

**Bat Activity Monitoring Project
using Anabat remote loggers near Ebernoe in 2009**

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Introduction

This study was run by the West Weald Landscape Project (WWLP) to complement contracted work by Frank Greenaway on bat species communities at the Butcherland reserve of the Sussex Wildlife Trust and neighbouring arable farmland at Moor Farm during 2009. The purpose was to establish a baseline dataset of comparative bat activity between the evolving reserve area and nearby agricultural land. This will enable future changes in bat communities as an environmental indicator group to be monitored as a result of different approaches to land management, including the Butcherland “re-wilding” initiative, agri-environment scheme options and conventional farming systems.

Our study used a pair of Anabat bat detectors as passive monitoring recorders of bat activity at three pairs of stations over the course of most of the active flight season, run almost continuously over a 152-day period (5th May – 3rd October), albeit with limited gaps in data collection due to equipment failure.

The contracted work (Greenaway 2009), in contrast, used a variety of methods to obtain more detailed information on bat species using these two areas over a limited period (16 nights in total), including bat capture, tagging and radio-tracking of individuals at various sites. In addition, a pair of simple DIY bat-pass loggers were run at fixed locations between the two areas over a 85-day period (between 24th May and 17th August), with subsequent limited analysis of a one-hour evening time period selected to isolate foraging activity by bats.

Methods

Two Anabat SD1 CF frequency-division bat detectors were purchased by the WWLP and were subjected to operational testing before being deployed in field locations from 5th May 2009. They were housed in identical specially constructed wooden ‘bird boxes’ (internal dimensions approx. 25x25x15 cm) elevated on posts of 1.8 m height and set in the ground at a fixed point and orientation using ‘metpost’ bases. The loggers were placed within these alongside 12V power batteries so that the microphone element faced out through a hole of c. 5 cm diameter, but did not actually protrude from them so as to avoid interference/damage from wind and rain.

The devices were each set to a frequency division ratio of 8 (and audio division of 16) and sensitivity of 5 (half-way), with the LEDs and volume turned off to conserve power from the batteries. Sequence file data of bat activity was recorded on Compact Flash memory cards (Lexar 2GB size). The cards were programmed to only record at night, commencing 30 minutes before sunset at the beginning of the recording period and ending 30 minutes after sunrise.

Each of the three pairs of recording stations between Butcherland and Moor Farm was sited in broadly comparable habitats, in each case facing away from linear bat-commuting features towards open field centres. Care was taken to ensure that the aspect of each pair was similar.

Habitat	Station	Environmental Characteristics
1. Hedge-field margin	Butcherland 1	Between outgrown hedgerow scrub of willow and hazel 3-4 m tall to N and W; orientation ESE 120 deg; detector c. 1.85 m height
	Moor Farm 1	Hedgerow of blackthorn and field maple mainly flailed at 1.2 m height and c 1.7 m wide, mature oak standard trees c 40 m to E, bounding 1 m grass strip by hedge and wheat crop each side; orientation SE 140 deg; detector c. 1.9 m height
2. Riverside (close to River Kird)	Butcherland 2	In long grass and wetland vegetation, with willow scrub behind along the river itself; orientation NW 310 deg
	Moor Farm 2	Edge of grass margin (cut by 27 th July and spike destroyed); field of flowering beans; willow scrub behind along river; orientation NW 320 deg
3. by Wetland features (ponds/ditch) on lower-lying ground	Butcherland 3	In cattle grazed grassland (not stock-protected); sward just 25 cm height, facing low damp area; willow scrub patches to W 15-20 m away, c 4 m height each; orientation SE 130 deg
	Moor Farm 3	Within long grass strip c 4 m wide, in gap between 2 mature oak standards 10-15 m away each, bounding wheat crop (each side) c 1 m tall; orientation ESE 110 deg

The stations were visited regularly to download recorded data, check unit functioning and battery power levels, and to swap the memory cards. At the end of each recording 'phase' (typical duration of 18 days, reduced by half for the final month of September) the units and housing were transported to the next pair of station locations. Details of the recording periods are given in Appendix 1, arranged by station and seasonal phase of recording:

- (i) Early Summer (May-June) pre-juvenile bats period;
- (ii) Late Summer (July-August) juvenile bats period;
- (iii) Autumn (September) colony dispersion, post-juvenile bats period.

A TinyTag 'Plus 2' temperature-humidity logger was run in parallel in a sheltered location at Butcherland to obtain an environmental dataset to enable any environmental correlations with bat activity to be identified in the future.

The station locations were carefully recorded and marked on the ground to assist future re-location for follow-up monitoring studies. Additionally at the Butcherland stations only, the basal post-holders were left in-situ; this was not done at Moor Farm however to avoid interference with agricultural management.

Data on the memory cards was downloaded using the 'CFCread' software package into folders for each night. Data analysis was carried out using 'AnalogW' software based upon sonogram graphic displays ('2 DPP' view) of each recorded sequence file (containing one or more ultrasound bat passes). Each file was labelled with location, time and date and species identification as possible using the reference sonograms in Russ (1999) and species template sonograms originally generated by the Anabat developer, Chris Corben. Bat species were identified by the characteristic shape, form and frequency of the sonograms. See Appendix 2 for an overview of the rationale employed to differentiate species during identification. Given the potential for misidentification of species which have calls of similar frequency and appearance, and the relative inexperience of the data analysts, a more limited suite of species groupings

were used for labelling and especially subsequent numeric analysis. Hence the key measure used for analysis is the total number of bat passes (activity levels), rather than individual species abundance.

The nightly results were recorded on Excel spreadsheets and totalled to compare bat activity between recording stations. Within the spreadsheets, the recordings were separated into the first hour, the middle of the night, and the final hour to attempt to partially separate commuting and foraging activity.

