were typically experienced in transect surveys and the use of bat detectors, however a range of bat detectors were used, ranging from simple heterodyne detectors (e.g. Bat Box models), frequency division detectors (e.g. Bat Box Duet) with and without recording and analysis, to time expansion detectors (e.g. Petersen D240X with recording and sound analysis).

The results of these surveys were reported in three reports, drafted by Jenny Ford and Gareth Harris. These surveys identified a number of areas of interest that led on to further surveys including trapping surveys and bat box monitoring schemes.

### 2.2. Trapping surveys

Regular trapping surveys, using mist nets and harp traps, and latterly acoustic lures, have been undertaken at numerous sites across the CWP each year since the project began. A number of sites may be subject to annual catches, often linked to ringing studies. This work has been coordinated by Will Ponting and has enabled the capture of several species of bat and enabling assessment of breeding status of species on these sites.

### 2.3. Bat box surveys

Bat box monitoring schemes have been established at a series of locations comprising mainly Schwegler bat boxes (ranging from the “rounds” such as 2F, 2FNs, 2F-DFP etc., to the “flat” 1FF, to the larger summer maternity 1FS and the larger winter hibernation 1FW box). The project undertook a trial of the designs in the American Bat House Builder’s Handbook, constructing 14 pairs of single, double and four-chamber boxes, and locating them at a series of locations around the CWP (including on buildings, trees and specially-erected poles).

Monitoring sites include Cokes Pit LNR, Cleveland Lakes Reserve, the Disused Railway Line (all CWPT owned or managed sites), Clattinger Farm/Sandpool Farm (Wiltshire Wildlife Trust), Freeth Mere SSSI/Pike Corner SSSI/Swillbrook Lakes Reserve (Lower Mill Estate), Whelford Pools SSSI & Roundhouse Lake SSSI (Gloucestershire Wildlife Trust Reserves) and Clayhill Copse and Cerney Wick Copse (in private landownership). Bat box schemes have also been established in the Braydon Forest at Stonehill Wood (in private landownership) and Ravensroost Wood SSSI Reserve (Wiltshire Wildlife Trust). All boxes are monitored at least 2-3 times annually, with all bats processed and species of interest ringed.

Will Ponting has undertaken a detailed ringing study of Soprano Pipistrelle bats using boxes in the Pike Corner SSSI and Freeth Mere SSSI schemes (2011 to date), generating some interesting insights into survival, fidelity and territory size.

## 2.4. Static detector surveys

In 2008 the project purchased an Anabat SD1; this has been regularly used across a range of sites in the CWP ever since, generating considerable volumes of data. Over-enthusiastic deployment in 2008 resulted in an unexpectedly large volume of data; thankfully, Dani Linton was able to rescue the situation and support extensive analyses and interpretation!

The various static detectors have produced some interesting data for the CWP, giving a greater insight into the proportion of passes by different species, as well as regularly recording species such as Nathusius' Pipistrelle, Barbastelle, Serotine, Noctule and occasionally Lesser Horseshoe bats.

## 2.5. Surveys of buildings including barns and churches

A perennial mystery in the CWP revolves around the scale of potential foraging habitat versus potential roosting sites. Despite finding a large number of roosting sites across the CWP in various buildings, it is clear that there are likely many more to found.

The large numbers of Cotswold stone and brick buildings within the settlements of the CWP area include large and small, old and modern structures, many of which are clearly potential roosting sites for bats. Such buildings include houses, barns and churches.

The project has surveyed a large number of buildings (over 55), plus ten churches (see Table 2.5). Roosts of many common species of bats have been found in the process, including Common and Soprano Pipistrelle, Brown Long-eared, Natterer's and Serotine bats.

The Chancel, Waterhay, Ashton Keynes	St Mary's Church, Kempford
Shorcote Church, Shorcote	St Sampson's Church, Cricklade
All Saints Church, Ashton Keynes	Holy Trinity Church, Cerney Wick
All Saints Church, Somerford Keynes	St Mary's Church, Meysey Hampton
St Anne's Church, Whelford	All Hallows Church, South Cerney

**Table 1 Churches surveyed since 2005**

Surveys have been undertaken of a number of additional churches, led by Dr Sandie Sowler and Richard Crompton, as part of their regular bat licence training courses, resulting in additional records of Lesser Horseshoe bats.

A number of the same churches were surveyed by Dr Sandie Sowler in the 1990s for Bat Conservation Trust's *National Bats in Churches Survey*. At that time none of those churches surveyed were found to support Serotine bats<sup>3</sup>. Recent re-surveys by this project however, have found Serotine in at least seven of the churches surveyed so far.

## 2.6. Bridge Surveys

During the course of the project over 30 bridges and associated structures have been surveyed and assessed. Features suitable for roosting bats were found in comparatively few, but roosting sites used by Daubenton's bats have been found in a number of bridges. Whilst most of the occupied roosts are in stone bridges over rivers and streams, a number are also found in red brick railway bridges and culverts along the disused railway line and disused Thames-Severn Canal. (See section 4.7 for further information).

All records of bridge-roosting bats have been shared with local biological records centres to ensure these data are available to local authorities undertaking maintenance works upon local bridges.

<sup>3</sup> Dr Sandie Sowler 2014, personal communication.

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However, concern has been expressed that Highways Departments in local authorities do not always consult their respective local records centre.

### **2.7. Roost surveys, visits and monitoring & local communities**

Considerable effort and time have been spent searching for new bat roosts in local villages, meeting with local communities and presenting evening talks to local groups. Such extensive communication and liaison with local communities has added a considerable amount to our knowledge of local bat populations, through invites to survey houses and churches, invites to access private land and in many cases, establish regular monitoring of roosting sites.

Also as invaluable has been the extensive knowledge shared by local bat workers, such as Dr Sandie Sowler, Andi Smart, Dave Endacott and Paul Darby, who have undertaken work in this area for a number of years and freely shared their knowledge.

### **2.8. Radio-tracking**

As we attempt to collect ever more detailed information about how our bats use the CWP so we adopt new techniques. A key aspect of local populations that is currently poorly understood is important flightlines. In 2012 Daubenton's bats were radiotagged in order to begin to describe flightlines in the vicinity of Cleveland Lakes Reserve and where possible to locate new roosting sites of this species. Further radiotracking is planned in the future.

### 3. Introduction to the Species Accounts

#### 3.1. Records: numbers and record types

Since the project began in 2005, the results of all survey events have been stored in a simple database, formatted to maximise the efficiency with which records can be shared with local records centres.

To date (as of 31<sup>st</sup> December 2013), a total of 1647 bat records have been logged, all of which have been shared with the local records centres. Table 3.1 presents the species checklist for the CWP. Table 3.2 presents the numbers of records generated by survey type and species: approximately one in five of the total records have been produced through static detector surveys, manual detector surveys or bat box monitoring surveys. Twelve percent of records were produced through emergence surveys, whilst 9.4% were derived from trapping surveys. 13% of records were produced through various roost visits.

#### 3.2. A checklist of species recorded in the CWP to date

Fourteen species of bat have been recorded in the CWP to date. The sequence and nomenclature follows Richardson 2000<sup>4</sup> and Dietz et al 2009<sup>5</sup>.

**Table 2 Species checklist for the CWP**

Order: <i>Chiroptera</i>	
Suborder: <i>Microchiroptera</i>	
Family: <i>Rhinolophidae</i> , the Horseshoe bats	Family: <i>Vespertilionidae</i> , the Vesper bats
Greater Horseshoe bat, <i>Rhinolophus ferrumequinum</i> Lesser Horseshoe bat, <i>Rhinolophus hipposideros</i>	Whiskered bat, <i>Myotis mystacinus</i> Brandt's bat, <i>Myotis brandtii</i> Natterer's bat, <i>Myotis nattereri</i> Bechstein's bat, <i>Myotis bechsteinii</i> Daubenton's bat, <i>Myotis daubentonii</i> Serotine bat, <i>Eptesicus serotinus</i> Noctule bat, <i>Nyctalus noctula</i> Common Pipistrelle bat, <i>Pipistrellus pipistrellus</i> Soprano Pipistrelle bat, <i>Pipistrellus pygmaeus</i> Nathusius' Pipistrelle bat, <i>Pipistrellus nathusii</i> Barbastelle bat, <i>Barbastella barbastellus</i> Brown Long-eared bat, <i>Plecotus auritus</i>

<sup>4</sup> Richardson, P. (2000) *Distribution Atlas of Bats in Britain and Ireland 1980-1999*. Bat Conservation Trust, London.

<sup>5</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. *Bats of Britain, Europe and Northwest Africa*. A&C Black.

Table 3 Records generated by survey type

Species	Survey Type* (Numbers of records)							Grand Total
	Static detector Survey	bat box survey	detector survey	emergence survey	Field Observation	harp trap / mist net	roost visit	
Barbastelle Bat	2		6	1		1		10
Bechstein's Bat		13		2	3	8		26
Brandt's Bat		2				3		5
Brown Long-eared Bat	4	16	7	10	2	23	24	86
Chiroptera		6		4			33	43
Common Pipistrelle Bat	95	11	66	26	8	27	7	240
Daubenton's Bat	6	3	14	17		22	34	99
Greater Horseshoe Bat	1		1					2
Lesser Horseshoe Bat	14		6	5			17	42
Nathusius' Pipistrelle Bat	15	1	8		1			25
Natterer's Bat	1	13	15	22	3	19	19	92
Noctule Bat	46		46	11	3	3	1	110
Pipistrelle Bat (Unidentified)	3	73	8	3	3		39	129
Serotine Bat	6		11	6	1	1	15	40
Soprano Pipistrelle Bat	95	196	67	74	5	35	12	484
Unidentified Long Eared Bat	8		9	3			11	31
Unidentified Myotis	95	1	40	13	1		4	154
Whiskered Bat		5			4	13		22
Whiskered/Brandt's Bat		2	4		1			7
<b>Grand Total</b>	391	342	308	197	38	155	216	1647
%	23.7	20.8	18.7	12.0	2.3	9.4	13.1	100%

\*Static detector survey comprises records generated by static detectors such as Anabat SDI/SDII, Song Meter 2 etc.; detector survey records typically comprise those arising from formal survey events involving heterodyne, frequency division or time expansion detectors; harp trap/mist net records result from trapping surveys; Field Observation represents records generated from various field events and informal detector results.

### 3.3 Summer Roosting bats

Of the 14 species of bat recorded in the CWP to date 11 species have been found roosting (in buildings, bat boxes etc.) and the remaining 3 species have been recorded only on bat detectors (see Table 5).

A number of species, such as the *Myotis*, *Nyctalus* and *Plecotus* species cannot often reliably be differentiated on bat detectors. In-the-hand records have confirmed the identity of these species.

All roosts visited were classified into one of three categories: *maternity roost*, *hibernation*, or simply *roost*. Table 5 presents the numbers of records generated for maternity roosts, hibernation roosts and other roosts.

To date, 138 records relating to 46 different confirmed maternity roosts have been recorded in the CWP, plus 562 records of 88 other roosts, but only 1 hibernation roost. [Note that those 562 records include many records of bats roosting in, but not breeding in, bat boxes. These numbers do not reflect each individual bat box, but the grouping of bat boxes: a calculation by individual box would dramatically increase this number since in excess of 300 bat boxes are monitored annually]. The confirmed maternity roosts include numerous houses, bridges and small numbers of bat boxes with confirmed maternity roosts of species such as Soprano Pipistrelle, Common Pipistrelle, Daubenton's, Natterer's, Bechstein's and Brown Long-eared bats.

**Table 4 Roost type and species concerned**

Species	Roost type (number of records)				Grand Total
	Hibernation Roost	Maternity Roost	Roost	Non-roost records	
Barbastelle Bat				10	10
Bechstein's Bat		8	9	9	26
Brandt's Bat			2	3	5
Brown Long-eared Bat		17	34	35	86
Chiroptera			22	21	43
Common Pipistrelle Bat		7	30	203	240
Daubenton's Bat	1	21	31	46	99
Greater Horseshoe Bat				2	2
Lesser Horseshoe Bat		1	25	16	42
Nathusius' Pipistrelle Bat			1	24	25
Natterer's Bat		23	32	37	92
Noctule Bat				110	110
Pipistrelle Bat (Unidentified)		3	111	15	129
Serotine Bat		1	13	26	40
Soprano Pipistrelle Bat		56	219	209	484
Unidentified Long Eared Bat			13	18	31
Unidentified Myotis		1	12	141	154
Whiskered Bat			6	16	22
Whiskered/Brandt's Bat			2	5	7
<b>Grand Total</b>	<b>1</b>	<b>138</b>	<b>562</b>	<b>946</b>	<b>1647</b>

### 3.4 Hibernating bats

To date little work has been undertaken in the CWP to survey for hibernating bats, although it may be assumed that a number of large built structures, such as large bridges and buildings, could offer opportunities for hibernating bats. This area of the Upper Thames Valley presents groundwater levels which are at or above ground level throughout much of the winter months. Consequently, the geology of much of the CWP precludes the presence of underground sites such as mines, cellars or infrastructure tunnels which are not entirely flooded during the winter months. However, there are other sites nearby such as Sapperton Tunnel and various limestone mines in the Cotswolds. If used by bats from the CWP, this would suggest that bats may travel some distance to certain hibernation sites.

Of note is the single known record of hibernating bats in the CWP (although bats have apparently been found in local churches when undertaking roofing works in the winter months). In December 2013 use of one of the red brick railway bridges on the disused railway line, near South Cerney, by hibernating Daubenton's bats was proven. Whilst the bridges on this railway line have been known to support breeding and/or summer roosting bats for many years, this is certainly the first proven evidence, to our knowledge, of bats hibernating here. This has significant conservation and development implications since these bridges have been subject to works by Gloucestershire Highways during 2011-2014 in order to improve drainage and public safety.

A casual assessment of potential sites within the CWP which may provide conditions for hibernating bats (in spite of the apparent limitations highlighted above) may highlight structures such as churches, stone barns, stone bridges associated with river crossings, brick railway bridges associated with the disused railway line and stone culverts associated with waterways such as rivers and the Thames-Severn Canal. An abundance of opportunities present themselves for surveys for

hibernating bats, and indeed, the vast numbers of bats present in the CWP during the summer suggest that some at least must be hibernating here.

### 3.5 Identification to genus or species level

Identification of bats has been undertaken carefully, accurately and consistently at all times. Use of published keys and reference material<sup>6</sup> along with ongoing training has helped to ensure identification remains up-to-date with current research and opinion.

Where possible all bats have been identified to species level, facilitated by considerable trapping surveys offering the opportunity to confirm species in-the-hand. Bats recorded on detectors (and/or software-analysed) may be only identified to genus level instead in some instances. Identification using software such as Anlook or BatSound has been undertaken conservatively: where more unusual or unexpected species were identified during analyses, second opinions were sought from more experienced observers. In such cases, Dr Dani Linton, amongst others, is warmly thanked for her knowledge and expertise given freely to this project. Where doubt remained records were attributed at genus level only.

Since all records are shared with partner organisations and local records centres, ultimately to find their way onto the National Biodiversity Network Gateway, identification must always remain accurate and conservative. Unless proven to species level, long-eared bats are recorded as *Plecotus species*, Myotis bats were simply recorded as *Myotis* species and *Nyctalids* were simply recorded as *Nyctalus sp.* etc. Where necessary, additional maps are presented in the species accounts to reflect these records.

### 3.6 Introduction to the species accounts and maps

The following section provides brief accounts for each species, outlining the national and local CWP status, typical habitats (nationally and locally) and observations resulting from fieldwork in and around the CWP and also recommendations for further work. These accounts are not intended to comprise a field guide or reference for the ecology of bats so such information is kept to a minimum and readers are encouraged to consult some of the many excellent texts on this subject such as those listed in the references section of this document.

Two maps are provided for each species where possible and where data allows;

- **Field Records:** The first map presents all field records (i.e. non-roost records) comprising records generated by static detectors, detector surveys, field observations and trapping surveys. As outlined in section 3.4 identification to species level is not always possible and consequently a number of maps are included where identification is to genus level only (e.g. *Plecotus* species, *Myotis* species etc.).

**Kilometre squares with positive field records for each species are highlighted green.**

- **Roost Records:** the second map presents all roost records, produced from roost monitoring, bat boxes, emergence surveys, hibernation records and counts at maternity sites.

**Kilometre squares with positive records for maternity, hibernation and other roosts are highlighted red, red with black cross-hatching and orange respectively.**

<sup>6</sup> References included;

Dietz C. & von Helversen O. (2004). Illustrated identification key to the bats of Europe. Electronic publication, Version 1.0, First released 15.12.2004

Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.



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All data presented are those records collected by Cotswold Water Park Trust staff and volunteers in contributing to the CWP Bat Initiative from 2005 to present date (31<sup>st</sup> December 2013), plus additional records submitted by project supporters such as local ecological consultants when undertaking works in the CWP.

All records have been plotted at monad level (i.e. 1km square level), balancing site confidentiality of privately-owned sites or species of conservation concern, with the production of meaningful maps presenting accurate and clear information.

Each map presents the project boundary. The Cotswold Water Park Biodiversity Action Plan project area was the original focus for the project however the discovery of Bechstein's bats in the Braydon Forest to the south led to the extension of the project area beyond this original boundary. This boundary is presented as a red solid line. (See section 1.6 The Study Area, for further details)

Since the CWP lies partly in four administrative areas (Gloucestershire County, Wiltshire County and Oxfordshire County, Cotswold District, and Swindon Borough), the administrative boundary is provided (grey, dashed line).

Kilometre squares with positive field or roost records are highlighted accordingly. Kilometre squares which remain blank represent, not a dearth of bats, but simply areas subjected to less recording. Such sites may be a focus for study in future years.

### **3.7. All species**

Figures 3.6a and 3.6b present the overall spread of all 1,647 bat records across the CWP, highlighting the monads with field records and roost records respectively. These figures highlight both the extensive nature of bat survey effort undertaken in the CWP, as well as the rich abundance of bats.

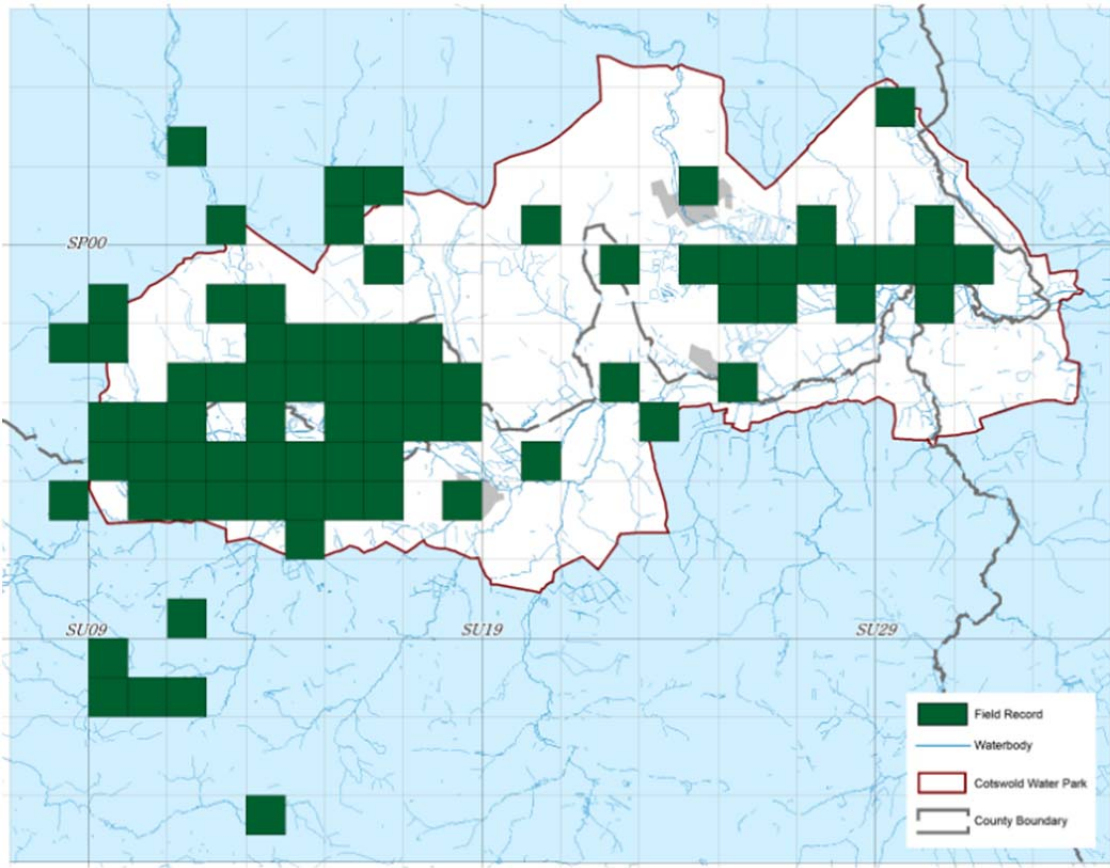


Figure 3.6a Field Records: All Species

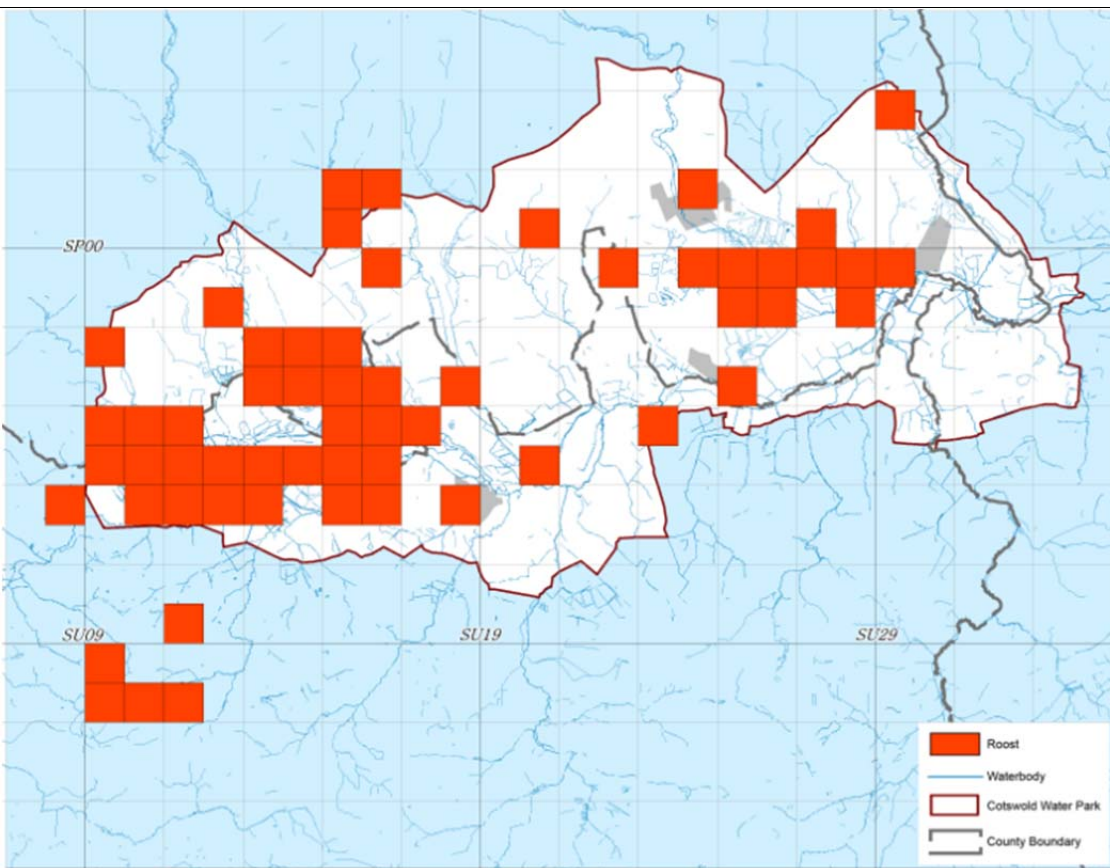


Figure 3.6b Roost Records: All Species

## 4 Species Accounts

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### 4.1 Greater Horseshoe bat, *Rhinolophus ferrumequinum* Schreber, 1774

#### National and local CWP status

Restricted to south-west England and south-west Wales<sup>7</sup>.

A single record in the CWP; an individual bat recorded by detector by Dr Sandie Sowler in 2007 adjacent to RAF Fairford. The second record for this project was generated in May 2010 in the Braydon Forest. This was an Anabat recording during trapping surveys.

#### Habitats

Forages in pasture, parkland, meadows and woodland, often associated with water and typically using landscape features to navigate between foraging areas<sup>8</sup>. Dietz et al (2009) stresses the importance of a diverse habitat structure comprising woodland, pastures, hedgerows and tree lines; riparian corridors may be important during cooler weather conditions<sup>9</sup>. Many authors, for example, Dietz et al (2009) also stress the important contribution that extensively-managed grazing systems provide for this species, which require grazing animals and the invertebrates (such as dung beetles) associated with their dung.

#### Observations from the CWP

Clearly very rare in the CWP; nevertheless a number of areas within the CWP offer suitable habitat, such as riparian corridors and wet meadows for foraging. Potential summer roosting sites are likely to comprise large old buildings, whilst it is perhaps more likely that this species would retreat to underground hibernation sites in the Cotswold Hills during the winter months. The CWP likely lacks an adequate resource of pasture and livestock in close proximity to suitable roosting sites, although this remains a presumption.

The Braydon Forest, to the south of the CWP, may offer considerable foraging habitat for horseshoe bats, ranging from large blocks of ancient and semi-natural broad-leaved woodland, to species-rich meadows and a highly permeable landscape with a dense hedgerow network. The greater abundance of livestock here, albeit associated with dairy farming, sheep grazing and horse pasture may offer greater opportunity for foraging horseshoe bats.

#### Further work in the CWP & Braydon Forest

Clarifying the status of this species in the Braydon Forest is a priority; few, if any, other records of this species are known from this area which was known to be under-surveyed until recently.

