Haweswater Aqueduct Resilience Programme

Chapter 9A - Appendix 9A.5

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United Utilities

Environmental Statement

Haweswater Aqueduct Resilience Programme

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Document history and status

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2.0	03/21	Updates to tree referencing	MW	AN	AN	AN

Contents

1. Bat Survey Technical Appendix

1.1 Introduction

1) TEP was appointed by United Utilities to complete an Ecological Impact Assessment (EcIA) for the Haweswater Aqueduct Resilience Programme - Proposed Bowland Section. The EcIA is required to inform an Environmental Impact Assessment (EIA) and support production of the Environmental Statement (ES).

2) A series of ecological surveys was undertaken to complete the EcIA. This Appendix is one of a series of Ecological Technical Reports (ETRs) produced to support the EcIA. This ETR documents the methods and findings of the bat surveys undertaken by Bowland Ecology.

1.2 Summary of Findings

3) Bat surveys completed by Bowland Ecology for the Proposed Bowland Section comprised a ground based assessment of trees for bat roost suitability, bat activity transects and a static bat activity survey comprising three static locations in or around the Newton-in-Bowland Compound and two static locations in or around the Lower Houses Compound.

1.2.1 Bat Records

4) Locations of bat records are illustrated in ES Figure LCC_RVBC-BO-FIG-009-01-04.

5) Records were obtained of the following bat species within 2 km of the Newton-in-Bowland Compound:

- Daubenton's bat
- Natterer's bat
- Soprano pipistrelle

6) Records were obtained of the following bat species within 2 km of the Lower Houses Compound:

- Brown long-eared
- Common pipistrelle
- Noctule
- Soprano pipistrelle

1.2.2 Bat Tree Assessment

7) Locations of trees with bat roost suitability are illustrated in ES Figure LCC_RVBC-BO-FIG-009-01-08.

8) Trees with bat roost suitability are summarised in Table 1, which provides the Jacobs AIA tree reference for consistency (T, W or G prefix) transposed to the relevant tree identification reference applied by Bowland tree identification numbers (BT prefix).

9) In some instances, a tree identified by Bowland Ecology to possess potential bat roost features may not be identified by the Jacobs AIA. This is due to a combination in different survey techniques between the AIA and bat survey and the different survey buffers applied as relevant to the feature zone of influence from the application boundary. In these instances, only the Bowland Ecology tree identification reference is applied.

Bat Roost Suitability	Newton-in-Bowland Compound				Lower Houses Compound			
	Within compound or on boundary*		Within <50 m		Within compound or on boundary*		Within <50 m	
Tree ID ref	*Jacobs*	*Bowland*	*Jacobs*	*Bowland*	*Jacobs*	*Bowland*	*Jacobs*	*Bowland*
High	-		-		-		-	
Moderate	G127	BT110*	G137	BG28	-		*(noID)*	BG3
	G103	BT113	G105	BG32			*(noID)*	BT34
	G128	BT117	G91	BG33*				
	G128	BT119	G91	BG34*				
	G129	BT121	G97	BT109				
	G132	BT124	G121	BT130				
	G132	BT125	G121	BT131				
	G132	BT126	G121	BT132				
	G132	BT127						
	T139	BT128						
	T94	BT142						
Low	H83	BG25	*(noID)*	BT102	T71	BT24	T65	BT30*
	G112	BG35	*(noID)*	BT105	G66	BT39	*(noID)*	BT31
	T78	BT103	T131	BT111			*(noID)*	BT32
	(noID	BT105	G135	BT114			*(noID)*	BT33
	G95	BT106	G121	BT129*			*(noID)*	BT36
	G95	BT107	G121	BT133				
	T100	BT108	G70	BG24				
	T109	BT112	G94	BG27				
	G129	BT115	G108	BG31				
	G128	BT116						
	G129	BT118						
	G129	BT120						
	G128	BT122						
	G132	BT123						
	G129	BT135						
	G115	BT138						
	T123	BT139						
	G115	BT140						
	G115	BT141						

1.2.3 Bat Activity Survey

10) Bat activity transect routes and static detector locations are illustrated at ES Figure LCC_RVBC-BO-FIG-009-01-09.

11) Transect 1 encompassed the Newton-in-Bowland Compound as well as the land to the north of this area. Static T1A was located within the construction access area to the east of the compound, along a line of trees. Static T1B was located at the western edge of the compound within the woodland strip at the northern edge of the River Hodder. Static T1C was located near to some farm buildings approximately 300 m north of the compound. Statics T1A to T1C are cited as statics 1-4 in the Bowland Ecology Report (Appendix B)

12) Bat species recorded during transect and static surveys around the Newton-in-Bowland Compound included: common pipistrelle, soprano pipistrelle, noctule, brown long-eared bat and Myotis species.

13) Transect 2 encompassed the Lower Houses Compound, skirting around the western edge and then passing through the centre of the compound and past Lower Houses Farm to the north. The transect also included a section extending 300 m north of the site and also a section extending up to 500 m south east of the compound. Static T2A was located within a woodland strip located approximately 250 m north of the compound. While offsite, the static location targets a potential nearby landscape corridor feature and is therefore considered to be relevant. Static T2B was located within the eastern end of the compound near to a larger tree and a few smaller trees.

14) Bat species recorded during transect surveys around the Lower Houses Compound included: common pipistrelle, soprano pipistrelle and brown long-eared. Bat species recorded during static surveys around the Lower Houses Compound included common pipistrelle, soprano pipistrelle, noctule, brown long-eared and Myotis species.

15) Soprano pipistrelle bats were the most abundant species recorded around both compounds. Species diversity in the landscape around the Newton-in-Bowland Compound appears more consistently diverse than around the Lower Houses Compound and higher numbers of bat passes and social calls were observed during the surveys associated with the Newton-in-Bowland Compound compared to those associated with the Lower Houses Compound.

Appendix A. Bowland Ecology Bat Tree Assessment Report

TR3 Ecology Survey Data Report: Bat Tree Assessment

1 Project Details			
Project Name:	Haweswater Aqueduct Resilience Programme	Project Number:	80061155
Written:	Ellen Milner, *Principal Ecologist* Eve Loxham, *Ecologist*	Approved:	Sarah Birtley, *Senior Ecologist* Eve Loxham, *Ecologist*
Report reference:	TR3 Bat Tree Assessment Report V1 TR3 Bat Tree Assessment Report V2	Date:	26/11/2019 19/06/2020
2 Project Drawings			
TR3 Bat Tree Plans Proposed Bowland Section Sheets 1 to 12		BOW167_HARP_9.5_BATS_TR3	
3 Ecology Surveys			
Surveyors:	Eve Loxham MBiolSci (Hons), GradCIEEM Ellen Milner MA, MRes, CEnv, MCIEEM Heather Whalley BSc (Hons) Sophie King MSc, BSc Sabina Ostalowska MSc, BSc, ACIEEM Abi Hamer BSc (Hons) Catrin Watkin MRes, BSc (Hons)		
Survey date(s):	01/04/2019, 02/04/2019, 03/04/2019, 09/04/2019, 10/04/2019, 01/05/2019, 07/05/2019, 08/05/2019, 14/05/2019, 15/05/2019, 21/05/2019, 22/05/2019, 29/05/2019, 30/05/2019, 31/05/2019, 10/06/2019, 11/06/2019, 19/06/2019, 26/06/2019, 04/12/2019, 12/12/2019, 23/01/2020, 29/01/2020,30/01/2020, 12/02/2020, 01/05/2020, 21/05/2020.		
Survey Method:	Trees were surveyed in accordance with Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). A preliminary ground level assessment to identify trees supporting Potential Roosting Features (PRFs) was undertaken during the extended Phase 1 habitat survey. The assessment was aided by close focus binoculars. All trees were assigned a unique reference number and their locations marked on a plan. Any evidence of bat usage and all PRFs visible from ground level were recorded for future reference, including their approximate height and orientation of access points. Representative photographs were taken and the tree species recorded. Where numerous trees within a group, such as a woodland or tree line were noted to have bat roosting potential, these were assessed as a group. Trees or groups of trees were classified as Low, Moderate or High suitability as bat roosting habitat (groups classified according to the highest potential tree) in accordance with Table 4.1 (Page 35) of The Good Practice Guidelines, summarised as follows: Low – A tree of sufficient size and age to contain PRFs but none seen from the ground, or features seen with only very limited roosting potential. Moderate – A tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitats but unlikely to support a roost of high conservations status. High – A tree with one or more PRFs, that are obviously suitable for larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.		

Weather Conditions:	01/04/2019 – Cloud cover 6/8, Wind Beaufort F1, 8°C, no precipitation. 02/04/2019 – Cloud cover 8/8, Wind Beaufort F1, 8°C, intermittent showers. 03/04/2019 – Cloud cover 8/8, Wind Beaufort F1, 3°C, some sleet. 09/04/2019 – Cloud cover 4/8, Wind Beaufort F3, 8°C, dry. 10/04/2019 – Cloud cover 1/8, Wind Beaufort F2, 10°C, dry. 01/05/2019 – Cloud cover 4/8, Wind Beaufort F2, 10°C, mostly dry (occasional light rain). 07/05/2019 – Cloud cover 5/8, Wind Beaufort 0, 9°C, light rain, some sunny spells. 08/05/2019 – Cloud cover 7/8, Wind Beaufort F4, 9°C, patchy rain. 14/05/2019 – Cloud cover 1/8, Wind Beaufort F1, 22°C, dry, sunny. 15/05/2019 – Cloud cover 3/8, Wind Beaufort F3, 19°C, dry, sunny. 21/05/2019 – Cloud cover 1/8, Wind Beaufort F3, 15°C, no precipitation. 22/05/2019 – Cloud cover 1/8, Wind Beaufort F2, 13°C, no precipitation. 29/05/2019 – Cloud cover 8/8, Wind Beaufort F2, 11°C, no precipitation. 30/05/2019 – Cloud cover 6/8, Wind Beaufort F2, 15°C, intermittent light rain. 31/05/2019 – Cloud cover 8/8, Wind Beaufort F3, 19°C, intermittent heavy rain. 10/06/2019 – Cloud cover 7/8, Wind Beaufort F1, 16°C, light rain. 11/06/2019 – Cloud cover 8/8, Wind Beaufort F3, 14°C, patchy rain. 19/06/2019 – Cloud cover 2/8, Wind Beaufort F1, 17°C, no precipitation. 26/06/2019 – Cloud cover 8/8, Wind Beaufort F2, 17°C, no precipitation. 04/12/2019 - Cloud cover 3/8, Wind Beaufort F1, 6°C, no precipitation. 12/12/2019 - Cloud cover 8/8, Wind Beaufort F1, 5°C, light rain. 23/01/2020 - Cloud cover 2/8, Wind Beaufort F1, 8°C, dry. 29/01/2020 - Cloud cover 8/8, Wind Beaufort F2, 8°C, moderate rain. 30/01/2020 - Cloud cover 8/8, Wind Beaufort F2, 8°C, dry. 12/02/2020 - Cloud cover 4/8, Wind Beaufort F3, 6°C, no precipitation. 01/05/2020 - Cloud cover 3/8, Wind Beaufort F3, 10°C, dry. 21/05/2020 - Cloud cover 1/8, Wind Beaufort F1, 14°C, dry.
Limitations to the survey:	The survey was undertaken from the road in the northern section of the survey area and therefore PRFs may not have been visible on the other sides of the tree. Similarly, at the edge of access boundaries surveys were only possible from one side. Some of the surveys were undertaken in the summer months when trees were in leaf, potentially obscuring PRFs. Once the development boundary/route option is finalised, further survey may be required to establish the presence of bat roosts.

