

On the occurrence and distribution of bats in Ogof Draenen.

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Abstract: The modest aim of this paper is to present records and observations of bat activity in Ogof Draenen. The records are predominantly collated from those made by cavers since the discovery of the cave system in 1994. Most of these records are unsystematic in nature, and are likely to be biased towards the more visible Horseshoe bats (which make up the vast majority of sightings), perhaps under-representing the more cryptic *Myotis* species. Nonetheless they help to provide a coherent picture of the way that bats use what is now probably Britain's longest cave. Bat activity is temporally concentrated to the winter months, and suggests that Lesser Horseshoes in particular exploit the deeper cave passages as solitary hibernation roosts in winter, probably moving dynamically in response to cold weather. There is little evidence of summer usage. Spatially, activity is concentrated in the relict passages close to the known hibernaculum at Siambre Ddu, with only occasional sightings elsewhere in the cave. The density of sightings is shown graphically and compared with the recorded distributions of guano accumulations and bat skeletons, and suggests a similar spatial usage now and historically, even though animal densities were formerly much higher and might once have involved summer usage of the cave. Dustings of faecal pellets throughout the cave suggest that bats may also use the entire system in a much more diffuse manner. Ogof Draenen therefore provides an important site for hibernation activity for several bat species, predominantly centred on the hibernaculum at Siambre Ddu.

The caves of South Wales are known to provide important roosting and hibernation sites for several species of bats living in Britain, some near the current limit of their ranges. In particular, both Lesser Horseshoe bats (*Rhinolophus hipposideros*) and Greater Horseshoe bats (*R. ferrumequinum*) are well known from caves such as Ogof Agen Allwedd on the edge of the northern limestone outcrop. The major cave system of Ogof Draenen, however, was only discovered in 1994 (Lovett, 2011), and is therefore a comparatively unstudied but potentially important site for bats because it has remained undisturbed by humans until very recently. This paper presents a record of the observed occurrence and distribution of bats in Ogof Draenen and the surrounding area, and discusses our understanding of how bats use the cave. It is based on data compiled from personal observations made by the authors, and on the records (which are presented here) supplied by cavers visiting the cave.

Geographical and geological context

Ogof Draenen, located on the western edge of the Brecon Beacons National Park, is probably the longest cave system in the UK, with a current surveyed length in excess of 70 km. Its known development is within the Northern Outcrop of the Main Carboniferous Limestone (Pembroke Limestone Group), but for much of its length, Ogof Draenen is overlain by Millstone Grit (Marros Group) and Coal Measures. The bulk of the known system lies beneath Gilwern Hill, the Bloreng and the intervening area of Pwll Du, extending southwards towards and beneath the town of Blaenavon. This is the upland area between the Usk and Afon Lwyd valleys. The cave's main stream runs for around 3 km before reaching the limit of exploration from where there is a further 8 km to the known risings at Snatchwood and Pontnewynydd near Pontypool (Gascoigne 1995; Maurice and Guilford, 2011). Given the cave's scale, and particularly its abundance of dry, relict passages that have remained undisturbed by humans until very recently, Ogof Draenen is potentially of very significant importance as a habitat for bats, both currently and historically.

Siambre Ddu and the neighbouring escarpment

It appears that the most important known area for bats in the Ogof Draenen system is the gritstone collapse chamber at Siambre Ddu, and the underlying passages relatively close to it. A winter hibernaculum seems to centre on Siambre Ddu, which has long been known to contain significant numbers of Lesser Horseshoe bats, but also small numbers of the much rarer Greater Horseshoe bat. As an SSSI for its bats (as well as its geology) Siambre Ddu has been monitored in the past by specialists, and our own observations support the site's continued importance for Lesser Horseshoe bats in particular. On one occasion TG counted in excess of 40 bats emerging from the entrance to Siambre Ddu on a spring night. A single attempt to track bats leaving the roost, by placing observers with heterodyne detectors at various positions on the escarpment, suggested that most fly directly downhill through the quarry below Siambre Ddu into Cwm Llanwenarth and towards the Usk valley, probably to feed. Sporadic Lesser Horseshoe bats fly repeatedly back and forth along the escarpment, or even up and over the hillside above (suggesting a possibility that the colony may also exploit foraging areas in the Afon Lwyd valley farther south). The escarpment is also used by foraging Pipistrelles throughout most of the year (species usually not determined). We also noted a Lesser Horseshoe bat (or bats) fly repeatedly around an area of hillside 20 m west of Siambre Ddu. Later inspection revealed a small draughting slot in the escarpment suggesting possible use of an alternative connection to passages below, and the closeness of the underlying cave to the surface along here suggests that there might be other entrances along the escarpment accessible only to bats. In addition, there are other small caves along the escarpment that might also have significance for bats, including Ogof Dwy Sir (see Fig. 1), where there has been a single probable sighting of a *Myotis* species.