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<sup>7</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>8</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>9</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

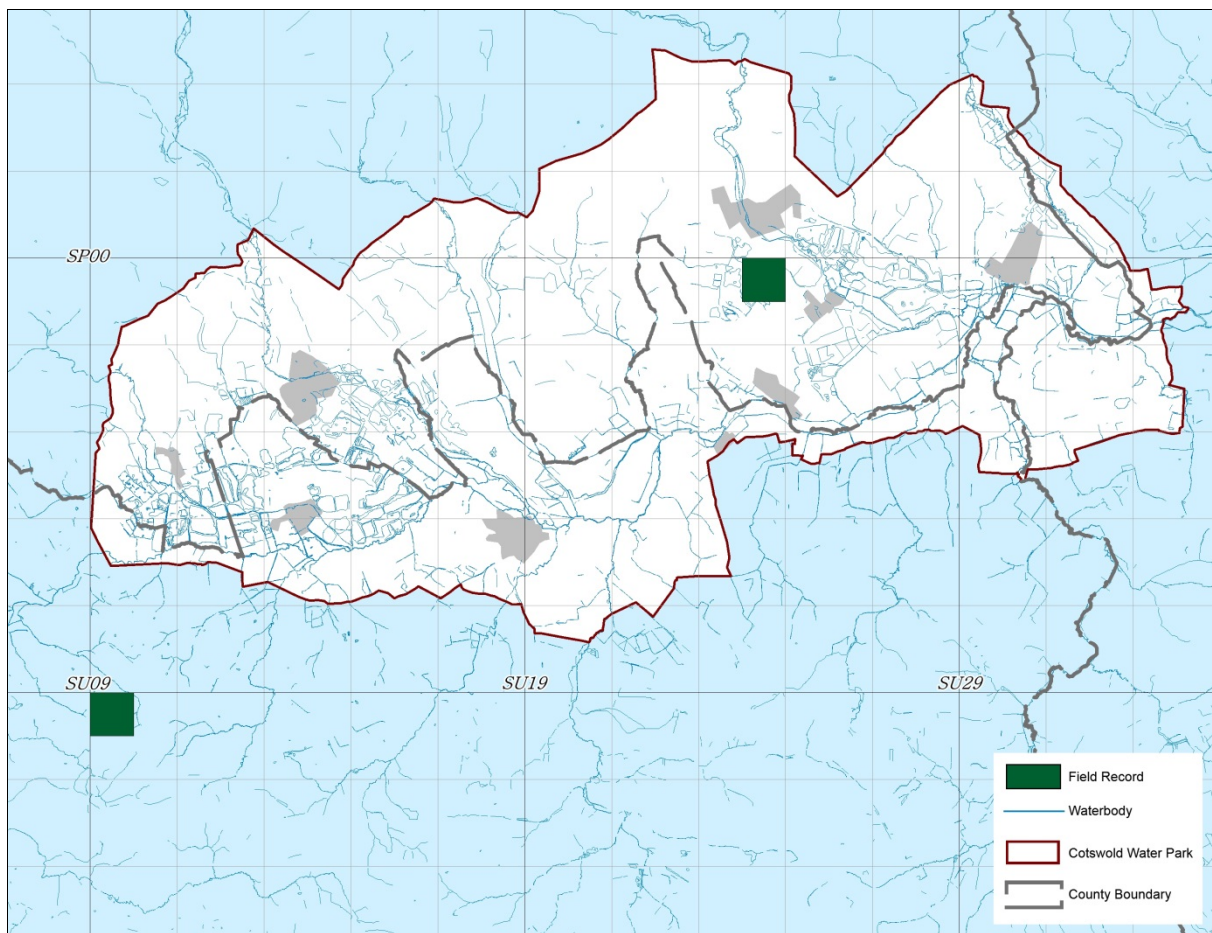


Figure 4.1 Greater Horseshoe bat: Field Records

## 4.2 Lesser Horseshoe bat, *Rhinolophus hipposideros* Bechstein, 1800

### National and local CWP status

Mainly restricted to south-west England, Wales and the west of Ireland. Warwickshire and Oxfordshire likely represent the eastern edge of the range of this species.<sup>10</sup> The UK represents the northern edge of its European range<sup>11</sup>.

Recorded foraging around a number of mature lakes in the western CWP; a shepherds field shelter, in South Cerney, converted to a bat house specifically for this species in 2009 (following advice and input from Dr Henry Schofield)<sup>12</sup> attracted an individual within five months of construction which has continued to night roost here regularly. No other roosting sites are known nearby, except for a small possibly historic maternity roost in Cerney Wick, now considered likely to be a long-term occasional roosting site or feeding perch. Day roosts recorded in Ewen, Southrop and Harnhill, with additional occasional/night roosts recorded in Whelford and near Somerford Keynes.

As for the Greater Horseshoe bat, this species was also recorded by Anabat static detectors during survey work in the Braydon Forest in 2010 and 2011.

### Habitats

Mainly deciduous woodland and wetlands, but also pasture, woodland edge and hedgerows; patrols riverbank edges next to luxuriant riparian vegetation. Broadleaved woodland generally used more than any other habitat<sup>13</sup>. Dietz et al (2009) stresses the importance of the proximity to water<sup>14</sup>.

Roosting sites are typically draught-free roof spaces of churches, castles and other large buildings, sometimes utilising closets, wardrobes, chimney breasts and boiler rooms<sup>8,9</sup>.

The CWP, being largely devoid of even modest areas of broad-leaved woodland, would appear unsuitable for this species; however the importance of wetland habitats in conjunction with a number of local records suggests the CWP may be more important than currently known. This species has been recorded foraging around lake margins on a number of occasions, typically favouring the dense vegetation of the older lakes, and likely using mature dense hedgerows with mature in-hedgerow trees as commuting routes. A large number of old, Cotswold stone buildings across the area may offer roosting sites.

### Observations from the CWP

Uncommon in the CWP but very under-recorded; this species is possibly more widely distributed. Clarifying its distribution in light of considerable built development in recent years, in order to ensure this species, its roosts, foraging areas and commuting routes are safeguarded is an urgent priority. This species is perhaps the greatest surprise in the CWP, surviving decades of landscape disruption and dramatic landscape degradation through changes in agriculture and of gravel extraction since the 1950's.

The Braydon Forest, to the south of the CWP, however, offers considerable foraging habitats for horseshoe bats, ranging from large blocks of ancient and semi-natural broad-leaved woodland, to species-rich meadows and a highly permeable landscape with a dense hedgerow network.

### Further work in the CWP & Braydon Forest

Clarifying the status of this species in the CWP and in the lower elevations of the Cotswold Hills is an urgent priority; conservation action is needed across a wide, landscape area in order to safeguard and understand this species. As yet unknown roosting sites are suspected in the Cerney Wick and Fairford areas of the CWP. Clarifying the status of this species in the Braydon Forest is also a priority. Few, if any, other records of this species are known from this area which was known to be under-surveyed until recently.

<sup>10</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>11</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>12</sup> Schofield, H.W. (2008). The Lesser Horseshoe Conservation Handbook. Vincent Wildlife Trust, London.

<sup>13</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>14</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.



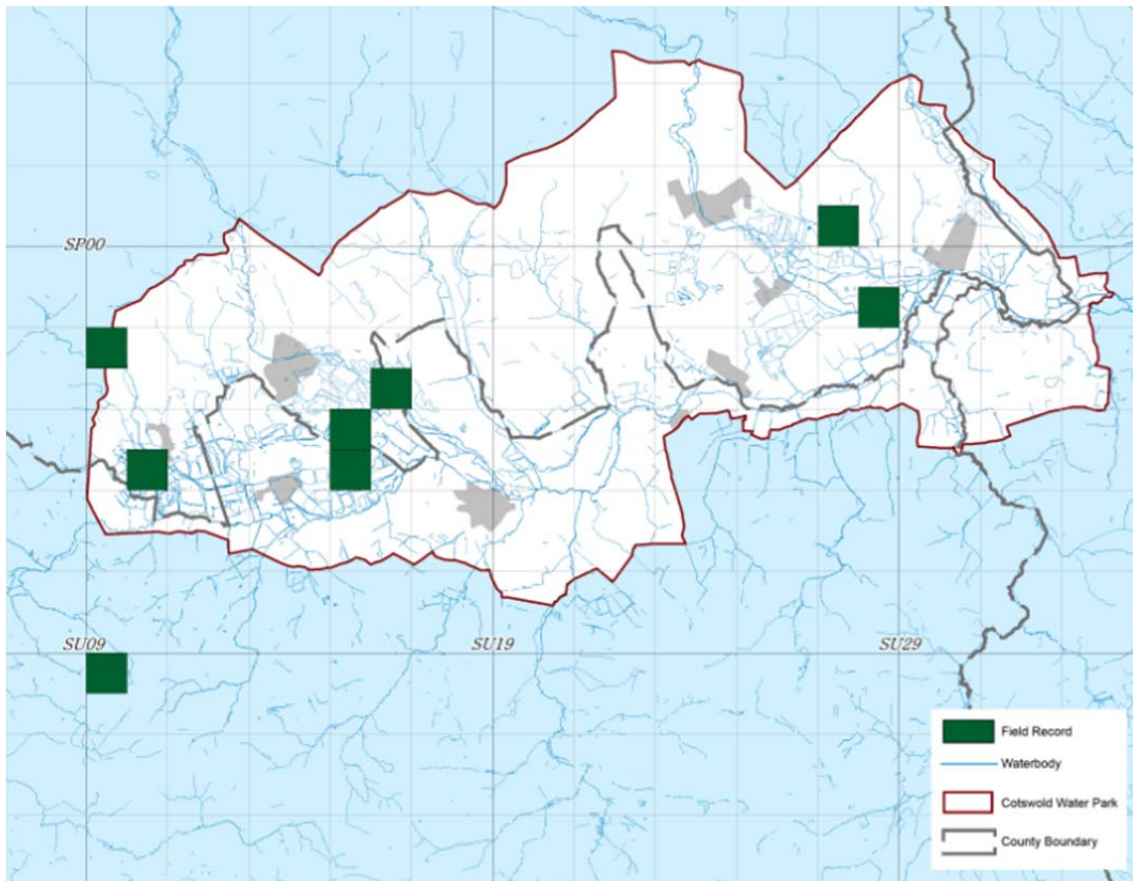


Figure 4.2a Lesser Horseshoe Bat: Field Records

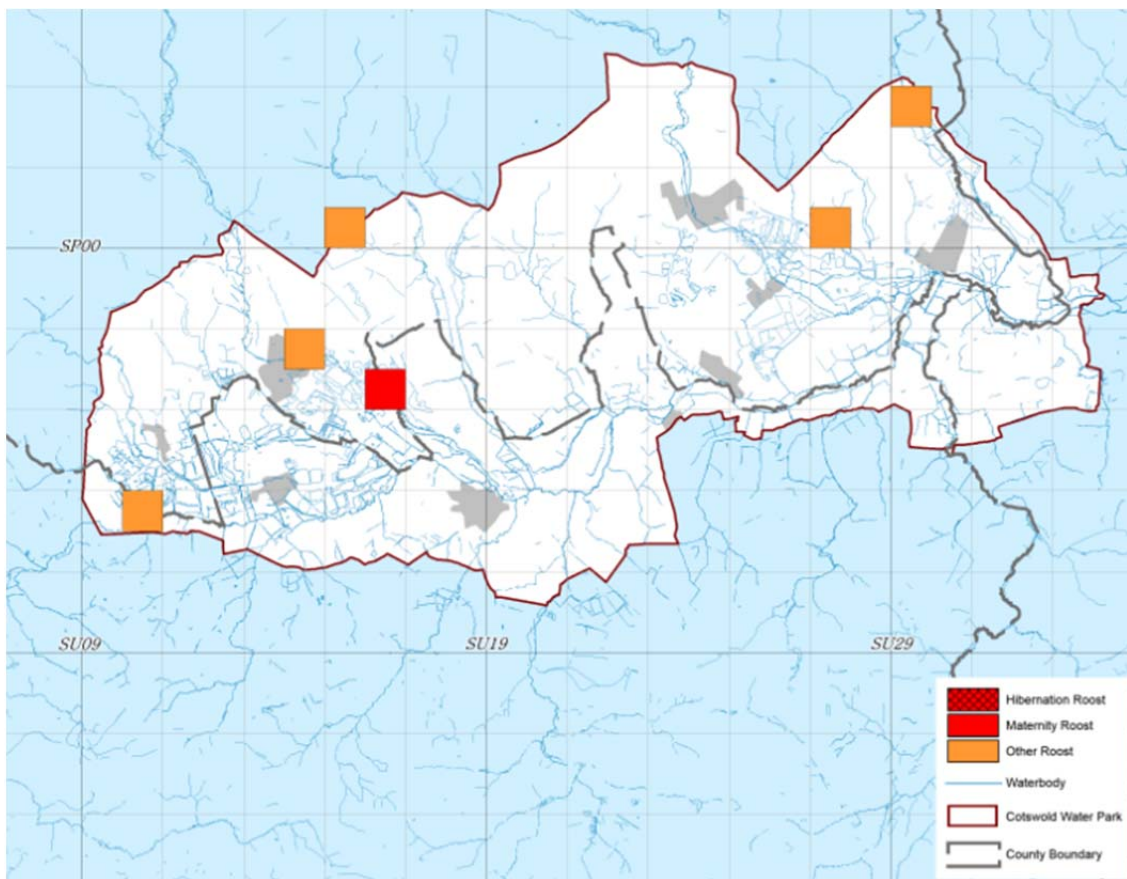


Figure 4.2b Lesser Horseshoe Bat: Roost Records

### 4.3 Whiskered bat, *Myotis mystacinus* Kuhl, 1819

#### National and local CWP status

Distributed across the Britain, through England, Wales, southern Scotland and Ireland<sup>15</sup>.

Recorded from a number of sites in the CWP, during either trapping surveys or bat box monitoring. Regular trapping surveys at Cleveland Lakes Reserve have recorded a number of individuals of adults and juveniles, males and females; they periodically use bat boxes in the western CWP, for example, Swillbrook Lakes and Freeth Mere SSSI. Trapping in the Braydon Forest has also produced a number of individuals. In 2012 Dr Dani Linton trapped an individual at Ravensroost Wood SSSI (Wiltshire Wildlife Trust Reserve) and radiotracked it back to a roosting site in a nearby barn (D. Linton, 2012, *pers. comm.*).

#### Habitats

Adopts a variety of habitats; woodland, parkland, meadows, flowing water and gardens, often foraging along the densest parts of edge habitats of woodlands and rides<sup>16</sup>. Russ (2012) also indicated that it favours woodland and riparian habitats, but “not quite as associated with water and woodland as Brandt’s bat”. Whiskered bats have been recorded roosting and foraging along edge habitats in the CWP, typically hedgerows, copses and lake margins, in particular where such habitats are mature and well developed.

#### Observations from the CWP

This species is infrequently but regularly recorded in the CWP, including adults and juveniles, indicating local breeding. Aside from individuals roosting in bat boxes no roosts have been found to date. Anecdotally, this species is encountered more frequently than Brandt’s bat in the CWP.

#### Further work in the CWP & Braydon Forest

Whilst further studies are initiated nationally to understand habitat use and partitioning by the three small *Myotis* species in the UK (*M. mystacinus*, *M. brandtii*, *M. alcathoe*), including the studies undertaken in 2013 by Phil Brown, Bristol University, further local studies can contribute to the national understanding of these species. Further study of the small *Myotis* in the CWP and Braydon Forest will be encouraged to assess local populations, preferred roosting sites and foraging areas, as well as to begin to understand interactions between these species (if *Alcathoe* is present!).

<sup>15</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>16</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

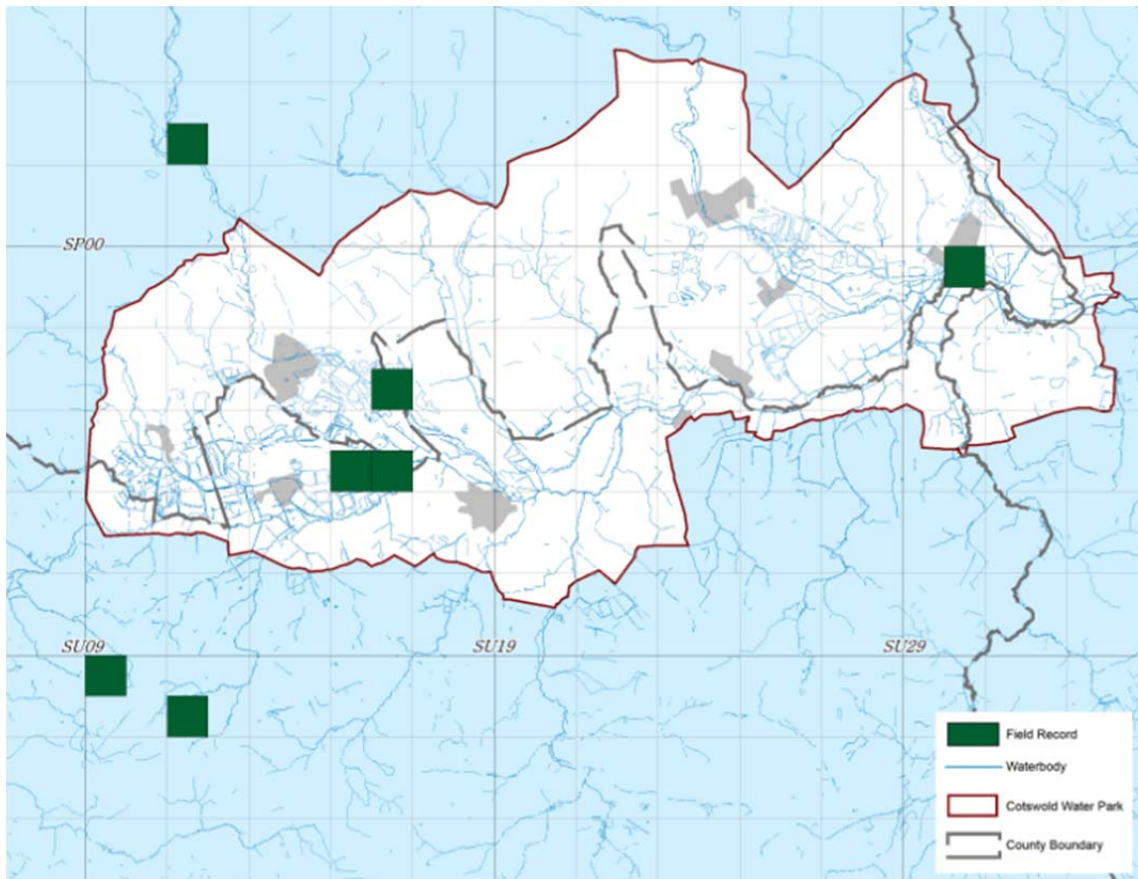


Figure 4.3a Whiskered Bat: Field Records

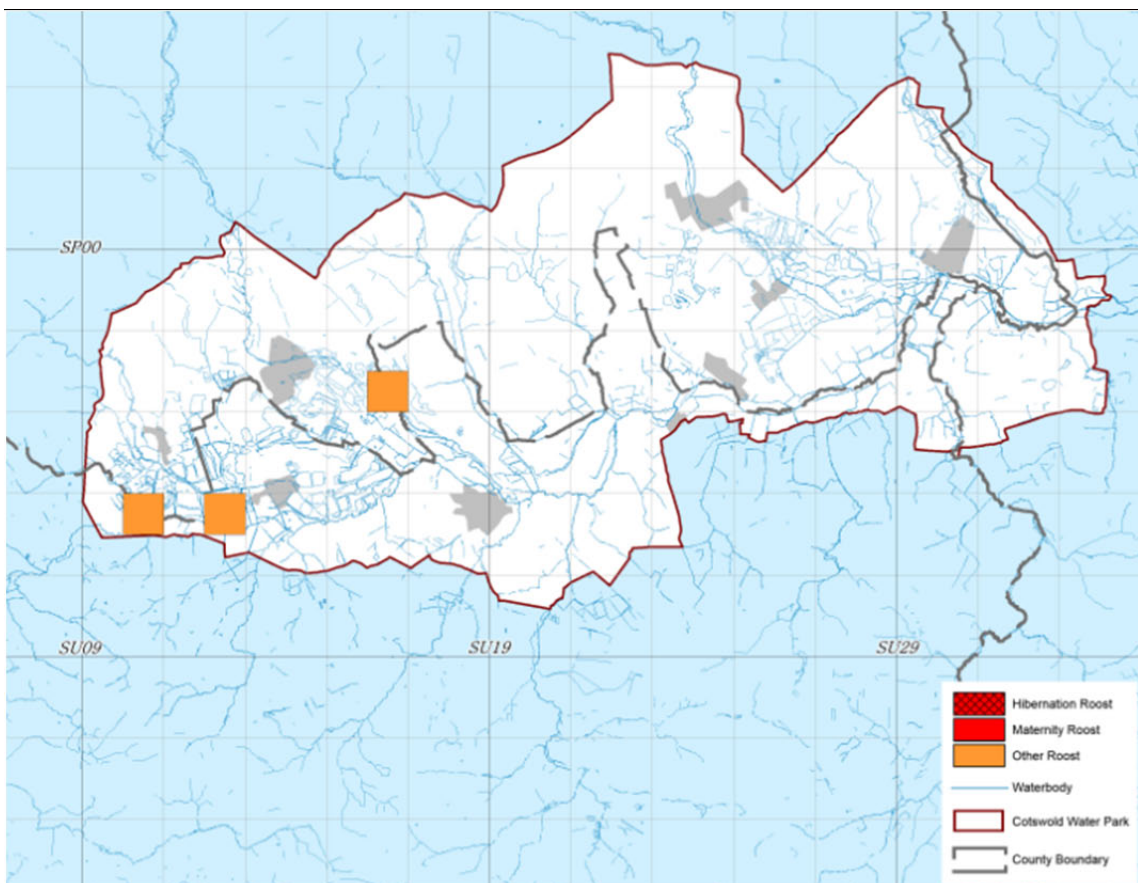


Figure 4.3b Whiskered Bat: Roost Records



#### 4.4 Brandt's bat, *Myotis brandtii* Eversmann, 1845

##### National and local CWP status

Restricted to England and Wales<sup>17</sup>.

Infrequently recorded in the CWP; three records in the CWP comprises two bat box records (both of adult males) and a mist-netting record of a male and female in May 2010. Two further records from the Braydon Forest were of a post-lactating adult female and an adult male. All records have been from the vicinity of the Swill Brook corridor (e.g. Swillbrook Lakes Reserve and Freeth Mere SSSI) lying in close proximity to the Braydon Forest.

##### Habitats

Russ (2012)<sup>18</sup> describes preferred habitats as similar to Whiskered bats (typically woodlands, parkland, meadows, flowing water and gardens), but showing greater association with woodland and bodies of water.

The Swill Brook corridor and Braydon Forest represents a close habitat match to the above description, comprising areas of mature broad-leaved and mixed woodland, riparian woodland and mature, dense hedgerows, in close proximity to mature and well-vegetated gravel pits.

##### Observations from the CWP

This is an infrequently-recorded species in the CWP, even allowing for difficulties in identification associated with the cryptic small *Myotis* species. Nevertheless all records have arisen in a small discrete area of the CWP. Further surveys of small *Myotis* bats elsewhere in the CWP and Braydon Forest may yield additional records.

##### Further work in the CWP & Braydon Forest

Beyond knowing that this species is present and likely breeding in the area, we know little of this species or of its local status.

Dietz et al (2009)<sup>19</sup> suggest that a colony (comprising 20-60 females, exceptionally up to 200) may utilise over 100km<sup>2</sup>, with females using up to 3 hunting grounds of 1-4ha within up to 10km of the roost. Such commuting bats may "follow guiding linear structures such as windbreaks, stream courses" and a network of hedgerows. This raises the possibility that some bats roosting in woodlands of the Braydon Forest may forage across much of the Braydon Forest and around the lakes of the CWP. Does the CWP support its own maternity colonies or comprise feeding grounds for a larger widely ranging population?

Landscape-scale conservation measures will be necessary to safeguard and enhance this species if indeed it is ranging so widely across a variety of habitat types. Dietz et al (2009)<sup>20</sup> goes further suggesting that "damp areas and semi-natural forests and their connection by windbreaks and hedges" should be maintained, while habitat fragmentation should be reversed by reconnecting fragmented landscapes.

<sup>17</sup> Russ J (2012). *British Bat Calls: A Guide to Species Identification*. Pelagic Publishing.

<sup>18</sup> Russ J (2012). *British Bat Calls: A Guide to Species Identification*. Pelagic Publishing.

<sup>19</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. *Bats of Britain, Europe and Northwest Africa*. A&C Black.

<sup>20</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. *Bats of Britain, Europe and Northwest Africa*. A&C Black.