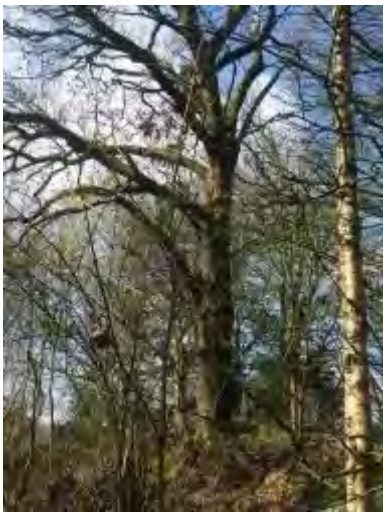
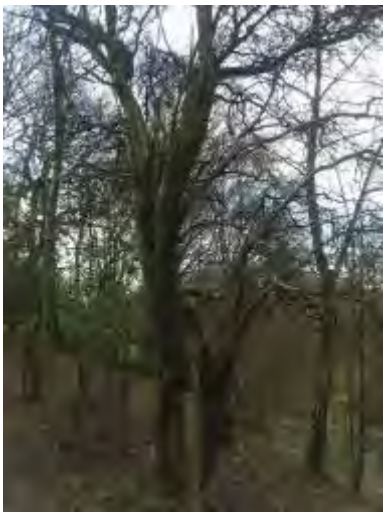
4 Survey Results	
Individual Trees	
TR3.BT1	
	NGR: SD 60664 67299 Species: Oak (*Quercus* sp.) Categorisation: Low potential
TR3.BT2	
	NGR: SD 60671 67282 Species: Oak species Categorisation: Low potential
TR3.BT3	
	NGR: SD 60693 67268 Species: Oak species Categorisation: High potential

TR3.BT4	
	NGR: SD 60877 67098 Species: Ash (*Fraxinus excelsior*) Categorisation: Moderate potential
TR3.BT5	
	NGR: SD 60884 67096 Species: Ash Categorisation: Low potential
TR3.BT6	
	NGR: SD 60909 67078 Species: Ash Categorisation: Low potential

TR3.BT7	
	NGR: SD 60735 67187 Species: Oak species Categorisation: Low potential
TR3.BT8	
	NGR: SD 61080 66901 Species: Oak species Categorisation: Low potential
TR3.BT9	
	NGR: SD 61137 66875 Species: Oak species Categorisation: Moderate potential

TR3.BT10	
	NGR: SD 61176 66879 Species: Oak species Categorisation: Moderate potential
TR3.BT11	
	NGR: SD 61204 66868 Species: Oak species Categorisation: Low potential
TR3.BT12	
	NGR: SD 61221 66861 Species: Oak species Categorisation: Low potential

TR3.BT13	
	NGR: SD 61933 66571 Species: Ash Categorisation: Low potential
TR3.BT14	
	NGR: SD 61482 66665 Species: Ash Categorisation: Low potential
TR3.BT15	
	NGR: SD 62056 66422 Species: Oak species Categorisation: Low potential

TR3.BT16	
	NGR: SD 62062 66411 Species: Ash Categorisation: Low potential
TR3.BT17	
	NGR: SD 62113 66417 Species: Oak species Categorisation: Moderate potential
TR3.BT18	
	NGR: SD 62133 66403 Species: Apple (*Malus* sp.) Categorisation: Low potential

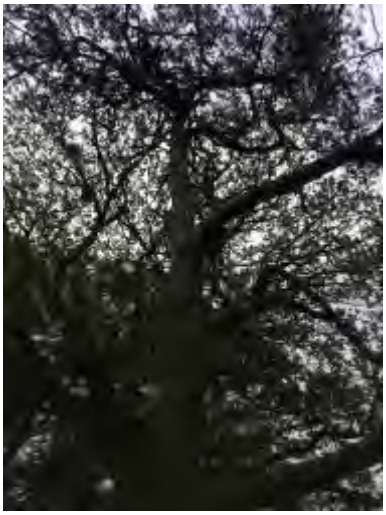
TR3.BT19	
	NGR: SD 36214 66359 Species: Oak species Categorisation: High potential
TR3.BT20	
	NGR: SD 62257 66288 Species: Holly (*Ilex aquifolium*) Categorisation: Low potential
TR3.BT21	
	NGR: SD 62244 66289 Species: Ash Categorisation: Low potential

TR3.BT22	
	NGR: SD 62237 66290 Species: Unknown (dead tree) Categorisation: Low potential
TR3.BT23	
	NGR: SD 62117 66431 Species: Sycamore (*Acer pseudoplatanus*) Categorisation: Low potential
TR3.BT24	
	NGR: SD 63448 65448 Species: Hawthorn (*Crataegus monogyna*) Categorisation: Low potential

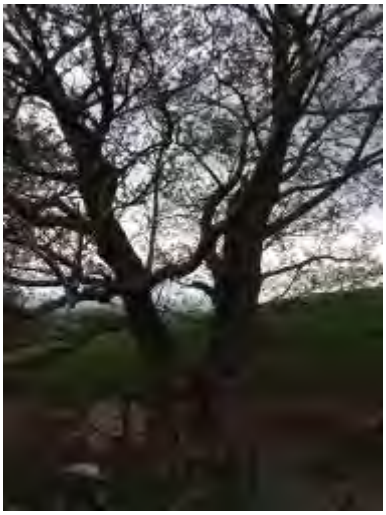
TR3.BT25	
	NGR: SD 63705 65893 Species: Alder (*Alnus glutinosa*) Categorisation: Low potential
TR3.BT26	
	NGR: SD 63678 65878 Species: Ash Categorisation: Low potential
TR3.BT27	
	NGR: SD 63660 65874 Species: Sycamore Categorisation: Low potential

TR3.BT28	
	NGR: SD 63650 65865 Species: Pedunculate oak (*Quercus robur*) Categorisation: Moderate potential
TR3.BT29	
	NGR: SDD 63624 65852 Species: Beech (*Fagus sylvatica*) Categorisation: Moderate potential
TR3.BT30	
	NGR: SD 63796 65696 Species: Horse chestnut (*Aesculus hippocastanum*) Categorisation: Low potential

TR3.BT31	
	NGR: SD 63824 65708 Species: Beech Categorisation: Low potential
TR3.BT32	
	NGR: SD 63829 65719 Species: Sycamore Categorisation: Low potential
TR3.BT33	
	NGR: SD 63834 65786 Species: Pedunculate oak Categorisation: Low potential

TR3.BT34	
	NGR: SD 63824 65790 Species: Pine (*Pinus* sp.) Categorisation: Moderate potential
TR3.BT35	
	NGR: SD 63813 65794 Species: Pine species Categorisation: Moderate potential
TR3.BT36	
	NGR: SD 63834 65586 Species: Willow (*Salix* sp.) Categorisation: Low potential

TR3.BT37	
	NGR: SD 63893 465520 Species: Oak species Categorisation: Low potential
TR3.BT38	
	NGR: SD 63918 65531 Species: Ash Categorisation: Low potential
TR3.BT39	
	NGR: SD 63624 65434 Species: Ash Categorisation: Low potential

TR3.BT40	
	NGR: SD 63566 65214 Species: Alder Categorisation: Moderate potential
TR3.BT41	
	NGR: SD 63759 65293 Species: Apple species Categorisation: Low potential
TR3.BT42	
	NGR: SD 63765 65287 Species: Silver birch (*Betula pendula*) Categorisation: Moderate potential

TR3.BT43	
	NGR: SD 63736 65335 Species: Oak species Categorisation: Low potential
TR3.BT44	
	NGR: SD 63994 64921 Species: Hawthorn Categorisation: Low potential
TR3.BT45	
	NGR: SD 64004 64913 Species: Hawthorn Categorisation: Low potential

TR3.BT46	
	NGR: SD 64016 64908 Species: Hawthorn Categorisation: Low potential
TR3.BT47	
	NGR: SD 64066 64858 Species: Sycamore Categorisation: Low potential
TR3.BT48	
	NGR: SD 64064 65079 Species: Ash Categorisation: Low potential

TR3.BT49	
	NGR: SD 64232 64991 Species: Ash Categorisation: Low potential
TR3.BT50	
	NGR: SD 64112 64834 Species: Sycamore Categorisation: Low potential
TR3.BT51	
	NGR: SD 64117 64845 Species: Oak species Categorisation: Low potential

TR3.BT52	
	NGR: SD 64105 64841 Species: Sycamore Categorisation: Low potential
TR3.BT53	
	NGR: SD 64524 63753 Species: Silver birch Categorisation: Low potential
TR3.BT54	
	NGR: SD 64419 64248 Species: Ash Categorisation: Low potential
TR3.BT55	
No photo	NGR: SD 64398 64246 Species: Ash Categorisation: Low potential

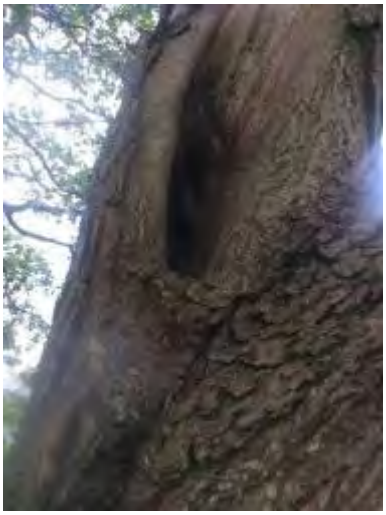
TR3.BT56	
	NGR: SD 64458 64381 Species: Ash Categorisation: Low potential
TR3.BT57	
	NGR: SD 64443 63565 Species: Oak species Categorisation: High potential
TR3.BT58	
	NGR: SD 64563 63523 Species: Oak species Categorisation: Moderate potential

TR3.BT59	
	NGR: SD 64553 63467 Species: Rowan (*Sorbus aucuparia*) Categorisation: Low potential
TR3.BT60	
	NGR: SD 64831 63174 Species: Sessile oak (*Quercus petraea*) Categorisation: Low potential
TR3.BT61	
	NGR: SD 64811 63167 Species: Oak species Categorisation: Low potential

TR3.BT62	
	NGR: SD 64643 62677 Species: Unknown (dead tree) Categorisation: Low potential
TR3.BT63	
	NGR: SD 64852 63346 Species: Alder Categorisation: Moderate potential
TR3.BT64	
	NGR: SD 64817 463383 Species: Alder Categorisation: Low potential

TR3.BT65	
	NGR: SD 64789 63420 Species: Alder Categorisation: Low potential
TR3.BT66	
	NGR: SD 65203 63022 Species: Rowan Categorisation: Low potential
TR3.BT67	
	NGR: SD 65273 63124 Species: Oak species Categorisation: Moderate potential

TR3.BT68	
	NGR: SD 65061 63124 Species: Alder Categorisation: Low potential
TR3.BT69	
	NGR: SD 65052 63112 Species: Alder Categorisation: Low potential
TR3.BT70	
	NGR: SD 65039 63103 Species: Alder Categorisation: Low potential

TR3.BT71	
	NGR: SD 65033 63096 Species: Alder Categorisation: Low potential
TR3.BT72	
	NGR: SD 65019 63450 Species: Alder Categorisation: Moderate potential
TR3.BT73	
	NGR: SD 64695 63689 Species: Oak species Categorisation: Low potential

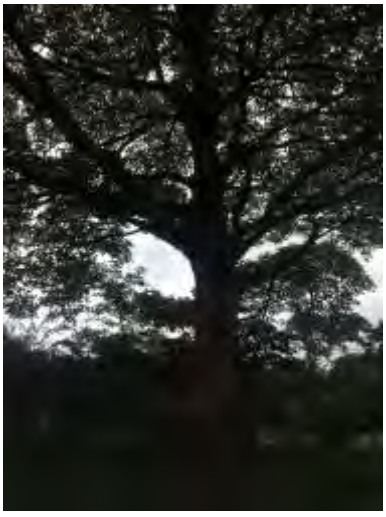
TR3.BT74	
	NGR: SD 64695 63707 Species: Oak species Categorisation: Low potential
TR3.BT75	
	NGR: SD 64691 63715 Species: Silver birch Categorisation: Low potential
TR3.BT76	
	NGR: SD 64684 63710 Species: Oak species Categorisation: Low potential

TR3.BT77	
	NGR: SD 64655 63834 Species: Holly Categorisation: Low potential
TR3.BT78	
	NGR: SD 64639 63840 Species: Rowan Categorisation: Low potential
TR3.BT79	
	NGR: SD 64594 63850 Species: Apple species Categorisation: Low potential

TR3.BT80	
	NGR: SD 64571 63852 Species: Rowan Categorisation: Low potential
TR3.BT81	
	NGR: SD 64529 63888 Species: Oak species Categorisation: Low potential
TR3.BT82	
	NGR: SD 64641 63919 Species: Rowan Categorisation: Low potential

TR3.BT83	
	NGR: SD 68684 55860 Species: Rowan Categorisation: Low potential (exposed location)
TR3.BT84	
	NGR: SD 69457 54584 Species: Alder Categorisation: Low potential
TR3.BT85	
	NGR: SD 69478 54555 Species: Alder Categorisation: Low potential

TR3.BT86	
	NGR: SD 69530 54521 Species: Alder Categorisation: Low potential
TR3.BT87	
	NGR: SD 69638 54420 Species: Alder Categorisation: Low potential
TR3.BT88	
No photo	NGR: SD 69635 54408 Species: Ash Categorisation: Low potential
TR3.BT89	
	NGR: SD 69660 54381 Species: Ash Categorisation: Moderate potential

TR3.BT90	
	NGR: SD 69699 54352 Species: Ash Categorisation: Moderate potential
TR3.BT91	
	NGR: SD 69713 54317 Species: Sycamore Categorisation: Low potential
TR3.BT92	
	NGR: SD 69733 54294 Species: Sycamore Categorisation: Low potential

TR3.BT93	
	NGR: SD 69778 54282 Species: Ash Categorisation: Low potential
TR3.BT94	
	NGR: SD 69810 54301 Species: Ash Categorisation: Moderate potential
TR3.BT95	
	NGR: SD 69816 54303 Species: Ash Categorisation: Low potential

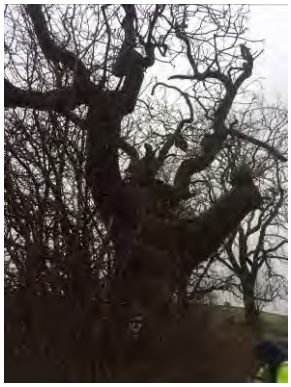
TR3.BT96	
	NGR:SD 69823 54305 Species: Ash Categorisation: Low potential
TR3.BT97	
	NGR: SD 69844 54299 Species: Sycamore Categorisation: Low potential
TR3.BT98	
	NGR: SD 66903 54279 Species: Alder Categorisation: Low potential