Results

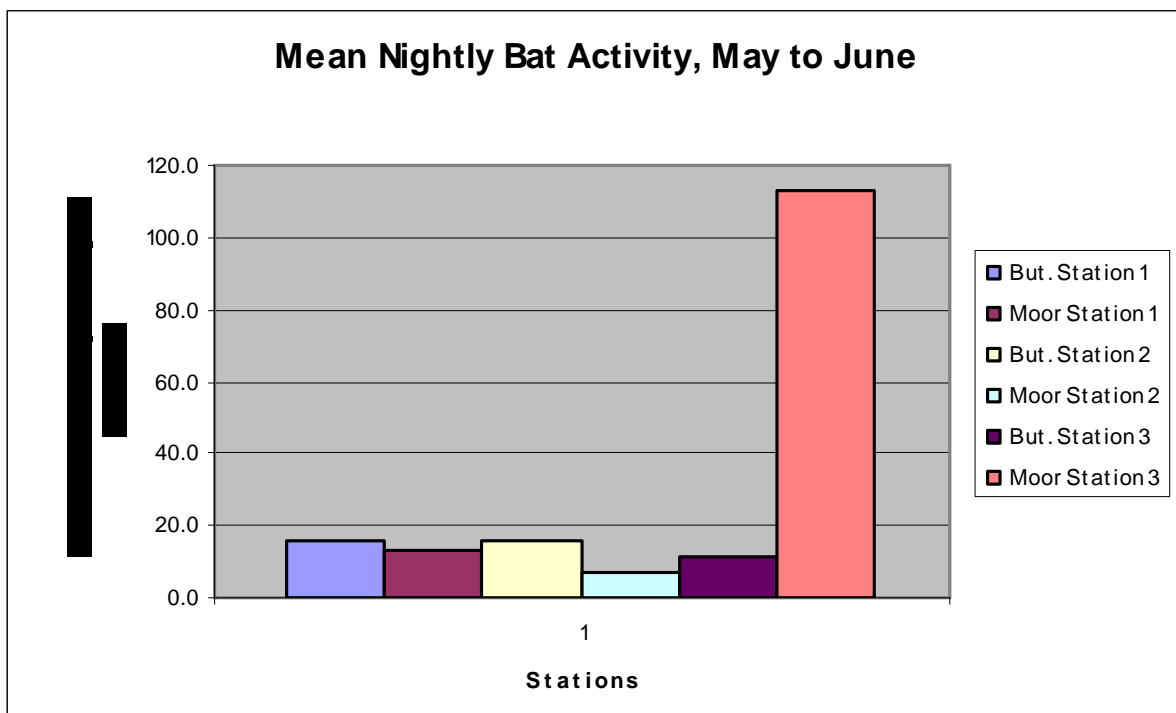
The recording periods were broadly similar at the six stations in each of the three seasons. However some technical problems with the recording equipment meant that there were large gaps in a few of the early recording phases and also slight variations of one or two days in the recording phases in early and mid seasons. The September recording phase varied too but was typically nine days in duration at the different stations. Therefore the data has been made comparable by calculating the mean nightly number of bat passes in each seasonal phase, which constitutes the basis for the analysis presented in the series of results tables below.

A second constraint was interference from wind and insects. Usually, these were clearly identifiable as being of 'non-bat' origin and, with a few exceptions, numbers of non-bat calls were low and infrequent therefore these records have not been included below (although have been retained in the spreadsheets for future reference).

(i) Early Summer

**Table 1: Comparison of mean nightly activity by station (habitat type):
Early Summer, May – June**

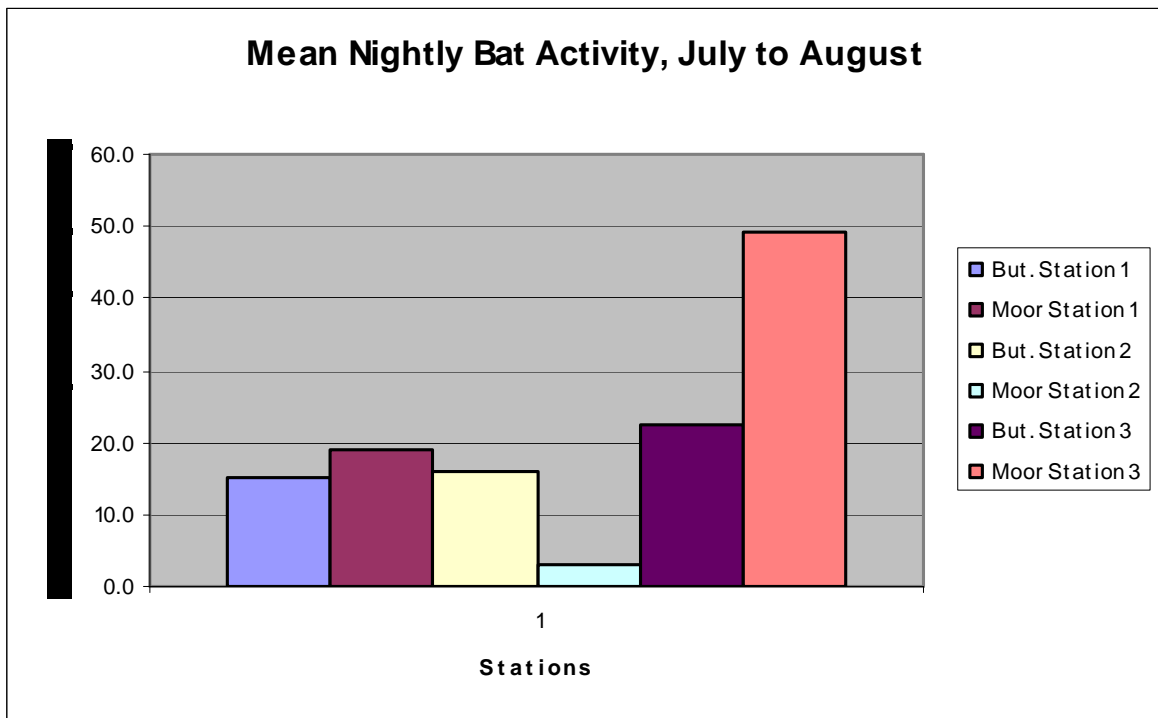
Species	Butch. Station 1	Moor Station 1	Butch. Station 2	Moor Station 2	Butch. Station 3	Moor Station 3
<i>P. pipistrellus</i>	10.5	10.5	4.3	3.7	4.3	45.4
<i>P. pygmaeus</i>	3.2	1.6	0.7	0.4	0.6	46.3
<i>P. nathusii</i>	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. leisleri</i>	0.0	0.0	0.1	0.0	0.0	1.0
<i>N. noctula</i>	0.0	0.0	4.5	0.4	0.0	6.1
<i>E. serotinus</i>	0.0	0.0	0.2	0.0	0.1	1.8
<i>Myotis</i>	1.2	0.6	2.6	1.2	5.1	2.3
<i>P. auritus</i>	0.0	0.0	0.0	0.2	0.2	0.1
<i>B. barbastellus</i>	0.1	0.0	1.2	0.4	0.2	0.5
Bat (unknown)	0.7	0.3	1.8	0.7	0.8	9.3
Totals	15.7	12.9	15.3	6.9	11.2	112.8