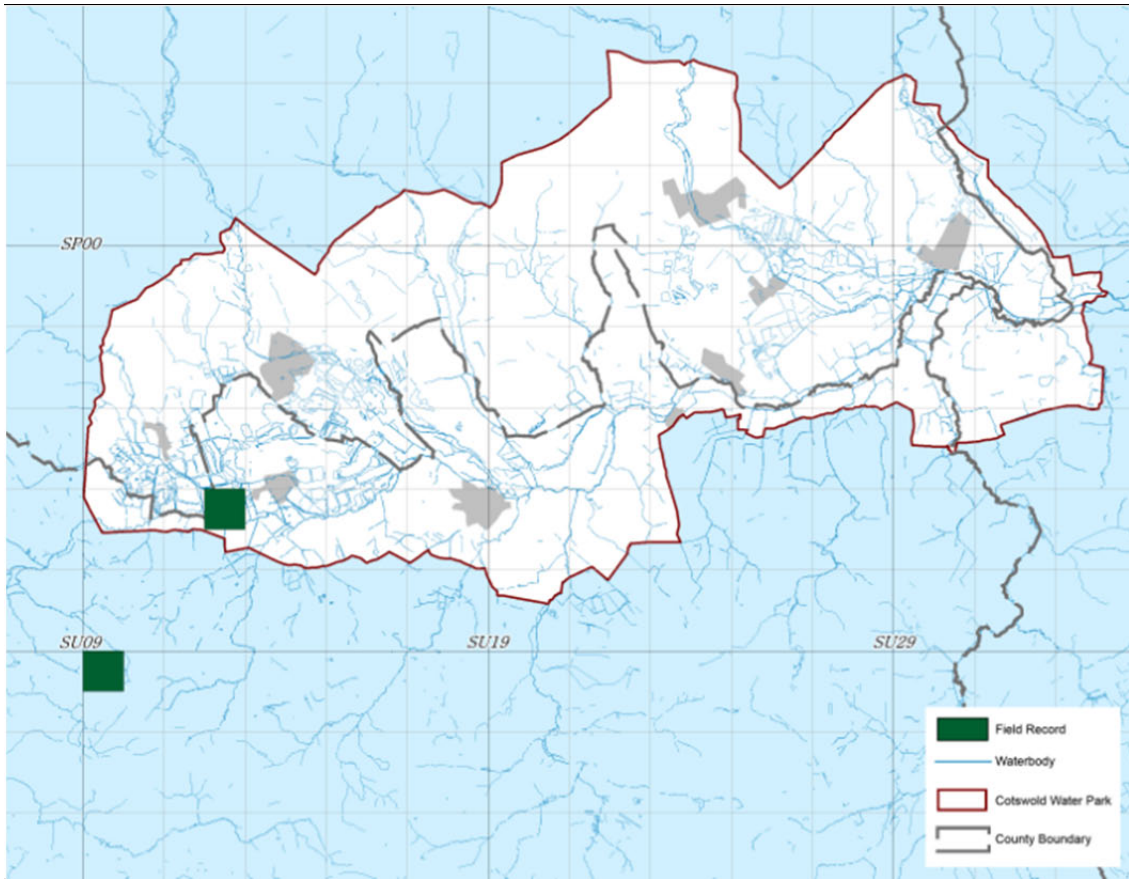


Figure 4.4a Brandt's Bat: Field Records

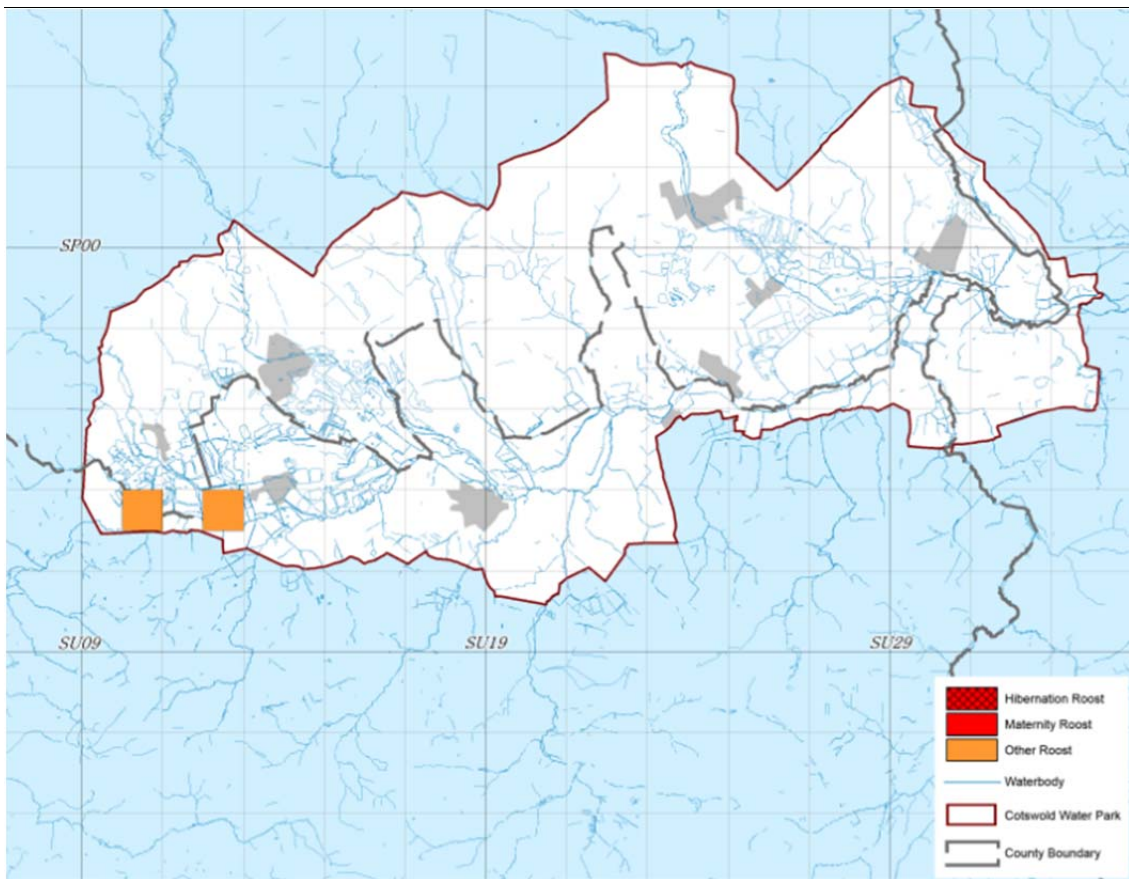


Figure 4.4b Brandt's Bat: Roost Records

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#### 4.5 Whiskered / Brandt's bat *Myotis sp*

A number of records of small *Myotis* bats have been collected where identification to species level was not possible, for example, where identification was made from photographs or where bats were found in crevices but were not available for in-the-hand examination.

Whilst such records may be of lower value than records where identification was possible to species-level, these records do add a modest amount to the species accounts for the individual species, specifically, that the records further highlight the field records and roosts in the western CWP in the vicinity of Somerford Keynes and the Swill Brook corridor.

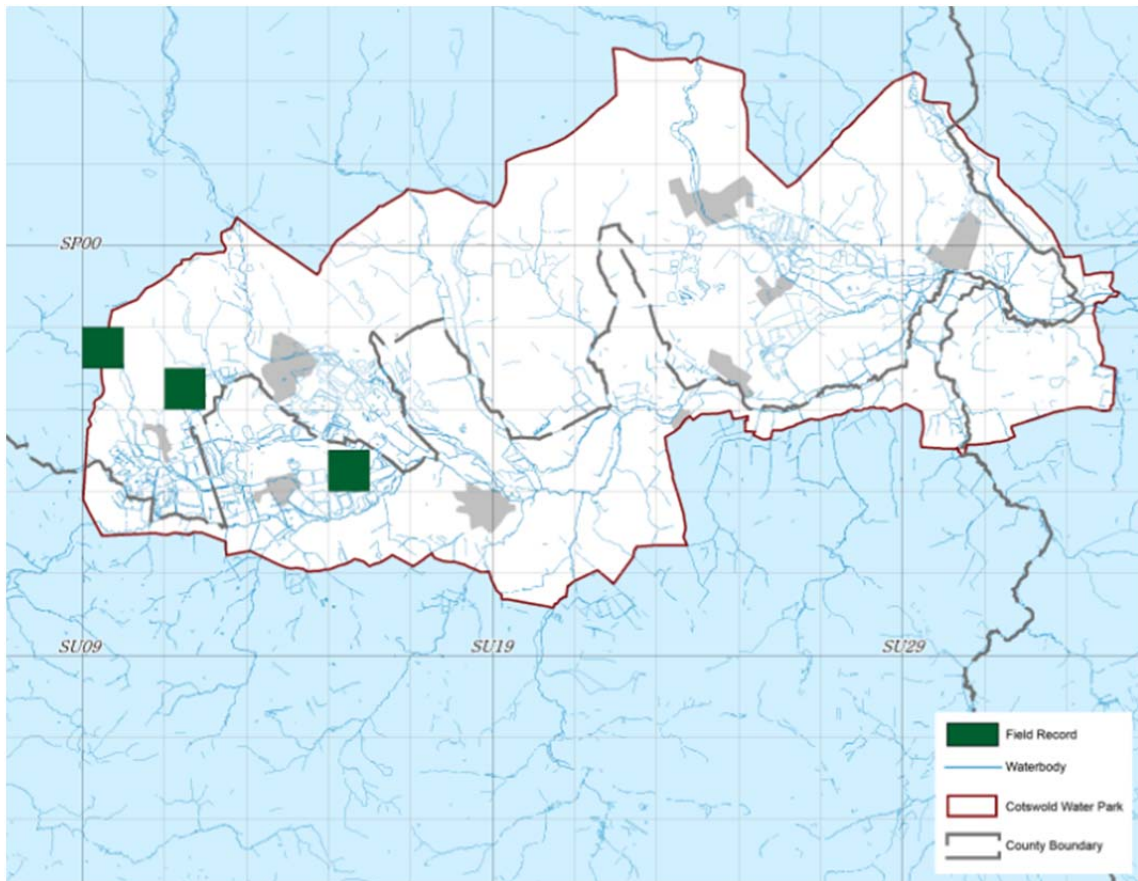


Figure 4.5a Whiskered / Brandt's Bat: Field Records

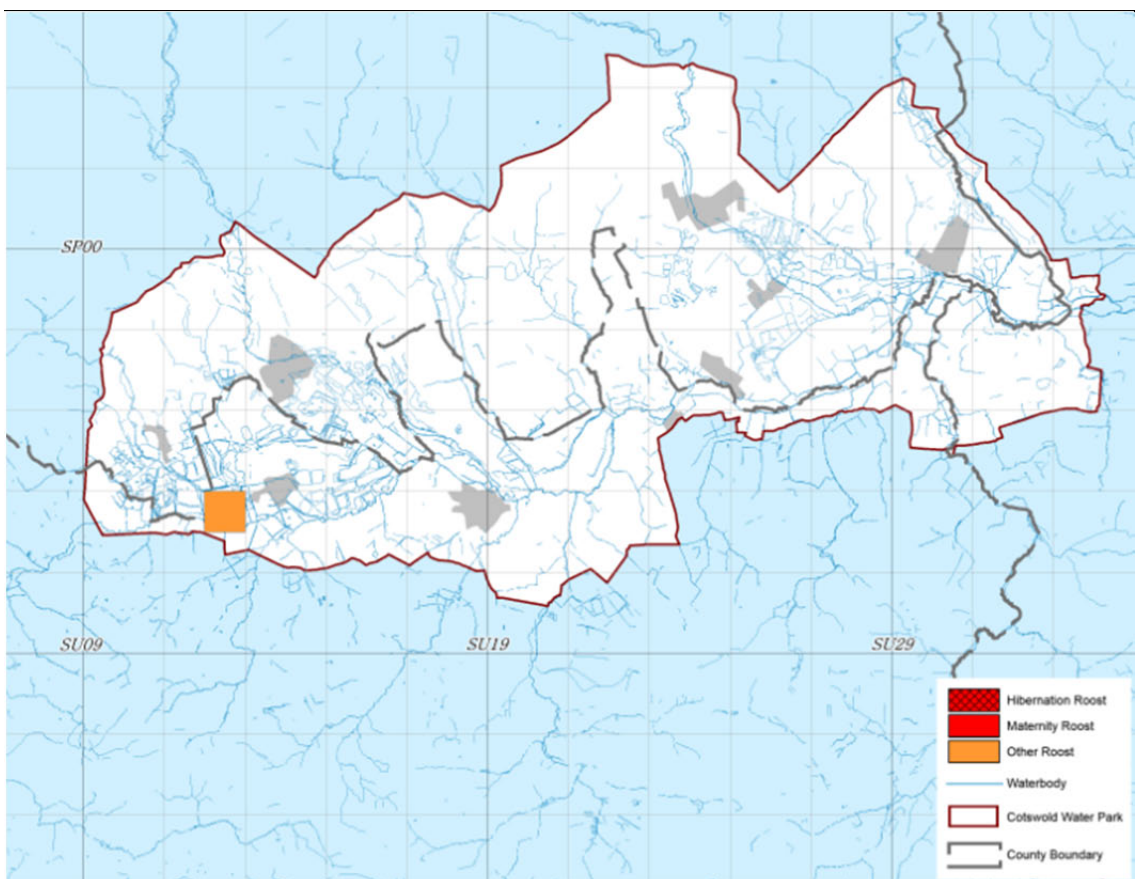


Figure 4.5b Whiskered / Brandt's Bat: Roost Records



## 4.6 Natterer's bat, *Myotis nattereri* Kuhl, 1817

### National and local CWP status

Widespread across much of Britain and Ireland, although not recorded as yet from the far north of Scotland.

Widely recorded from a number of monads across the CWP and Braydon Forest through bat box monitoring, mist netting and bat detector surveys. A number of regular maternity roost sites are known, in large stone barns, churches and in bat boxes. A number of individual male bats have also been found using bat boxes on occasion.

### Habitats

Russ (2012)<sup>21</sup> and Dietz (2009)<sup>22</sup> indicate that coniferous and broad-leaved woodland (including treelines, orchards and parkland) and alongside vegetated watercourses and wetland margins are utilised. Known to hunt over water and may be confused with Daubenton's bat when doing so, although typically forages higher above the water than Daubenton's bat.

In the CWP this species is found across a range of habitats, typically open habitats associated with villages (e.g. Ashton Keynes and Whelford), open mixed farmland with hedgerows (e.g., near Cricklade), mature trees and hedgerows associated with older gravel pits (e.g. Swillbrook Lakes). Where surveys have been targeted at woodlands in the CWP and Braydon Forest, this species has frequently been recorded through trapping and bat detectors. A number of trapping surveys across the CWP have found this species, foraging along river corridors, tree lines and dense hedgerows, as well as lake margins.

### Observations from the CWP

Frequently encountered during a range of survey types in the CWP in a range of habitats.

This is a species frequently recorded during hibernation and swarming surveys throughout the UK, however the CWP is yet to yield a hibernation or swarming site. A stone culvert in Cerney Wick, used by a large roost of male Daubenton's bats for much of the year is also frequently used by Natterer's bats during the autumn. Further work is required to understand the purpose and status of this roosting site, for example, to assess how this site is using by mating bats.

### Further work in the CWP & Braydon Forest

Relatively low numbers of summer roosting sites are known in the CWP. Based upon counts made at hibernation sites the UK is considered likely to support internationally-important numbers<sup>23</sup>; further maternity roosts are therefore anticipated to be found in the CWP. This species is clearly threatened by the loss of roosting sites in large buildings in particular through barn conversions and works in churches; during her study in Hertfordshire, Briggs (2000) found that of 14 barns with Natterer's roosts, 11 were developed or converted to dwellings resulting in the loss of 8 roosting sites and colonies<sup>24</sup>. Environmental consultants, Baker Shepherd & Gillespie (BSG) undertook successful mitigation works at Totterdown Farm, near Fairford, successfully retaining the features used by roosting Natterer's bats in the barn conversion, thereby retaining the summer roost site. During the course of these works, it was also found that the bats also hibernated elsewhere in the same roof space<sup>25</sup>. These works provide a benchmark for future mitigation works involving roosts of Natterer's bat.

Further surveys are required to locate additional maternity roosts in the CWP, in particular in any remaining undeveloped/unconverted stone barns. These sites should be safeguarded for this (and other species), either as undeveloped buildings or with effective mitigation within re-development. Identification of such roosts

<sup>21</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>22</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>23</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>24</sup> Briggs, P. (2000). A STUDY OF BATS IN BARN CONVERSIONS IN HERTFORDSHIRE IN 2000. Commissioned by Hertfordshire Biological Records Centre and Hertfordshire County Council.

<sup>25</sup> Anon 2009. Protected species: Totterdown farm barns, barn conversion mitigation for bats. Baker Shepherd Gillespie Ecological Consultants LLP.

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should be by a combination of volunteer and consultancy work. The woodlands and barns of the Braydon Forest are also likely to yield new roosts.

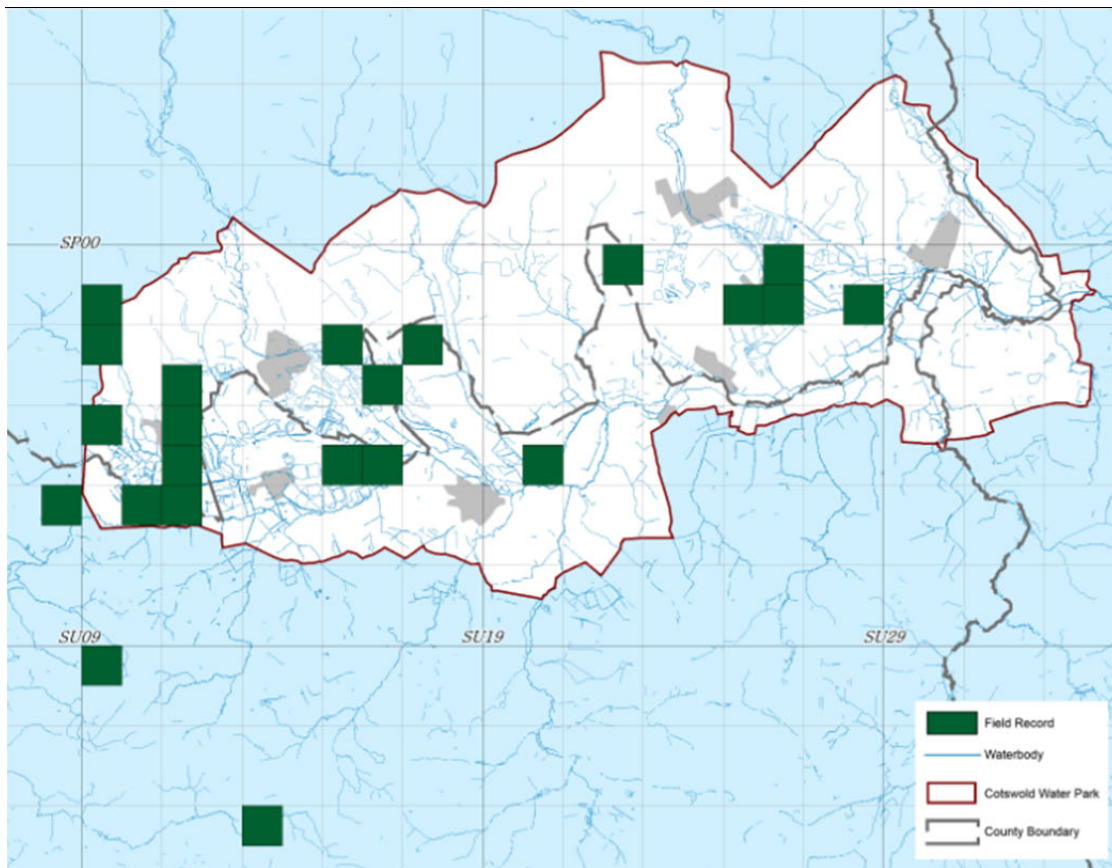


Figure 4.6a Natterer's Bat: Field Records

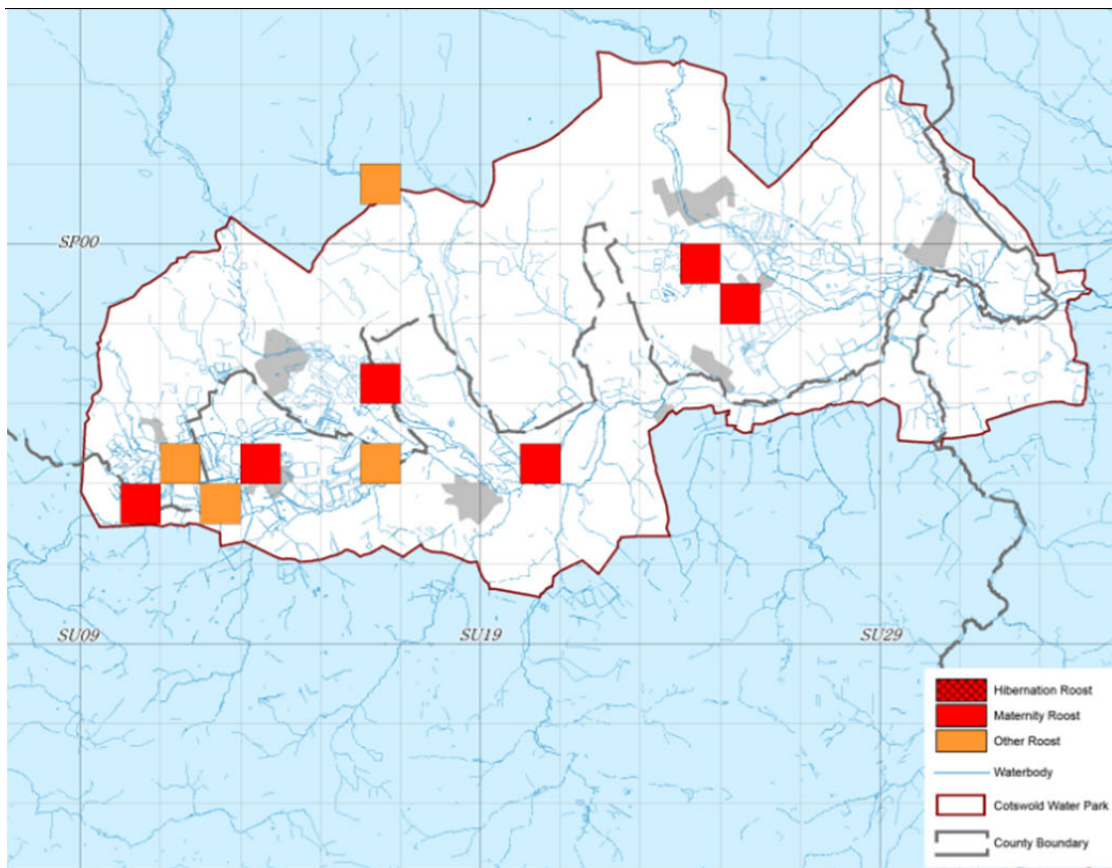


Figure 4.6b Natterer's Bat: Roost Records

## 4.7 Bechstein's bat, *Myotis bechsteinii* Kuhl, 1817

### National and local CWP status

A rare species in the UK restricted to southern England and south Wales<sup>26</sup>. Widespread but patchy distribution across Europe; the UK lies on the northern extreme of this species' range.

Two different males have been recorded in the CWP; the first was found using 1-2 bat boxes at Clattinger Farm SSSI (Wiltshire Wildlife Trust Reserve) in 2006 and 2007; the second was found in bat boxes in 2009 at the Disused Railway Line, near Cerney Wick (Cotswold Water Park Trust Reserve). Some authors have suggested that male Bechstein's bats may occupy summer roosts away from the main maternity sites, relinquishing higher quality feeding areas to the females and their young. Therefore, male Bechstein's bats may be found during the summer months in habitat considered sub-optimal.

The discovery of the first male Bechstein's bat led to surveys in the wooded landscape of the Braydon Forest area where breeding populations were thought likely to be found. This work is on-going. Within the Braydon Forest, Bechstein's bats have now been confirmed in three different woodlands;

- **Stonehill Wood** (privately-owned); since 2006 regular trapping surveys and bat box monitoring have been undertaken along with two seasons of radiotracking in 2010 and 2011 which highlighted core foraging areas and a number of tree roosts. So far, over 60 individual females have been ringed at this site, with over 30 adults and juveniles recorded here during bat box monitoring each year. Work here continues.
- **Ravensroost Wood SSSI** (Wiltshire Wildlife Trust Reserve); to date only 3 male Bechstein's have been recorded using the bat boxes here. However, during 2012 Dr Dani Linton, Wiltshire Wildlife Trust undertook studies here, trapping and radiotracking a female. Two new tree roosts for Bechstein's were found on the edge of the wood and emergence surveys recorded up to 19 bats emerging<sup>27</sup>. One of these tree roosts suffered significant damage during the storms of winter 2013-14<sup>28</sup>.
- **Braydon Pond** (privately-owned); during the radiotracking of 2010 and 2011, a single female Bechstein's bat flew from Stonehill Wood 1km south to Braydon Pond, utilising the dense hedgerow network to do so. Considerable time was spent foraging around the margins of the lake before the tag was shed.

Based upon these findings, and upon the presence of further areas of suitable habitat, it is strongly suspected that further colonies of this species remain to be found in the Braydon Forest.

### Habitats

A species of moist forests, primarily of mixed or broad-leaved forests but also using parks and gardens. Prefers foraging in closed canopy woodlands with a well-structured under-storey, often close to waterbodies<sup>29</sup>. This species prefers old-growth forest; roosts in tree holes, trunk crevices and frequently in nesting boxes<sup>30</sup>.

### Observations from the CWP

Mist netting surveys commenced in Stonehill Wood in 2007. In 2008 female and juvenile Bechstein's bats were trapped and since then small numbers have been trapped each year. In 2010, supported by Eric Palmer, radiotracking studies of the Bechstein's bat was undertaken in order to find some roosts and then undertake emergence surveys to clarify the size of the population here. Three female Bechstein's were tracked in 2010 and a number of roost trees were found, including some within the woodland and some on adjacent hedgerows. Emergence surveys indicated these were small colonies of only 12 bats. In 2011 the team aimed to catch and track another 2 bats. In late May 2011 bats were recorded in the bat boxes for the first time, notably 11 and 21 female Bechstein's bats. A bat was tagged from each box and these bats were also tracked for several nights enabling location of additional tree roosts.

<sup>26</sup> Russ J (2012). *British Bat Calls: A Guide to Species Identification*. Pelagic Publishing.

<sup>27</sup> Dr Dani Linton, 2012. *Pers.comm.*

<sup>28</sup> Dr Dani Linton, 2014, *Pers.comm.*

<sup>29</sup> Russ J (2012). *British Bat Calls: A Guide to Species Identification*. Pelagic Publishing.

<sup>30</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. *Bats of Britain, Europe and Northwest Africa*. A&C Black.



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During September 2011, it was noted that the Bechstein's were using 8 of the 22 boxes (as indicated by their droppings) whilst the bats themselves were found in just one box; a box of 26 Bechstein's. In 2012 30 Bechstein's were recorded in boxes during the late summer check and then in 2013 36 in the late summer checks. New bats were ringed each time, but a sizeable number of retraps is helping to construct some interesting life histories for these individuals. During 2013, the majority of the boxes were being used, from time to time, by Bechstein's bats but they still clearly favour a smaller subset of these. Notably they seem to prefer boxes placed in a high degree of clutter, in some cases obstructed by the canopy growth.