TR3.BT99	
	NGR: SD 69941 54253 Species: Alder Categorisation: Low potential
TR3.BT100	
	NGR: SD 69970 54237 Species: Alder Categorisation: Low potential
TR3.BT102	
	NGR: SD 69027 50482 Species: Ash Categorisation: Low potential

TR3.BT103	
	NGR: SD 68813 50377 Species: Ash Categorisation: Low potential

TR3.BT104	
	NGR: SD 69249 50691 Species: Ash Categorisation: Moderate potential

TR3.BT105	
	NGR: SD 69108 50122 Species: Sycamore Categorisation: Low potential

TR3.BT106	
	NGR: SD 68798 50155 Species: Ash Categorisation: Low potential
TR3.BT107	
	NGR: SD 68793 50153 Species: Ash Categorisation: Low potential
TR3.BT108	
	NGR: SD 68776 50150 Species: Ash Categorisation: Low potential

TR3.BT109	
No photo.	NGR: SD 68748 50151 Species: Ash Categorisation: Moderate potential
TR3.BT110	
	NGR: SD 69076 49954 Species: Alder Categorisation: Moderate potential
TR3.BT111	
	NGR: SD 69076 49954 Species: Alder Categorisation: Low potential

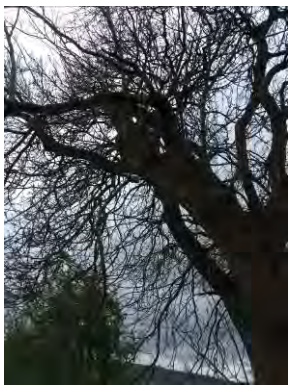
TR3.BT112	
	NGR: SD 68984 50073 Species: Ash Categorisation: Low potential
TR3.BT113	
	NGR: SD 68951 50103 Species: Alder Categorisation: Moderate potential
TR3.BT114	
	NGR: SD 69103 49913 Species: Ash Categorisation: Low potential

TR3.BT115	
	NGR: SD 69174 49942 Species: Ash Categorisation: Low potential
TR3.BT116	
	NGR: SD 69183 49939 Species: Ash Categorisation: Low potential
TR3.BT117	
	NGR: SD 69200 49939 Species: Ash Categorisation: Moderate potential

TR3.BT118	
	NGR: SD 69208 49939 Species: Ash Categorisation: Low potential
TR3.BT119	
	NGR: SD 69213 49940 Species: Ash Categorisation: Moderate potential
TR3.BT120	
	NGR: SD 69221 49941 Species: Ash Categorisation: Low potential

TR3.BT121	
	NGR: SD 69225 49942 Species: Ash Categorisation: Moderate potential
TR3.BT122	
	NGR: SD 69235 49939 Species: Ash Categorisation: Low potential
TR3.BT123	
	NGR: SD 69241 49941 Species: Ash Categorisation: Low potential

TR3.BT124	
	NGR: SD 69293 49934 Species: Ash Categorisation: Moderate potential
TR3.BT125	
	NGR: SD 69303 49931 Species: Ash Categorisation: Moderate potential
TR3.BT126	
	NGR: SD 69315 49929 Species: Ash Categorisation: Moderate potential

TR3.BT127	
	NGR: SD 69324 49928 Species: Ash Categorisation: Moderate potential
TR3.BT128	
	NGR: SD 69334 49927 Species: Ash Categorisation: Moderate potential
TR3.BT129	
	NGR: SD 69332 49937 Species: Ash Categorisation: Low potential

TR3.BT130	
	NGR: SD 69325 49947 Species: Ash Categorisation: Moderate potential
TR3.BT131	
	NGR: SD 69320 49958 Species: Ash Categorisation: Moderate potential
TR3.BT132	
	NGR: SD 69306 49996 Species: Ash Categorisation: Moderate potential

TR3.BT133	
	NGR: SD 69298 50011 Species: Ash Categorisation: Low potential
TR3.BT134	
	NGR: SD 69293 50024 Species: Ash Categorisation: Moderate potential
TR3.BT135	
No photo.	NGR: SD 69168 49939 Species: Ash Categorisation: Low potential

TR3.BT136	
	NGR: SD 68741 51041 Species: Sycamore Categorisation: Moderate potential
TR3.BT137	
	NGR: SD 68699 51066 Species: Sycamore Categorisation: Moderate potential
TR3.BT138	
	NGR: SD 69605 50040 Species: Sycamore Categorisation: Low potential

TR3.BT139	
	NGR: SD 69574 50004 Species: Sycamore Categorisation: Low potential
TR3.BT140	
	NGR: SD 69582 50017 Species: Sycamore Categorisation: Low potential
TR3.BT141	
	NGR: SD 69592 50031 Species: Sycamore Categorisation: Low potential

TR3.BT142	
	NGR: SD 69972 50190 Species: Ash Categorisation: Moderate potential
Tree Groups	
TR3.BG1	
	NGR: SD 60626 67378 Species: Beech, hazel (*Corylus avellana*), ash, sycamore Number of trees: 4 Overall categorisation: Low potential
TR3.BG2	
	NGR: SD 62160 66302 Species: Oak, sycamore, beech, holly, silver birch Number of trees: 10 Overall categorisation: Moderate potential

TR3.BG3	
 	NGR: SD 63712 465757 Species: Beech, pedunculate oak, sycamore Number of trees: 7 Overall categorisation: Moderate potential
TR3.BG4	
 	NGR: SD 64023 65099 Species: Sycamore, oak Number of trees: 6 Overall categorisation: Moderate potential

TR3.BG5	
 	NGR: SD 64228 64936 Species: Beech, sycamore, oak, rowan Number of trees: 20-30 Overall categorisation: Moderate potential
TR3.BG6	
 	NGR: SD 64243 64925 Species: Oak, beech Number of trees: 15 Overall categorisation: Moderate potential

TR3.BG7	
	NGR: SD 64271 64723 Species: Hawthorn Number of trees: 15 Overall categorisation: Low potential
TR3.BG8	
 	NGR: SD 64237 63617 Species: Alder, willow, silver birch Number of trees: 10 Overall categorisation: Moderate potential

TR3.BG9	
	NGR: SD 64610 63340 Species: Alder, hazel, rowan, hawthorn Number of trees: 10 Overall categorisation: Low potential
TR3.BG10	
	NGR: SD 64716 63545 Species: Alder, pedunculate oak, hazel, rowan Number of trees: 5 Overall categorisation: Moderate potential
TR3.BG11	
 	NGR: SD 64735 63378 Species: Rowan, oak, hawthorn, holly, silver birch Number of trees: 4 Overall categorisation: Moderate potential

TR3.BG12	
	NGR: SD 64446 62907 Species: Alder, rowan Number of trees: 10 Overall categorisation: Moderate potential
TR3.BG13	
 	NGR: SD 64734 63164 Species: Ash, holly, willow, hazel, hawthorn, oak Number of trees: 8 Overall categorisation: High potential
TR3.BG14	
	NGR: SD 64781 63450 Species: Alder, ash, holly, silver birch, hawthorn, hazel Number of trees: 7 Overall categorisation: Moderate potential

TR3.BG15	
No photo	NGR: SD 64948 63395 Species: Alder, rowan Number of trees: 10 Overall categorisation: Low potential
TR3.BG16	
 	NGR: SD 65014 63488 Species: Alder, hawthorn, rowan, holly Number of trees: 10 Overall categorisation: Low potential
TR3.BG17	
	NGR: SD 64828 63740 Species: Beech, oak, hazel, alder, hawthorn, silver birch, rowan, cherry species (*Prunus* sp.) Number of trees: 20 Overall categorisation: Moderate potential

TR3.BG18	
	NGR: SD 64726 63911 Species: Oak, rowan, alder Number of trees: 3 Overall categorisation: Low potential
TR3.BG19	
	NGR: SD 64748 63838 Species: Ash, hawthorn, willow, cherry species Number of trees: 6 Overall categorisation: Low potential
TR3.BG20	
	NGR: SD 64492 63790 Species: Silver birch, hawthorn, willow Number of trees: 4 Overall categorisation: Low potential

TR3.BG21	
 	NGR: SD 69355 54689 Species: Alder, sycamore, rowan Number of trees: 10 Overall categorisation: Low potential
TR3.BG22	
 	NGR: SD 69753 54269 Species: Alder, ash, oak, sycamore, hazel Number of trees: 8 Overall categorisation: Moderate potential

TR3.BG23	
 	NGR:SD 69990 54253 Species: Rowan, alder, hawthorn Number of trees: 5 Overall categorisation: Moderate potential
TR3.BG24	
	NGR: SD 68811 50541 Species: Ash, hawthorn, sycamore, hazel, oak Number of trees: 12 Overall categorisation: Low potential

TR3.BG25	
 	NGR: SD 68855 50250 Species: Ash, sycamore, alder, hawthorn Number of trees: 10 Overall categorisation: Low potential
TR3.BG26	
	NGR: SD 69103 53046 Species: Sycamore Number of trees: 9 Overall categorisation: Low potential

TR3.BG27	
	NGR: SD 68731 50158 Species: Oak, beech, sycamore Number of trees: 3 Overall categorisation: Low potential
TR3.BG28	
  	NGR: SD 69009 49910 Species: Oak, sycamore, alder, ash, cypress (*Cupressus* sp.), conifer species Number of trees: 10 Overall categorisation: Moderate potential

TR3.BG29	
	NGR: Species: Oak Number of trees: 6 Overall categorisation: Low potential
TR3.BG30	
	NGR: SD 68648 51094 Species: Ash, sycamore Number of trees: 5 Overall categorisation: Moderate potential
TR3.BG31	
	NGR: SD 69607 50092 Species: Ash Number of trees: 7 Overall categorisation: Moderate potential
TR3.BG32	
	NGR: SD 69667 50090 Species: Ash Number of trees: 5 Overall categorisation: Moderate potential

TR3.BG33	
	NGR: SD 69749 50139 Species: Alder, sycamore, beech Number of trees: 8 Overall categorisation: Moderate potential
TR3.BG34	
	NGR: SD 69789 50222 Species: Beech Number of trees: 20 Overall categorisation: Moderate potential
TR3.BG35	
	NGR: SD 69735 50053 Species: Unknown (dead) Number of trees: 2 Overall categorisation: Low potential

References

Collins, J. (Ed). (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). The Bat Conservation Trust, London.

Appendix B. Bowland Ecology Bat Activity Report

1 Project Details			
Project Name:	Haweswater Aqueduct Resilience Programme	Project Number:	80061155
Written:	Mark Breaks, *Ecologist* Eve Loxham, *Ecologist* Lucy Pocock, *Assistant Ecologist*	Approved:	Matt Clifford, *Senior Ecologist*
Report reference:	TR3 Ecology Survey Data Report Bat Activity 2020	Date:	14/08/2020
2 Project Drawings			
Bat Transects and Static Locations Proposed Bowland Section Sheets 1 to 2		BOW167_HARP_9.5_BATS_TR3	
3 Ecology Surveys			
Surveyors:	Sarah Birtley MBiolSci Catrin Watkin MRes BSc (Hons) Sophie King BSc (Hons) Mark Breaks BSc (Hons) Abigail Hamer BSc (Hons) Eve Loxham MBiolSci (Hons) Lucy Pocock BSc (Hons) Fiona Shuttle BSc (Hons) Helena Davies BSc (Hons)	Data analysts:	Jack Taylor BSc (Hons) Mark Breaks BSc (Hons)

Survey date(s):	**Visit, Type, Location**	**Date**	**Visit, Type, Location**	**Date**
	Visit 1, (South) Transect 1, TR3	02/04/2020	Visit 1, (South) Transect 1, Static A, B & C TR3	31/03/2020 to 06/04/2020
	Visit 2, (South) Transect 1, TR3	22/04/2020	Visit 2, (South) Transect 1, Static A, B & C TR3	22/04/2020 to 29/04/2020
	Visit 3, (South) Transect 1, TR3	07/05/2020	Visit 3, (South) Transect 1, Static A, B & C TR3	07/05/2020 to 19/05/2020
	Visit 4, (South) Transect 1, TR3	20/05/2020	Visit 4, (South) Transect 1, Static A, B & C TR3	26/05/2020 to 01/06/2020
	Visit 5, (South) Transect 1, TR3	04/06/2020	Visit 5, (South) Transect 1, Static A, B & C TR3	08/06/2020 to 15/06/2020
	Visit 6, (South) Transect 1, TR3	24/06/2020	Visit 6, (South) Transect 1, Static A, B & C TR3	25/06/2020 to 01/07/2020
	Visit 7, (South) Transect 1, TR3	06/07/2020	Visit 7, (South) Transect 1, Static A, B	13/07/2020 to 20/07/2020

			& C TR3	
	Visit 8, (South) Transect 1, TR3	28/07/2020	Visit 8, (South) Transect 1, Static A & C TR3	27/07/2020 to 02/08/2020
	Visit 1, (North) Transect 2, TR3	29/04/2020	Visit 1, (North) Transect 2, Static A & B, TR3	22/04/2020 to 29/04/2020
	Visit 2, (North) Transect 2, TR3	26/05/2020	Visit 2, (North) Transect 2, Static A & B, TR3	19/05/2020 to 26/05/2020
	Visit 3, (North) Transect 2, TR3	18/06/2020	Visit 3, (North) Transect 2, Static A & B, TR3	04/06/2020 to 12/06/2020
	Visit 4, (North) Transect 2, TR3	30/07/2020	Visit 4, (North) Transect 2, Static A & B, TR3	20/07/2020 to 27/07/2020

Survey Method:

Habitat Evaluation and Survey Effort

The transect routes identified for survey cover a variety of habitats throughout the landscape of TR3. These include; agricultural fields lined with minor watercourses and mature tree lines; hedgerow-lined minor roads; and embankments of rivers comprising broadleaved woodland. The transect routes have been given the following foraging and commuting classifications in accordance with the Bat Conservation Trust (BCT) survey guidelines (Collins, 2016):

- North Transect - TR3 Transect 2: Moderate potential
- South Transect - TR3 Transect 1: High potential

A detailed description of the habitats surrounding each transect route is provided in section 4 'Survey Findings'. The transects and static locations were updated to allow for the amended development envelope survey areas released in February and April 2020 to follow on from the data collected in 2019. The transects assessed in 2020 reflect the new development boundaries. South (Transect 1) was extended compared with the 2019 surveys to include the habitats to the south along the River Hodder. Transect 2 was not included in the 2019 surveys and report. For ease, the transect routes were renamed North and South for Transect 2 and Transect 1 respectively.