Bat activity within Ogof Draenen

With the discovery of Ogor Draenen in 1994 it became possible to observe bat activity underground and beyond the confines of the known hibernaculum at Siambre Ddu. Since that time, many cavers have supplied details of their sightings of bats and other biological observations to the Biological Recorder of the Pwll Du Cave Management Group. The following observations on bat activity within Ogor Draenen are made on the basis of these records, and those of the authors. Records include those of live bats, guano deposits, and bat skeletons.

Sampling Methods

There are many limitations to the sampling methods utilized in this report. By their nature the records are, for the main part, simple observations made by cavers as they made their way through the cave on sporting or exploratory trips. They take the form either of notes made in the cave's entry logbook or of later direct reporting to the Biological Recorder, with some additional privately documented observations. Records vary in quality, relating to the relevant expertise of the caver and a desire and encouragement by the caving community not to linger near, or interfere with, bats wherever they are found. For that reason, many of the records are listed simply as "bat" rather than to species. It is, however, fairly safe to assume that most of these records are of Lesser Horseshoe bats, as this is by far the most common species found in the cave. This method of collecting data has another inherent problem in that it is skewed in favour of the passages that are most regularly visited by cavers. Absence of records does not indicate that there are no bats present, simply that they have not been seen. Furthermore, many additional sightings might have been made by cavers insufficiently motivated to report or record their observations. Nevertheless, the regularity with which some passages are used by bats does give a good level of confidence in these results. In addition to these serendipitous observations, a number of more systematic bat counts have been made in those parts of the cave where bats are very common, leading to very large numbers of bats being observed. These counts were carried out by experienced observers who are able to distinguish bat species with confidence, and this confidence is indicated by attribution of species names in the full data listings in Table 4.

Results

Figure 3 summarizes the observations, counts and records of bats, guano, and skeletal remains in relation to the publicly available line survey of the cave annotated with relevant passage names. Although there is an element of subjectivity in the grading, live bat sighting densities fall roughly into the categories absent (no sightings), rare (a single sighting), common (2 or more sightings), and very frequent (more than 10 sightings). Table 4 collates the individual records on which this analysis is based, including, for completeness, a small number that are not directly interpretable.

Live bat observation densities

Table 1 shows the documented observations of live bats within the cave since 1994, being total counts over the time that records have been kept (1994–2010). Figure 3 provides the positions of some of the main passage names, and summarizes their associated observation densities. The vast majority of sightings (about 95%) are recorded during the winter months December to March, with the peak in January and February. Within the limits of the data this is consistent with the pattern of usage reported at Ogor Agen Allwedd, a few kilometres to the northwest, where this species has been observed hibernating for many years (CCC website). There are no recorded sightings from July to October. Nevertheless, there are occasional recordings from April, May, June and November, and a few observations of apparently fresh droppings during the early summer months.

Live bat observations by species

Lesser Horseshoe Bats (*Rhinolophus hipposideros*)

Most of the UK population of Lesser Horseshoe bats is found in Wales (CCC website) and, whereas the population declined during the last century it might more recently have stabilized at around 10,000 (Leroy and Simms, 2006; Warren and Witter, 2002). Most identified live bat observations within Ogor Draenen are of Lesser Horseshoes (234). It is highly likely that most of the undetermined sightings (121) are also of this species.

Greater Horseshoe Bats (*Rhinolophus ferrumequinum*)

Greater Horseshoe bats underwent major decline in Britain during the 1900s, with fragmented populations genetically isolated from each other (Rossiter *et al.*, 2000). They are far less common than Lesser Horseshoe bats in Wales, and not commonly reported in Ogor Draenen. Only 9 individual sightings have been made. 5 individuals were recorded in Raiders Passage in December 2009, 2 from Megadrive in 1997 and 2004, 1 in 6th Heaven (2003), and 1 in Canyons (1997). Sporadic Greater Horseshoe bats have also been sighted emerging from Siambre Ddu.