#### **Further work in the CWP & Braydon Forest**

Surveys to date in the Braydon Forest have highlighted the high connectivity between the Braydon Forest woodlands and of the presence of a high abundance of bat species, including Greater Horseshoe, Lesser Horseshoe, Bechstein's bat and Barbastelle bat. Further work is encouraged in additional woodlands in the Braydon Forest to locate new Bechstein's colonies, as well as other species.

An assessment of woodland management in the Braydon Forest is required to ensure that management is optimal for the remarkable assemblage of bats found here, in particular Bechstein's bats, working with private landowners, Wiltshire Wildlife Trust and Forestry Commission.

A wider assessment of the Braydon Forest is encouraged to ensure that the landscape permeability is maintained and habitat fragmentation is prevented.

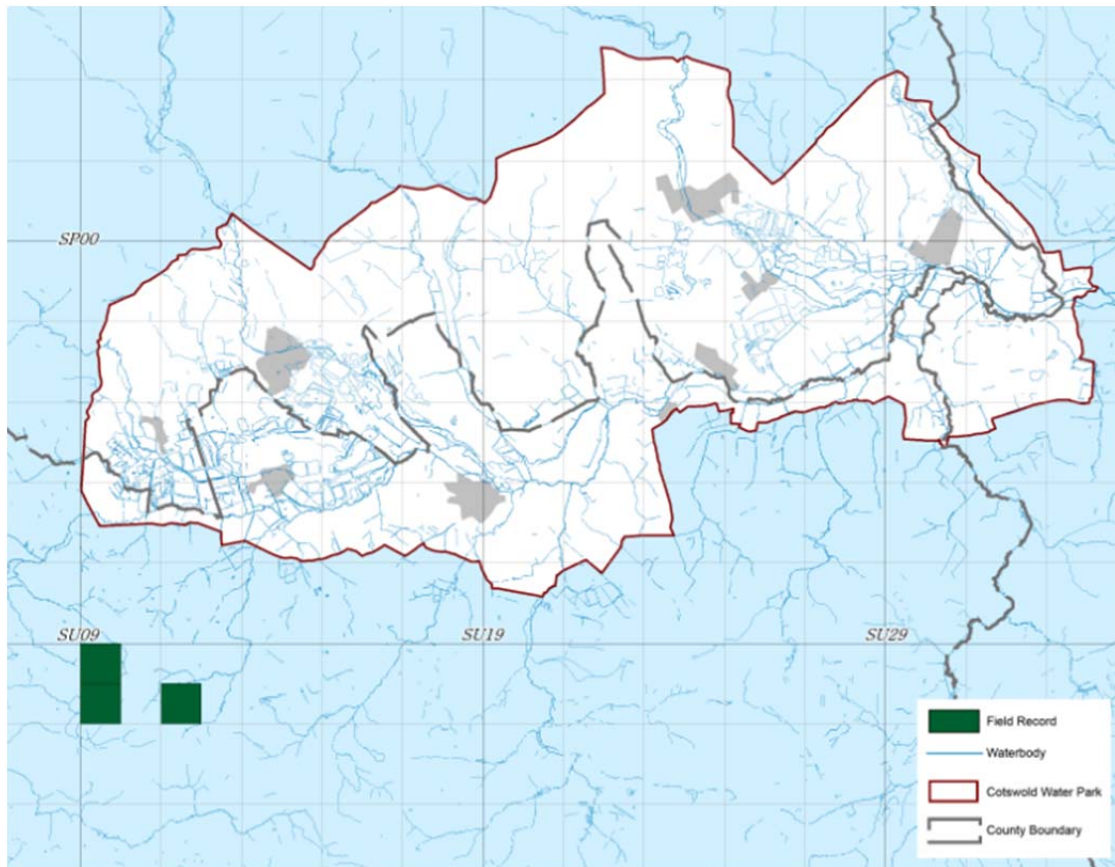


Figure 4.7a Bechstein's Bat: Field Records

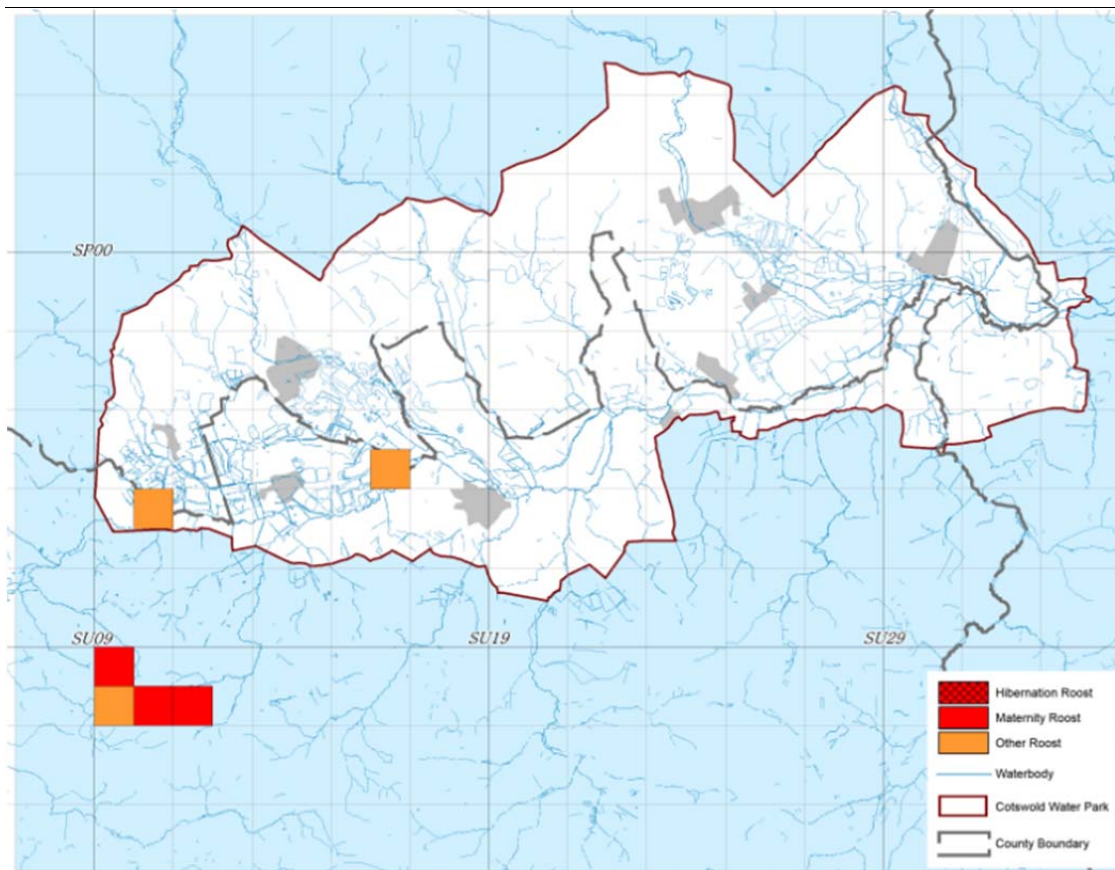


Figure 4.7b Bechstein's Bat: Roost Records

## 4.8 Daubenton's bat, *Myotis daubentonii* Kuhl, 1819

### National and local CWP status

Common and widespread throughout Britain and Ireland<sup>31</sup> and indeed much of Europe and into Asia<sup>32</sup>.

This species is common and widespread across the CWP utilising the 150+ lakes and ponds and over 200km of rivers and streams. It has been recorded from 19 monads in the CWP, of which 16 are in the western section, and 3 in the eastern section. A number of individuals were also recorded during trapping surveys in the Braydon Forest.

### Habitats

Preferring ponds, lakes, streams and canals with calm water, avoiding areas of turbulence. Typically associated with wetland habitats however it may also be found foraging in habitats away from wetlands in treelines and woodlands<sup>33</sup>.

### Observations from the CWP

Since 2005, CWPT staff and volunteers have undertaken a detailed series of bridge surveys across the CWP, targeting this species. Over 35 bridges have been assessed in this way, in particular by Will Ponting and Gareth Harris. The majority of these surveys suggested that most bridges were of a concrete construction and lacked suitable roosting features. A number of bridges and related structures did provide suitable roosting sites and Daubenton's bats have been recorded using them.

Despite being so widespread in the CWP, comparatively few maternity roosts have been found thus far; 9 confirmed or presumed maternity roosts (in stone bridges and a mature apple tree) and 4 infrequently used roosts (mainly rarely-used bridges and bat boxes). A number of authors indicate that male roosts are frequently found in cracks in bridges and tree holes; males form their own colonies of up to 20 animals<sup>34</sup>. In the CWP a number of the bridge roosts are considered to be "bachelor roosts" however many are also known to be maternity colonies, confirmed by trapping lactating females.

The large red-brick railway bridges along the disused railway line, between South Cerney and Cricklade, each support multiple roosting sites for Daubenton's bat in drainage pipes and crevices; significant numbers of bats may be present in each bridge in different roosting sites simultaneously. Furthermore monitoring of all bridges prior to emergence at dusk (during the summer months) typically highlights that all bridges are simultaneously occupied too. One of these bridges is a confirmed hibernation site, following the assessment of a bridge adjacent to South Cerney via endoscope in December 2013<sup>35</sup>.

### Further work in the CWP & Braydon Forest

The relative lack of known maternity colonies is surprising given the relative abundance of this species in the CWP. Coordinated efforts to locate additional roosts in trees is encouraged and indeed a priority, in particular of riparian woodlands.

Given the obvious importance of stone and brick bridges in the CWP it is of concern that the county Highways departments have undertaken considerable works on bridges supporting Daubenton's bats, with plans for further works. Whilst it may be likely that bridges in partial states of disrepair may offer a greater abundance of roosting sites, it is nonetheless of concern that such remedial works may negatively impact Daubenton's bats in the CWP. Thus far, at least six large roosts in bridges have been affected and in most cases the roosting requirements of Daubenton's bats have been maintained.

<sup>31</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>32</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>33</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>34</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>35</sup> Harris, G. Protected Species Surveys and Non-Licensable Method Statement relating to Health & Safety Works, Depot Bridge, South Cerney, Gloucestershire A Report Prepared for Gloucestershire County Council. Johns Associates Ltd November 2013

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Daubenton's bats are known to prefer foraging in darkness, remaining in the shadows if light conditions are too bright<sup>36</sup>. This was supported by radiotracking of Daubenton's bat in the CWP whereby in bright moonlight they foraged in the shadows of overhanging willows. Furthermore, surveys on lakes with significant built development creating significant light spill onto the lake edges, also highlighted how Daubenton's bats avoided the areas of light spill and remained in the shadows to forage. The impact of water-side lighting from built development upon bat species such as Daubenton's bat is of concern. Excessive lighting of foraging areas and commuting routes is likely to result in the loss of significant habitat. With increasing built development likely in the future, such habitat losses are likely to be cumulative.

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<sup>36</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

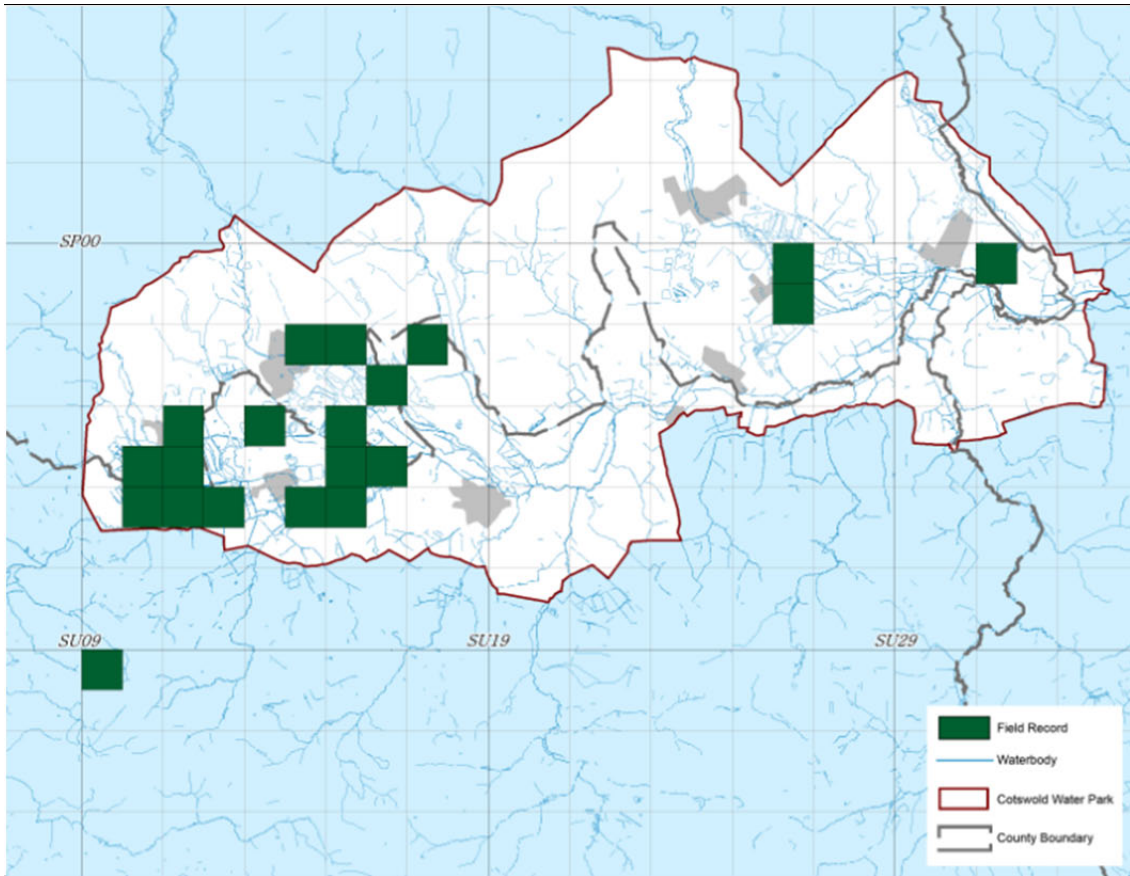


Figure 4.8a Daubenton's Bat: Field Records

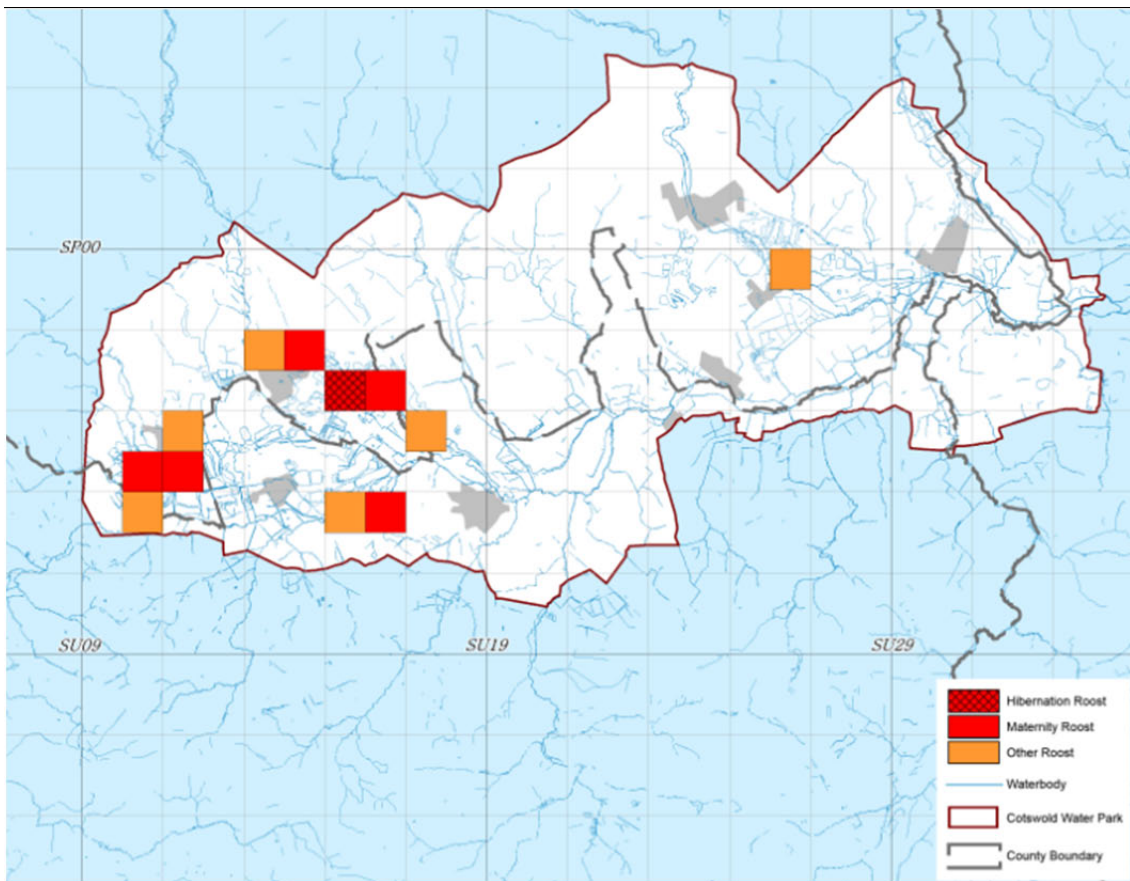


Figure 4.8b Daubenton's Bat: Field Records



## 4.9 Unidentified *Myotis* bats *Myotis sp*

As noted in section 3.4, identification of *Myotis* species to species level is frequently not possible with a high degree of confidence typically during bat detector surveys and during the analysis of static detector data. In such cases, the project recorded such bats as *Unidentified Myotis Bat*. Note that these records are additional to those presented for each individual *Myotis* bat and additional to the Whiskered/Brandt's bat records.

A separate map of Field Records has therefore been included. Whilst these records will add little further information to that presented for the individual *Myotis* species, it is presented here for completeness. Broadly speaking however, this map presents the outcome of static detector surveys.

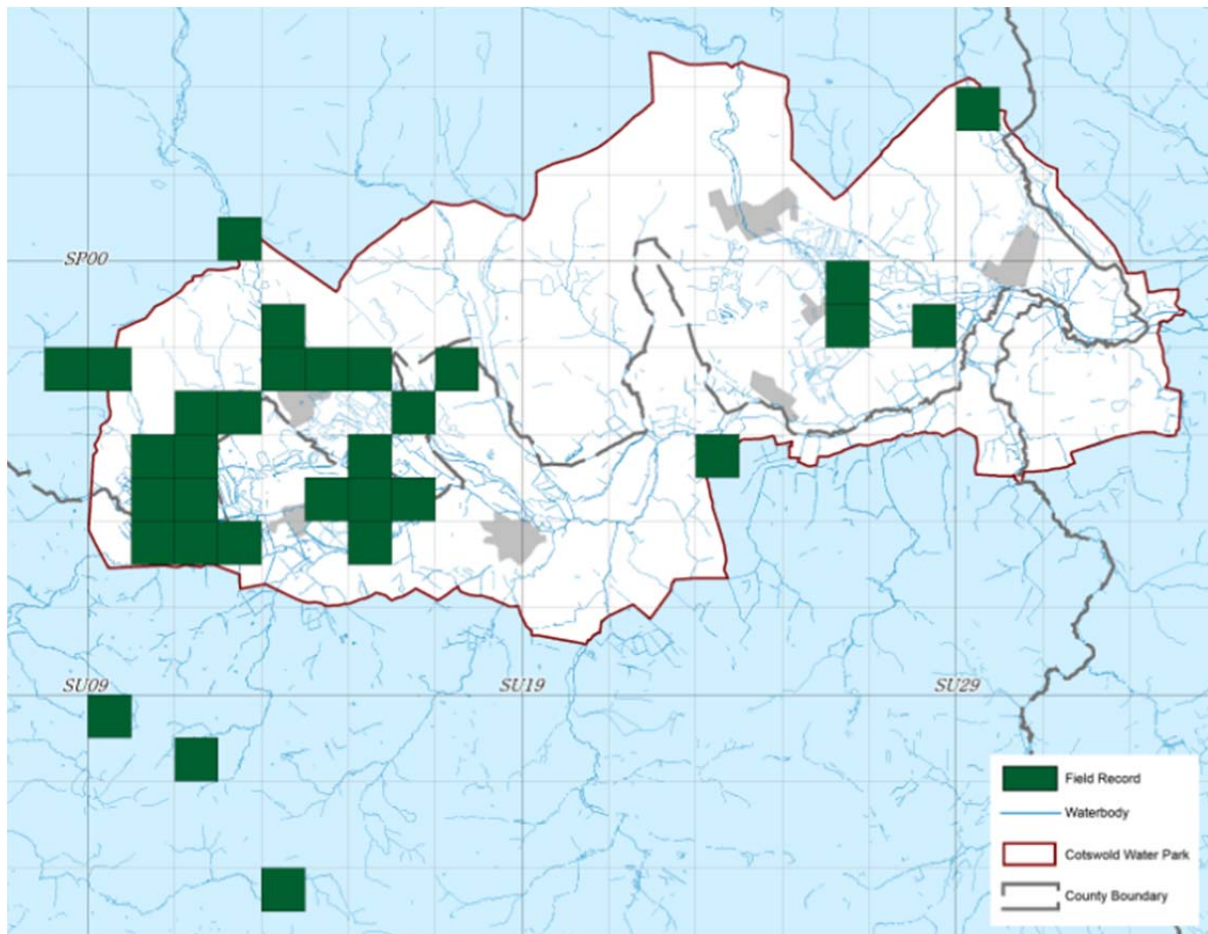


Figure 4.9 Unidentified *Myotis* Bats: Field Records

## 4.10 Serotine bat, *Eptesicus serotinus* Schreber, 1774

### National and local CWP status

Generally restricted to southern England, south of the Humber Estuary, and to Wales<sup>37</sup>; there has been some evidence recently of a range expansion northwards<sup>38</sup>.

Considered widespread but not abundant in the CWP. Systematic surveys of churches have confirmed seven roosting sites, but none were confirmed to be maternity roosts. A further two roost sites have been located, including a maternity roost found during a Natural England roost visit in Ewen. Field records generated through detector surveys, static detector surveys and trapping have generated a wide spread of records across the CWP. Surveys in the Braydon Forest resulted in an individual being trapped and in several detector recordings.

### Habitats

Forages along woodland edges, along tall hedgerows and over parkland and pasture; also along canals, rivers and lake shorelines; known to forage within deciduous woodland<sup>39</sup>.

Almost exclusively a building-roosting bat, maternity roosts are typically found in cracks in unused roof structures, or in voids in cavity walls or ridge tiles for example<sup>40</sup>.

In the CWP individuals have been seen and recorded foraging high over lakes, lake margins and along woodland edge. Surveys in Whelford (2008) highlighted that each small pasture surrounding the village supported a single foraging Serotine bat, perhaps suggestive of favoured feeding areas of individual bats. In each case bats were observed foraging high over the pasture, well above the height of trees in the adjacent hedgerows.

### Observations from the CWP

This species is frequently recorded on bat detectors across the CWP, particularly by static detectors, however relatively few roosts are known and those which have been found to date are typically of a small number of individuals or are known from droppings only. During early evening small numbers of Serotine bats (for example 2-3 bats) have been observed feeding high over the lakes, behaving much like foraging Swifts, *Apus apus*. Such behaviour likely suggests they are foraging upon swarms of insects<sup>41</sup>.

### Further work in the CWP & Braydon Forest

At present virtually nothing is known of how this species is utilising the CWP for roosting and foraging. It is considered likely that a number of roosts remain to be found in local villages; Whelford should be where the search begins.

It is likely that the pastures and wet meadows of the CWP and Upper Thames comprise an important foraging resource for this species. This species may benefit from future habitat creation works relating to mineral restoration works and grassland restoration on farmland, but likewise may also suffer from the loss of grasslands to quarrying or agricultural intensification.

<sup>37</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>38</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black. Cited from.