For low potential routes, three bat activity survey visits are required, covering the spring (April to May), summer (June to August) and autumn (September to October) seasons. For moderate potential routes, one survey visit per month (April to October) are required. For high potential routes, up to two survey visits per month (April to October) are required. This report details the results of bat activity surveys carried out in April to July 2020. The results of the August to October surveys for South (Transect 1) are detailed in 'TR3 Ecology Survey Data Report Bat Activity 2019' (Bowland Ecology, 2020). However caution should be applied when comparing the results since the transect route has been updated for the 2020 development boundary.

Each transect visit comprises a single transect route, complemented by one static detector (for low potential), two static detectors (for moderate potential) or three static detectors (for high potential).

Transect Surveys

The walked transect survey commenced at dusk and included monitoring points, at which surveyors remained stationary for a standardised three to five minute period. Walked sections of the transect between each monitoring point were walked at a slow steady pace. Surveyors carried a broadband full spectrum detector (EM3 Touch attached to iPad) supplemented by heterodyne detectors. Bat passes at each walk and monitoring point were recorded with the number of bats observed, species and any other contextual data such as flight direction, social calling or foraging. The transect route and monitoring points were designed to sample the range of habitats present across the site, whilst

	avoiding any features which could be difficult to safely navigate in darkness. Sonogram analysis was undertaken using Analook software at Bowland Ecology by Mark Breaks and Jack Taylor. No automated filters or automated identification packages have been applied during sonogram analysis. **Static Surveys** Static remote monitoring bat detectors (Anabat Express, set to night mode) were deployed at fixed locations for a minimum of five consecutive nights per visit. The static locations were non-random (as micro-siting was determined by habitat and/or potential impacts). Detectors were deployed with standardised sensitivity settings. Sonogram analysis was undertaken using Analook software at Bowland Ecology by Mark Breaks and Jack Taylor. No automated filters or automated identification packages have been applied during sonogram analysis. For the purposes of presentation, data have been transformed to calculate bat activity indices (BAI) or bat passes per night. The BAI represents bat passes per hour (bph), to account for different night lengths throughout the recording period.

Weather Conditions – Transect Surveys:

Transect & Visit	North Transect – Visit 1	North Transect – Visit 2	North Transect – Visit 3	North Transect – Visit 4
Date	29/04/2020	26/05/2020	18/06/2020	30/07/2020
Start Time	20:39	21:24	21:45	21:11
End Time	22:16	22:46	23:03	22:39
Sunset	20:39	21:24	21:45	21:11
Moonlight	Waxing crescent	Waxing crescent	Waning crescent	Waxing gibbous
Temp. °C (start)	7.5	11	13	18
Rain (start)	dry	dry	dry	dry
Wind[1] (start)	1	2	2-4	4
Cloud[2] (start)	3	2	8	4
Temp. °C (end)	7	8	10	16
Rain (end)	dry	dry	dry	dry
Wind[1] (end)	1	2	2-4	4
Cloud[2] (end)	3	2	8	4

Weather Conditions – Transect Surveys:

Transect & Visit	South Transect – Visit 1	South Transect - Visit 2	South Transect – Visit 3	South Transect – Visit 4
Date	02/04/2020	22/04/2020	07/05/2020	20/05/2020
Start Time	19:57	20:26	20:54	21:15
End Time	22:10	21:58	22:46	22:40
Sunset	19:48	20:26	20:54	21:15
Moonlight	Waxing gibbous	Waning crescent	Full moon	Waning crescent
Temp. °C (start)	8	12.5	18.5	19
Rain (start)	dry	dry	dry	dry

Wind[1] (start)	3	1-2	0	0
Cloud[2] (start)	5	0	3	0
Temp. °C (end)	6	10.5	12	13.5
Rain (end)	dry	dry	dry	dry
Wind[1] (end)	3	1-2	0	0
Cloud[2] (end)	5	0	3	0
Weather Conditions – Transect Surveys:				
Transect & Visit	South Transect – Visit 5	South Transect - Visit 6	South Transect – Visit 7	South Transect – Visit 8
Date	04/06/2020	24/06/2020	06/07/2020	28/07/2020
Start Time	21:35	21:46	21:41	21:14
End Time	23:37	23:18	23:12	22:41
Sunset	21:35	21:46	21:41	21:14
Moonlight	Waxing gibbous	Waxing crescent	Waning gibbous	Waxing gibbous
Temp. °C (start)	13	23	13	13
Rain (start)	dry	dry	dry	dry
Wind[1] (start)	4	1	2	1-2
Cloud[2] (start)	8	0	8	8
Temp. °C (end)	12	20	11	12
Rain (end)	dry	dry	dry	Light rain
Wind[1] (end)	4	1	2	1-2
Cloud[2] (end)	8	0	8	8
Weather Conditions – Static Surveys:				
Static & Visit	North, Static A-B, Visit 1	North, Static A-B, Visit 2	North, Static A-B, Visit 3	North, Static A-B, Visit 4
Date	22/04/2020 to 29/04/2020	19/05/2020 to 26/05/2020	04/06/2020 to 12/06/2020	20/07/2020 to 27/07/2020
Location	A: SD 63934 66043 B: SD 6367365546	A: SD 63934 66043 B: SD 6367365546	A: SD 63934 66043 B: SD 6367365546	A: SD 63934 66043 B: SD 6367365546
Sunset	20:26 to 20:39	21:14 to 21:24	21:36 to 21:43	21:27 to 21:16
Sunrise	05:51 to 05:36	04:59 to 04:50	04:41 to 04:37	05:05 to 05:15
Start Temp. °C	7 to 18	13 to 18	11 to 17	14 to 18
Midnight Temp. °C	2 to 11	6 to 16	5 to 10	7 to 15
End Temp. °C	6 to 17	11 to 22	9 to 16	14 to 18
Rain	Light rain 28/04/2020 otherwise dry	Drizzle 26/05/2020 otherwise dry	Scattered showers 05/06/2020, 10/06/2020, 11/06/2020, otherwise dry	Light rain 23/07/2020, 25/07/2020, otherwise dry

Wind (kmh)	22 (4), 14 (3), 6 (1), 12 (3), 14 (3), 14 (3), 13 (3), 23 (4)	14 (3), 9 (2), 12 (2), 54 (7), 48 (6), 14 (3), 11 (2)	49 (6), 22 (4), 14 (3), 11 (2), 9 (2), 21 (4), 22 (4), 30 (4)	17 (3), 8 (2), 25 (4), 14 (3), 9 (2), 19 (3), 29 (4), 30 (4)
Wind Direction	E, NE, N, NW, NW, NNW, ESE, SE	NW, N, E, WSW, W, W, NNW	NW, NW, NNW, NW, WNW, ESE, NE, E	WNW, W, WSW, WNW, SW, W, WSW, SSE
Cloud	Scattered clouds 26/04/2020, passing clouds 27/04/2020, overcast 28/04/2020, 29/04/2020	Passing/scattered clouds throughout deployment duration	Passing/scattered clouds throughout deployment duration	Passing/scattered clouds throughout deployment duration
Moonlight	1% to 38%	10% to 15%	60% to 95%	0% to 52%
Weather Conditions – Static Surveys:				
Static & Visit	South, Static A-C, Visit 1	South, Static A-C, Visit 2	South, Static A-C, Visit 3	South, Static A-C, Visit 4
Date	31/03/2020 to 07/04/2020	22/04/2020 to 29/04/2020	07/05/2020 to 19/05/2020	26/05/2020 to 01/06/2020
Location	A: SD 69653 50427 B: SD 68852 50054 C: SD 6929549581	A: SD 69653 50427 B: SD 68852 50054 C: SD 6929549581	A: SD 69653 50427 B: SD 68852 50054 C: SD 6929549581	A: SD 69653 50427 B: SD 68852 50054 C: SD 6929549581
Sunset	20:01 to 19:57	20:25 to 20:38	20:52 to 21:13	21:23 to 21:31
Sunrise	06:44 to 06:27	05:52 to 05:36	05:20 to 05:00	04:50 to 04:44
Start Temp. °C	8 to 20	7 to 18	7 to 20	14 to 25
Midnight Temp. °C	4 to 9	2 to 10	-3 to 10	4 to 16
End Temp. °C	3 to 15	6 to 17	1 to 19	10 to 22
Rain	Dry	Light rain 28/04/2020 otherwise dry	Scattered showers 17/05/2020 otherwise dry	Drizzle 26/05/2020 otherwise dry
Wind (kmh)	14 (3), 22 (4), 25 (4), 21 (4), 19 (3), 35 (5), 14 (3), 9 (2)	22 (4), 14 (3), 6 (1), 12 (2), 14 (3), 14 (3), 13 (3), 23 (4)	12 (3), 12 (3), 12 (3), 28 (4), 24 (4), 27 (4), 12 (3), 22 (4), 25 (4), 17 (3), 25 (4), 25 (4), 27 (4)	11 (2), 14 (3), 9 (2), 17 (3), 27 (4), 21 (2), 12 (3)
Wind Direction	NW, NW, NW, W, S, SW, WSW, NNW	E, NE, N, NW, NW, NNW, ESE, SE	NNW, NNW, N, ENE, NNW, NW, E, NW, WNW, WNW, W, W, W	NNW, N, N, SSE, ESE, ESE, E
Cloud	Passing clouds 31/03/2020, 01/04/2020, 03/04/2020, scattered clouds 03/04/2020	Scattered clouds 26/04/2020, passing clouds 27/04/2020, overcast 28/04/2020, 29/04/2020	Passing clouds 09/05/2020 to 15/05/2020, scattered clouds 16/05/2020, 17/05/2020, broken clouds 18/05/2020, 19/05/2020	Passing clouds 29/05/2020, 01/06/2020, otherwise clear
Moonlight	43% to 98%	1% to 38%	10% to 100%	15% to 80%
Weather Conditions – Static Surveys:				
Static & Visit	South, Static A-C, Visit 5	South, Static A-C, Visit 6	South, Static A-C, Visit 7	South, Static A-C, Visit 8

Date	08/06/2020 to 15/06/2020	25/06/2020 to 01/07/2020	13/07/2020 to 20/07/2020	27/07/2020 to 02/08/2020
Location	A: SD 69653 50427 B: SD 68852 50054 C: SD 6929549581	A: SD 69653 50427 B: SD 68852 50054 C: SD 6929549581	A: SD 69653 50427 B: SD 68852 50054 C: SD 6929549581	A: SD 69653 50427 B: Access denied C: SD 6929549581
Sunset	21:38 to 21:43	21:45 to 21:44	21:35 to 21:26	21:15 to 21:05
Sunrise	04:39 to 04:37	04:39 to 04:42	04:55 to 05:04	05:15 to 05:25
Start Temp. °C	12 to 23	13 to 30	13 to 18	14 to 24
Midnight Temp. °C	5 to 15	10 to 21	7 to 15	9 to 19
End Temp. °C	10 to 22	12 to 20	13 to 17	13 to 28
Rain	Light rain 10/06/2020, 11/06/2020, scattered showers 13/06/2020, 14/06/2020 otherwise dry	Scattered showers 26/06/2020 to 29/06/2020, drizzle 01/07/2020	Scattered showers 15/07/2020, 16/07/2020, 18/07/2020 otherwise dry	Scattered showers 27/06/2020, 28/06/2020, 30/06/2020
Wind (kmh)	11 (2), 9 (2), 21 (3), 22 (3), 30 (4), 12 (3), 12 (3), 9 (2)	17 (3), 17 (3), 45 (6), 46 (6), 4 (1), 9 (2)	19 (3), 10 (2), 10 (2), 17 (3), 22 (4), 14 (3), 21 (4)	30 (5), 22 (4), 6 (1), 12 (3), 17 (3)
Wind Direction	NW, WNW, ESE, NE, E, E, W, W	SE, NW, WSW, W, W, ENE	WNW, WNW, WNW, SW, WNW, NW	WNW, NW, WNW, SE, NW
Cloud	Passing clouds 08/06/2020 to 10/06/2020, 12/06/2020 overcast 11/06/2020, 13/06/2020, 14/06/2020	Overcast 26/06/2020 to 29/06/2020, 01/07/2020	Scattered clouds throughout deployment duration	Passing clouds throughout deployment duration
Moonlight	31% to 93%	21% to 87%	0% to 47%	53% to 99%

[1]Wind strength is reported using the Beaufort Scale of Wind Force, this scale runs from 0 to 12, information on the conditions experienced during surveys are as follows: 0 – Calm (vertical smoke); 1 – Light Air (slight smoke drift); 2 – Light Breeze (leaves gently rustle).