(ii) Late Summer

Table 2: Comparison of mean nightly activity by station (habitat type): Late Summer, July - August

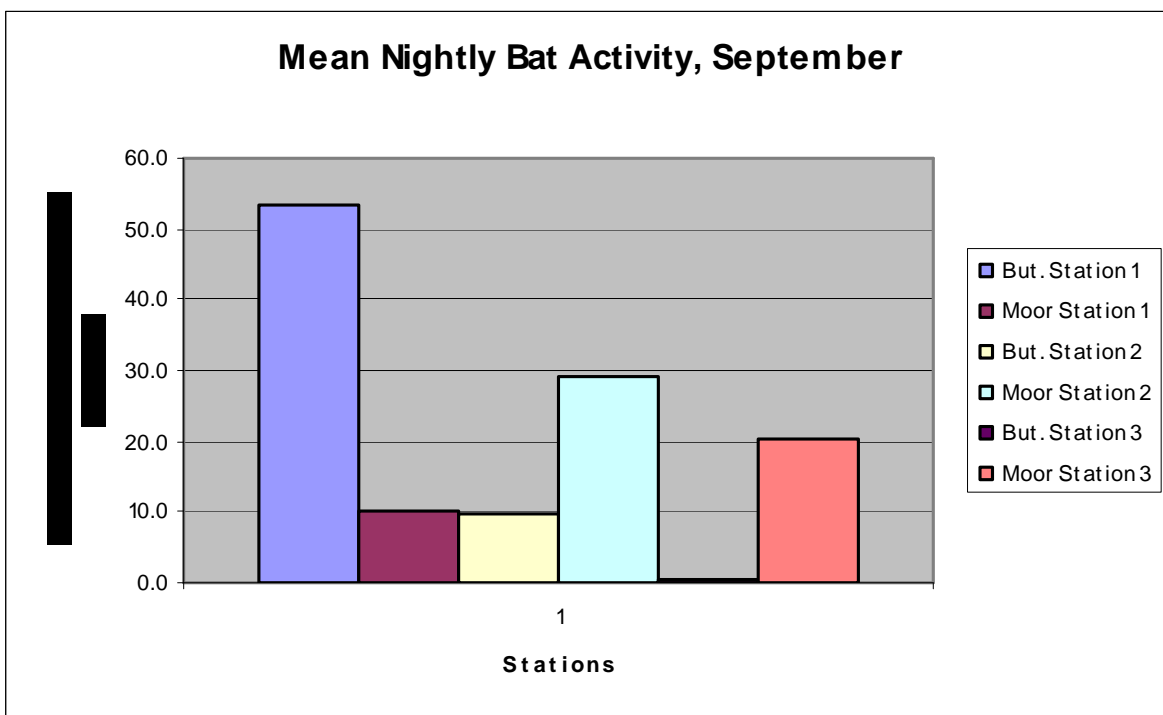
Species	Butch. Station 1	Moor Station 1	Butch. Station 2	Moor Station 2	Butch. Station 3	Moor Station 3
<i>P. pipistrellus</i>	7.6	15.7	7.7	1.2	9.7	15.3
<i>P. pygmaeus</i>	4.6	1.6	1.4	0.7	3.7	19.9
<i>P. nathusii</i>	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. leisleri</i>	0.0	0.0	0.0	0.0	0.0	0.1
<i>N. noctula</i>	0.0	0.0	0.0	0.0	0.0	0.2
<i>E. serotinus</i>	0.0	0.1	0.2	0.1	0.0	0.7
<i>Myotis</i>	2.2	0.8	4.5	0.6	7.2	9.0
<i>P. auritus</i>	0.0	0.1	0.2	0.0	0.2	0.4
<i>B. barbastellus</i>	0.4	0.4	1.2	0.1	0.5	1.5
Bat (unknown)	0.3	0.2	0.5	0.3	1.1	2.1
Totals	15.1	18.9	15.8	2.8	22.3	49.2



(iii) Autumn

**Table 3: Comparison of mean nightly activity by station (habitat type):
Autumn, September**

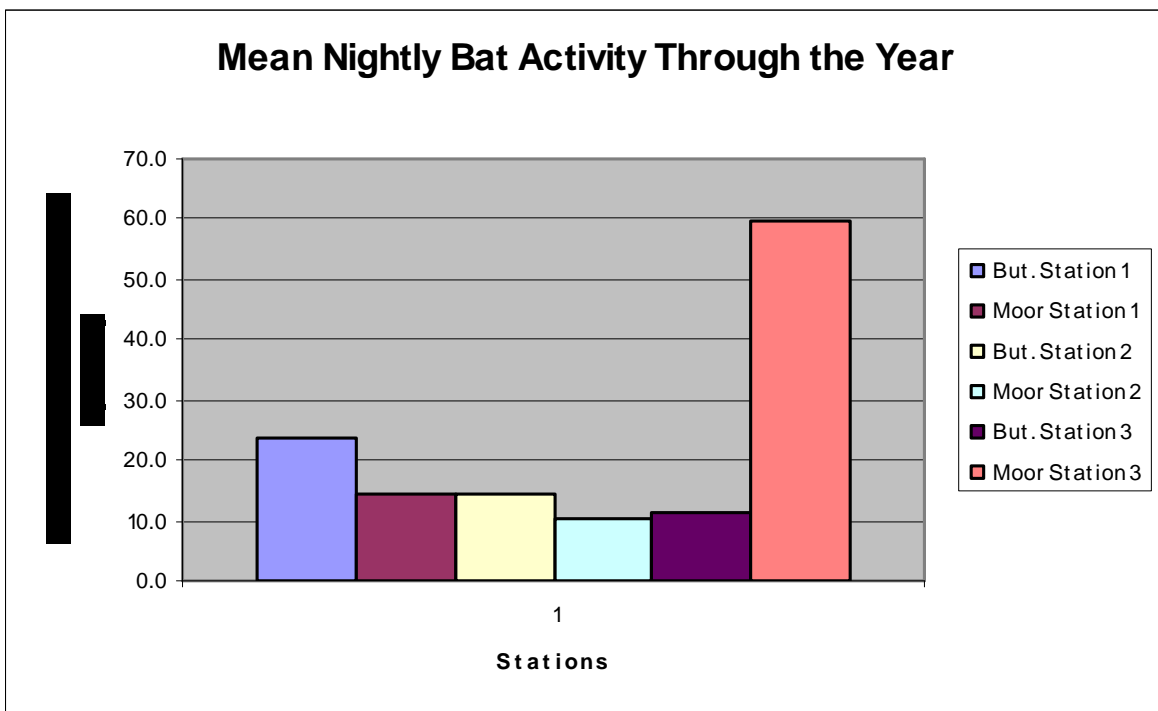
Species	Butch. Station 1	Moor Station 1	Butch. Station 2	Moor Station 2	Butch. Station 3	Moor Station 3
<i>P. pipistrellus</i>	34.9	4.3	3.1	8.4	0.1	3.9
<i>P. pygmaeus</i>	8.8	1.0	1.1	9.6	0.0	4.9
<i>P. nathusii</i>	0.0	0.1	0.2	0.0	0.0	0.0
<i>N. leisleri</i>	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. noctula</i>	0.0	0.1	0.1	0.2	0.0	0.5
<i>E. serotinus</i>	0.0	0.0	0.2	0.0	0.0	0.0
<i>Myotis</i>	6.6	3.1	2.3	5.0	0.3	5.7
<i>P. auritus</i>	0.0	0.0	0.1	0.1	0.0	0.0
<i>B. barbastellus</i>	1.0	0.4	0.9	1.2	0.0	1.0
Bat (unknown)	2.3	1.1	1.7	4.6	0.1	4.3
Totals	53.6	10.1	9.5	29.1	0.4	20.4