Myotis species

Though less closely associated with caves than are Horseshoe bats (but see Glover and Altringham, 2008), three *Myotis* species individuals have been recorded from Ogor Draenen, although none was identified confidently to species. These individuals were recorded in Snowball, Indiana Highway and Megadrive. An additional observation was made of a *Myotis* bat in Ogor Dwy Sir, a cave that lies close to the known Ogor Draenen system on Gilwern Hill.

Positions of skeletal remains of bats

The presence of skeletal remains is interesting for several reasons. They are fascinating objects in their own right and the unusual decay processes in the cave (lack of large predators to disperse the remains) give a rare opportunity to admire such fragile specimens. Where known, they are carefully taped to avoid damage by passing cavers. The skeletons are interesting

in that they give an indication of bat distribution but also raise questions of why the bats perished where they did. Research by Leroy and Simms (2006) suggests a different ancient use of the cave by bats (as a summer as well as a winter roost) leading to the possibility that entrances to the caves used by bats were suddenly and catastrophically changed, perhaps because of early exploitation of the escarpment by industry. No work has been done to establish the validity of these theories but radiocarbon testing on some of the skeletons might help establish their plausibility. Locations of reported bat skeletons are given in Table 2, and their distribution is summarized in Figure 3.

Guano

Ogof Draenen is of exceptional importance for its bat guano deposits. Table 3 lists sites where significant quantities of guano have been recorded, including some observations from Leroy and Simms (2006). Scattered droppings, sometimes described as “dustings”, of faecal pellets are observed far more widely in the dry, relict parts of the cave, but have rarely been reported formally. The pattern of major guano deposits, summarized on Fig.3, shows again that historical spatial usage of the cave broadly parallels current usage, with most activity concentrated in dry passages behind the escarpment close to Siambre Ddu. Radiocarbon dating has shown that some of these guano accumulations date from the Iron Age to Medieval periods (Leroy and Simms, 2006), and conjectured accumulation rates suggest periods of more intense usage than appears to be the case now. Furthermore, palynological evidence (pollen analysis) suggests that the cave was used, predominantly by Lesser Horseshoe bats, as a summer as well as a winter roost, contrasting with the current pattern of behaviour in which bats leave the cave for the summer months probably to breed at lower altitude sites.

Discussion on bat distribution in Ogof Draenen

Bats are most commonly found in the Megadrive, Indiana Highway and Canyons areas of the cave: the dry relict passages closest to Siambre Ddu. Because Indiana Highway and Megadrive are used by cavers on route to the southeastern parts of the cave, densities based on informal observations could potentially be inflated relative to less visited areas of the cave. Nevertheless, other intensively visited areas, such as Gilwern Passage, the main stream, or Squirrel Rifts, do not return frequent observations. Furthermore the Canyons and Megadrive North are located off this traverse route but also show high densities in this same area. Thus it is likely that the high densities recorded are genuinely representative of bat usage. Accumulations of guano in these areas, which have been dated back to the Iron Age, suggest that it might have been this way for a very long time. Although historical evidence indicates that bats once used this area in far greater numbers than now, and perhaps in a different way, distribution of major guano accumulations suggests that spatial patterns of usage may have been broadly similar. At present, during winter, bats are regularly sighted roosting in the major passages below and behind Siambre Ddu, indicating that this or somewhere close to this is their common route of access. These passages also have the highest accumulations of guano and skeletons, suggesting that historical access to the cave might also have been close by. The number of bats roosting in the cave peaks during cold periods in winter. Regular counts by one of us (TG) of bats visible only from the taped route on traverses of the passages from Indiana Highway through Megadrive (and without entering Canyons or Raiders’) over the past 15 years, gave a peak of 38 (with rarely fewer than 5). Most of the sightings are concentrated between Canyons Junction and the end of Megadrive on this traverse. All but one sighting (probably a Daubenton’s bat, *Myotis daubentonii*) were of Lesser Horseshoe bats, including on one occasion a mating pair. More systematic counts were undertaken in 2001, 2002 and 2005 by John Steven and Peter Smith, all during the winter months. In 2001 they recorded 50 bats in Megadrive and Canyons. In 2002 a similar area (Megadrive, Megadrive North and Canyons East and West) 49 were counted. In 2005, 69 were recorded in the Megadrive area. It is likely that even these peaks represent underestimates since conservation taping prevents human access to many sections of large passages, and many small passages are inherently inaccessible to humans. It is noticeable that numbers are highly variable even in the middle of winter, with numbers greatly increasing here during very cold weather. The simplest explanation is that bats hibernating in and around Siambre Ddu move dynamically deeper into the cave during very cold weather in search of more suitable microclimates (see Park *et al.*, 2000).