[2]Cloud cover is reported in oktas or eighths (i.e. 0 oktas represents the complete absence of cloud, 1 okta cloud cover of 1 eighth or less, and so on to 8 oktas which represents full cloud cover), with the additional convention that 9 oktas represents sky obscured by fog or mist.

Weather data for the static monitoring surveys including sunset time, sunrise time, temperature, rainfall, wind speed, wind direction, cloud and moonlight have been obtained from timeanddate.com.

Limitations to the survey:	*Access* Access was denied for the second survey of August 2010 at South Transect Static B which means there is no data or subsequent analysis for Visit 8 Static B. Access was also denied for one landowner on South Transect for the transect survey Visit 1. This meant the route was cut off between listening stop 5 and 8, and stops 6 and 7 were not undertaken. *Detector errors* South Static B Visit 4 and 8, and South Static C Visit 1, 2 and 3 recorded no data for any of the nights. This is likely due to detector error rather than lack of bats since the nearby detectors recorded bats throughout the same monitoring period.

Lack of bat activity

Of note is 28/04 which recorded no bat activity across all statics. No errors were recorded on the log and therefore it is assumed that this is due to absence of bat activity rather than detector malfunction, particularly as bat activity was recorded on other nights within the same monitoring period.

Timings

South Transect Visit 1 started approximately 9 minutes after sunset instead of at sunset. It is possible early emerging bat species could therefore have been missed for this survey visit. However, the use of static detectors should identify the presence of early emerging bat species along the transect and this is not considered a significant constraint of the surveys.

Temperature

Start temperatures for transect surveys were below 10°C during Visit 1 for both North and South transects (7.5°C and 8°C respectively). This is typical of spring months in northern England, and not considered to be a significant constraint as bat activity was still recorded and bats are typically active at temperatures above 6°C.

Start temperatures for static surveys were below 10°C for at least one night for Visit 1 of North and South statics, and also Visit 2 and 3 of South statics. No start temperatures below 6°C were noted, however overnight temperatures in particular did drop to -3°C on South statics Visit 3 (14/05); this is not considered to be a significant constraint since bat activity was still recorded. Lower temperatures reduce bat activity and may reduce the overall number of bat calls recorded during the survey periods. Where possible and suitable temperatures followed, static monitoring periods were extended to take this into account.

Rainfall

No rainfall was recorded during the transect surveys. And no heavy rainfall was recorded across the static monitoring periods. Light rain and scattered showers were recorded on several nights throughout the static monitoring period, however of those dates only 28/04 recorded no bats across all statics and is therefore not considered to be a significant constraint. Where possible and suitable weather followed, the monitoring period was extended past the initial five days to take this into account.

Wind

Wind speed was considered high (Beaufort Scale 4 and above*) for North Transect Visit 3 (18/06) and Visit 4 (30/07), and South Transect Visit 5 (04/06). This is not considered to be a significant constraint since bat activity was still recorded on these dates.

Wind speed was considered high (Beaufort Scale 4 and above*) for several nights of static deployment throughout all static monitoring periods; i.e. North statics Visit 1 to 4 and South statics Visit 1 to 8. Of particular note was eight nights of high wind recorded on South statics Visit 3 (10-12, 14, 15, 17-19/05). Bat calls were still recorded during this period for south statics. The effect of wind speed on bat activity varies depending on the topography of the landscape. The north transect is relatively exposed in the landscape and has limited wind screening from farm buildings and a wooded clough to the north. The south transect covers land which slopes steeply down to the River Hodder at the south and is potentially screened in places by woodland. See habitat description in Section 4 below.

*Slack and Tinsley (2015) recorded a reduction in bat activity at wind speeds of 5.4 m/s (Beaufort Scale 4).

Species analysis

Detectability of some bat species e.g. *Plecotus* is lower than others e.g. *Nyctalus* and *Pipistrellus,* as a consequence of echolocation and hunting strategies. Careful interpretation has been applied when comparing across species.

During data analyses, some pipistrelle bat calls were undeterminable to species level (e.g. peak frequencies at 50kHz). These calls have therefore been classified as pipistrelle species.

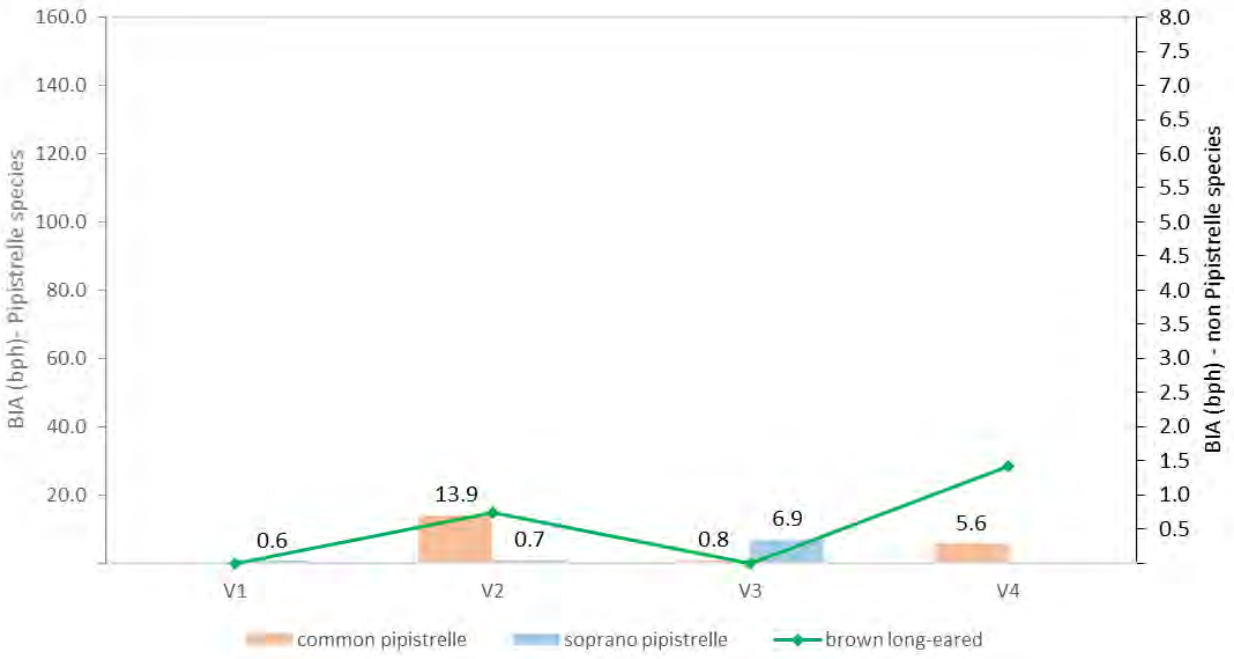
Myotis species have overlapping call characteristics and it is therefore not possible to identify these bats to species level with confidence (at least 80%). Where possible, species have been identified to a smaller group e.g. whiskered/Brandt's bats (*Myotis mystacinus/Myotis brandti*) or

	Natterer's/Bechstein's bats (*Myotis nattereri/Myotis bechsteinii*) through sonogram analysis. However, *Myotis* data represent a small proportion of the activity recorded and therefore, for the purposes of meaningful data presentation, *Myotis* species have been grouped.
4 Survey findings	
Habitat Description	
  	North Transect (Transect 2) The transect route follows a section of minor road from High Park House to Lower House Cottage which are low lying and slope approximately northwards towards the River Hindburn. The route extends across sheep grazed fields, following minor drainage ditch lines and then follows a section of unnamed road (between Wray and Helk's Brow). The surrounding habitat is predominantly species-poor semi-improved grassland, with some areas of marshy grassland / fen towards the west of the transect. There are scattered broadleaved trees, mainly focussed towards the northern half of the transect around the farm buildings and field boundaries. Static A This static was positioned at the roadside within a wooded clough with surrounds Cod Gill, a tributary of the River Hindburn. The ground slopes roughly northwards and there are a number of mature trees which line the watercourse. Static B This static was positioned on a mature tree at the field boundary. Habitats immediately surrounding the static include livestock grazed grassland and scattered small areas of marshy grassland. There are operational utility buildings to the north, along with farm buildings further north in the valley.
 	South Transect (Transect 1) The transect route follows a short section of Back Lane and then crosses a series of grazed fields which roughly slope down steeply towards the south-east. The route also follows a minor watercourse (TR3.WC66) down towards the River Hodder which is lined with scattered trees. The transect also surveys a series of fields which are roughly flat and are within a meander of the River Hodder. These fields are mainly used for livestock grazing and are lined by mature trees and small tributary watercourses/drainage ditches which flow into the River Hodder. There are also small patches of marshy grassland present. Static A Static A was positioned on a mature tree which is on the embankment of the River Hodder (TR3.WC80). Habitats surrounding this static also include operational utility buildings, bare ground and broadleaved plantation woodland. Static B Static B was positioned at the woodland (TR3.TN133) edge where the aqueduct crosses the River Hodder (TR3.TN136). The landscape slopes steeply down to the south towards the river and northern habitats include large areas of species-poor semi-improved grassland, with a minor watercourse (TR3.WC66) which is

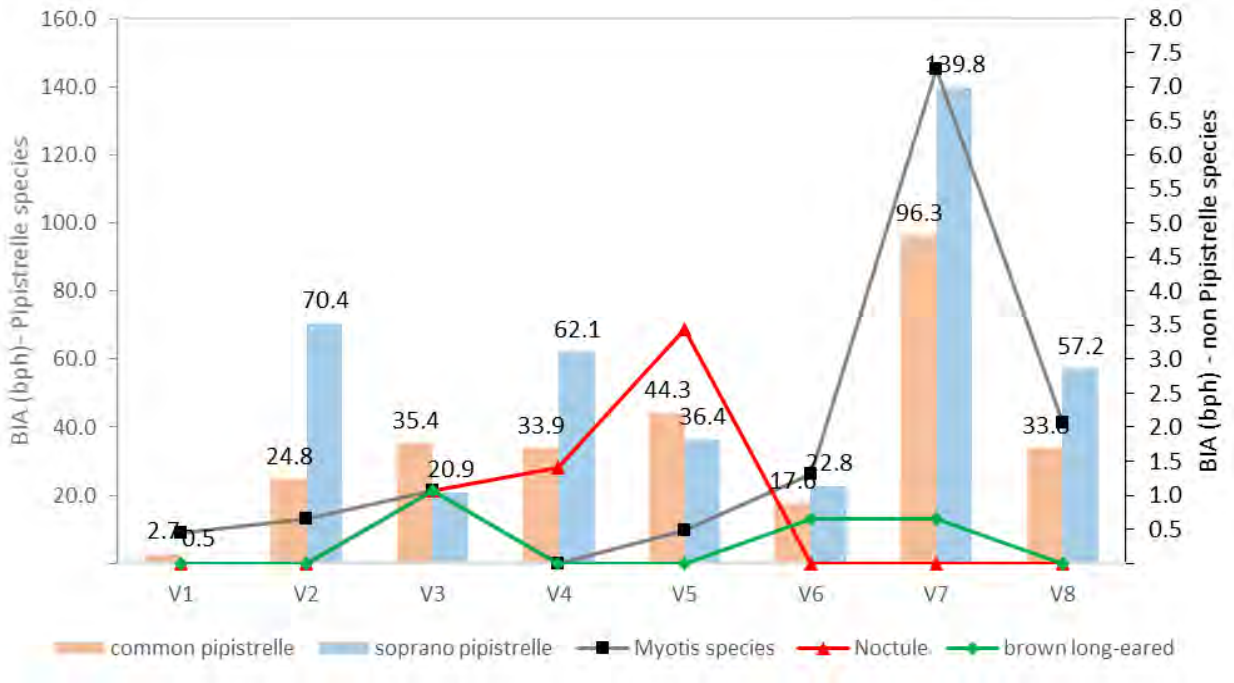
	bounded by a mature tree line. Static C This static was positioned within an overgrown tree line at the boundary of a field close to a minor road. The road is sheltered and lined by mature trees on both sides. Surrounding habitats include livestock grazed grassland with scattered scrub at the field edges.