(iv) Whole Year

Table 4: Comparison of mean annual activity by station (habitat type)

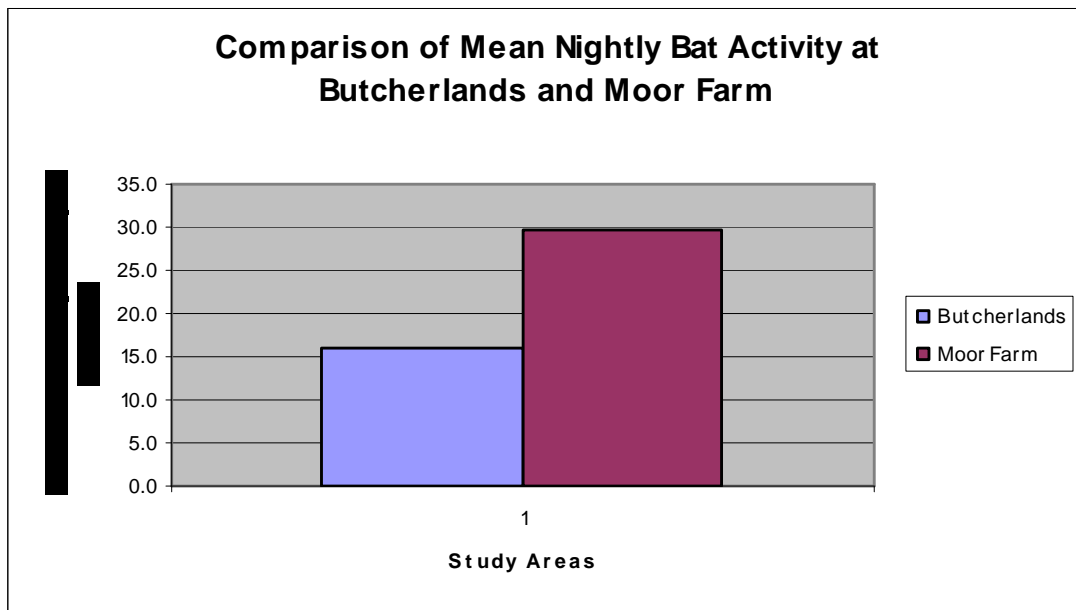
Species	Butch. Station 1	Moor Station 1	Butch. Station 2	Moor Station 2	Butch. Station 3	Moor Station 3
<i>P. pipistrellus</i>	14.6	11.2	5.4	3.7	4.8	21.1
<i>P. pygmaeus</i>	4.9	1.4	1.1	2.5	1.4	23.3
<i>P. nathusii</i>	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. leisleri</i>	0.0	0.0	0.0	0.0	0.0	0.3
<i>N. noctula</i>	0.0	0.0	1.7	0.2	0.0	2.2
<i>E. serotinus</i>	0.0	0.0	0.2	0.0	0.0	0.8
<i>Myotis</i>	2.7	1.2	3.3	1.8	4.3	5.7
<i>P. auritus</i>	0.0	0.0	0.1	0.1	0.1	0.2
<i>B. barbastellus</i>	0.4	0.2	1.2	0.5	0.2	1.0
Bat (unknown)	0.9	0.4	1.2	1.4	0.6	5.2
Totals	23.5	14.6	14.2	10.2	11.5	59.8



(v) Overall Sites

Table 5: Comparison of Mean Activity by Site (Butcherlands/Moor Farm)

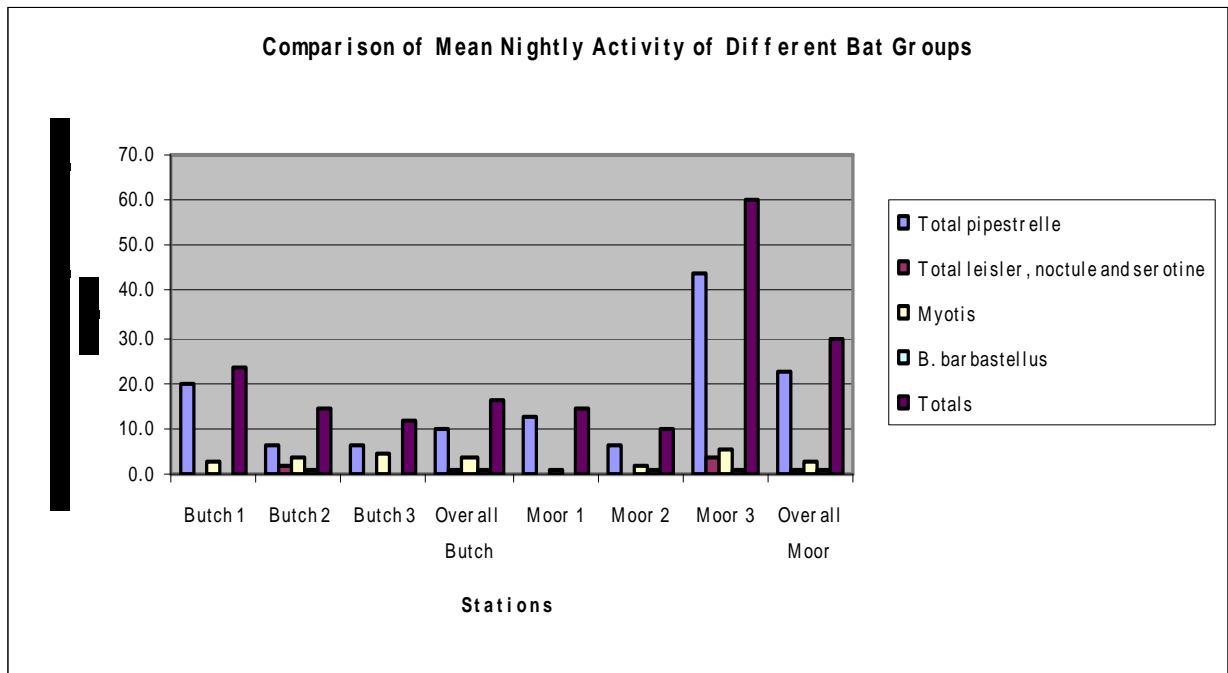
Species	Butcherlands	Moor Farm
<i>P. pipistrellus</i>	7.9	12.4
<i>P. pygmaeus</i>	2.4	9.7
<i>P. nathusii</i>	0.0	0.0
<i>N. leisleri</i>	0.0	0.1
<i>N. noctula</i>	0.6	0.9
<i>E. serotinus</i>	0.1	0.3
<i>Myotis</i>	3.5	3.0
<i>P. auritus</i>	0.1	0.1
<i>B. barbastellus</i>	0.6	0.6
Bat (unknown)	0.9	2.4
Totals	16.0	29.6