Extensive use of the dry cave

Whereas the major concentration of bat activity is the area close to Siambre Ddu, there is evidence of sparse bat activity in almost every area of the dry, relict cave – even the apparently remotest areas (to humans). Bat skeletons can be found in many places, widely distributed (see Fig.3 for those documented, but there are many more). Small concentrations of faecal pellets are sometimes seen on undisturbed floors, suggesting temporary solitary roosts, and single relatively fresh pellets may appear between caver visits on disturbed passage floors (crawls). Indeed, dustings of faecal pellets are so prevalent in extent in the relict sections of Ogof Draenen that their locations have rarely been recorded in any detail. It is likely that most cavers do not even notice them. Finally, single bats are occasionally seen flying (in Elliptic Passage or the Wessex Series for example), and occasionally seen roosting solitarily in these other, remoter areas of the cave. TG has seen one bat roosting in a rift connection across an elbow in Perseverance II, one in the Wessex Series, and there have been reports of one roosting in the cave below Drws Cefn. It seems, therefore, that bats also make use of the whole extent of the cave, at least its dry sections, in a much less intensive way. The purpose of this activity is unclear, but could be related to exploration behaviour, or could involve individuals that have of *Myotis* or *Plecotus* are using the dry cave widely during swarming in the autumn (Glover and Altringham, 2008), but that this behaviour is too ephemeral to have been noticed (except once outside Siambre Ddu).

Conclusion

It is clear that bats, Lesser Horseshoe bats in particular but also sporadic examples of Greater Horseshoe bat and *Myotis* species, make significant use of Ogof Draenen mainly in winter. There is limited evidence that a small number of bats might

also be active within the cave during early summer. Based on the sum of these observations and experience with the cave, it is possible to construct a simple conceptual model for how bats use Ogof Draenen. The likelihood is that there is one main winter hibernaculum at Siambre Ddu, the occupants of which spread out into deeper passages below this chamber (predominantly Megadrive, Canyons, and associated passages) during cold conditions as bats search for more suitable microhabitats. This behaviour is dynamic even in winter. Hibernating bats are known to emerge from winter torpor periodically, perhaps to restore metabolic balance and sometimes to feed in warmer conditions, and dynamic choice of roosting site in response to climatic conditions may reflect the bat's optimum strategy for balancing torpor and arousal (e.g. Park *et al.*, 2000). Thus the role of air-temperature is evident, but draught patterns may also be important. In addition, bats might explore the entire dry extent of the cave at a very much lower level of activity. There is no evidence that bats use the cave during the breeding season, except possibly occasional individuals during the early summer. Entry to the system could be by several routes, but the proximity of most activity to Siambre Ddu suggests that entry might in fact be restricted to this small part of the system. Mating behaviour has also been observed in the cave, and display behaviour has been noted at the entrance to Siambre Ddu. The nature of the observations, however, imposes limitations on these conclusions. In particular, *Myotis* species are much less visible because they commonly hibernate in crevices, and these may be seriously under-represented. Furthermore, it is possible that autumn swarming species (*Myotis* and *Plecotus* species) might also be under-represented (Glover and Altringham, 2008). Further study may show that the cave is a significant autumn mating site, and possibly hibernation site, for *Myotis* and *Plecotus* species.

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The authors thank the many cavers who have contributed observations to this study since records started in 1994. None of these observations could have been made without the long and continued understanding and support shown towards the caving community by Brian Lewis and Peter Jones who own and live on the land at Pwll Du. We are all very grateful.

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Figures

Figure 1. Location map showing the positions of the Ogof Draenen entrance, Siambre Ddu, Ogof Dwy Sir and the escarpment formatted from Brorange and Gilwern Hill.