Average Bat Activity Recorded During Each Transect Across All Visits (bat passes per hour by species/group)

North Transect:



South Transect:



Average Bat Activity Recorded at Each Static Location Across All Visits (bat passes per night by species/group)	
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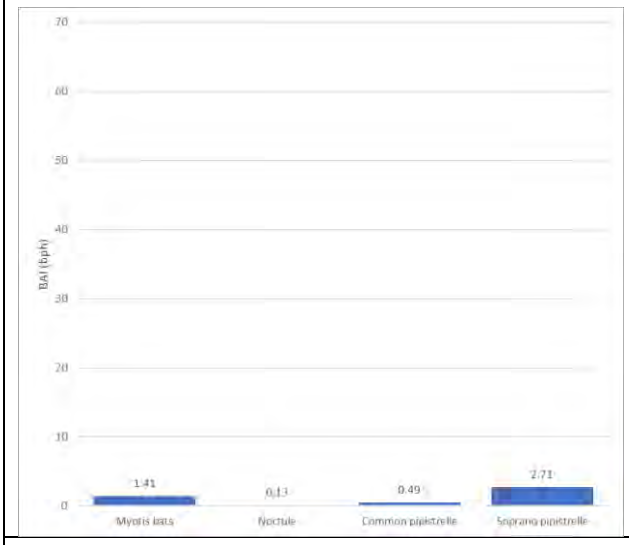
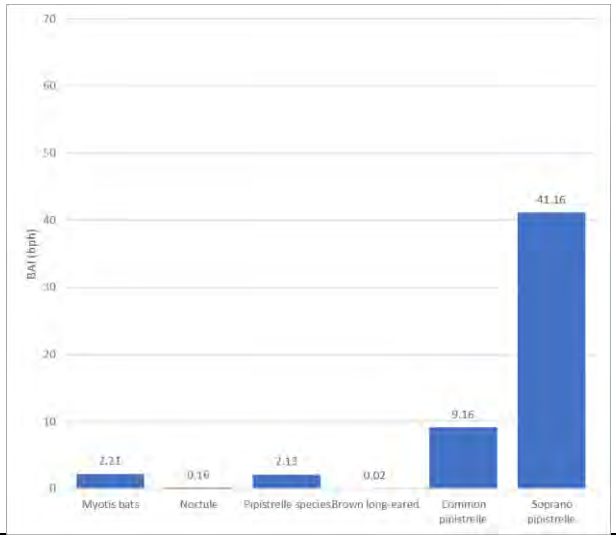
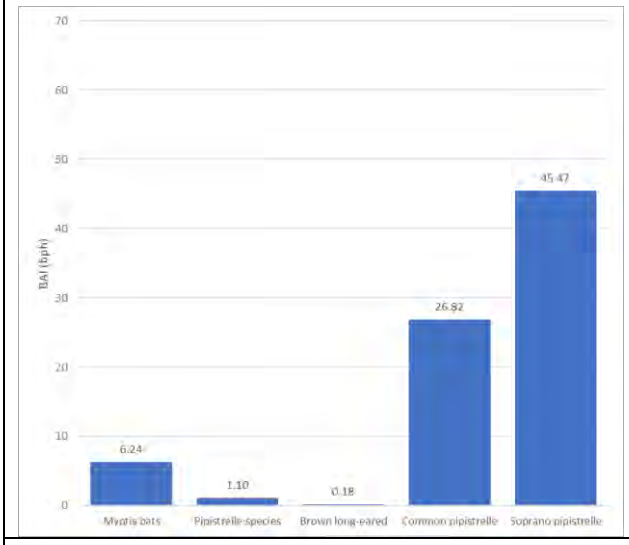
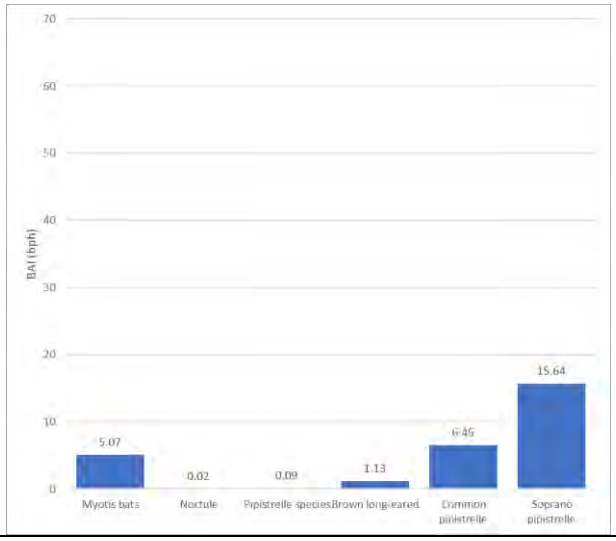
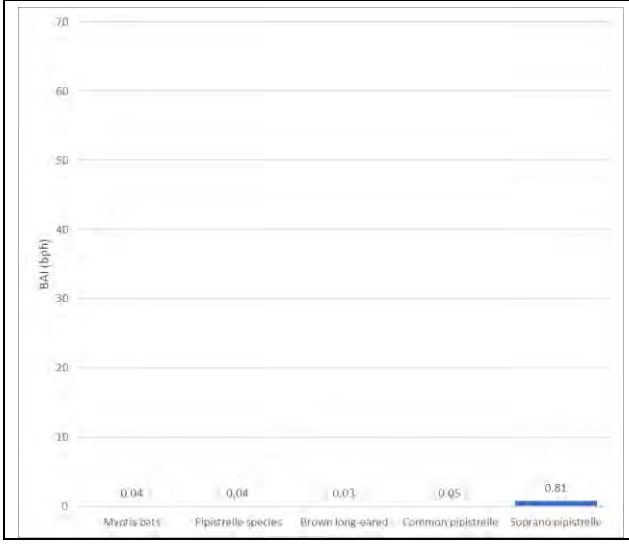
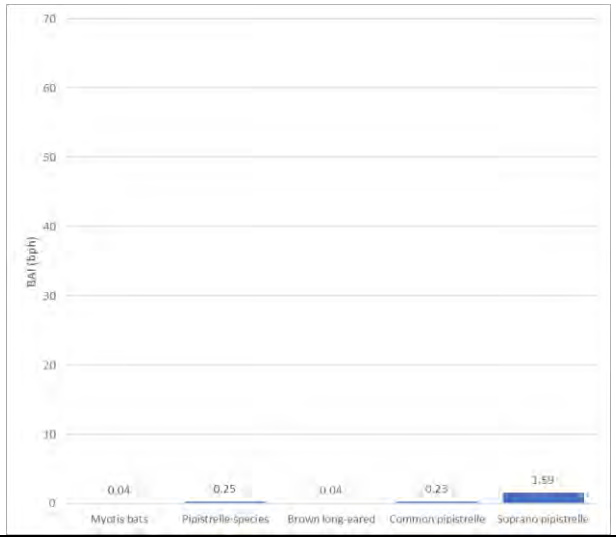
	
North_Static A (Visit 3):	**North_Static A (Visit 4):**
	
North_Static B (Visit 1):	**North_Static B (Visit 2):**
	

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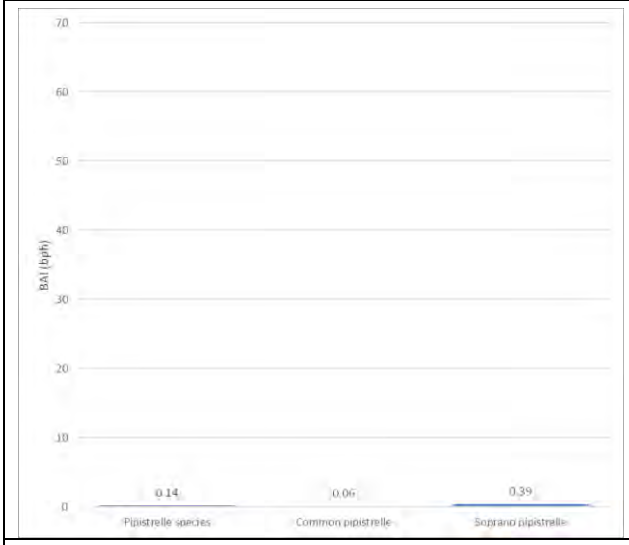

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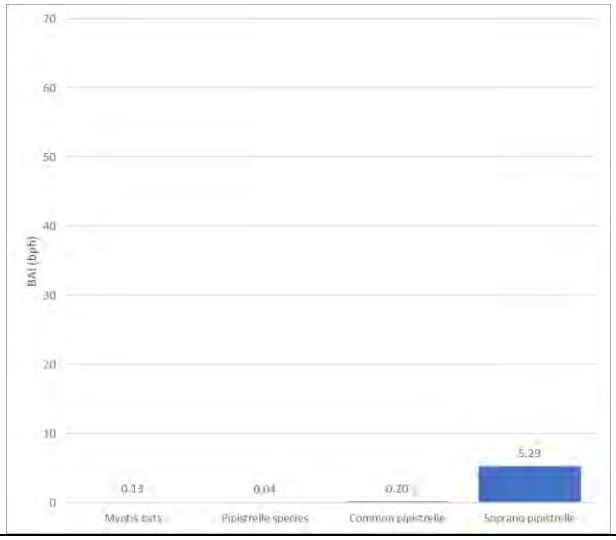
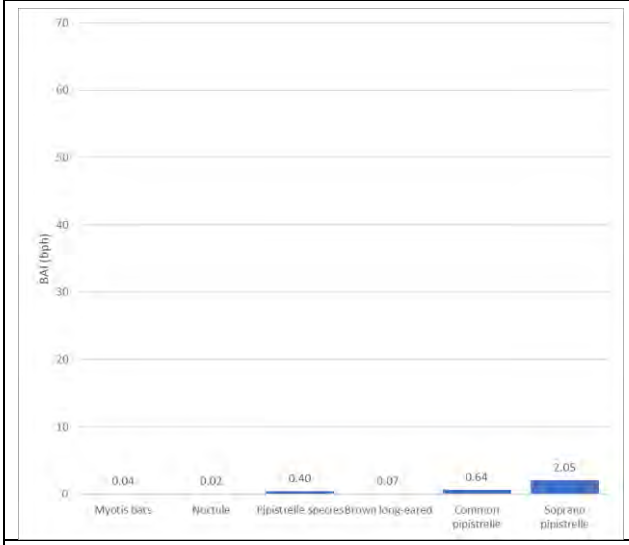


South_Static A (Visit 1):



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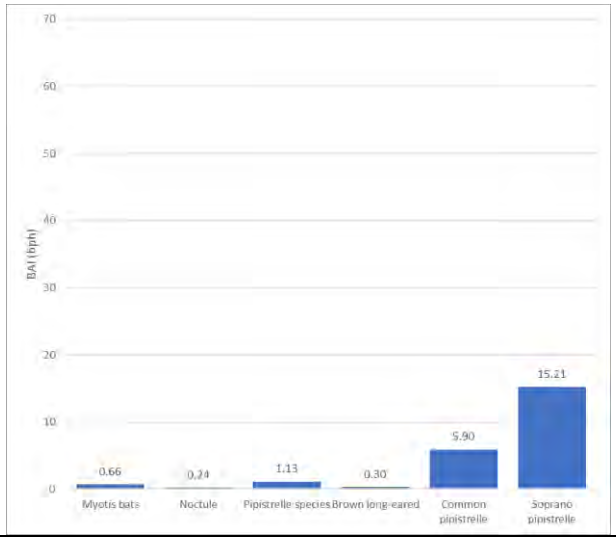

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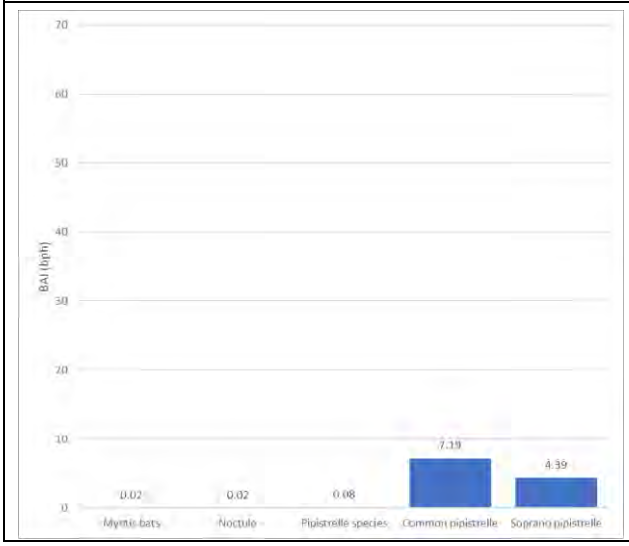