(vi) Species Groups

Table 6: Comparison of mean activity by bat species group

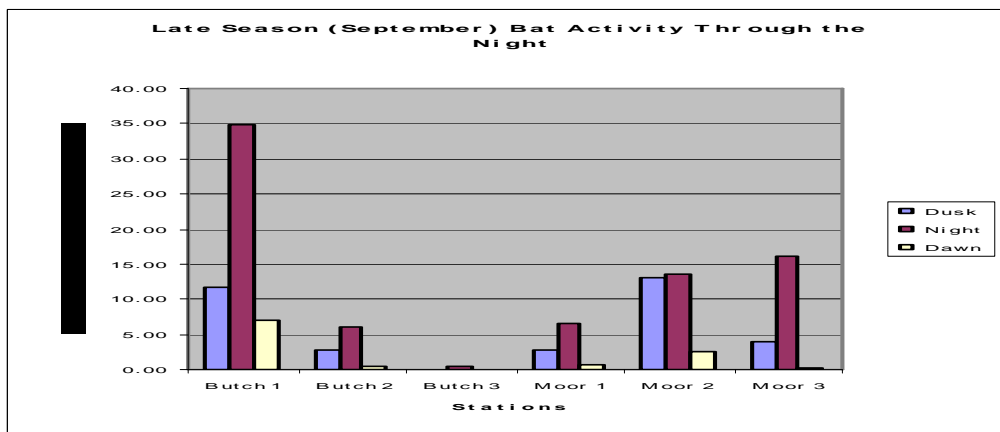
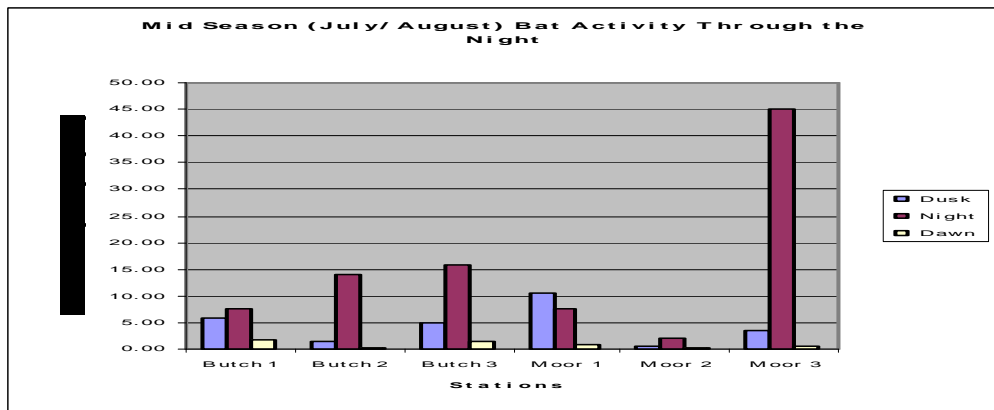
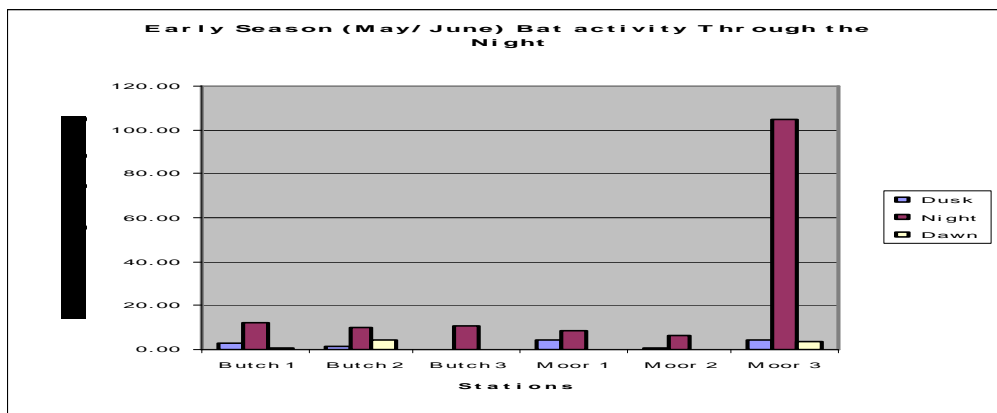
Mean nightly activity								
Species	Butch 1	Butch 2	Butch 3	Overall Butch	Moor 1	Moor 2	Moor 3	Overall Moor
Total Pipistrelle	19.5	6.5	6.2	10.3	12.6	6.2	44.4	22.1
Total Leisler, Noctule and Serotine	0.0	1.9	0.0	0.6	0.1	0.2	3.4	1.3
<i>Myotis</i> bats	2.7	3.3	4.3	3.5	1.2	1.8	5.7	3.0
Barbastelle	0.4	1.2	0.2	0.6	0.2	0.5	1.0	0.6
Totals	23.5	14.2	11.5	16.0	14.6	10.2	59.8	29.6