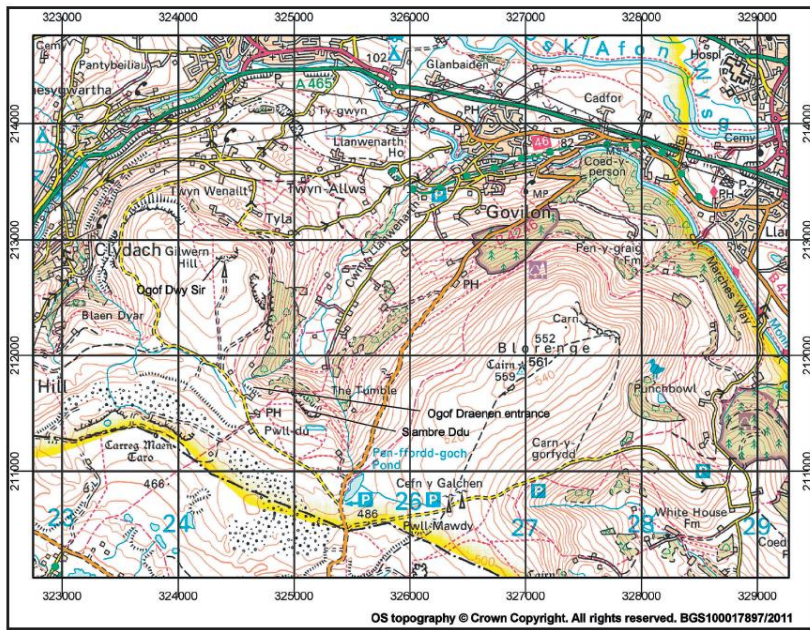


Figure 2 The Pwll Du Escarpment from Gilwern Hill looking towards the Tumble. Photograph by Rhian Kendall