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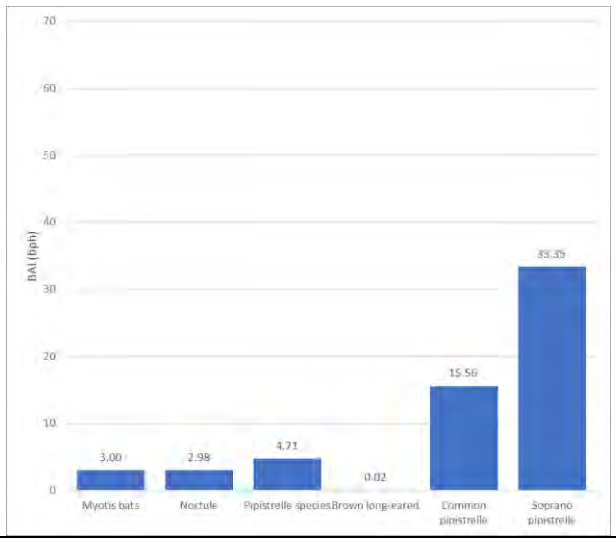
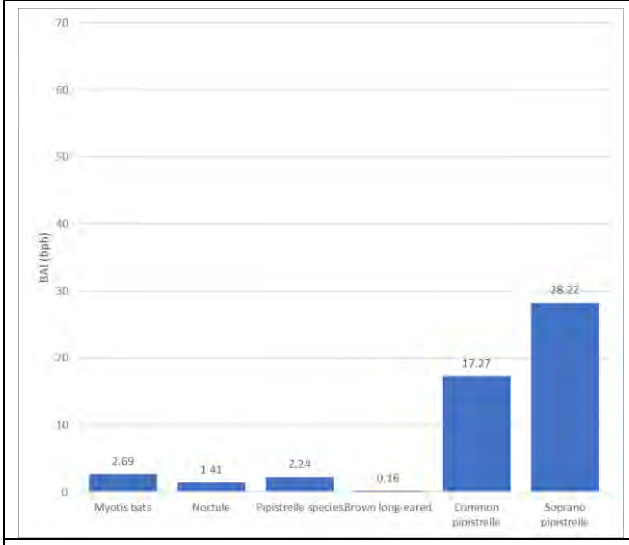
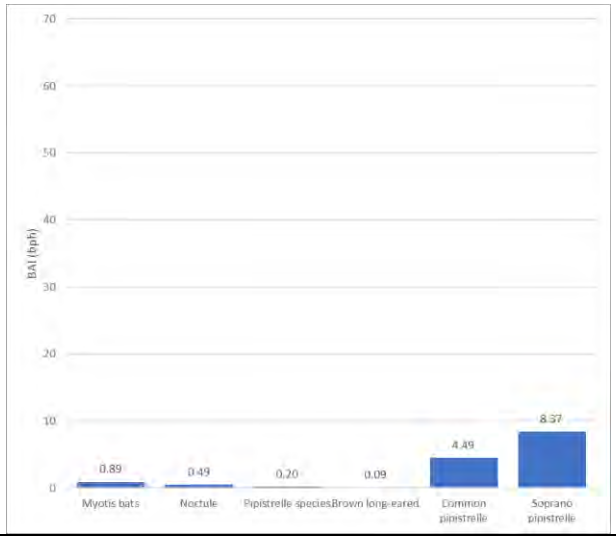


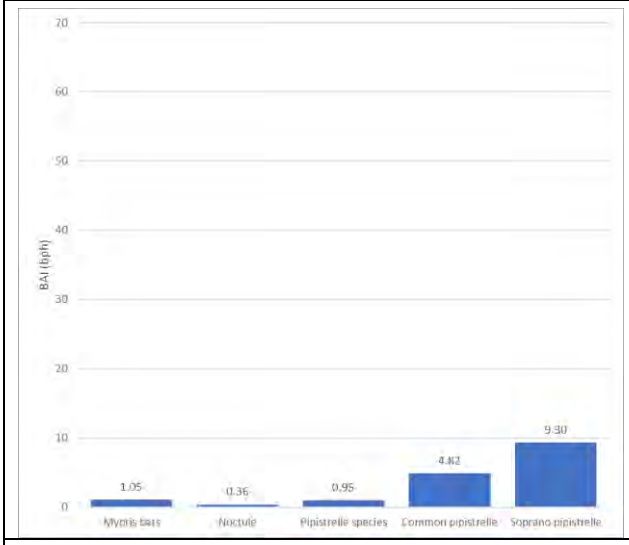
South_Static A (Visit 5):



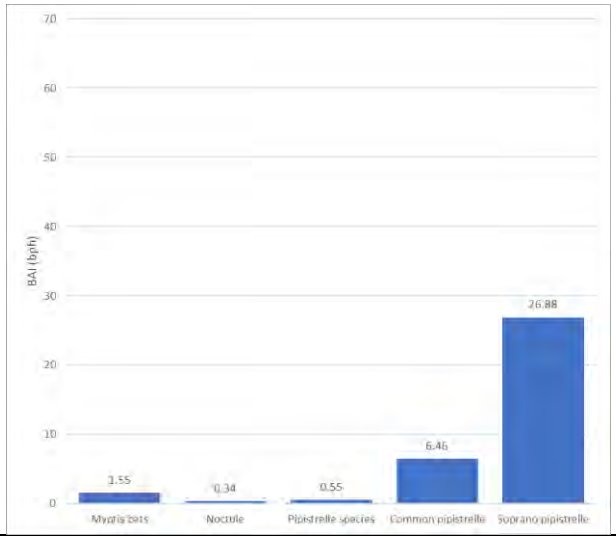
South_Static A (Visit 6):



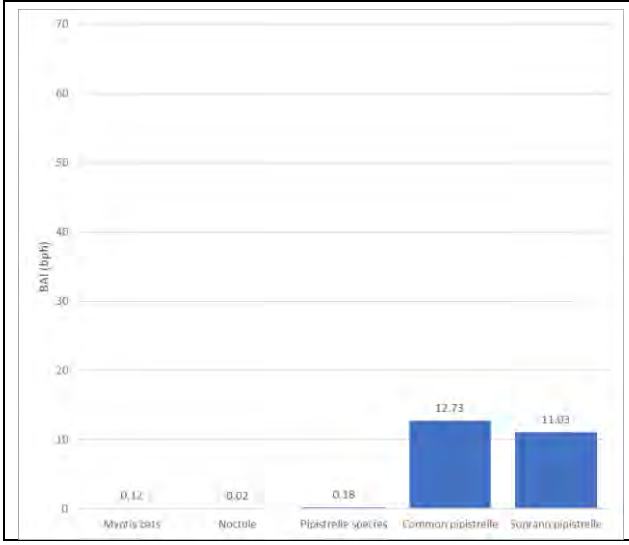
South_Static A (Visit 7):



South_Static A (Visit 8):



South_Static B (Visit 1):



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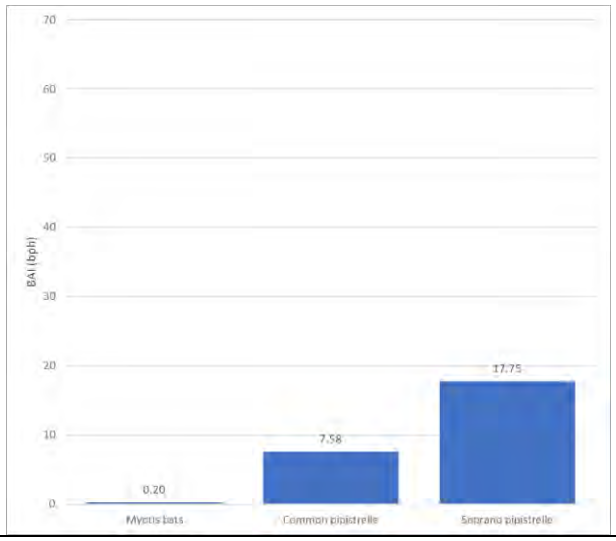
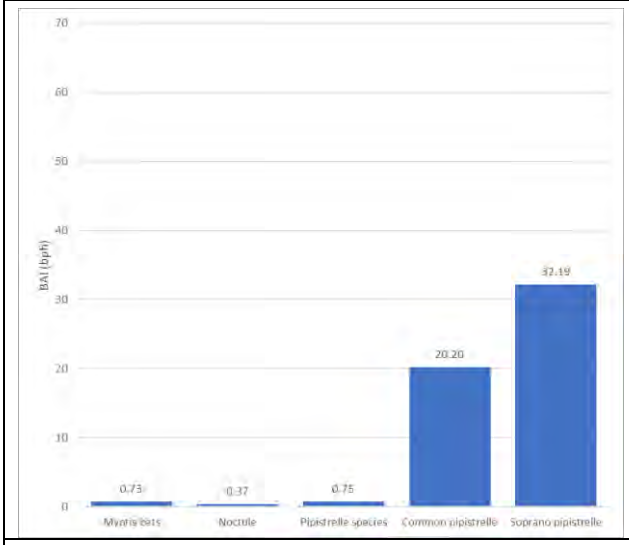


South_Static B (Visit 3):	South_Static B (Visit 4):
	No data
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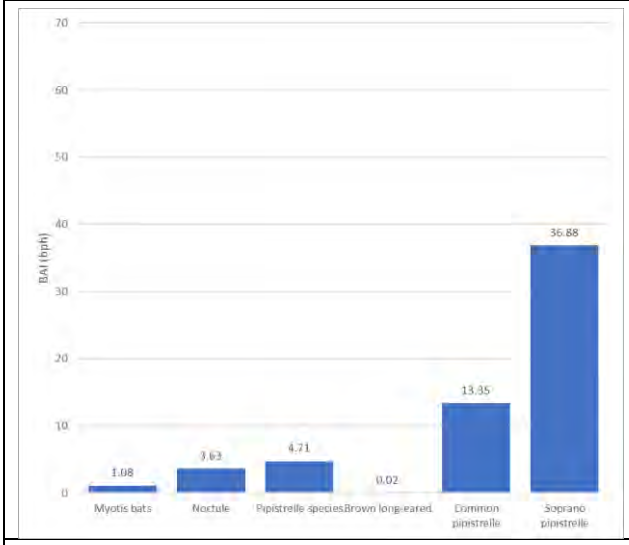
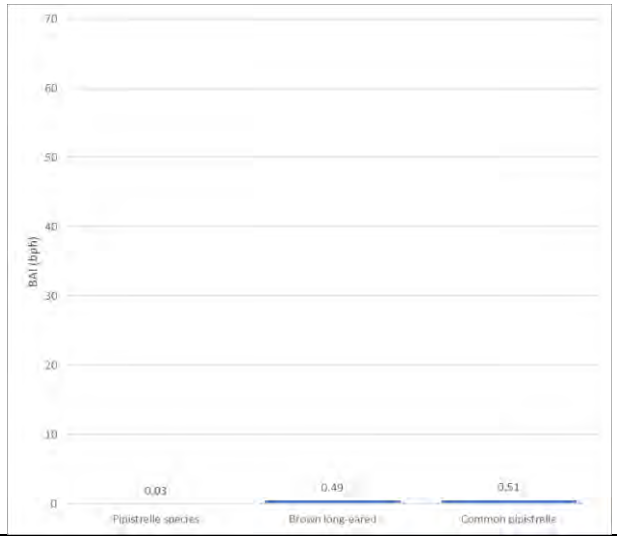
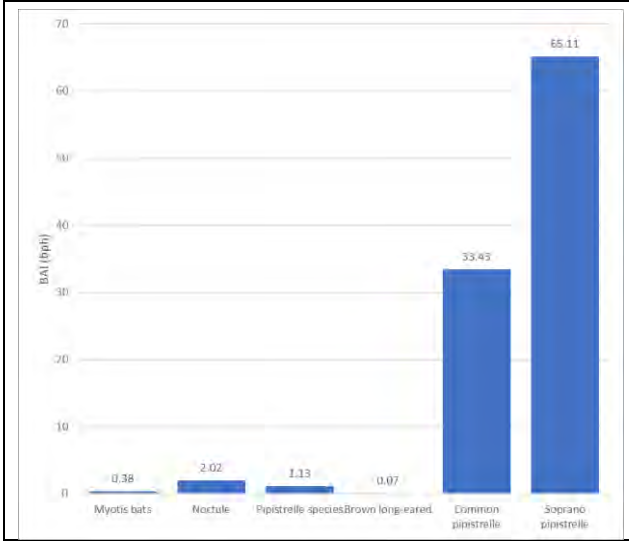
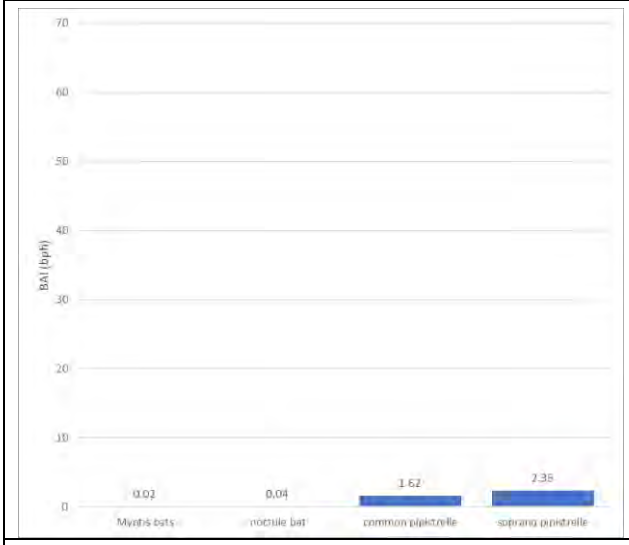
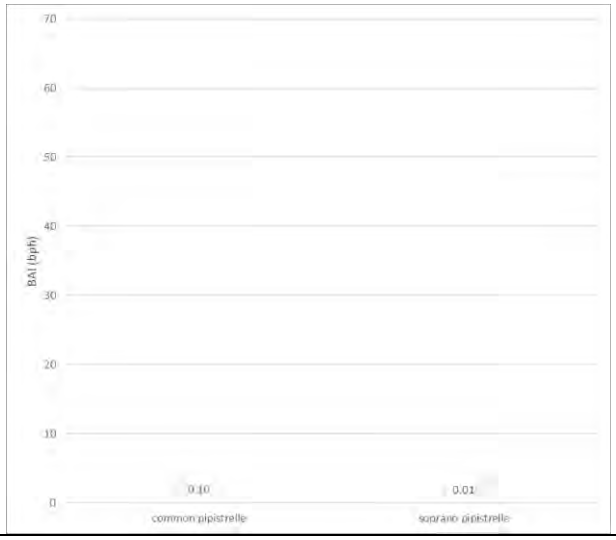
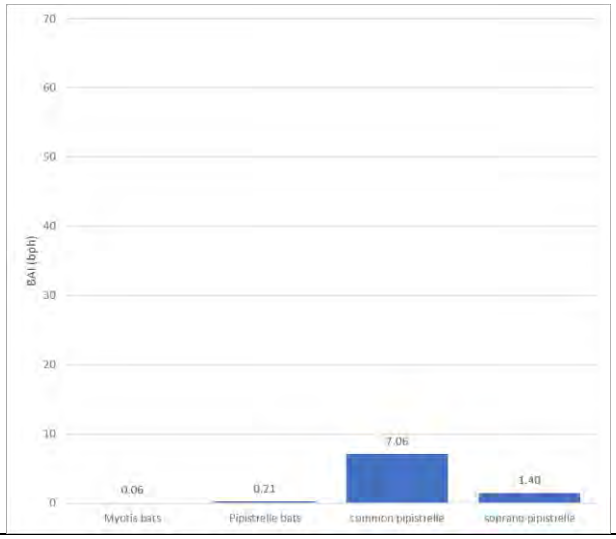
	