(vii) Temporal Analysis

Table 7: Mean Activity by time of night

	May/June			July/August			September		
	Dusk	Night	Dawn	Dusk	Night	Dawn	Dusk	Night	Dawn
Butch 1	2.95	12.37	0.37	5.72	7.56	1.83	11.70	34.80	7.10
Butch 2	1.32	9.89	4.21	1.43	14.00	0.33	2.92	6.00	0.58
Butch 3	0.1	10.8	0.25	5.05	15.68	1.53	0.00	0.39	0.00
Moor 1	4.42	8.37	0.16	10.56	7.50	0.83	2.90	6.60	0.60
Moor 2	0.50	6.39	0.06	0.50	2.17	0.17	13.00	13.60	2.50
Moor 3	4.00	104.88	3.94	3.61	44.89	0.67	3.89	16.22	0.33



Interpretation of Results

1. Variation between stations and study areas

The results show that overall activity levels at the three Butcherland stations were similar in the early summer (May - June) recording period, varying between 11.2 and 15.7 bat passes per night. At Moor Farm, however, activity levels were considerably more varied, ranging from 6.9 to 112.8 bat passes per night, with most of the activity (91.7 bat passes) at the upper end (Moor Station 3) being attributable to the two main Pipistrelle species.

There was a similar, though less extreme, pattern in late summer (July – August), with the three Butcherland stations recording similar activity levels of between 15.1 and 22.3 bat passes per night, and the Moor Farm stations' results ranging far more widely from 2.8 to 49.2 bat passes per night, the latter (Moor 3) being due mainly to Pipistrelle activity again.

The bat activity in autumn (September) was very different. We recorded the most activity, 53.6 bat passes per night at Butcherland Station 1, and the second highest activity, 29.1 bat passes, at Moor Farm Station 2. Moor Farm Station 3 this time recorded only the third highest activity, 20.4 bat passes per night.

Analysis of the bat activity throughout the whole recording year showed most overall activity at Moor Farm Station 3, with 59.8 bat passes per night. This was substantially more than at any of the other stations, whose mean activity ranged from 10.2 (Moor Farm Station 2) to 23.5 bat passes per night (Butcherland Station 1). Greenaway (2009) attributed similar peaks in bat activity at the fishing ponds of Moor Farm to sporadic blooms of emergent aquatic insects. He noted that these high levels of activity were mainly due to Soprano Pipistrelles, a species known to select such wet habitats in contrast to Common Pipistrelles which prefer foraging in hedgerows, bushes and woodland edges. Indeed, he located a large roost of Soprano Pipistrelles one kilometre away by Petworth that are using the Moor Farm Station 3 ditch line as a major flightline with foraging activity along it too. Our study in contrast found broadly similar activity levels in the two Pipistrelle species early in the season, and only slightly more activity by Soprano Pipistrelles than Common Pipistrelles in late summer.

Comparison of flight activity by habitat-type (paired stations) through the year shows that there was greater overall activity at Butcherlands Station 1 than at Moor Farm Station 1 and similarly greater activity at Butcherlands Station 2 than at Moor Farm Station 2, but much less activity at Butcherlands Station 3 than at Moor Farm Station 3. Pooling the data for the three stations at each study site gives an overall activity figure of 16.0 bat passes per night at Butcherland and 29.6 bat passes per night at Moor Farm, but the latter figure is inflated significantly by the early season Pipistrelle activity at Moor Station 3 which is unlikely to be representative of the farm habitats as a whole. Greenaway (2009) found that foraging at Butcherland was sustained all summer, in contrast to that at Moor Farm which experienced temporary peaks of foraging activity amongst otherwise lower activity levels. Setting the high levels at the fishing lakes aside, Greenaway (2009) noted slightly more foraging activity overall at Butcherland than at Moor Farm, which he suggested was due to increased use of the 're-wilded' fields there. He further suggested that as woody habitat cover increases, a marked increase in bat use at Butcherland can be expected.

2. Variation between bat species/groups

Similarities in call types and frequency between some species, for example Leislars, Noctules and Serotines, and also between the five *Myotis* species, meant that it was not possible to separate their calls with certainty and therefore these species have been grouped accordingly. The two Pipistrelle species, whose separation is relatively clear-cut, were also grouped together in our analysis. Examination of the mean number of nightly bat passes for these species groups at the different recording stations shows that the Pipistrelles were consistently the most evident bats, the results ranging from a mean of 6.2 at (Butcherland Station 3) to 44.4 nightly bat passes (Moor Farm Station 3). There were only limited records of Leislars, Noctules and Serotines, with none recorded at Butcherland Station 1, and results at the other stations ranging from 0.04 (Butcherland Station 3) to 3.4 nightly bat passes (Moor Farm Station 3). *Myotis* species activity was a little more evident, with results ranging from 1.2 (Moor Farm Station 1) to 5.7 nightly bat passes (Moor Station 3). Barbastelles were recorded at all six stations but in low numbers, ranging from 0.2 (Butcherland Station 3) to 1.2 nightly bat passes (Butcherland Station 2). Greenaway (2009) commented that the low numbers of Barbastelle records reflect large individual foraging areas. Apart from Pipistrelle records there is insufficient data to draw comparisons between activity levels at the different stations for these species, except possibly *Myotis spp.* which, like the Pipistrelles, were most active at Moor Farm Station 3.

3. Commuting and Foraging Activity

With respect to the separation of the recording period into three timeframes, Greenaway (2009) found that commuting bats frequently foraged en-route and that in late summer female bats would undertake an extra commute as mothers returned to feed their pups during the nights. Thus the results for all three timeframes are likely to relate to a combination of foraging and commuting activities, and should be treated with caution. Furthermore the mid-period extended over several hours, so is not directly comparable to the one-hour early evening and early morning recording periods without further analysis to calculate mean activity per hour. In his survey, in order to distinguish between commuting and foraging activity, Greenaway (2009) thus isolated the one-hour period only between 10.30 and 11.30pm from the bat-pass logger component of his study to assess foraging activity.

Bearing this in mind, the data still reveals some basic trends. Generally dawn activity is considerably less than dusk activity in all seasons and at all stations. The only exception is at Butcherland Station 2 in early summer, when dawn activity (4.2 bat passes) exceeded dusk activity (1.3 bat passes).