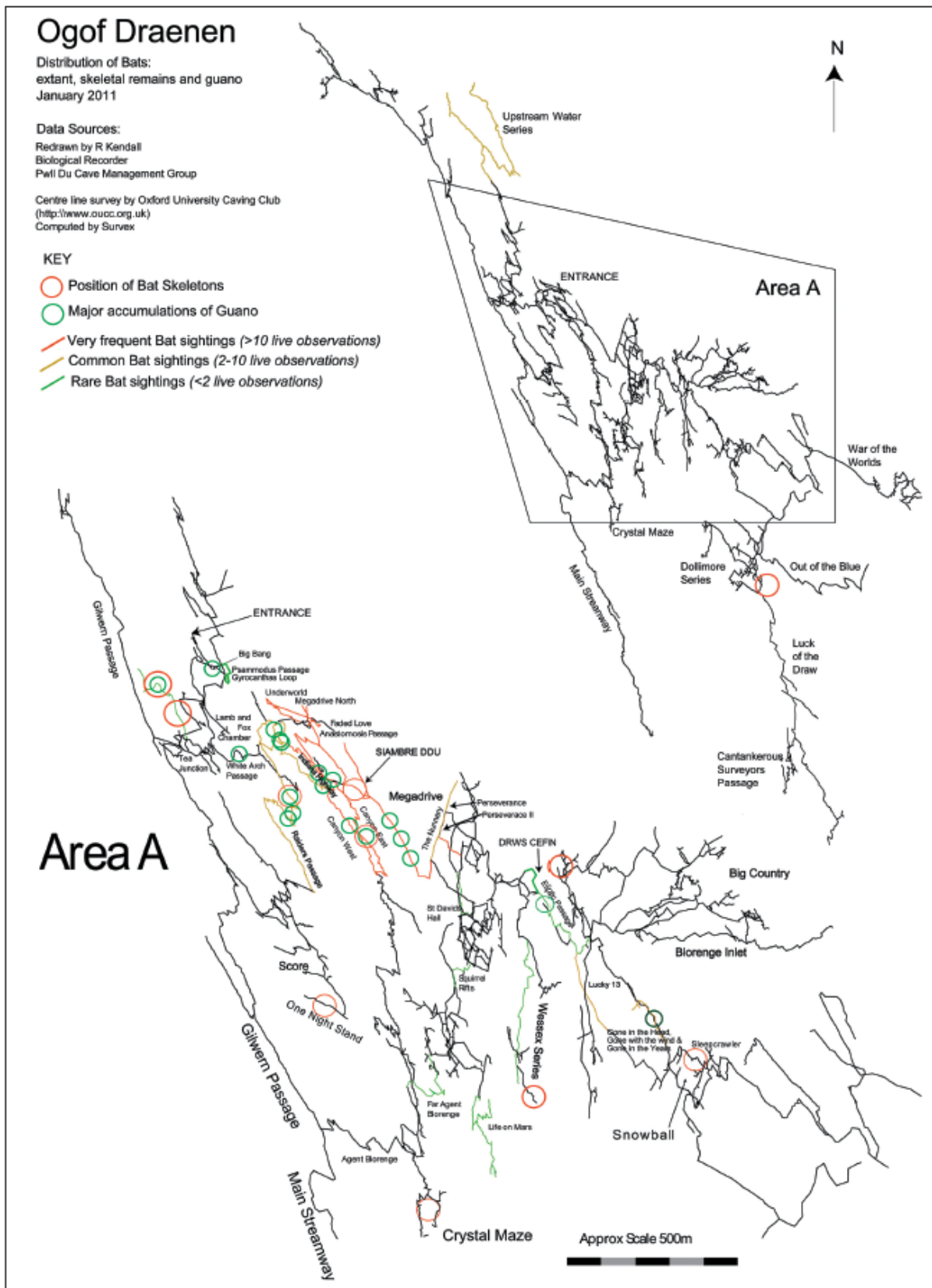


Figure 3

Figure 4 is not available

Table 1 Total reported live bat counts in Ogof Draenen with siting locations

Passage Name Total	Count
Megadrive	243
Megadrive North	44
Indiana Highway	34
Canyon East	22
Canyons to Megadrive North	22
Northern Loop	16
Perseverance Passage	10
Raiders	8
Canyons (unspecified)	>6
Nunnery	>5
Canyon West	5
Lamb and Fox Chamber	4
Waterfall Series	4
Siambre Ddu Passage	3
Anastomosis Passage	2
Gone in the Years	2
Gone with the Wind	2
Big Bang Pitch	1
Canyon to start of Big Mole Passage	1
Elliptic Passage	1
Life on Mars	1
Snowball	1
Squirrel Rifts	1
St. Davids Hall	1
Underworld	1
6th Heaven	1
Streamway	1
Strawberry Way	Heard not seen

Table 3 Records of bat guano accumulations and other deposits, with notes from original observers (sometimes abbreviated).

Location	Notes
Beer Challenge	Fresh droppings
Big Bang Pitch	Above and below the pitch
Canyon East	Scattered guano
Canyon East	Fresh
Canyon West	Start of Canyon West
Canyon West	Largest single heap in cave system (Leroy and Simms 2006 – location 7)
Canyons undet	Leroy and Simms 2006 – location 9
Dollimore's	
Elliptic Passage	
Gone in the Head	
Guano Crawl	Leroy and Simms 2006 – location 11
Indiana Highway Droppings	Indiana and Raiders Junction
Indiana Highway droppings	Scattered guano. Including late summer fresh
Indiana Highway	Leroy and Simms 2006 – location 10
Lamb and Fox Chamber	Scattered guano
Mega Drive	Deep piles of Lesser Horseshoe piles guano at start of Megadrive and Canyon Passage West
Megadrive	Leroy and Simms 2006 – locations 1 and 2
Nunnery	Fresh Droppings in late autumn
Raiders	4 large piles at the beginning of Raiders (Leroy and Simms 2006 - locations 13 and 14)
Score Scattering	
Siambre Ddu Passage	Only few scattered faeces throughout Siambre Ddu Passage. Very sparse lines of guano below edge of Undercut just north of junction with Megadrive (Leroy and Simms 2006 - location 4).
Strawberry Way	few fresh droppings
Wessex Series	Fresh droppings
White Arch Series	Scattered guano

Reported numbers and positions of bat skeletons in Ogof Draenen

Location	Number
Indiana Highway at junction with Megadrive	4
Crystal Maze	1
Raiders	2
Indiana Highway at junction with Raiders	3
One Night Stand	1

Sleep Crawler	2
Upstream T Junction	1
Canyon East	>1
Dollimores – Mouldy Bat Passage	1
Dollimores – Beginning of Luck of the Draw	1
Big Country – Nervous Breakdown	1
Far Agent Blorange	1
Wessex Series – Pond Passage	1