<sup>39</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>40</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>41</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

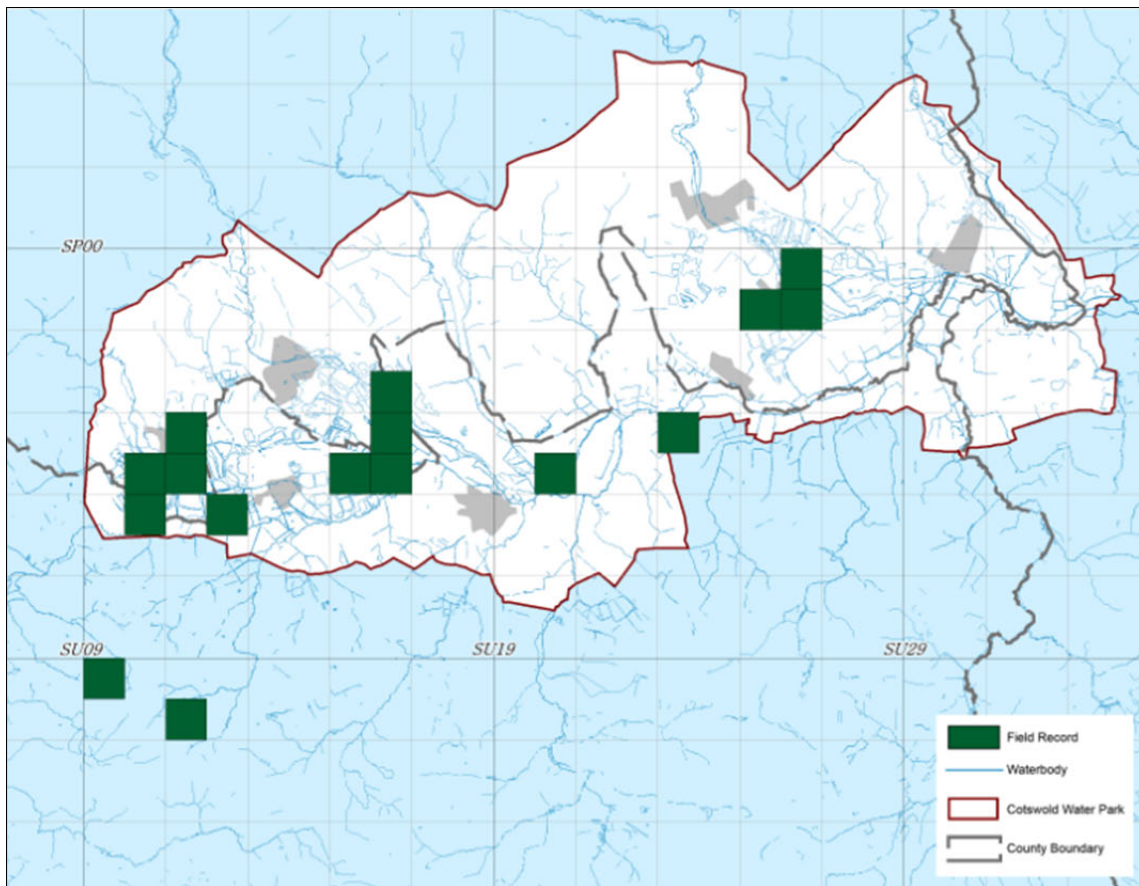


Figure 4.10a Serotine Bat: Field Records

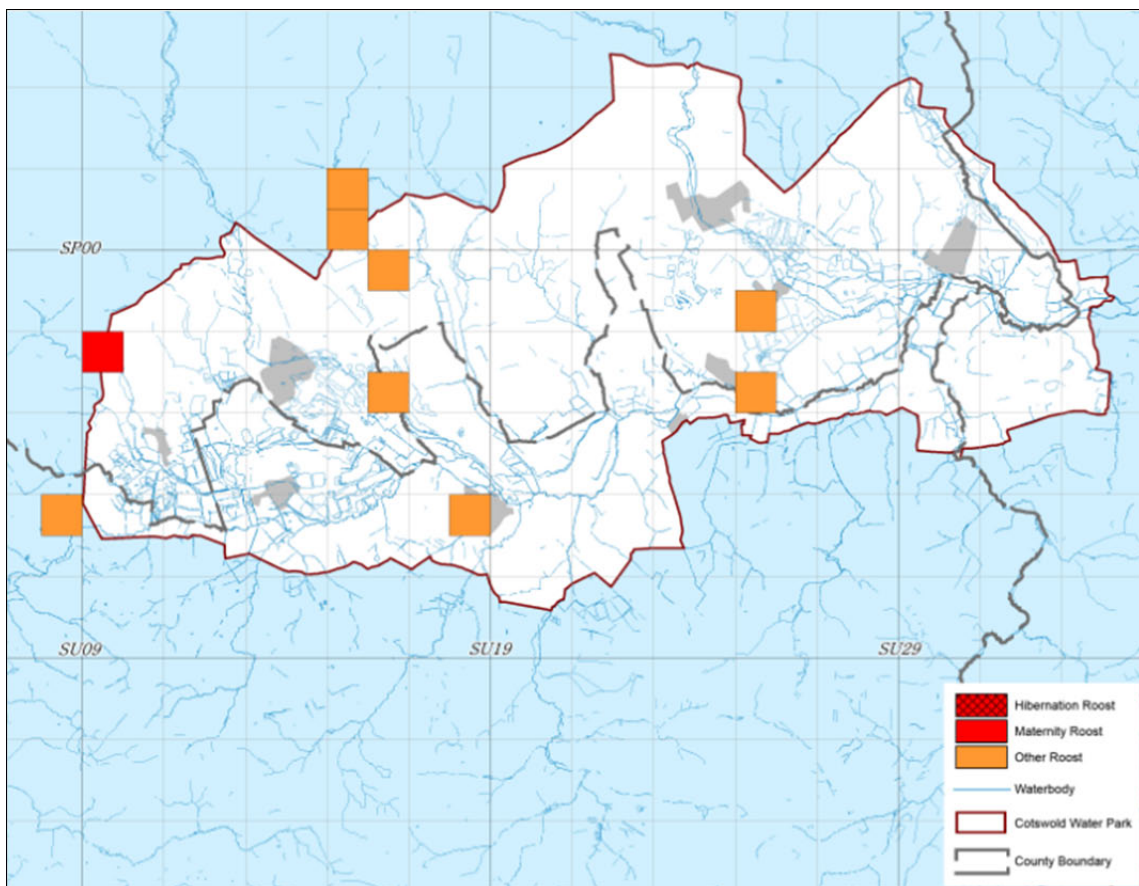


Figure 4.10b Serotine Bat: Roost Records



## 4.11 Noctule bat, *Nyctalus noctula* Schreber, 1774

### National and local CWP status

Restricted to Wales, England and southern Scotland. Not present in Ireland. Occasional records from the Shetland and Orkney Islands<sup>42</sup> are likely to represent migratory records although the populations on the northern limit of range, in Britain and Sweden are considered to be largely sedentary<sup>43</sup>.

Widely recorded in the CWP and Braydon Forest although no roosts found to date. Recorded through detectors and trapping surveys from 33 monads across the CWP and Braydon Forest.

### Habitats

Utilises a wide range of open habitats, commonly over various woodland types (especially broad-leaved woodland, riparian woodland, parkland) but also over wetlands, pastures and river corridors.

Dietz et al (2009) quotes that animals may forage 2.5km, or exceptionally up to 26km, from the roost site<sup>44</sup>. As for other species, such as Brandt's bat, it is not known how this species is using the CWP landscape. It is easy to presume that the CWP supports small roosts of this species, due to a potential scarcity of natural roost sites, but that the massive abundance of invertebrates may attract foraging bats from further afield, including the Braydon Forest.

### Observations from the CWP

All records typically generated by hand-held bat detectors and static detectors. Two individuals have been trapped, including an adult female trapped early in the evening at Cleveland Lakes Reserve (Cotswold Water Park Trust) in September 2013, attracted to a Sussex Autobat Acoustic Lure. This site has long been suspected to support a roost of this species; proving this will be difficult since the roost likely lies within woodland used by a large colony of breeding Grey Heron, *Ardea cinerea*, and Little Egret, *Egretta garzetta*, which may be easily disturbed during the breeding season.

Frequently observed foraging high over lakes and pastures in the CWP. On a number of occasions individuals have been observed "trawling" repeatedly through large swarms of *Chironomids* (non-biting midges) gathering over the lakes.

During August 2010, this author witnessed a Hobby, *Falco subbuteo*, attacking a group of four Noctule bats foraging high over Cleveland Lakes Reserve. The Noctule bat was heard screaming in the talons of the Hobby overhead as it was carried off, southwards, presumably to a nest of hungry youngsters. The Hobby is a well-known predator of a number of bat species, but in particular the Noctule bat. Chapman (1999) states that Noctule bat is the most frequent mammalian prey item, with severed bat wings often being found in Hobby nests in Europe typically comprising Noctule bat and Serotine Bat<sup>45</sup>. Chapman considered that Hobbies hunt Noctule bats as they fly high in the twilight along woodland edges<sup>46</sup>.

### Further work in the CWP & Braydon Forest

To locate roosting site of this species. In the CWP such sites will be scarce due to the general lack of woodland cover and mature trees with features necessary for roosting Noctule bats. A greater density of roost sites is anticipated in the Braydon Forest where woodland cover is predominantly broad-leaved, dense and more extensive than the CWP. Parkland habitats in the CWP will offer some potential roosting sites.

<sup>42</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>43</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>44</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>45</sup> Chapman, A. 1999. The Hobby. Arlequin Press.

<sup>46</sup> Chapman, A. 1999. The Hobby. Arlequin Press.

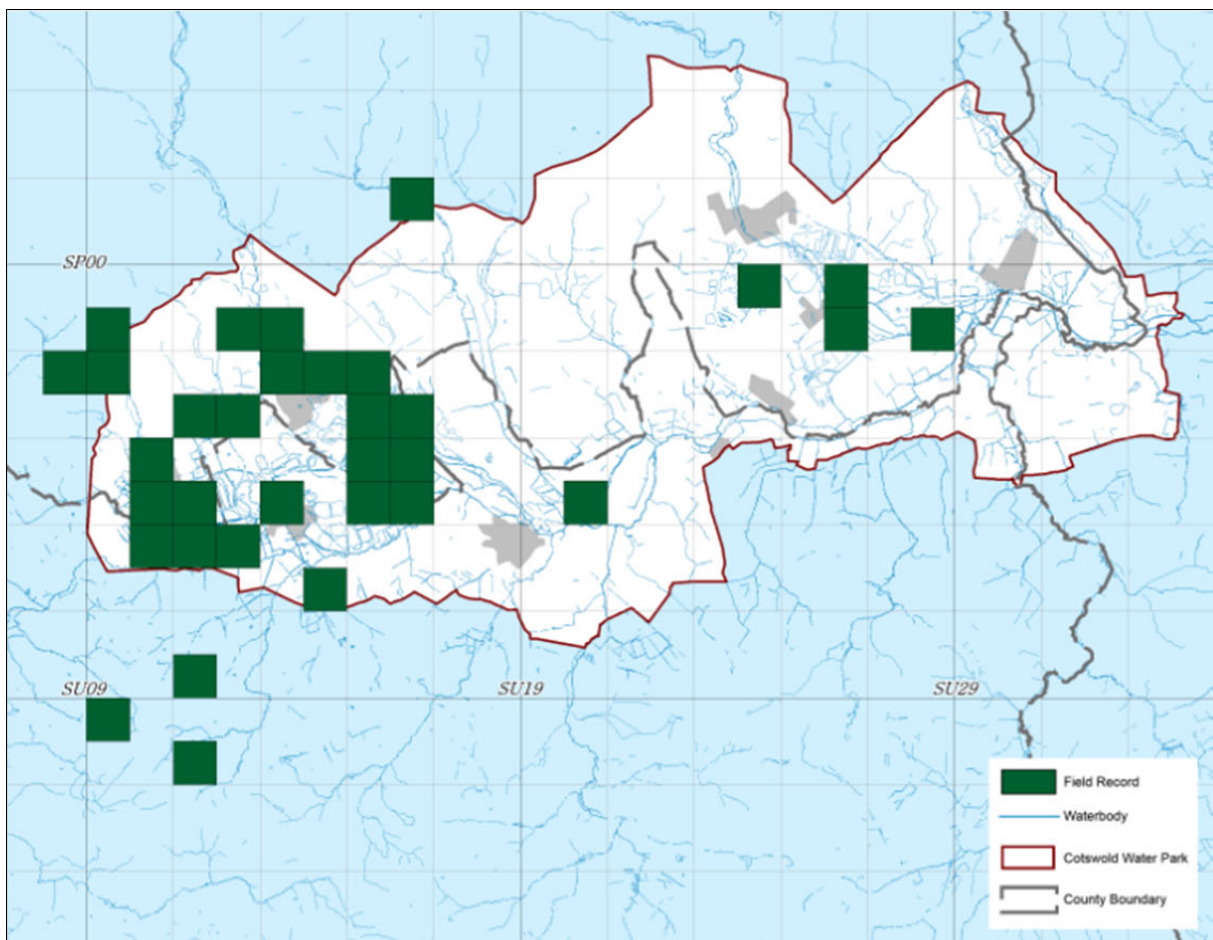


Figure 4.11a Noctule Bat: Field Records

## Leisler's Bat, *Nyctalus leisleri* Kuhl, 1818

Although this species is yet to be confirmed in the CWP, details are included below to flag up the potential for this species in the area.

### National and local CWP status

Mainly restricted to southern and eastern England, with some records from northern England and southern Scotland. Relatively common and widespread in Ireland.

This species is yet to be confirmed in the CWP, although a number of ecological consultants have claimed to record this species on detectors. Examination of the sonograms (if and when supplied) and discussion with experts has always cast doubt on these records. In all cases the identification was made using the most up-to-date guidance but errors in judgement appear to have been made, presumably through inexperience in interpretation.

The CWP is within known range for this species; known maternity roosts lie in West Oxfordshire, in relative close proximity to the CWP and Lechlade. A search of potential roosting sites in the eastern CWP seems most likely to yield positive results. In 2012 Dr Dani Linton recorded bats, to the south of Swindon, whose sonograms showed characteristics of this species<sup>47</sup>.

### Habitats

Frequently observed over parkland, pasture and meadows, often observed foraging along interfaces between such habitats; recorded foraging over waterbodies, sometimes close to the water's surface<sup>48</sup>. Although typically considered a woodland bat (roosting in woodpecker holes, rot holes etc. and often in bat boxes), in the UK (and throughout much of its European range) it is commonly found roosting in buildings, with maternity colonies in buildings comprising 20-50 females, exceptionally up to 1000 females in Ireland<sup>49</sup>.

### Further work in the CWP & Braydon Forest

To confirm presence of this species in the CWP.

<sup>47</sup> Linton, D. Dr. 2012. *Pers.comm.*

<sup>48</sup> Russ J (2012). *British Bat Calls: A Guide to Species Identification*. Pelagic Publishing.

<sup>49</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. *Bats of Britain, Europe and Northwest Africa*. A&C Black.

## 4.12 Common Pipistrelle bat, *Pipistrellus pipistrellus* Schreber, 1774

### National and local CWP status

Widespread and common throughout Britain and Ireland<sup>50</sup>.

A species clearly abundant in the CWP, borne out by the distribution map of field records highlighting field records (i.e. detector surveys, static detectors, trapping surveys) from 42 monads in the CWP, plus a further 3 in the Braydon Forest.

### Habitats

Utilises a variety of habitats, foraging within gardens, farmland, parkland, woodland and along rivers and lake margins, frequently using the edges of such habitats for foraging, but usually avoiding foraging in open space<sup>51</sup>. An adaptable and flexible species being found in city centres and rural settlements, but typically favouring woodland and wetlands<sup>52</sup>.

Found in abundance in the CWP foraging over the lakes and along the lake margins. Static detector surveys adjacent to large lakes in the CWP (for example, Cleveland Lakes Reserve) typically result in over 1,000 bat files per night and typically show that approximately between a third and a quarter of files will be this species.

Summer and maternity roosting sites are typically associated with crevice-like spaces in human dwellings (for example behind timber cladding and under roof lining), whilst hibernation sites are also frequently found in buildings<sup>53</sup>. In February 2014, during a training workshop lead by Henry Andrews, a hibernation roost was found in vertical fissures in a large dead tree, comprising four or more bats, in Ravensroost Wood SSSI (Wiltshire Wildlife Trust Reserve).

### Observations from the CWP

Despite the apparent abundance of this species in the CWP, based on the numbers of field records generated through detector surveys and trapping surveys, relatively few maternity roosts have been encountered. Only six maternity roosts have been found to date, all in buildings that are typically in local villages/towns (such as Minety and Cricklade), or in new holiday home developments (such as Lower Mill Estate). A number have also been found in farm buildings (always stone barns).

A number of additional roost sites have been found, including five local churches, one manor house, five stone barns/mills and five bat box locations; these are usually of single bats, or of small numbers (less than ten) at a time of year when it would not be / was not confirmed to be a maternity roost. The predominance of Soprano Pipistrelle bats at the bat box locations in the CWP is marked; it is considered rare to find Common Pipistrelle bats in the CWP's bat boxes, albeit perhaps an annual event.

Whilst no great efforts have been expended in searching for and finding roosts of this species, it is nonetheless surprising that so few roosts have been found.

Davidson-Watts et al (2006)<sup>54</sup> highlighted that "*P. pygmaeus* selected riparian habitats over all other habitat types in its core foraging areas, whereas *P. pipistrellus*, although preferring deciduous woodland overall, was more of a generalist, spreading its foraging time in a wider range of habitats." Davidson-Watts & Jones (2005)<sup>55</sup> indicated that Common Pipistrelle bats and Soprano Pipistrelle bats also differed in their foraging

<sup>50</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>51</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>52</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>53</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>54</sup> Davidson-Watts, I., Walls, S. & Jones, G. 2006. Differential habitat selection by *Pipistrellus pipistrellus* and *Pipistrellus pygmaeus* identifies distinct conservation needs for cryptic species of echolocating bats. *Biological Conservation* 133 (2006) 118–127. Elsevier.

<sup>55</sup> Davidson-Watts, I. & Jones, G. 2005. Differences in foraging behaviour between *Pipistrellus pipistrellus* (Schreber, 1774) and *Pipistrellus pygmaeus* (Leach, 1825). *Journal of Zoology* 268 (2006) 55–62 (The Zoological Society of London)

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behaviour (at study sites on the Wiltshire / Hampshire border). Likely as a result of differences in preferred foraging habitat, Common Pipistrelle bats were found to commute shorter distances to their foraging sites but consequently make more frequent foraging bouts. *“In contrast, P. pygmaeus spends less time flying, makes fewer foraging bouts but travels further distances, suggesting that this species is selecting specific foraging habitats. These differences in foraging behaviour support the hypothesis that these species occupy different ecological niches through habitat selection”*.

How might this compare in the CWP? Due to the high abundance of foraging habitat, high abundance of invertebrate food and close proximity of an abundance of potential roosting sites would the same observations and conclusions be reached? Is there an abundance of Common Pipistrelle maternity roosts spread across the CWP yet to be discovered but in close proximity to foraging grounds?

#### **Further work in the CWP & Braydon Forest**

Further work is encouraged in searching for and locating new maternity roosts of this species. An assessment of the distance between roosts and foraging grounds, and frequency of feeding bouts, in order to compare to Davidson-Watts & Jones (2005) would provide a fascinating insight into how bat behaviour and habitat use may differ in a location such as the CWP.

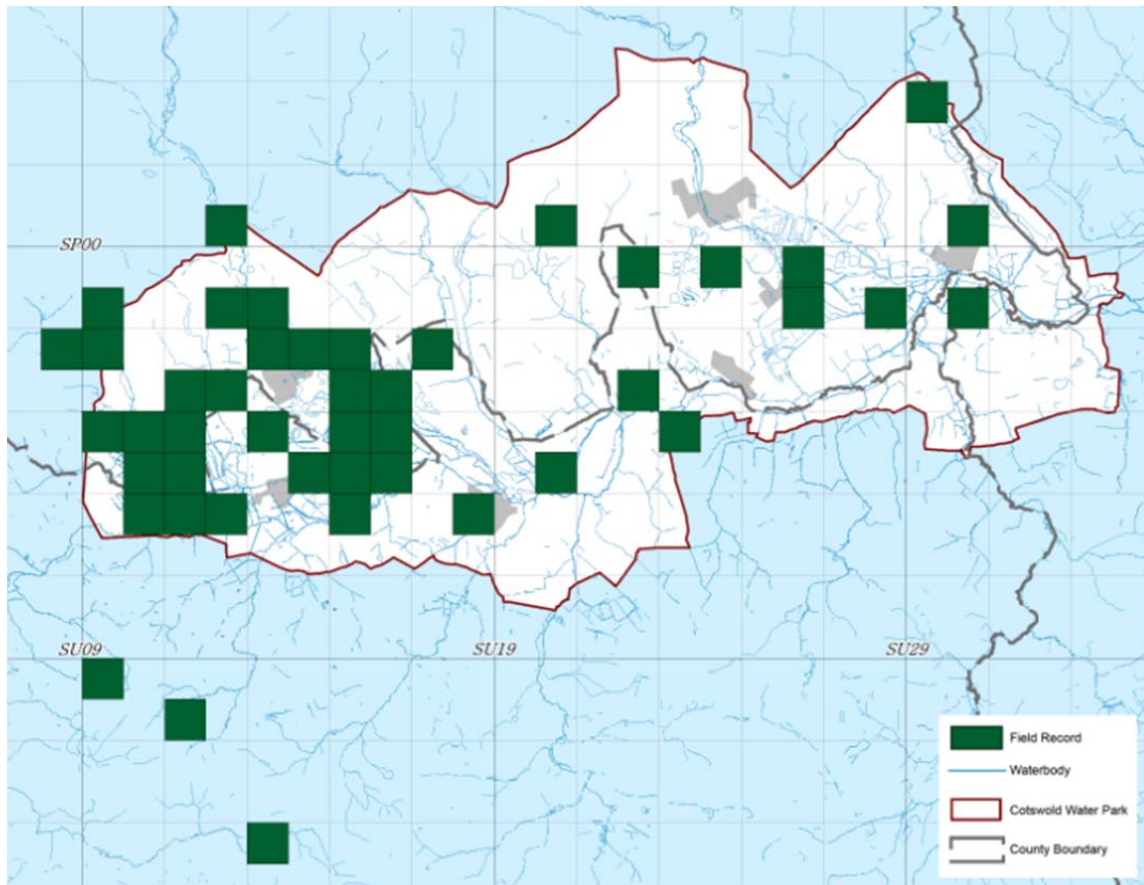


Figure 4.12a Common Pipistrelle Bat: Field Records

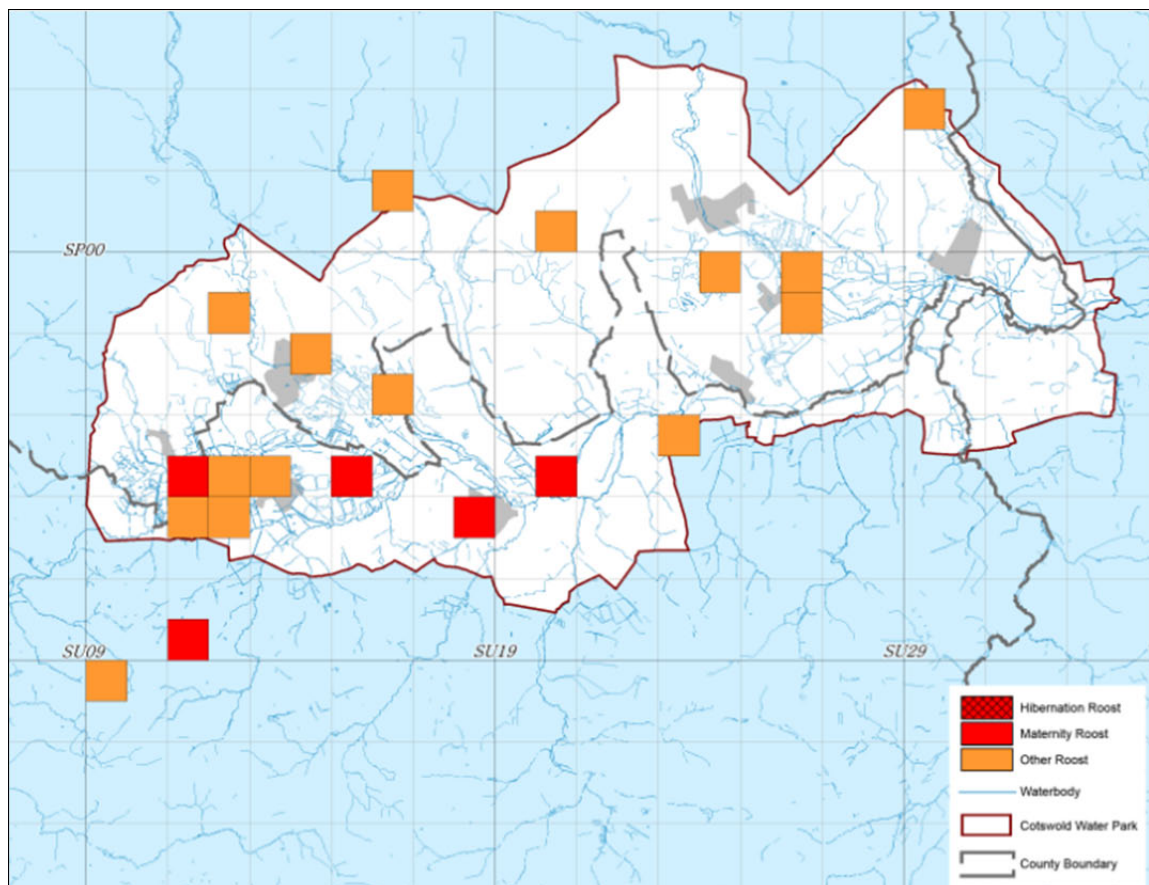


Figure 4.12b Common Pipistrelle Bat: Roost Records

### 4.13 Soprano Pipistrelle bat, *Pipistrellus pygmaeus* Leach, 1825

#### National and local CWP status

Widespread and generally common throughout Britain and Ireland<sup>56</sup>.

Perhaps the CWP's most abundant and frequently encountered bat species, with field records (detector and trapping survey records) from 38 monads in the CWP, and a further 3 squares in the Braydon Forest. Interestingly, although greater numbers of this species are recorded, encountered and trapped than the Common Pipistrelle, it has an apparently smaller range in the CWP. This is likely to reflect a more restrictive habitat preference.

Thirty maternity roosts of this species have been recorded, including over 20 in the village of Somerford Keynes<sup>57</sup>. At least 17 roosts are known to have supported over 100 adult females during the maternity period, with 7 of these numbering over 300. In Somerford Keynes, a large roost of over 500 females is thought to move between several properties in and around the village, typically not using the same property for more than 3 years consecutively. Throughout the CWP three different roosts are known to support / have supported roosts of over 500 females, however, there are rumours of larger roosts which have proven hard to track down since this species can be mobile within and between years.

#### Habitats

More of a specialist of wetland and riparian habitats, with greater abundance around watercourses, canals, ponds, lakes and reservoirs, in particular when associated with fringing waterside vegetation<sup>47, 58</sup>. See also comparisons in section 4.12.

Maternity roosts are usually located in buildings, in wall cladding, cavity walls, between roof lining and tiles and in eaves<sup>59</sup>. In the CWP the largest roosts may favour cavity walls and eaves in recently re-roofed properties (or perhaps these are simply more likely to be encountered).

#### Observations from the CWP

During late summer and autumn large numbers of Soprano Pipistrelle bats use bat boxes deployed across the CWP; during autumn 2013 the two annual checks found 210 bats (as well as small numbers of other species). At this time of year, these roosts typically comprise breeding males gathering a harem of females.

In August 2011 a ringing study of Soprano Pipistrelle bats using the bat boxes at Pike Corner SSSI and Freeth Mere SSSI (both sites within Lower Mill Estate) was launched. Since 21<sup>st</sup> August 2011 73 bats have been ringed at these sites: 26 bats in 2011, 25 bats in 2012 and 22 new bats in 2013 as well as generating numerous re-traps too. Typically, the males are re-trapped throughout the spring, summer and autumn months, usually from the same boxes. The females are recorded mainly during late summer and autumn when the males are gathering their mating harems. Many of the ringed females are re-trapped and have been recorded moving between males within and between seasons.