The high levels of Pipistrelle activity recorded at Moor Farm Station 3 in the early and late summer recording periods appear to be a combination of both foraging and commuting activity. Certainly the dusk and dawn records for that station are not notably high, 3.9 and 4.0 bat passes respectively, when compared with the night-time activity level of 104.9 bat passes. Interestingly however, the high activity levels recorded at Butcherland Station 1 and Moor Farm Station 2 in September, stem from a combination of dusk, dawn and night-time activity, for example, at Butcherland Station 1, there was a mean of 11.7 bat passes at dusk, compared with 34.8 night-time records and 7.1 dawn records, and at Moor Farm Station 2, there was a mean of 13.0 bat passes at dusk, compared with 13.6 night-time records and 2.5 dawn records. Our data shows a change in bat behaviour later in the season (in autumn), when juveniles have been weaned and can forage for themselves, adult female metabolic demands are much reduced, and bat communities come to focus on social and mating behaviours prior to dispersal to their winter hibernation sites. Relatively little is known of this period of bat activity however.

Suggestions for Further Work

- Analysis of bat activity in relation to the environmental dataset (temperature-humidity) collected in parallel
- Analysis of bat data from the 1-hour time window used by Frank Greenaway in order to isolate relative foraging activity
- Potential to conduct an analysis of activity over the 'rest of the night' period by an hourly breakdown
- Possible comparison with Frank Greenaway's full bat-pass logger dataset, which provides complementary and potentially comparable information, although this dataset is complicated by significant levels of 'non-bat' triggers from rain showers and insect noise especially.
- Repeat this survey after 5-10 years (2014-2019) to determine any changes which might be expected from both the evolution of the 're-wilding initiative at Butcherland as well as the Higher Level Stewardship agri-environment targeted measures for Barbastelle bats at Moor Farm.

References

- **Greenaway F (2009)** *Butcherlands rewilding project: Baseline data for a comparison of bat activity with Moor Farm* Contract report to the West Weald Landscape Project, Sussex Wildlife Trust, Henfield.

- **Russ J (1999)** *The Bats of Britain & Ireland - Echolocation Calls, Sound Analysis, and Species Identification* Alana Books, Alana Ecology Ltd.

Acknowledgements

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- Roger Jones and Charlie Dwight for providing advice on analysis and species identification from sonograms.
- Andrew McLeish at Alana Ecology for providing loan units when the originally supplied Anabat systems malfunctioned.

Appendices

Appendix 1 – Metadata of recording periods

Butcherland 1 (hedge/field)							
Start	End	Nights	Start	Finish	Hours	Bat calls	Notes
05/05/2009	10/05/2009	6	20:35	05:25	08:50	174	Weather windy at times; cool; some rain; warmer, drier and more settled towards end of period
11/05/2009	22/05/2009	12	20:38	05:18	08:40	130	Weather windy; heavy showers; cool
09/07/2009	13/07/2009	5	21:15	05:00	07:45	28	Weather changeable; cool
14/07/2009	26/07/2009	13	21:10	05:00	07:50	348	Weather remaining showery most days and relatively cool
04/09/2009	13/09/2009	9	19:44	06:17	10:33	677	

Moor Farm1 (hedge/field)							
Start	End	Nights	Start	Finish	Hours	Bat calls	Notes
05/05/2009	10/05/2009	6	20:35	05:25	08:50	74	Weather windy at times; cool; some rain; warmer, drier and more settled towards end of period
11/05/2009	22/05/2009	12	20:38	05:18	08:40	174	Weather windy; heavy showers; cool
09/07/2009	13/07/2009	5	21:15	05:00	07:45	69	Weather changeable; cool
14/07/2009	26/07/2009	13	21:10	05:00	07:50	340	Weather remaining showery most days and relatively cool
04/09/2009	13/09/2009	9	19:44	06:17	10:33	106	

The results from these two sampling stations are directly comparable in terms of sampling dates and time periods.

Butcherland 2 (River Kird margin)							
Start	End	Nights	Start	Finish	Hours	Bat calls	Notes
23/05/2009	02/06/2009	11	20:55	05:02	08:07	220	Weather relatively warm and dry but cooler nights
03/06/2009	10/06/2009	8	21:08	04:51	07:43	85	Weather cooler with rain
29/07/2009	07/08/2009	9	20:50	05:25	09:35	171	
08/08/2009	16/08/2009	8	20:24	05:48	09:24	167	
14/09/2009	24/09/2009	10	19:22	06:33	11:11	510	

Moor Farm 2 (River Kird margin)							
Start	End	Nights	Start	Finish	Hours	Bat Calls	Notes
23/05/2009	02/06/2009	11	20:55	05:02	08:07	127	Weather relatively warm and dry but cooler nights
03/06/2009	10/06/2009	8	21:08	04:51	07:43	0	Weather cooler with rain; detector not working so no data recorded
29/07/2009	07/08/2009	9	20:50	05:25	09:35	26	
08/08/2009	16/08/2009	8	20:24	05:48	09:24	25	
14/09/2009	23/09/2009	10	19:22	06:33	11:11	291	

The results from these two sampling stations are directly comparable in terms of sampling dates and time periods except for the period from 3rd to 10th June when no data was recorded at Moor Farm 2.