Location	Date	Observer No.	Records. Notes	Genus/Species
Megadrive	22/11/97	unknown	2	Mating
Snowball	16/05/98	CSS	1	Possibly <i>M. nattereri</i>
Megadrive 23/01/99	unknown	1	Bat sp.	<i>M. daubentonii</i>
Megadrive 01/05/99	CSS 2	Active, date guessed	Bat sp.	
Waterfall Series 12/12/99	B. Lovett	3	Bat sp.	
Life on Mars 22/01/00	CSS 1	Flying	Bat sp.	
Megadrive 23/01/00	B. Lovett	10	Bat sp.	
Megadrive 30/01/00	B. Lovett	2	Bat sp.	
Gone in the Years 30/01/00	B. Lovett	1	Bat sp.	
Canyon East 12/02/00	A. Millett	12	And Megadrive	Bat sp.
Megadrive 13/02/00	A. Millett	>10	"Teens of bats"	Bat sp.
Megadrive 18/03/00	unknown	4	Bat sp.	
Gone in the Head, Indiana Highway and Megadrive 24/09/00	T. Guilford, L. Maurice, B. Lovett	0	No bats; but fresh droppings on path suggests active	Bat sp.
Raiders; Siambre Ddu Passage; Megadrive 08/10/00	T. Guilford	0	No bats seen	
Wessex, Elliptic, Nunnery, Beer Challenge 08/10/00	T. Guilford	0	No bats, but fresh droppings	
Indiana Highway 18/11/00	T. Guilford	1	Roosting	<i>R. hipposideros</i>
Megadrive, Canyons 12/02/01	P. Smith, J. Stevens	50	Bat sp.	
Raiders 14/01/02	P. Smith, J. Stevens	1	Before descent into rift	<i>R. hipposideros</i>
Indiana Highway 14/01/02	P. Smith, J. Stevens	1	High level before Canyon Junction	<i>R. hipposideros</i>
Indiana Highway 14/01/02	P. Smith, J. Stevens	3	Canyon junction to Megadrive	<i>R. hipposideros</i>
Indiana Highway 14/01/02	P. Smith, J. Stevens	2	Low Level before Canyon Junction	<i>R. hipposideros</i>
Faded Love, Underworld, Lamb and Fox, Big Bang, Psammodus 14/01/02	P. Smith, J. Stevens	0	No bats seen	<i>R. hipposideros</i>
Canyon East 14/01/02	P. Smith, J. Stevens	4	<i>R. hipposideros</i>	
Canyon to Big Mole Passage 14/01/02	P. Smith, J. Stevens	1	<i>R. hipposideros</i>	
Northern Loop 14/01/02	P. Smith, J. Stevens	7	One flying high level	<i>R. hipposideros</i>
Megadrive North 14/01/02	P. Smith, J. Stevens	25	<i>R. hipposideros</i>	
Canyon West 14/01/02	P. Smith, J. Stevens	3	<i>R. hipposideros</i>	
Mega Drive 14/01/02	P. Smith, J. Stevens	16	<i>R. hipposideros</i>	
Anastomosis 14/01/02	P. Smith, J. Stevens	2	Start of passage	<i>R. hipposideros</i>
Siambre Ddu Passage 14/01/02	P. Smith, J. Stevens	2	To dripping aven	<i>R. hipposideros</i>
Raiders 10/02/02	T. Guilford	1	Roosting	<i>R. ferrumequinum</i>
Megadrive 10/02/02	T. Guilford	11	<i>R. hipposideros</i>	
Lamb and Fox 10/02/02	P. Smith, J. Stevens	2	1 Lamb and Fox, 1 chamber beyond	<i>R. hipposideros</i>
Raiders 10/02/02	P. Smith, J. Stevens	1	Before descent into rift	<i>R. hipposideros</i>
Canyon West 10/02/02	P. Smith, J. Stevens	2	<i>R. hipposideros</i>	
Indiana Highway 10/02/02	P. Smith, J. Stevens	2	Canyon junction to Megadrive	<i>R. hipposideros</i>
Indiana Highway 10/02/02	P. Smith, J. Stevens	1	High level, before Canyon Junction	<i>R. hipposideros</i>
Faded Love, Underworld, Canyon to Big Mole, Lamb and Fox, Anastomosis 10/02/02	P. Smith, J. Stevens	0	No bat records	<i>R. hipposideros</i>
Northern Loop 10/02/02	P. Smith, J. Stevens	8	One flying high level	<i>R. hipposideros</i>
Canyon East 10/02/02	P. Smith, J. Stevens	6	<i>R. hipposideros</i>	
Megadrive 10/02/02	P. Smith, J. Stevens	22	Plus one <i>Myotis</i>	<i>R. hipposideros</i>
Megadrive North 10/02/02	P. Smith, J. Stevens	19	<i>R. hipposideros</i>	
Siambri Ddu Passage 10/02/02	P. Smith, J. Stevens	1	To dripping aven	<i>R. hipposideros</i>
Indiana Highway 10/02/02	P. Smith, J. Stevens	2	Low level before Canyon Junction	<i>R. hipposideros</i>
Squirrel Rifts 16/12/02	T. Guilford	1	Roosting	<i>R. hipposideros</i>
6th Heaven 19/01/03	G. O'Dell	1	<i>R. ferrumequinum</i>	
Canyon West 23/03/03	Leroy and Simms	2006	0 Largest guano heap in cave, area 2.50x1.50m; ~0.50m thick	Bat sp.
Indiana Highway 23/03/03	Leroy and Simms	2006	0 Guano lines 2-3cm thick beneath undercut edges for ~30m	Bat sp.
Guano Crawl 23/03/03	Leroy and Simms	2006	0 Abundant guano patches below rough roof	Bat sp.
Siambre Ddu Passage 23/03/03	Leroy and Simms	2006	0 Scattered faeces throughout; guano lines below edges.	Bat sp.
Canyons (undet.) 23/03/03	Leroy and Simms	2006	0 Guano patches beneath rough roof sections	Bat sp.
Raiders 23/03/03	Leroy and Simms	2006	1 Several patches of guano, one roosting bat	<i>R. hipposideros</i>
Megadrive 23/03/03	Leroy and Simms	2006	0 Guano patches beneath edges	Bat sp.
Megadrive 01/12/04	A. Millett	1	Date guessed	<i>R. ferrumequinum</i>
St David's Hall 01/12/04	A. Millett	1	Date guessed	<i>R. hipposideros</i>
Megadrive 01/02/05	P. Smith, J. Stevens	1	Identification uncertain	<i>Myotis nattereri</i>
Megadrive 01/02/05	P. Smith, J. Stevens	69	<i>R. hipposideros</i>	
Canyon West 01/12/08	P. Talling	? 5-14	on each trip to dig at end Canyon, winter 08/09	Bat sp.
Megadrive 07/03/09	T. Guilford	23	No bats in Indiana Highway	<i>R. hipposideros</i>
Megadrive 05/12/09	P. Talling	2	Flying	Bat sp.
Indiana Highway 12/12/09	F. Loveridge	1	Same bat several occasions	Bat sp.
Megadrive 22/12/09	P. Talling	2	flying	Bat sp.
Raiders 31/12/09	A. Garman	5	<i>R. hipposideros</i>	
Canyons to Megadrive 01/03/10	T. Guilford	12	Date guessed	<i>R. hipposideros</i>
Mega Drive 20/03/10	P. Talling	3	Roosting	<i>R. hipposideros</i>
Canyons to Megadrive 28/03/10	T. Guilford	10	Roosting	<i>R. hipposideros</i>
Indiana Highway 04/04/10	F. Loveridge	1	Roosting low down	Bat sp.