Some of the males have been recorded numerous times, typically from the same small number of boxes; e.g. L00235, ringed as an adult male on the very first visit of the study on the 21/8/2011, has been recovered 9 times and has used 5 different boxes. On 6 occasions he has been alone; on the other three occasions he has been recorded with the same single female L00237 (on 2/10/11, 30/9/12 and 29/9/13) in the same box at Pike Corner. The only other bats he has been seen with were 2 juveniles in Sept 2012.

Despite the Pike Corner and Freeth Mere box schemes being only 250 metres apart, records show that only 1 bat (Female L00239) has been recorded moving between the box schemes. All other bats have been recorded within the scheme in which they were ringed. This study continues.

<sup>56</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>57</sup> With particular thanks to Dr Les Jones and the many property owners in the village who supported our work.

<sup>58</sup> Davidson-Watts, I., Walls, S. & Jones, G. 2006. Differential habitat selection by *Pipistrellus pipistrellus* and *Pipistrellus pygmaeus* identifies distinct conservation needs for cryptic species of echolocating bats. *Biological Conservation* 133 (2) 06) 118–127. Elsevier

<sup>59</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

**Further work in the CWP & Braydon Forest**

This is arguably the CWP's most abundant bat species, with the greatest number of known roost sites thus far. It is therefore arguably appropriate that a proportionate level of conservation effort is invested in this species. Although 250+ *woodcrete* bat boxes and 14 pairs of American-style bat houses<sup>60</sup> have been provided, these are typically providing opportunities for males throughout the summer and mating harems during the autumn months. Nothing is currently known of hibernation roosts for this species and little work has been achieved thus far in providing new maternity roosts for this species. The nomadic nature of this species and its reliance upon a series of roosting sites within and between seasons may mean it is at risk from development works of roosting sites, which may or may not be occupied at a given time. Conversely of course, reliance upon a network of roosting sites guarantees availability of known roosting sites.

Davidson-Watts et al (2006) demonstrated that this species travelled further (in order to utilise wetland and riparian habitats) than the Common Pipistrelle bat (which typically foraged over a greater variety of habitats in closer proximity to the maternity roost site)<sup>61</sup>. To date, no detailed study has been made of this species in the CWP with respect to typical commuting distances between maternity roosts and foraging areas.

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<sup>60</sup> Tuttle, M.D., Kiser, M. and Kiser S. 2004. The Bat House Builder's Handbook. Completely Revised and Updated. Bat Conservation International.

<sup>61</sup> Davidson-Watts, I., Walls, S. & Jones, G. 2006. Differential habitat selection by *Pipistrellus pipistrellus* and *Pipistrellus pygmaeus* identifies distinct conservation needs for cryptic species of echolocating bats. *Biological Conservation* 133 (2006) 118–127. Elsevier



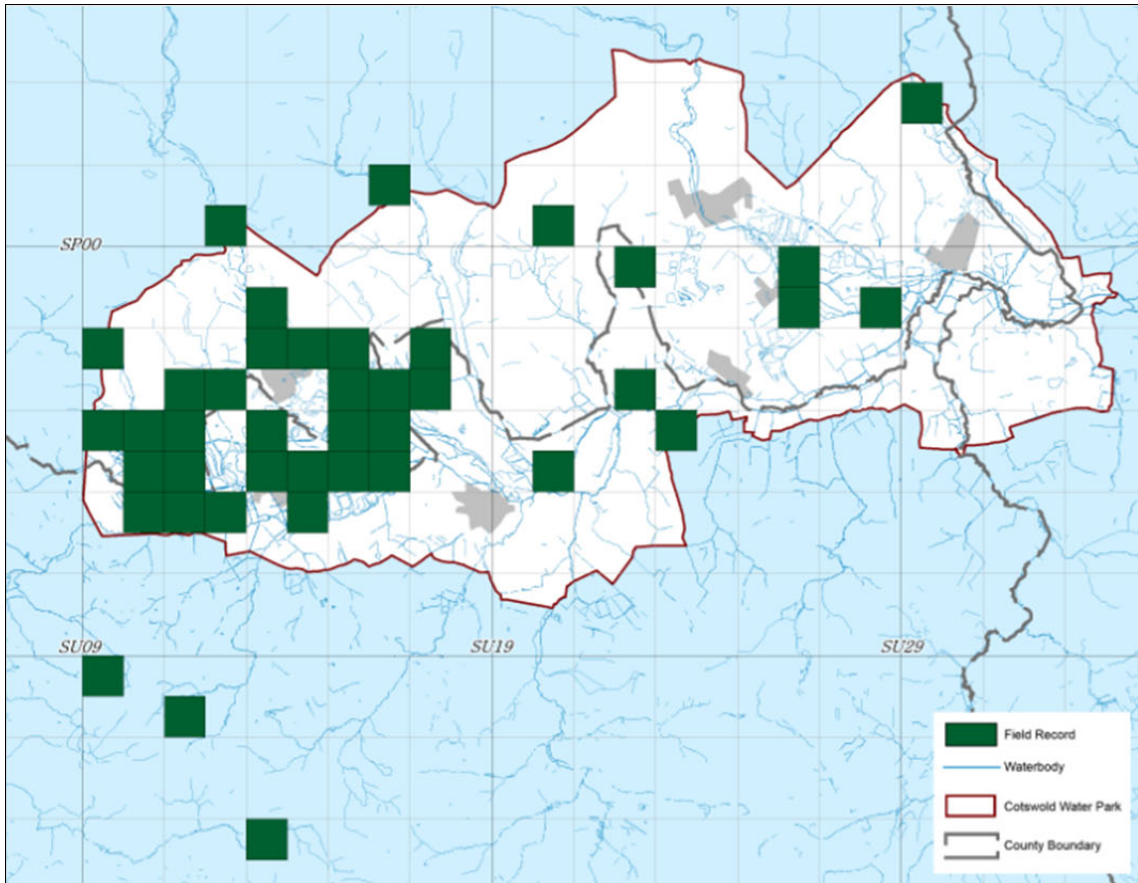


Figure 4.13a Soprano Pipistrelle Bat: Field Records

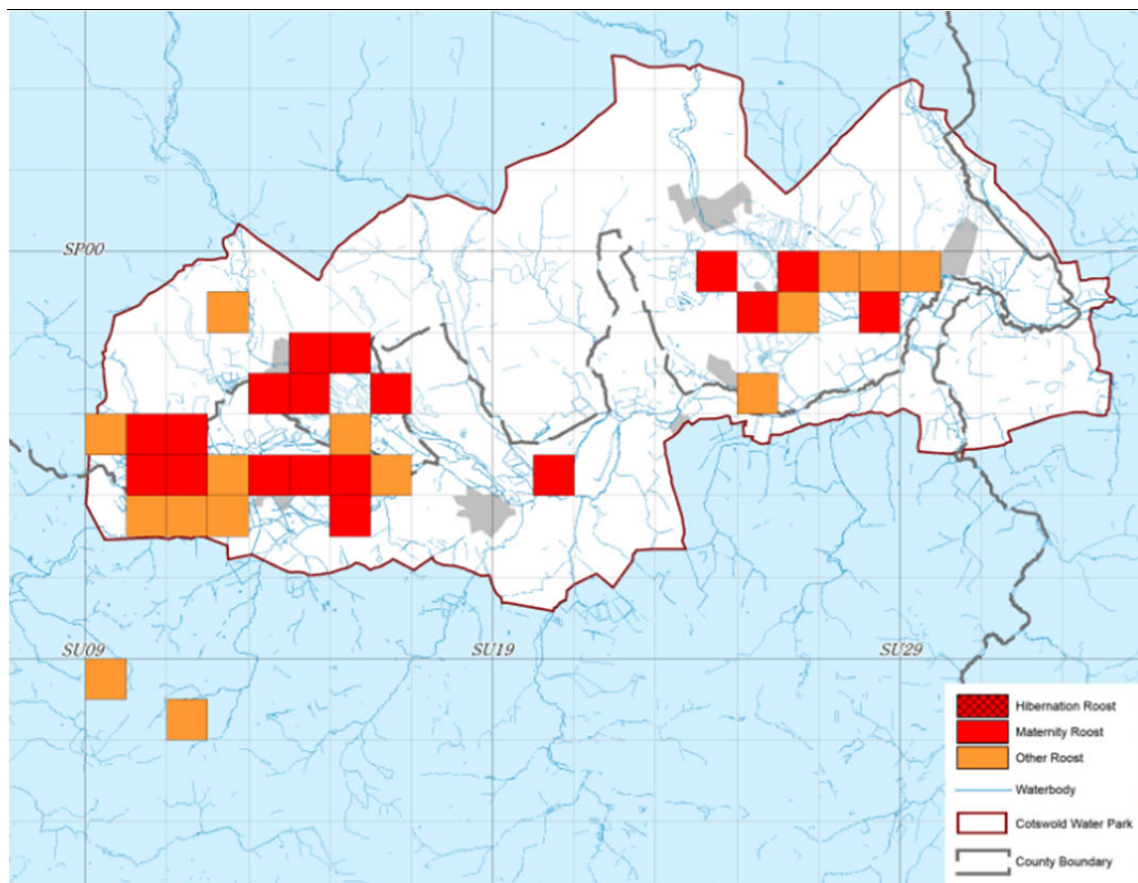


Figure 4.13b Soprano Pipistrelle Bat: Roost Records

#### 4.14 Nathusius' Pipistrelle bat, *Pipistrellus nathusii* Keyserling & Blasius, 1839

##### National and local CWP status

Generally considered rare but widely spread in the UK<sup>62</sup>. The Nathusius Pipistrelle website<sup>63</sup> presents a plethora of information on this species, including the current known distribution and the recorded history of this species in the Britain and Ireland. A further summary is also provided in Russ et al (2001)<sup>64</sup>. In summary, despite over 1,200 reported records<sup>65</sup> only a handful of maternity colonies (perhaps 3) have been reported to date<sup>56</sup>, with the majority of records comprising bat detector records, grounded bats and more rarely songflighting or roosting males<sup>56</sup>.

A known long distance migrant, with the core reproductive range lying in the north-east of the range (e.g. Scandinavia, Russia, eastern Europe) and the core hibernation areas lying in the south-west of the range (e.g. France, Iberian Peninsula etc.)<sup>66</sup>. A large number of grounded bats along the British coastline (in particular the east and south coasts as well as North Sea Oil Rigs, indicate the British population is likely to also be supplemented by migrant bats; a ring recovery in late 2013 of a bat originally ringed at Blagdon Lake, Somerset by Daniel Hargreaves, 600km away on the north coast of the Netherlands proves migratory bats cross the North Sea and English Channel<sup>67</sup>.

Generally rare in the CWP, this species has, however, been recorded on bat detectors at a number of locations across its western section. The absence of records from the eastern section probably reflects survey effort, which has been biased towards the west side. Further surveys are required in the eastern section to determine the presence of this species.

##### Habitats

In the British Isles, most records are within a few kilometres of large waterbodies. Found foraging along lowland woodland rides and woodland edge, meadows and adjacent to and over waterbodies such as lakes, canals, rivers and other wetland habitats<sup>68</sup>.

In this context, the CWP supports ideal foraging habitat for this species, with a large area of wetland and numerous habitat features attractive to this species, as well as numerous mature trees along lake margins and riparian corridors.

##### Observations from the CWP

In the CWP, 25 records of this species have been generated thus far (see Table 3 Records generated by survey sample type and species), of which 15 resulted from static detector surveys (typically Anabat SD1 and SD2), 8 from hand-held bat detector surveys and 1 male in a bat box in 2012. (Furthermore a grounded bat was founded and taken into care in Latton in 2001, prior to this project; with thanks to David Endacott for supplying this record).

To date, field records of this species have been recorded from 9 monads, and the bat box-roosting male found in a tenth square. Records are concentrated around Cleveland Lakes Reserve and Lower Mill Estate, although these areas represent some of the most frequently surveyed areas of the CWP. Records relate to 11 different locations.

<sup>62</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>63</sup> Russ, J.M. (undated); <http://www.nathusius.org.uk/>

<sup>64</sup> Russ, J.M., Hutson, A. M., Montgomery, W. I., Racey, P. A. and Speakman, J. R. (2001). The status of Nathusius' pipistrelle (*Pipistrellus nathusii* Keyserling & Blasius, 1839) in the British Isles. *J. Zool., Lond.* (2001) 254, 91-100 (2001). The Zoological Society of London

<sup>65</sup> Russ, J.M. (undated); <http://www.nathusius.org.uk/>

<sup>66</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>67</sup> BBC website, 20<sup>th</sup> January 2014; *British bat makes incredible journey* <http://www.bbc.co.uk/nature/25759149>

<sup>68</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

This species has been recorded in all months April to October inclusive (see Table 4.12). These records however, represent only casual observations and surveys and to date no regular monitoring programme has been established. Further work is required here to assess if seasonal variations in records are observed and if these may be attributed to migratory behaviour.

**Table 6 Incidence of Nathusius' Pipistrelle records, by month (2001-2013)**

Year	Month (aggregated data, all years)							Total
	April	May	June	July	August	September	October	
2001	1							1
2005				1				1
2006								0
2007							2	2
2008		1	3					4
2009	1					7		8
2010				2	1	1	1	5
2011			1					1
2012		1		1		1		3
2013								0
<b>Total</b>	2	2	4	4	1	9	3	25

Three trapping surveys, with acoustic lures<sup>69</sup> (including multiple Sussex Autobats), have been attempted in order to trap this species, with the aim of confirming this species' presence in the CWP, to confirm breeding activity and also to radio-tag and track individuals to locate roosts. Each session failed to trap the target species, despite the use of acoustic lures and proven trapping expertise.

#### **Further work in the CWP & Braydon Forest**

A coordinated monitoring programme is recommended to attempt to clarify the status of this species in the CWP. The seasonal spread of records suggests that this species is resident; however resident bats may be supplemented by migrants. Fieldworkers in the UK and the Netherlands have suggested that resident males may be joined by migratory females. Clarifying if this species is indeed resident and potentially breeding in the CWP and then the protection of such roosting sites is a key conservation objective for the CWP, particularly considering how few such roosts have been found in the UK.

Dietz et al (2009)<sup>70</sup> comments that foraging areas may lie 6.5 km from the roost and can extend over 20km<sup>2</sup>, within which foraging occurs within 4-11 smaller areas of a few hectares. In the context of the CWP, such a vast area of wetland may support a large number of foraging areas. Locating a roost therefore will require concerted efforts and fieldwork.

<sup>69</sup> With thanks to Daniel Hargreaves (2011) and Daniel Whitby (2012 and 2013).

<sup>70</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

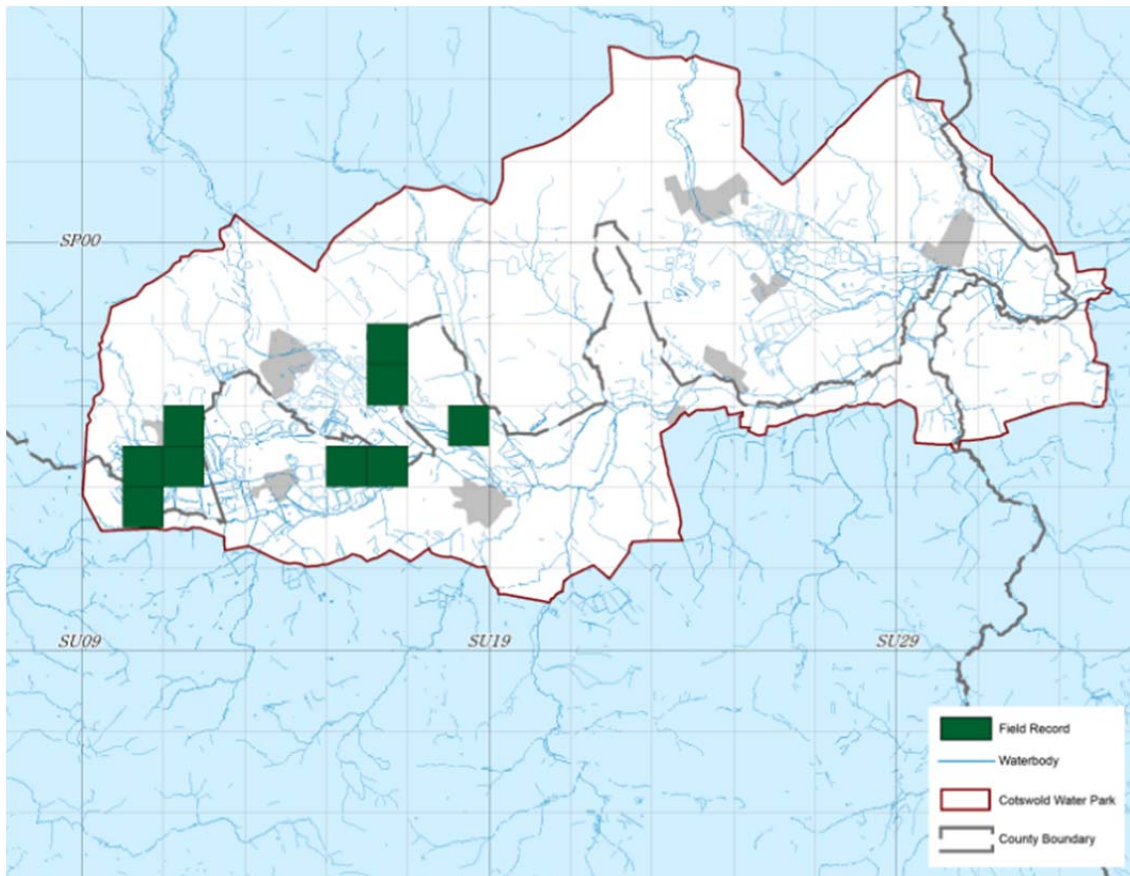


Figure 4.14a Nathusius' Pipistrelle Bat: Field Records

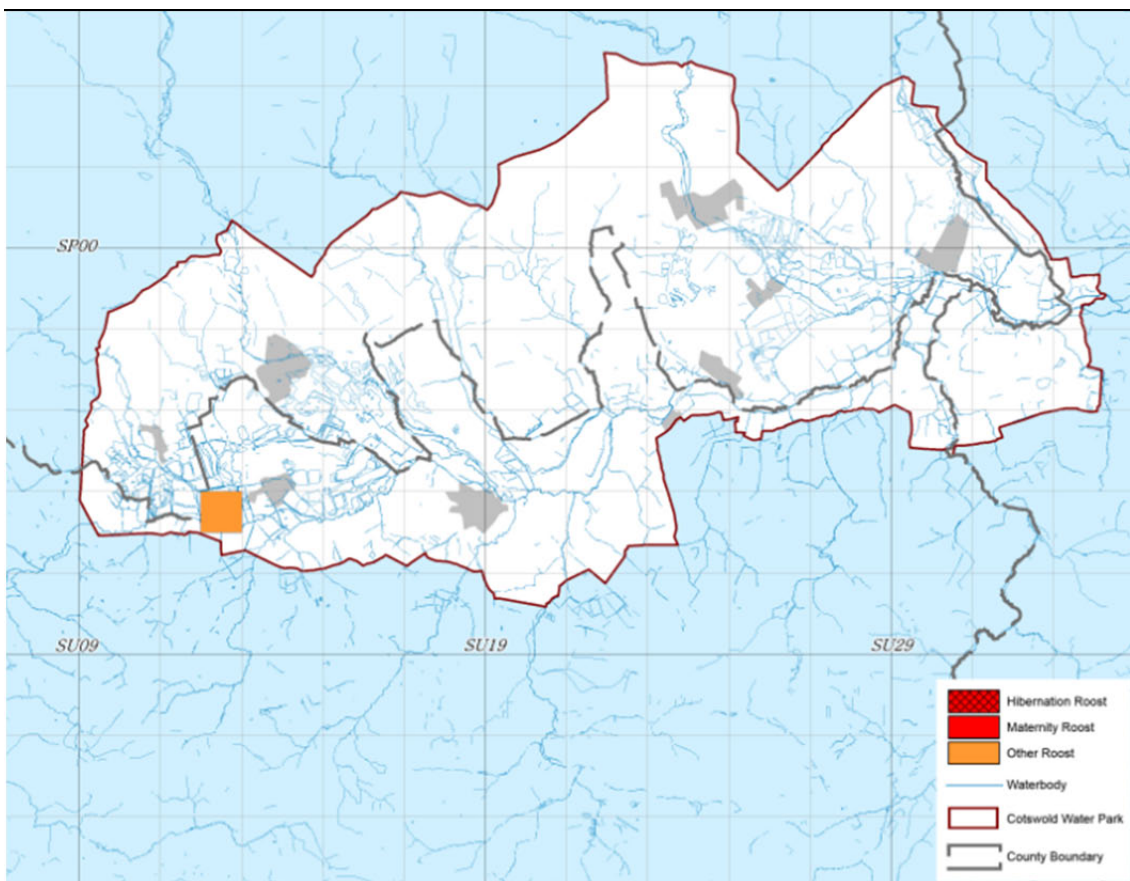


Figure 4.14b Nathusius' Pipistrelle Bat: Roost Records

## 4.15 Barbastelle bat, *Barbastella barbastellus* Schreber, 1774

### National and local CWP status

Generally considered rare in the UK, limited to southern and central England and Wales<sup>71</sup>.

Five records of this species in the CWP have been generated thus far across four monads; four of these records were overnight Anabat static detector surveys at locations such as Cleveland Lakes Reserve and Lower Mill Estate, in the western section of the CWP. A fifth record was provided by Dr Johnny Birks, Swift Ecology, whilst undertaking survey work upon a church in the eastern section of the CWP in 2010; a single bat pass was recorded.

A further five records have been generated during Bechstein's bat-related fieldwork in the Braydon Forest, including trapping a male in May 2010, and four static detector records also in May 2010. All records relate to a single monad.

### Habitats

Typically prefers wooded countryside, hunting in wooded river valleys. Sometimes forages over meadows, ponds and along rivers, but generally foraging in close proximity to waterbodies. Also known to forage in open countryside<sup>72</sup>.

Dietz et al (2009) comments that although the exact tree species may not be significant, a high structural diversity with a range of age groups and edge structures may be most important<sup>73</sup>.

Radiotracking in Gloucestershire highlighted that this species would commute and forage along river valleys<sup>74</sup>, whilst in Wiltshire this species was radio-tracked commuting across large expanses of chalk downland and intensive arable farmland on the Marlborough Downs, between the Savernake Forest and Avebury<sup>75</sup>

### Observations from the CWP

This species is considered rare in the CWP and the presence of roost sites in the CWP is thought to be unlikely. However the Braydon Forest to the south is likely to support maternity colonies. Dietz et al (2009) cites a figure of up to 4.5km for the distance of foraging from the maternity roost, whilst Greenaway (2004) indicates that "*The lengths of flightlines can vary from a few kilometres to as many as twenty kilometres. The average length of flightline for pregnant female barbastelles is about eight kilometres in West Sussex*"<sup>76</sup>. The length of such flightlines places the CWP within range of Barbastelle bats potentially roosting in the Braydon Forest, or indeed in Cirencester Park to the north<sup>77</sup>.

### Further work in the CWP & Braydon Forest

It is considered likely that maternity colonies of Barbastelle bat remain to be discovered in the Braydon Forest; further works are encouraged to survey those woodlands with the greatest potential. The CWP offers a diverse and abundant foraging resource whilst a dense network of watercourses, ditches, hedgerows and mature trees offer high habitat connectivity and commuting routes to access these foraging grounds.

<sup>71</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>72</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>73</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>74</sup> Palmer, E. 2014. *Pers.comm*; Radiotracking from Highnam Woods RSPB in the Leadon Valley, Gloucestershire.

<sup>75</sup> Wade, L 2014. *Pers.comm*. Radiotracking in the Savernake Forest, Wiltshire.

<sup>76</sup> Greenaway, F. (2004). English Nature Research Reports, Number 657; Advice for the management of flightlines and foraging habitats of the barbastelle bat *Barbastella barbastellus*. July 2004.

<sup>77</sup> Eric Palmer trapped this species during swarming surveys of Sapperton Tunnel, at the Daneway end, during 2009. E. Palmer 2014.