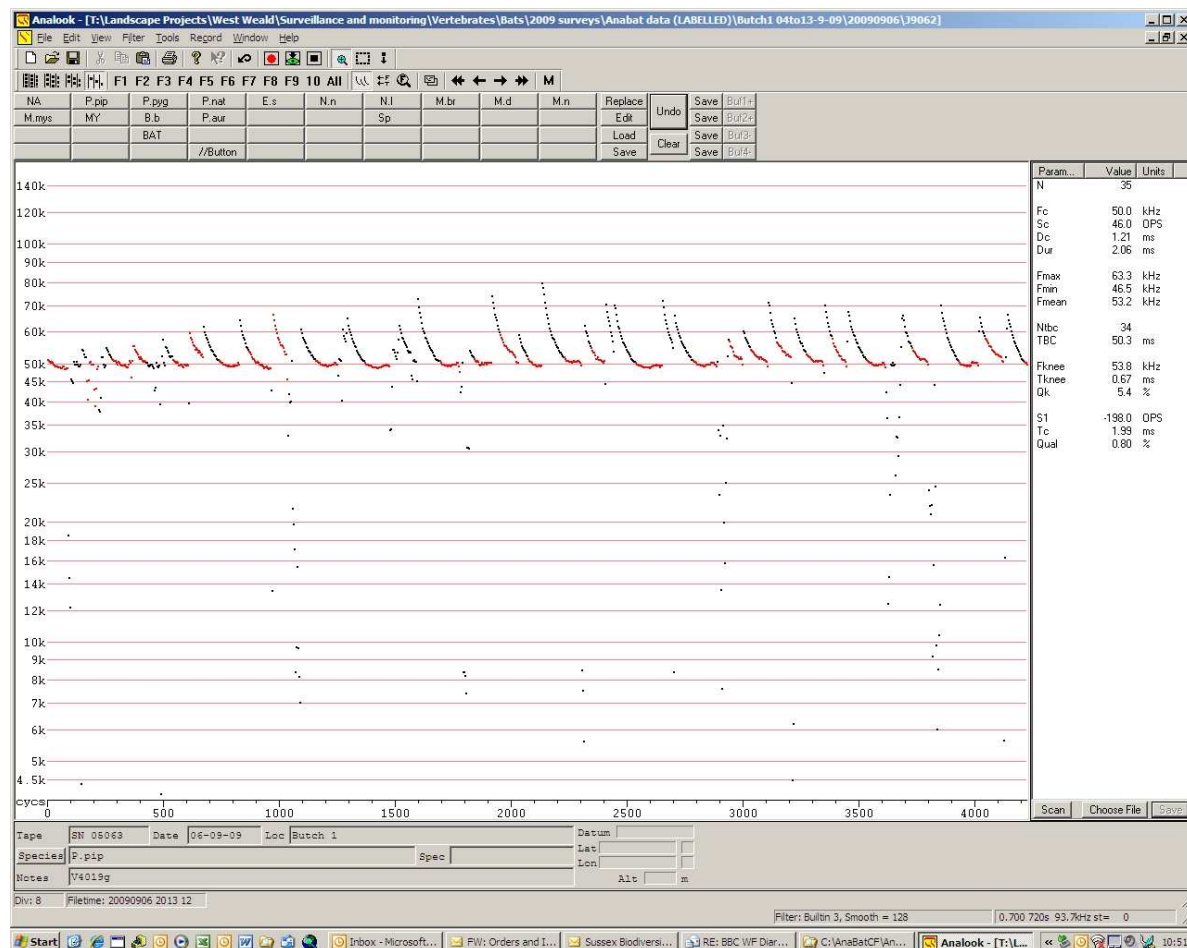
Butcherland 3 (ditch/field)							
Start	End	Nights	Start	Finish	Hours	Bat calls	Notes
11/06/2009	17/06/2009	7	21:15	04:47	07:32	0	No sequence files recorded (reason unknown)
18/06/2009	21/06/2009	4	21:17	04:47	07:30	0	No sequence files recorded
22/06/2009	30/06/2009	9	21:20	04:50	07:30	224	
01/07/2009	08/07/2009	8	21:19	04:50	07:31	0	No sequence files recorded (despite using replacement detector)
17/08/2009	Small location shift of detector						
17/08/2009	25/08/2009	8	20:20	05:50	09:30	660	
26/08/2009	03/09/2009	8	20:04	06:03	09:59	660	Frequent rain
24/09/2009	06/10/2009	12	18:59	06:49	11:48	7	Recording station at angle towards ground, and data collection reduced; battery ran out probably on 30/9

Moor Farm 3 (ditch/field)							
Start	End	Nights	Start	Finish	Hours	Bat calls	Notes
11/06/2009	17/06/2009	7	21:15	04:47	07:32	0	Technical problems with detector: no sequence files recorded
18/06/2009	21/06/2009	4				0	No detector available
22/06/2009	30/06/2009	9	21:20	04:50	07:30	0	Further technical problems with detector timer; no sequence files recorded
01/07/2009	08/07/2009	8	21:19	04:50	07:31	1971	Heatwave, then cooler with heavy showers;
17/08/2009	25/08/2009	8	20:20	05:50	09:30	549	
26/08/2009	03/09/2009	8	20:04	06:03	09:59	336	Frequent rain
24/09/2009	06/10/2009	12	18:59	06:49	11:48	368	No data after 3/10 as detector stopped working, possibly due to heavy rain; before that weather warm for time of year and very dry

Various technical problems with the detectors at both these sites resulted in a lack of data at Butcherland 3 from 11th to 21st June and from 1st to 8th July, and limited data from 24th September to 6th October. At Moor Farm 3, no data was recorded from 11th to 30th June, and incomplete data from 24th September to 6th October.

Appendix 2 – Sonogram analyses - species divisions rationale

As undertaken by Elanor Whythe, with a small sub-sample verified by Frank Greenaway.



Example sonogram – Soprano pipistrelle.

Soprano pipistrelle (*Pipistrellus pygmaeus*) - P.pip

The same call as the Common Pip but above 50 kHz.

Common Pipistrelle (*Pipistrellus pipistrellus*)

The same call as the Soprano Pip but Below 50 kHz. Two distinct call types:

Nathusius pipistrelle (*Pipistrellus nathusii*) - P.pyg

Only one Analoek ID was available, indicating its similarity to Common and Soprano Pips but at a slightly lower frequency (40 kHz). One lower frequency call was present throughout the recording period and although it was labelled as Nathusius... however due to only one of these calls found, it is concluded that it may well have been a Common Pip.

Leisler's bat (*Nyctalus leisleri*) – N.l

The same call as both Noctule and Serotine, however the frequency at a mid point between 20 and 25 kHz.

Noctule bat (*Nyctalus noctula*) - N.n

The same call as Leisler's and Serotine, however the frequency is between 16 and 20 kHz. Usually seen as CF sweeps. Any possible bat call below 20 kHz has been classed as N.n, although many or most of them may way be social calls of other bats or creative insect calls.

Serotine bat (*Eptesicus serotinus*) - E.s

The same call as Noctule and Leisler's, however the frequency is between 25 and 35 kHz. Both fast FM calls and CF sweeps regularly seen.

Myotis - MY

Most CF calls are Myotis and are of a wide variety. Typically long, covering the length of 15 to 50 kHz.

Brown long-eared bat (*Plecotus auritus*) – P.aur

These calls can be similar to Myotis calls, however most are distinguishable once you have become familiar with a typical P.aur call. The frequency height is from 25 to 50 kHz. – shown below (notice the characteristic flags/tags between the main FM calls).

Barbastelle bat (*Barbastella barbastellus*) - B.b

These calls are usually very clear and easily separated from other species. Short (10 kHz – length) CF calls that have clearly defined edges.

BAT

Any call that appears to be a bat, but can not be identified from the ID examples.

Other – NA

Anything that triggered the sensor to record but that does not appear to be a bat call. Largely this category is made up of blurred insect calls.