Megadrive 04/04/10 F. Loveridge 3 Bat sp.
Big Country 14/04/10 T. Guilford 1 Skeleton, Nervous Breakdown *R. hipposideros*
Dollimores 14/04/10 T. Guilford 1 Skeleton, Mouldy Bat Passage Bat sp.
Wessex Series 14/04/10 T. Guilford 1 Skeleton, Pond Passage Bat sp.
Far Agent Blorenge Undated unknown 0 Skeleton Bat sp.
Indiana Highway Undated R. Kendall 3 Skeletons, junction with Raiders Bat sp.
Indiana Highway, Lamb and Fox,
Canyon East, White Arch Undated R. Kendall 0 Scattered guano
Raiders Undated R. Kendall 0 4 large piles guano at start
Indiana Highway Undated R. Kendall 4 Skeletons, junction with Megadrive
Raiders Undated R. Kendall 2 Skeletons
Perseverance Undated R. Kendall 1 Between Perseverance I and II *R. hipposideros*
Dollimores 12/96 C. Bailey 1 Skeleton and droppings Bat sp.
Perseverance C. Bailey 2 Multiple sightings in shortcut Bat sp.
Elliptic Passage Unknown 1 End of Elliptic *R. hipposideros*

Table 4 (continued from the previous page): Detailed records of bat sightings provided to the PDCMG Biological Recorder between 1994 and 2010, with notes from