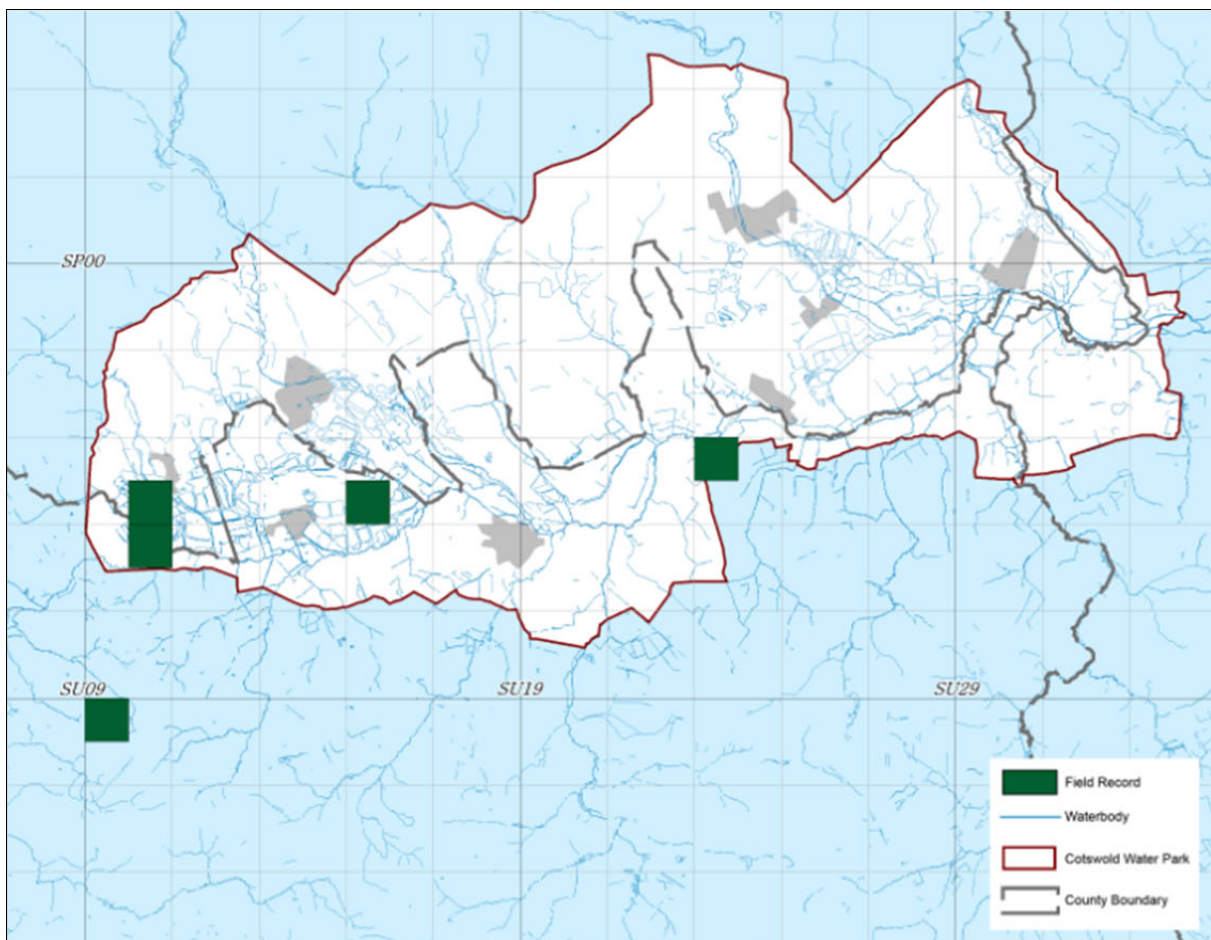


Figure 4.15 Barbastelle Bat: Field Records



## 4.16 Brown Long-eared bat, *Plecotus auritus* Linnaeus, 1758

### National and local CWP status

Common and widespread throughout Britain and Ireland<sup>78</sup>.

Common and widespread throughout the CWP. All long-eared bats are checked to discount that they are Grey Long-eared Bat, *Plecotus austriacus*. Where bats cannot be checked *in the hand* they are recorded simply as *Plecotus sp.* Consequently these cryptic species are conservatively recorded in the CWP and no assumptions are made regarding identification. Therefore two maps of Field Records are presented; one for confirmed *in the hand* record, and other for unconfirmed Field Records (i.e. such as bat detector records).

*Plecotus sp* records have been generated in 12 monads across the CWP; however Brown Long-eared Bat records were confirmed in 18 monads in the CWP and a further 3 in the Braydon Forest. This therefore represents one of the more widespread bats in the CWP.

Roost records demonstrate that maternity roosts have been recorded from seven separate monads in the CWP, plus a further one monad in the Braydon Forest. Additional roosting sites were also confirmed in a further 13 monads, including a number of bat box records. Thus far, all maternity roosts have been recorded in stone barns/churches (5), roof voids (1) and bat boxes (1). It is of note that one of the maternity roosts comprises over 50 females, representing a significant maternity roost in the county (Gloucestershire) but within known parameters indicated in Dietz et al (2009)<sup>79</sup>.

### Habitats

Typically feeding in open deciduous woodland, parkland and gardens, in rural and urban areas where suitable foraging areas are found. Uses hedges, treelines and river corridors and other landscape features to commute along<sup>80</sup>.

Summer roosts are typically found in trees or in buildings, whilst wintering bats also use underground sites<sup>81</sup>. Tree roosting sites include loose bark, rot holes and woodpecker holes as well as bat boxes. In roof spaces they use crevices between tiles, battens and timberwork, but frequently most obvious along ridge beams<sup>82</sup>.

### Observations from the CWP

This species is frequently encountered across the CWP, typically feeding along treelines, hedgerows and lake margins with some tree cover. On a number of occasions it has also been mist netted in open pasture and meadows only a few centimetres above the ground, feeding low over the grassland.

Bat boxes in the CWP and Braydon Forest are sometimes used during the maternity period, but rarely for long periods and rarely on repeated occasions.

### Further work in the CWP & Braydon Forest

Additional roosting sites for this species are likely to be found in suitable cavities and crevices in trees; a search in suitable habitat in CWP may yield new tree roosts for this species, in particular in riparian woodland.

This species is dependent upon man-made roosting sites such as housing, churches and barns; it is therefore at risk of losing roosting sites through minor and major works to buildings, in particular barn conversions. During studies in Hertfordshire Briggs (2000) found that of 22 barns visited that previously supported Brown Long-eared Bat colonies, 20 had been developed and Brown Long-eared bats were now absent from 14 of these barns. Colonies were still present in all of the undeveloped barns included in the study<sup>83</sup>. Further safeguards

<sup>78</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>79</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>80</sup> Russ J (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing.

<sup>81</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>82</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A&C Black.

<sup>83</sup> Briggs, P. (2000). A STUDY OF BATS IN BARN CONVERSIONS IN HERTFORDSHIRE IN 2000. Commissioned by Hertfordshire Biological Records Centre and Hertfordshire County Council.

will be necessary in the CWP to maintain this species as one of the more widespread and commonly encountered species since loss of suitable roosting sites arising from development of barns is considered to be a problem already.

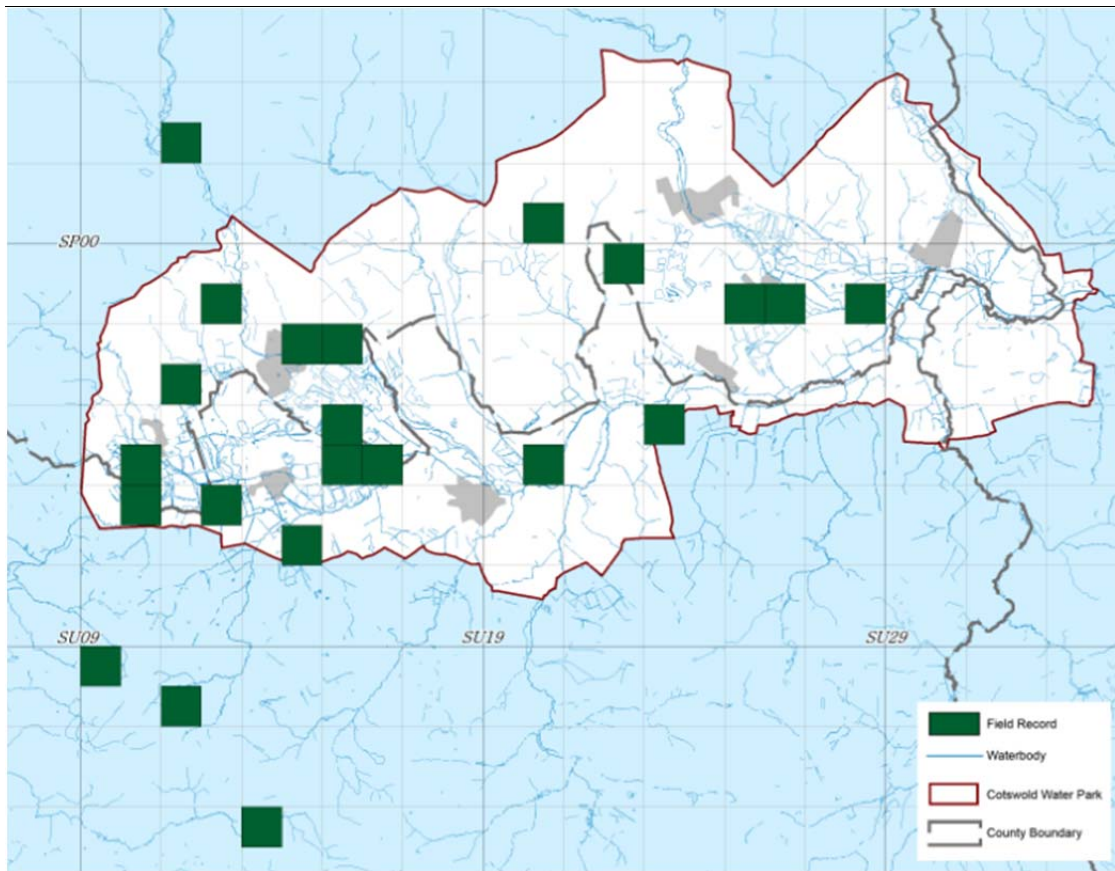


Figure 4.16a Brown Long-eared bat: Field Records

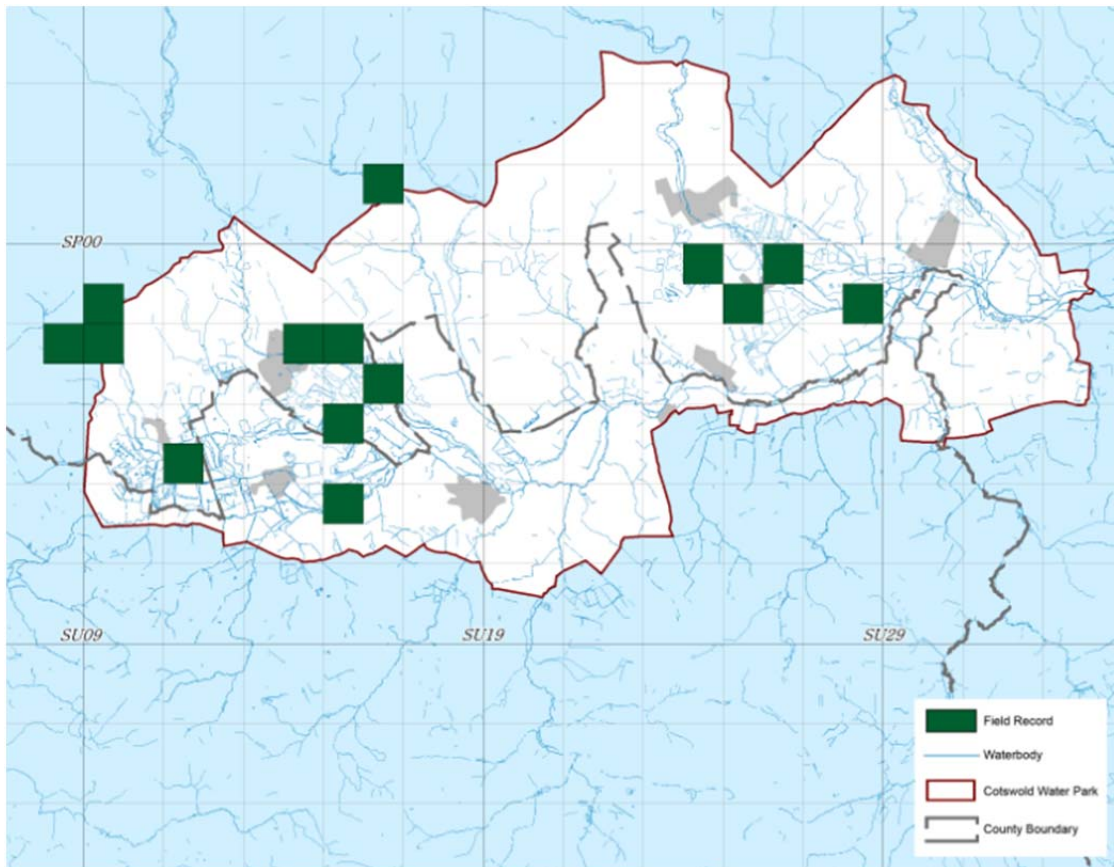


Figure 4.16b Unidentified Long-eared bat: Field Records

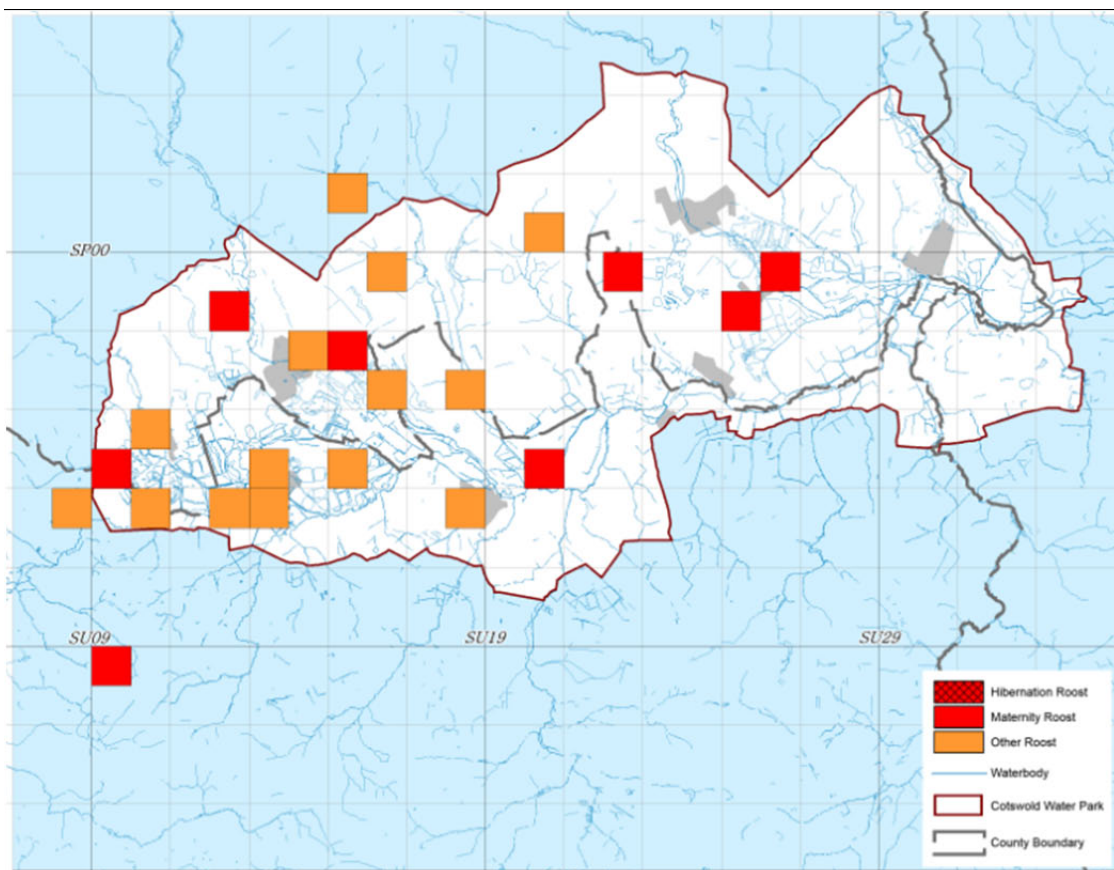


Figure 4.16c Brown Long-eared bat: Roost Records

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## 5 Recommendations for bat conservation in the CWP

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Section 5 begins by detailing the threats, constraints and opportunities to bats and bat conservation efforts in the CWP, before moving onto future work necessary to overcome them. The final section summarises the recommendations outlined in section 4, detailing the species-specific requirements for further survey and research.

As such, section 5 aims to provide some guidance for the direction of future bat conservation effort in the CWP. It is recognised that such guidance has equal and equivalent relevance for all biodiversity in the CWP.

### 5.1 Threats & opportunities to bat habitats in the Cotswold Water Park

The following section details some key issues for bat conservation in the CWP and some recommendations to address these. This is not an exhaustive list of issues encountered across the UK, but some CWP-specific issues for consideration and attention.

- **Landscape-scale change**

The CWP has been, and continues to be, subject to landscape-scale changes notably through mineral extraction & restoration, built development around the gravel pits and changes in farming practices (whether historic intensification or more recent agri-environment schemes). Such changes can result in permanent or temporary loss of habitat or indeed in the restoration or creation of new habitats.

The CWP, and in particular the areas of gravel extraction and restored mineral workings, is unusual in being so extensively affected by planning decisions (relating to mineral applications, sports & recreation and various scales of built development for example) at a level far greater than the wider countryside. This is stimulated through the extraction of sand & gravel in the first instance; however restoration of mineral sites creates further opportunities for built development such as holiday home developments and hotels, as well as opportunities for sport and recreation.

Changes in farming practices since the 1940s resulted in the loss of semi-natural habitats only fragments of which now remain, such as North Meadow NNR and Clattinger Farm SSSI. Intensive arable farming compounded these habitat losses, further impacting upon the health of river systems and water quality. Today, a number of changes in the landscape and in its biodiversity value are evident as agri-environment schemes begin to reverse historical changes, for example, through arable reversion to grassland, hedgerow restoration and creation and pond creation. A landscape approach to these agri-environment schemes (Entry Level and Higher Level Environmental Stewardship in the latter years) has initiated the restoration of a series of connected meadows and wetlands.

Consequently, whether through planning decisions or agri-environment schemes, the landscape is impacted by decision-making by various organisations (for example, local planning authorities and Natural England) based upon national or local policies (such as the National Planning Policy Framework). The differences in planning policy between different local authorities within the CWP, the wide range of land owners and the requirement to determine planning applications on their individual merits, has made it difficult to assess the potential cumulative impacts of this extensive landscape change on habitats and species populations. The lack of a coordinated strategic approach to biodiversity issues within the CWP also means that opportunities for landscape scale habitat creation have not been exploited fully.

- **Mineral extraction and restoration**

Of all of the land uses in the CWP this is the land use with the capacity for the greatest degree of landscape disruption but also offering significant opportunities for bat conservation in the later stages as sites are “restored”, landscaped and made available for the next stage in the life cycle of a gravel pit.

Mineral extraction has, and continues to, greatly disrupt the CWP landscape. On a site-by-site scale habitat such as farmland, grassland and woodland may be lost and minerals extracted; hedgerows and other boundary features may be lost, severed or rendered temporarily unavailable; changes in groundwater flow and de-watering activities may result in drainage of adjacent habitats and may impact upon the flow of rivers and streams. The result can be the loss or degradation of bat foraging areas and flightlines across the landscape. Roosting sites in mature trees and hedgerows may be lost or degraded, sometimes temporarily but sometimes permanently.

Improved environmental and planning legislation has placed additional requirements upon local planning authorities and mineral companies to safeguard and maintain habitats within and adjacent to mineral sites and to deliver more effective mitigation. Mineral companies today have their own detailed corporate policies recognising their commitments to biodiversity and local communities. Site restoration plans are improving in biodiversity terms and new schemes will deliver greater biodiversity enhancements.

Mineral restoration therefore offers considerable opportunities for biodiversity. As site restoration is delivered and landscaping works are delivered, new habitats are created and established, including new wetlands such as lakes, ponds and reedbed, but also wet grassland and woodland. New hedgerows are frequently created and new ditches created to support future water-level management. Such works therefore enable the establishment of new foraging areas for bats and new commuting routes, enabling bats to access new foraging grounds and to traverse the new habitats and wider landscape.

The restoration of mineral workings over time has created a massive wetland complex of over 150 gravel pits and associated wetland habitats, all contributing to a significant abundance of foraging habitats for bats. Whilst it is probable that a net gain for bats has resulted from this activity in the past 50 years, there must have been negative impacts upon more specialist species such as Lesser Horseshoe bat as the landscape connectivity was disrupted and foraging areas were lost and gained. Whilst it is easy to presume that the area has seen a net gain in bat species and abundance, the risk is that specialist species suffer whilst widespread, generalist species have gained.

- **Built development around the lakes**

In the CWP, built development frequently follows mineral extraction in the life cycle of a gravel pit, leading to a number of potential impacts directly and indirectly upon wetland habitats such as lake margins including (but not exclusively);

- Loss of existing roosting sites in buildings, mature trees etc.
- Direct loss of foraging areas on lake edges to the development footprint, as well as indirect losses resulting from the degradation of adjacent habitats through associated development and land management;
- Loss, severance and degradation of linear landscape features such as hedgerows, watercourses, tree-lines etc. either directly or indirectly, through development, insensitive lighting, road-building and management for amenity uses;
- Impacts upon water quality (due to surface runoff from roads and hard standing, or from so-called “grey” water sources);
- Artificial lighting sources of new developments impacting upon foraging areas and

flightlines, particularly impacting species which avoid lit areas, such as the Daubenton's bat;

It is considered that the majority of the built developments permitted on the lakes and gravel pits in the CWP have directly impacted upon lake margins as a result of the installation of artificial exterior lighting around buildings, along paths and in car parking areas, allowing light to spill onto lake shorelines or adjacent hedge lines.

Thus far at least 20 lakes (of the 154 in total) have been impacted by built development and associated artificial lighting. Much of this built development comprises major holiday home developments. Each of these lakes may be considered to have suffered degradation of foraging and commuting habitats for bats through the loss of foraging habitats on the lake margins through construction and light spillage. Whilst each individual development may not result in significant impacts to the bat population, the cumulative impact of degradation of bat habitats resulting from built development in the CWP has not been assessed or quantified.

Further development will take place within the CWP as existing permitted developments are implemented and completed. In addition, other developments may come forward on currently developed lakes or on undeveloped lakes that could impact on bat populations, if the appropriate protection and mitigation measures are not put in place.

- **Maintenance of key roosting sites (development works to bridges, churches, stone barns, mills and other historic buildings)**

The CWP offers a diverse range of old stone and brick buildings and structures providing opportunities for roosting bats, ranging from bridges, churches, agricultural buildings, water mills and historic buildings associated with the disused Thames-Severn Canal (such as the roundhouses). Many of these buildings lie close to water and may be centuries old.

There is potential for suitable features for roosting bats in these buildings and structures, whether bats are present or not, to be inadvertently threatened. Small rural properties may be renovated and extended. Barns may be converted into housing and historic buildings such as mills and roundhouses (found along the canal) may be renovated and repaired. Churches have seen increasing repair works and in some cases in the CWP, concerns from those charged with maintaining the church fabric have been raised over the presence of bats inside.

As such, bats are under increasing pressure from the human population at a time when they are increasingly dependent upon roosting sites provided in human dwellings and other such buildings. The various works undertaken (repairs, renovation, extension, conversion etc.) typically serve to reduce opportunities for roosting bats (and nesting birds) unless safeguards are put in place to prevent this.

Whilst bats are afforded considerable legal protection and excellent frameworks are in place to support and guide the owners of buildings with bat roosts, concerns remain over the status of bat populations in the UK including where bats are reliant upon potential roosting sites in buildings.

This is summed up perfectly in Simon et al (2004)<sup>84</sup>; *".....the loss of summer roosts, particularly within maternity roost assemblages, is the greatest threat to house-dwelling bat species. Despite the*

<sup>84</sup> Simon, M., Huttenbugel, S. & Smit-Viergutz, J. (2004). Ecology and Conservation of Bats in Villages and Towns. Results of the scientific part of the testing and development project "Creating a network of roost sites for bat species inhabiting human settlements". Federal Agency for Nature Conservation. Bonn, Germany 2004.



roosts being protected by law.....and appropriate technologies to conserve and create roosts....the number of roosts for house-dwelling bat species is nevertheless steadily shrinking. This is evidenced by the annual destruction rate of common pipistrelle roosts of up to 8% and by the threat to every fourth Serotine bat roost during the time of the project. The bats cannot meet their natural roost switching requirement without a sufficient number of summer roosts. A maternity roost which is too small may be unfavourable for the raising of young, i.e. the reproduction rate could drop or the death rate of young could rise if the mothers cannot evade a temperature anomaly or a parasite calamity in the roost. Also the destruction of roosts in buildings are often connected with the killing of bats, namely if bats are ignorantly trapped, intentionally killed or if juvenile bats get separated from their mothers". Whilst these comments related to their study site in Germany, they are applicable in the UK and ably illustrate the concerns of many bat workers.

Simon et al (2004) continued; "For bat species which are extremely loyal to the location of their roosts, (e.g. the Lesser Horseshoe bat), the destruction of one maternity roost can directly lead to the demise of the affected colony. In contrast to roost switching species, these species cannot simply move to another roost".

It is obviously therefore of great importance to safeguard not only the foraging areas and flightlines of bats in the CWP, but also their roosting sites in dwellings and other buildings. It is already likely that the limiting factor for bats in the CWP is the availability of roosting sites. At present, there are no data to confirm this and it will be some time before sufficient high quality data are available to contemplate assessment of the rate of attrition of roosting sites within built structures and the degree to which this is affecting the bat population. It is imperative therefore that the precautionary principle is applied, that the bat conservation message is widely spread through the CWP and surrounding area and that widespread conservation efforts are delivered to create new roosting sites in buildings and to maintain and safeguard existing roost sites.

- **Landscape-scale nature conservation: land management in the wider countryside**

Conservation effort for bats in the CWP will also depend upon wider countryside management to help restore, create and maintain habitats whilst also improving corridors for wildlife between sites.

Nature reserve management at a number of large sites across the CWP (e.g. by partners such as Cotswold Water Park Trust, Natural England, Wiltshire Wildlife Trust and Gloucestershire Wildlife Trust) has the ability to create wildlife-rich "islands" in the wider landscape where management can promote all of the bat's life cycle requirements. However, management in the wider countryside can help to connect these sites through the landscape.

Agricultural activities and associated management, including catchment sensitive farming, nutrient management, improved soil conservation and cross compliance, also impacts upon the area's biodiversity in an increasingly positive manner through enhancements to water quality, protection of groundwater and surface water, and improved recognition of features of nature conservation value.

Furthermore, the large number of local stakeholders in the CWP who show a strong interest in management for nature conservation and a willingness to adopt improved land management practices for wildlife such as bats provides considerable hope for nature conservation gain in the future. Such opportunities exist on a variety of scales, from the more enlightened local landowners keen to accommodate and encourage wildlife, to the many home-owners and parish councils managing gardens and green space.

There are, therefore, numerous means available to achieve significant delivery for bat conservation outside of the planning system in working with local landowners, farmers, nature reserve managers, local communities and individuals. The future lies in their successful engagement.

Promoting the messages of bat conservation to the CWP's stakeholders and ensuring positive outcomes requires resources and support from the local biodiversity partnerships (primarily the CWP Nature Conservation Forum, as well as the Gloucestershire Biodiversity Partnership and the Wiltshire & Swindon Biodiversity Partnerships, also currently known as the Gloucestershire and Wiltshire Local Nature Partnerships respectively).

## Conclusions: The Future

- **What needs to happen and why?**

Landscape-scale changes should aim to provide a net gain for biodiversity, a concept underpinning policies such as the National Planning Policy Framework<sup>85</sup> and the 2011 Natural Environment White Paper - *"We will move from net biodiversity loss to net gain, by supporting healthy, well-functioning ecosystems and coherent ecological networks"*<sup>86</sup>.

In order to achieve such coherent ecological networks, the CWP must be considered strategically at a landscape-scale to ensure that habitat loss as a result of development is mitigated for and replaced. Most importantly however a net gain for biodiversity must be achieved and these new habitats fully integrated into the wider landscape.

In the future, greater consideration of the cumulative impact of proposed mineral extraction schemes and built developments associated with wetland habitat will be necessary in order to fully comprehend their impact upon the landscape permeability of the CWP for a variety of species. A strategic and coordinated approach to habitat creation and enhancement will also be required in order to achieve a large scale and connected network of high quality habitat rather than isolated fragments.

- **Why focus on bats?**

Bats are an excellent flagship group of species to demonstrate and support strategic biodiversity policy. They are mobile species requiring entire landscapes to meet the needs of their life cycles, using a range of habitats for roosting, commuting and feeding. They require a variety of roosting sites which may be in natural and man-made features. Bats may therefore be considered an excellent "environmental canary", an indicator of the overall health of the landscape and wider environment.

Proposals considered likely to reduce the attractiveness of a site for bats, whether roosting, commuting or foraging, are likely to have a similar negative impact upon other species and their habitats too (thereby comprising an overall net loss for biodiversity).

- **How can a quality 'batscape' be achieved in the CWP?**

The strategic and coordinated approach to habitat protection, enhancement and creation will need

<sup>85</sup> Anon 2012. National Planning Policy Framework. March 2012, Department for Communities and Local Government ([www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/6077/2116950.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf))

<sup>86</sup> Anon. 2011. The Natural Choice: securing the value of nature. Presented to Parliament by the Secretary of State for Environment, Food and Rural Affairs by Command of Her Majesty, June 2011. CM 8082

to be adopted and endorsed by all key decision-makers involved in the CWP if it is to be successful. Promoting the messages of bat conservation to the CWP's stakeholders and ensuring positive outcomes requires resources and support from the local biodiversity partnerships.

A key part of delivering improved land and lake management at a landscape scale for bats will be ensuring that efforts and resources are targeted and coordinated at a landscape scale. Further work is required to develop landscape initiatives for the CWP promoting CWP-wide habitat restoration and management which benefits flagship species such as bats. The species accounts in section 4 repeatedly highlight the importance of landscape-scale conservation efforts for many bat species.

Appropriate policy will need to be developed within strategic documents such as Local Plans. It will be important for decision makers to recognise and address any gaps in the data used to underpin the evidence base, particularly where this is needed to assess the magnitude and significance of cumulative effects such as lighting. Overall, strategic policy should aim to build in the following for bats:

- Identification, safeguard and enhancement of important roosting sites and landscape features important for commuting and foraging within and across proposed development sites informed by an understanding of how these integrate into the wider landscape.
- Creation of new habitats and roosting sites in new developments integrated as part of this network of retained and enhanced landscape features. Final mineral restoration schemes and landscaping plans of built development should demonstrate how they will enhance the "batscape" in the context of the known ecology of the CWP's bat populations.

In order to assist with developing such strategic policy, the CWP Bat Initiative should continue to develop the evidence base of the local bat assemblage in the support of the development and delivery of local planning policies. It is recommended that a key part of the policy comprises a spatial element: a map showing key habitat features to be protected and areas for targeting habitat enhancement and creation would potentially be a powerful tool.

In addition, the CWP should be recognised for its landscape, biodiversity and ecosystem services. Bats and their conservation are integrated into all of these aspects of the CWP. Such recognition may be through appropriate statutory designations (for example, by inclusion on a reviewed Site of Special Scientific Interest designation for the CWP). Recognition may also be through non-statutory landscape and biodiversity initiatives, for example as a Nature Improvement Area, through an updated draft of the Cotswold Water Park Biodiversity Action Plan (2008-2016)<sup>87</sup> and the associated yet-to-be-published biodiversity vision (which was strongly linked to South-West Nature Map<sup>88</sup>).

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<sup>87</sup> Harris, G and Pickering, Dr. S J (Eds) (2008). Cotswold Water Park Biodiversity Action Plan 2007 – 2016. Cotswold Water Park Society.

<sup>88</sup> Biodiversity South-West website, <http://www.biodiversitysouthwest.org.uk/nmap.html>, accessed March 2014.

## 5.2 General recommendations for bat conservation in the CWP & Braydon Forest

In January 2014 an analysis was undertaken of the current status of delivery of the CWP Biodiversity Action Plan (2008-2016)<sup>89</sup>. This detailed how delivery of the Bat Species Action Plan had achieved a considerable amount, particularly in respect to establishing an initial baseline of bat data, engaging and training volunteers and engaging with local communities. Further work is required however to promote bat conservation and clarify the status of a number of species in the CWP and Braydon Forest and to deliver habitat enhancements at a landscape-scale.

Such priority actions may be summarised as follows. Further project planning and stakeholder engagement (for example with local landowners, Natural England and local planning authorities) may be necessary to agree future targets for bat survey, monitoring and advisory work.

### Strategy & policy

- 1 Joint working with the CWPBI and key nature conservation stakeholders to develop the vision for the CWP 'batscape'.
- 2 Subsequently, work with local planning authorities to: develop coordinated spatial development plan policy relating to bats requiring retention of key habitat features and habitat enhancement and creation within target areas; and to develop the evidence base to enable assessment of cumulative impacts of development on bat populations.
3. Landscape-scale nature conservation as set out in the CWP Batscape vision should be promoted to local communities, landowners, lake owners and house-holders to promote the safeguard and creation of bat roosting sites, commuting routes and foraging habitats. Demonstration projects and delivery projects to be facilitated to promote this aim.
- 4 The development and delivery of Green Infrastructure across the CWP will consider the habitat requirements of bats and integrate these requirements into habitat creation and management. This includes the consideration of sensitive lighting to minimise the impact upon bat habitats.
- 5 All built developments and mineral sites to deliver a net gain for bat conservation, by retaining important bat habitat (particularly roost sites of conservation significance and associated foraging habitat and flyways), delivering a net increase in roosting sites, improved landscape connectivity and improved foraging sites for bats.
- 5 Secure funds to support the local planning authorities and Natural England with respect to development control, mineral planning and strategic land management across the CWP, with respect to bat conservation in the CWP and Braydon Forest. Such funds could for example enable: 1) development of a strategic biodiversity officer role for the CWP to promote and facilitate such landscape-scale working for bat conservation; 2) development of monitoring and survey programme to deliver studies and evidence base necessary to support future Local Plans and associated Sustainability Appraisal (incorporating the requirements of Strategic Environmental Assessment); 3) delivery of demonstration projects such as roost creation, habitat enhancements and creation to improve commuting routes and foraging habitat on landscape features such as river corridors, the disused railway line or disused Thames-Severn

<sup>89</sup> Harris, G. (2014). The Cotswold Water Park Biodiversity Action Plan (2007-2016). Delivery & progress reporting 2013. A Report Prepared for the Cotswold Water Park Nature Conservation Forum & Cotswold Water Park Trust. Johns Associates Ltd (February 2014).

Canal; and 4) radiotracking studies to identify additional important commuting routes to enable their protection and enhancement.

- 5 Assess potential to include the bat assemblage, or components of it, within a potential revised Site of Special Scientific Interest (SSSI) designation for the CWP, to ensure national recognition of this important bat assemblage.

### **Survey & monitoring**

- 1 Continue the survey and monitoring of bat populations in the CWP and Braydon Forest, working towards delivery of the species-specific recommendations in sections 4 and 5.3.
- 2 Continue to provide bat data to local records centres but also provide interpretation of such data in order to promote key messages of bat conservation, guide mineral extraction and built development mitigation & enhancements, and to inform development of future planning policies.
- 3 Deliver a series of radiotracking studies on species including Soprano Pipistrelle, Daubenton's bat, Natterer's bat, Whiskered Bat, Brandt's bat and Lesser Horseshoe bat to assess commuting routes, roosting sites and the extent and location of foraging rounds thereby identifying habitat enhancements to support such species and individual colonies.
- 4 Assess potential for development of a CWP-wide network of monitoring points for monitoring bat activity levels in the long term from which meaningful, statistically robust population trends may be derived.

### **Landowner advice & conservation delivery**

- 1 Secure funds to deliver advice to landowners, promoting bat conservation and delivering demonstration projects, including 1) the inclusion of features for roosting bats in new built development and renovation projects, 2) safeguard of existing roosts and creation of new roosting sites in existing buildings, 3) construction of large structures, such as bat houses and water-side structures for roosting bats including Lesser Horseshoe, Daubenton's and Natterer's bats, 4) enhancement of a river corridor for roosting, foraging and commuting bats, 5) enhancement of the disused railway line for roosting, foraging and commuting bats, and 6) assessment of potential to reduce spillage of artificial light on foraging grounds and commuting routes as well as mitigation to lessen impacts. This list is not exhaustive and additional projects should be identified.
- 2 Secure funds to support and deliver habitat restoration and enhancement works to benefit bats, with reference to delivery of the species-specific recommendations in section 5.3 and Survey & monitoring points above.
- 3 Ensure that the requirements of bats are recognised in site restoration plans for mineral sites to ensure that landscape connectivity is restored and integrated within habitat restoration works.

### **People & engagement**

- 1 Continue to develop a volunteer team supporting and delivering bat survey, monitoring and advisory work in the CWP; coordination of such a team and associated fundraising would require an employed project officer, as described in Strategy & policy point 4 above.
- 2 Delivery of work outlined above will necessitate considerable fundraising by local biodiversity

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partners, for example, for

- For ongoing support of existing bat conservation efforts, such as roost monitoring, trapping surveys, bat box monitoring and maintenance and training of project personnel and volunteers will necessitate an ongoing funding commitment.
  - Research proposals, for example, radiotracking studies and a monitoring grid of static detectors (see Survey & Monitoring point 4 above) will likewise necessitate significant fundraising.
  - Centres of excellence for the research of British bats should be engaged to establish more formal bat research in the CWP, for example the Bat Lab at Bristol University.
- 3 Promote the importance of the CWP's and Braydon Forest's bat assemblage to local landowners, local communities and government agencies, such as Natural England and Forestry Commission, for consideration in land management initiatives, grants, woodland management grants and agri-environment schemes.



### 5.3 Summary of recommendations by species: future research & surveys

The following is a summary of the recommendations listed within each species account, presented here for easy reference.

#### **Greater Horseshoe bat**

Clarifying the status of this species in the Braydon Forest is a priority. Few, if any, other records of this species are known from this area which is known to be under-surveyed until recently.

#### **Lesser Horseshoe bat**

Clarifying the status of this species in the CWP and in the lower elevations of the Cotswold Hills is an urgent priority. Conservation action is needed across a wide, landscape area in order to safeguard and understand this species. Clarifying the status of this species in the Braydon Forest is also a priority. Few, if any, other records of this species are known from this area which is known to be under-surveyed until recently.

#### **Whiskered bat**

Whilst further studies are initiated nationally to understand habitat use and partitioning by the three small *Myotis* species in the UK (*M. mystacinus*, *M. brandtii*, *M. alcathoe*), including the studies undertaken in 2013 by Phil Brown, Bristol University, further local studies can contribute to the national understanding of these species. Further study of the small *Myotis* in the CWP and Braydon Forest will be encouraged to assess local populations, preferred roosting sites and foraging areas, as well as to begin to understand interactions between these species (if *Alcathoe* is present!).

#### **Brandt's bat**

Beyond knowing that this species is present and likely breeding in the area, we know little of this species or of its local status.

Dietz et al (2009) suggest that a colony (comprising 20-60 females, exceptionally up to 200) may utilise over 100km<sup>2</sup>, with females using up to 3 hunting grounds of 1-4ha within up to 10km of the roost. Such commuting bats may “follow guiding linear structures such as windbreaks, stream courses” and a network of hedgerows. This raises the possibility that some bats roosting in woodlands of the Braydon Forest may foraging across much of the Braydon Forest and around the lakes of the CWP. Does the CWP support its own maternity colonies or comprise feeding grounds for a larger widely ranging population?

Landscape-scale conservation measures will be necessary to safeguard and enhance this species if indeed it is ranging so widely across a variety of habitat types. Dietz et al (2009) goes further suggesting that “damp areas and semi-natural forests and their connection by windbreaks and hedges” should be maintained, while habitat fragmentation should be reversed by reconnecting fragmented landscapes.

#### **Natterer's bat**

Further surveys are required to locate additional maternity roosts in the CWP, in particular in any remaining undeveloped/unconverted stone barns. These sites should be safeguarded for this (and other species), either as undeveloped buildings or with effective mitigation within re-development. Identification of such roosts should be by a combination of volunteer and consultancy work. The woodlands and barns of the Braydon Forest are likely to yield new roosts.

**Bechstein's bat**

Further work is encouraged on additional woodlands in the Braydon Forest to locate new Bechstein's colonies.

An assessment of woodland management in the Braydon Forest is required to ensure that management is optimal for the remarkable assemblage of bats found here, in particular Bechstein's bats, working with private landowners, Wiltshire Wildlife Trust and Forestry Commission.

A wider assessment of the Braydon Forest is encouraged to ensure that the landscape permeability is maintained and habitat fragmentation is prevented.

**Daubenton's bat**

The relative lack of known maternity colonies is surprising given the relative abundance of this species in the CWP. Coordinated efforts to locate additional roosts in trees are encouraged, in particular of riparian woodlands.

Further surveys and monitoring of bridges and related structures are required to monitor the roosts in the long term and following repair and remedial works.

The impact of water-side lighting from built development upon bat species such as Daubenton's bat is of concern; excessive lighting of foraging areas and commuting routes is likely to result in the loss of significant habitat. With increasing built development likely in the future, such habitat losses are likely to be cumulative. Efforts by local planning authorities and local landowners are required to minimise or avoid such future impacts where possible.

**Serotine bat**

At present virtually nothing is known of how this species is utilising the CWP for roosting and foraging. It is considered likely that a number of roosts remain to be found in local villages; Whelford should be where the search begins.

**Noctule bat**

To locate roosting site of this species. In the CWP such sites will be scarce due to the lack of woodland cover and mature trees with features necessary for roosting Noctule bats. A greater density of roost sites is anticipated in the Braydon Forest where woodland cover is predominantly broad-leaved, dense and more extensive than the CWP.

**Leisler's bat**

To confirm the presence of this species in the CWP, particularly in the east of the CWP.

**Common Pipistrelle bat**

Further work is encouraged in searching for and locating new maternity roosts of this species. An assessment of the distance between roosts and foraging grounds, and frequency of feeding bouts, in order to compare to Davidson-Watts & Jones (2005) would provide a fascinating insight into how bat behaviour and habitat use may differ in a location such as the CWP.

**Soprano Pipistrelle bat**

This is arguably the CWP's most abundant bat species, with the greatest number of known roost sites thus far. Nothing is currently known of hibernation roosts for this species and little work has been achieved thus far in providing new maternity roosts for this species.

Davidson-Watts et al (2006) demonstrated that this species travelled further (in order to utilise

wetland and riparian habitats) than the Common Pipistrelle bat (which typically foraged over a greater variety of habitats in closer proximity to the maternity roost site)<sup>90</sup>. To date, no detailed study has been made of this species in the CWP with respect to typical commuting distances between maternity roosts and foraging areas.

#### **Nathusius' Pipistrelle bat**

A coordinated monitoring programme is recommended to attempt to clarify the status of this species in the CWP. The seasonal spread of records suggests that this species is resident; however resident bats may be supplemented by migrants, or may comprise mainly male bats. Clarifying if this species is resident and potentially breeding in the CWP and then the protection of such roosting sites is a key conservation objective for the CWP, in particular considering how few such roosts have been found in the UK.

#### **Barbastelle bat**

It is considered likely that maternity colonies of Barbastelle bat remain to be discovered in the Braydon Forest; further works are encouraged to survey those woodlands with the greatest potential.

#### **Brown Long-eared Bat**

Additional roosting sites for this species will likely be found in suitable cavities and crevices in trees; a search in suitable habitat in CWP may yield new tree roosts for this species, in particular in riparian woodland.

This species is dependent upon man-made roosting sites such as housing, churches and barns; it is therefore at risk of losing roosting sites through minor and major works to buildings, in particular barn conversions. Further safeguards will be necessary in the CWP to maintain this species as one of the more widespread and commonly encountered species since loss of suitable roosting sites arising from development of barns is considered to be a problem already. This includes safeguarding existing roosting sites as well as creating new roosts.

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<sup>90</sup> Davidson-Watts, I., Walls, S. & Jones, G. 2006. Differential habitat selection by *Pipistrellus pipistrellus* and *Pipistrellus pygmaeus* identifies distinct conservation needs for cryptic species of echolocating bats. *Biological Conservation* 133 (2006) 118–127. Elsevier

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## Appendix: Bat Species Action Plan, Cotswold Water Park Biodiversity Action Plan (2008-2016)

Bats Species Action Plan								
Bats Species Action Plan 2007 – 2016								
Objective 1: Maintain and enhance bat populations in the CWP								
Objective 2: Protect and enhance habitats and roosts used by bats in the CWP								
Objective 3: Increase public awareness of bats in the CWP								
Action Plan	Target Code	Target Text	Target Year	Action Code	Action Text	Action Lead	Action Partners	Measure (units)
Objective 1: Maintain and enhance bat populations in the CWP								
Bat SAP	BAT-T1	Establish comprehensive baseline data for bat populations in the CWP	2008	BAT-A1	Create and maintain database of bat records for the Cotswold Water Park, following advice from GCER and WSBRC with regarding to effective recording of bat data.	CWP BAP Team	WSBRC, GCER	Database created by 2007 and maintained annually
Bat SAP	BAT-T1	Establish comprehensive baseline data for bat populations in the CWP	2008	BAT-A2	Establish regular data exchange mechanism between Glos and Wilts Biological Records Centres and the database maintained by the CWPBI.	CWP BAP Team	WSBRC, GCER	Data exchanged annually between local records centres and CWPBI.
Bat SAP	BAT-T1	Establish comprehensive baseline data for bat populations in the CWP	2008	BAT-A3	Undertake bat activity transects across the CWP with bat detectors to determine species present in the CWP,	CWP BAP Team	Glos Bat Group, Wilts Bat Group	25 transects undertaken by 2007.

					areas of importance for bats, activity levels, important flightlines and foraging areas and where possible, roost sites. These surveys may also comprise the basis for a repeatable monitoring programme.			
Bat SAP	BAT-T2	Locate 3 new bat roosts each year.	2007 ongoing	BAT-A4	Find new roosts each year, through building survey, house visits, emergence surveys and dawn swarming surveys and determine type of roost, species and numbers of bats.	CWP BAP Team	Glos Bat Group, Wilts Bat Group	3 (or more) new roosts found each year
Bat SAP	BAT-T3	Establish 5 new bat box monitoring schemes	2010	BAT-A5	Establish new bat box schemes to determine bat species present in the Cotswold Water Park and their distribution. Box schemes are an additional tool to clarify species habitat use in an area, as well as being a way of involving volunteers and creating training opportunities in bat handling and identification. Care should be taken to ensure that adequate resources, time and people are available to monitor these schemes. A variety of habitats should be targeted for monitoring and study.	CWP BAP Team	Glos Bat Group, Wilts Bat Group	5 bat box schemes established Monitoring of bat boxes undertaken 2-3 times per year. Records of all checks
<b>Objective 2: Protect and enhance habitats and roosts used by bats in the CWP</b>								
Bat SAP	BAT-T4	All large developments to	2007	BAT-A6	Landscaping schemes to	CWP BAP Team	NCF	All large-scale

		generate a net gain for bats	ongoing		create and improve and link foraging areas, commuting routes and known and newly created roosts. Built developments to include creation of bat lofts, hibernacula and bat tiles/bricks.			developments incorporating habitat creation and management for bats. (Measure length of flyways and commuting routes created and managed number of roosts created etc.).
Bat SAP	BAT-T4	All large developments to generate a net gain for bats	2007 ongoing	BAT-A7	Where bats are likely to be present and affected by development, planning applications should be submitted with adequate baseline on bats, assessment of potential impacts on bat populations and mitigation measures for bats. There should be an overall gain in biodiversity.	LA's (Planning & Development)	NCF	Number of permitted developments that include/have delivered positive measures for the enhancement of the status of the BAP species.
Bat SAP	BAT-T5	Protect all known roost sites	2007 ongoing	BAT-A8	Liaise with landowners and managers to alert them to the presence of roosts and other important bat habitat features (particularly mature trees and hedgerows). Provide advice on conservation management of roosts and nearby foraging habitat.	CWP BAP Team	Glos Bat Group, Wilts Bat Group	Number of times advice provided to landowners/managers per year.
Bat SAP	BAT-T6	Protect and enhance foraging areas and key habitat features	2016	BAT-A9	Identify and map known/potential roosts and key habitat features such as	CWP BAP Team	Glos Bat Group, Wilts Bat	Production of map by 2008

		comprising commuting routes between roosts and foraging sites.			commuting routes and foraging areas. (By 2008). Efforts should be made to maintain habitat connectivity between key corridors such as the canal, river corridors, disused railway line and key hedgerows. Efforts should be made to link human settlement where the majority of bat roosts may be found, with foraging areas through these habitat corridors.		Group	
Bat SAP	BAT-T6	Protect and enhance foraging areas and key habitat features comprising commuting routes between roosts and foraging sites	2016	BAT-A10	Identify obstructions to habitat connectivity for commuting bats using map produced [above] and identify solutions. (By 2009)	CWP BAP Team	Glos Bat Group, Wilts Bat Group	Publication of report detailing obstructions and solutions where possible
Bat SAP	BAT-T6	Protect and enhance foraging areas and key habitat features comprising commuting routes between roosts and foraging sites	2016	BAT-A11	Undertake habitat creation and management where appropriate to improve habitat connectivity as identified [above]. By 2016.	CWP BAP Team	Landowners,	Length and/or area of habitat created to restore habitat connectivity
Bat SAP	BAT-T7	All Bridge structures, where bats present or likely to be present, to be assessed for bat usage prior to maintenance or repairs that may adversely affect bats.	2007 ongoing	BAT-A12	Incorporate bat surveys, at the appropriate time of year, early into the planning stages of bridge repair/ maintenance works and ensure appropriate mitigation is provided during the works if necessary.	LA's (Management of Land/ Buildings/ Highways)	CWP BAP Team, Natural England	Number of bridge repairs works undertaken following a bat survey and mitigation where necessary. Also refer to <b>Built Structures HAP</b>

Bat SAP	BAT-T8	3 Bat lofts created in buildings	2010	BAT-A13	Seek advice on best designs and techniques available. Proactively seek and develop opportunities to achieve this.	CWP BAP Team	Developer s, LAs (Planning & Development)	3 lofts created. Also refer to <b>Built Structures HAP</b>
Bat SAP	BAT-T9	2 hibernacula created in buildings	2016	BAT-A14	Seek advice on best designs and techniques available. Proactively seek and develop opportunities to achieve this.	CWP BAP Team	Developer s, LAs (Planning & Development)	2 hibernacula created. Also refer to <b>Built Structures HAP</b>
Bat SAP	BAT-T10	Bat bricks/tiles to be incorporated into 100 new buildings	2016	BAT-A15	Seek advice on best designs and techniques available. Proactively seek and develop opportunities to achieve this.	CWP BAP Team	Developer s, LAs (Planning & Development)	Bat bricks and tiles incorporated into 100 new buildings. Also refer to <b>Built Structures HAP</b>
Bat SAP	BAT-T11	2 roosts created in new/repared bridges	2016	BAT-A16	Seek advice on best designs and techniques available. Proactively seek and develop opportunities to achieve this.	CWP BAP Team	LA's (Management of Land/Buildings/Highways)	2 roosts included in bridges. Also refer to <b>Built Structures HAP</b>
Bat SAP	BAT-T12	Management by Environment Agency of riparian habitat is undertaken in accordance with the Management Guidelines for Daubenton's Bat (Environment Agency Habitat and Species Handbook).	2007 ongoing	BAT-A17	Ensure Environment Agency management of riparian habitat is undertaken in accordance with the Management Guidelines for Daubenton's Bat, including management of willow pollards and other large trees and the maintenance of some overhanging branches.	Environment Agency	CWP BAP Team	Length of river (km) managed in accordance with the Management Guidelines for Daubenton's bat.

<b>Objective 3: Increase public awareness of bats in the CWP</b>								
Bat SAP	BAT-T13	Undertake 2 guided bat walks in the CWP per year	2007 ongoing	BAT-A18	Walks may be undertaken as part of existing programmes of events.	CWP BAP Team	Glos Bat Group, Wilts Bat Group	2 bat walks per year
Bat SAP	BAT-T14	Develop the CWP BAP Team website to include a section on the CWPBI.	2007 ongoing	BAT-A19		CWP BAP Team	Glos Bat Group, Wilts Bat Group	Section on CWP BAP Team website created and updated at least annually.
Bat SAP	BAT-T15	Give 1 illustrated talk per year on bats to interested parties upon request.	2007 ongoing	BAT-A20		CWP BAP Team	Glos Bat Group, Wilts Bat Group	1 talk given per year.
Bat SAP	BAT-T16	Provide 1 training event per year for bat workers in the CWP	2007 ongoing	BAT-A21	Working with Gloucestershire and Wiltshire Bat Groups bring together a range of expertise and training opportunities including mist netting, bat box checks, roost visits, building surveys and bat detector surveys. Training events may include detector surveys, bat sound analysis and mist netting and identification of bats in the hand.	CWP BAP Team	Glos Bat Group, Wilts Bat Group	1 training event per year.
Bat SAP	BAT-T17	Publication of annual newsletter	2007 ongoing	BAT-A22	This will provide to volunteers, landowners and partner organisations as well as funding organisations.	CWP BAP Team		Publication and distribution of newsletter each year.