South_Static B (Visit 7):	**South_Static B (Visit 8):**
	No data

South_Static C (Visit 1):	South_Static C (Visit 2):
	
South_Static C (Visit 3):	**South_Static C (Visit 4):**
No data	
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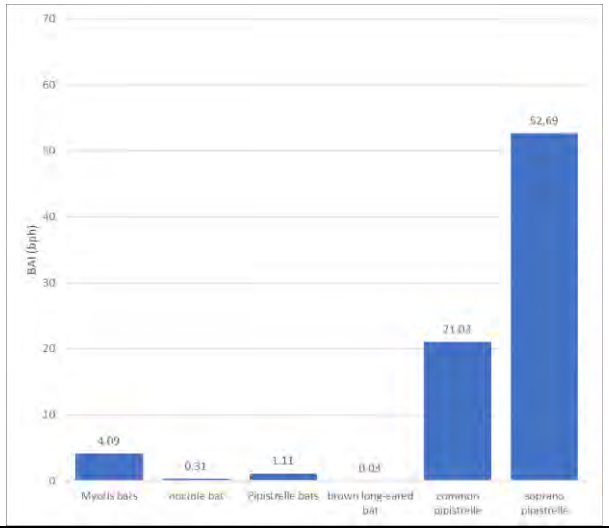
No data	

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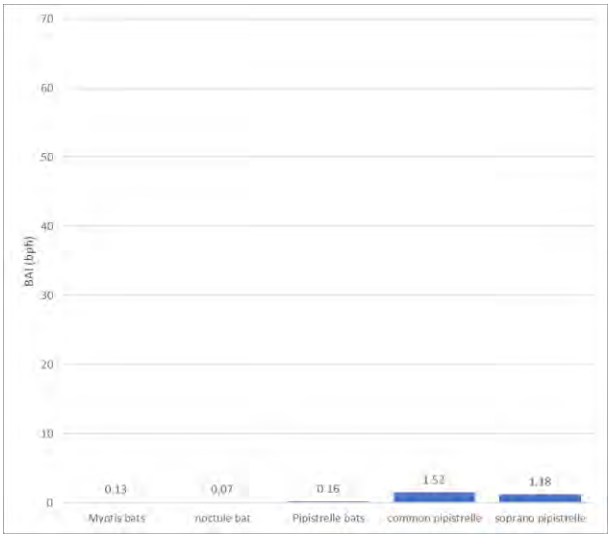
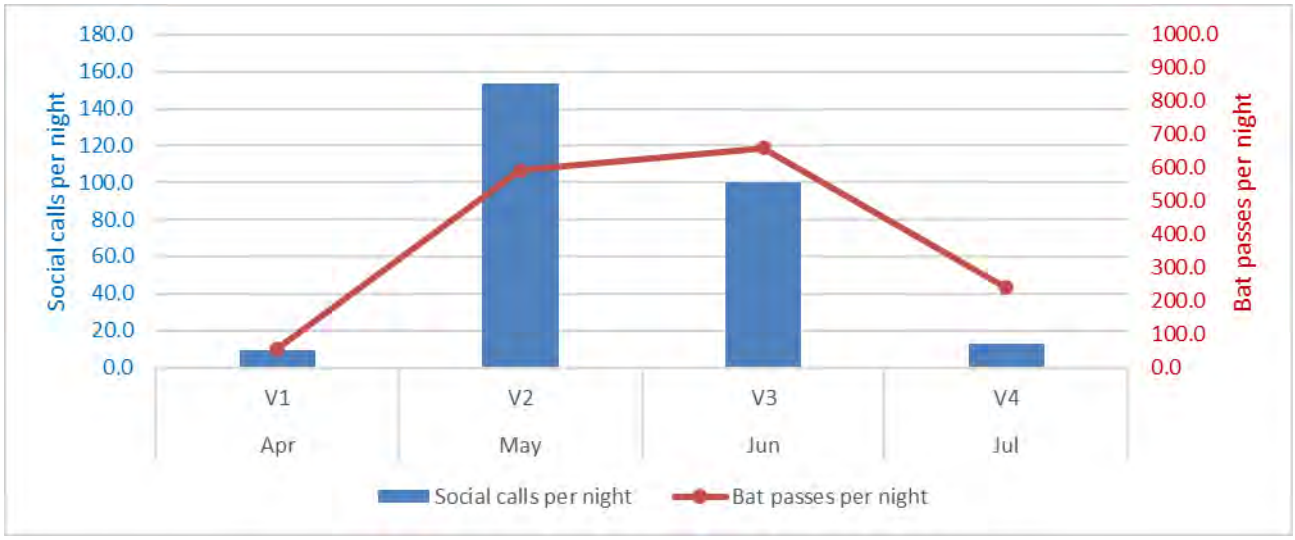
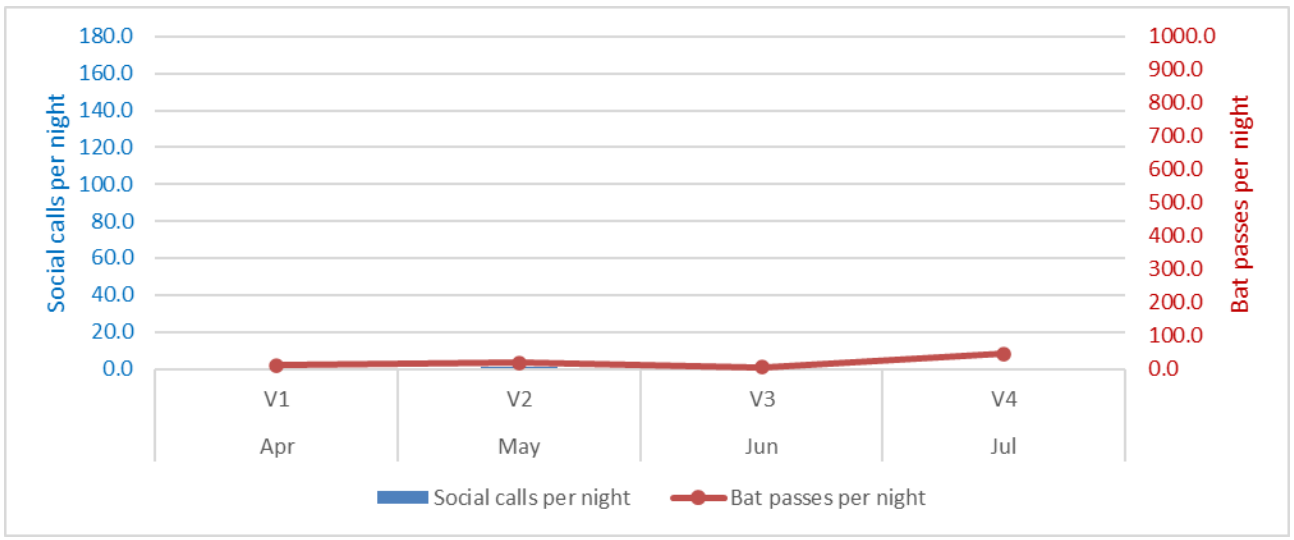
No data	

Seasonal Variation in Bat Social Calls Recorded during Static Monitoring (for entire bat assemblage at all locations)

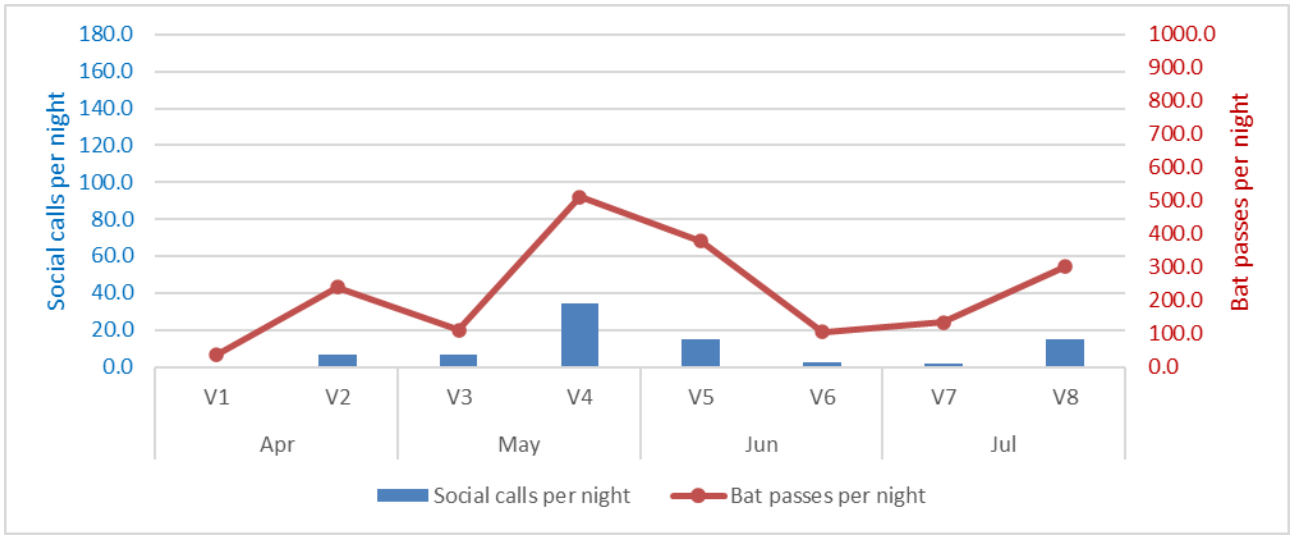
North, Static A:



North, Static B:



South, Static A:



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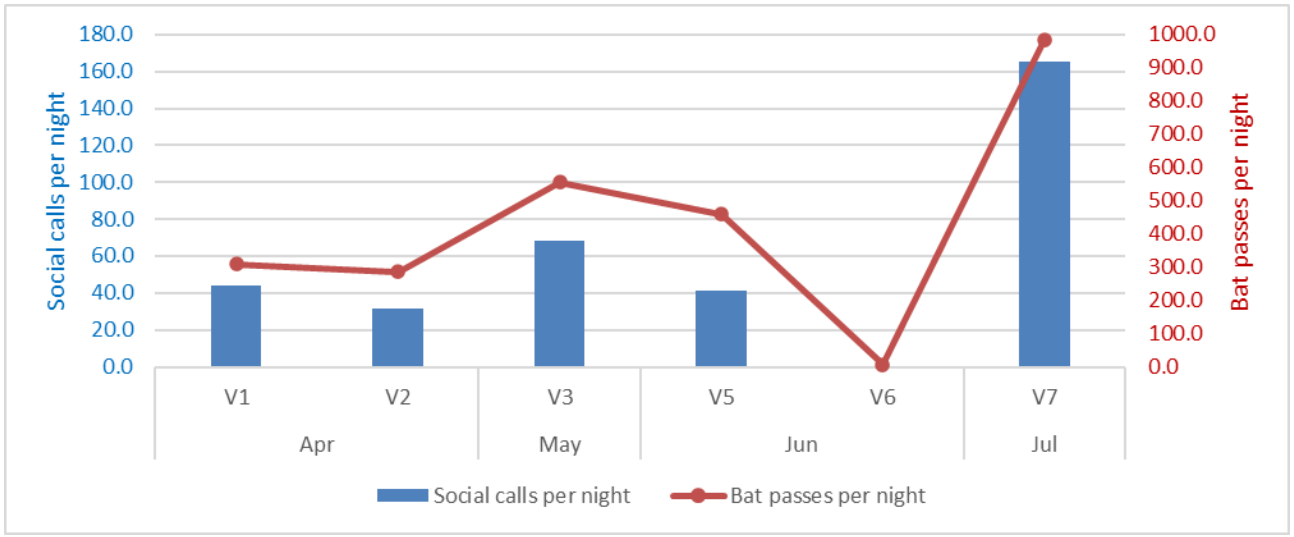
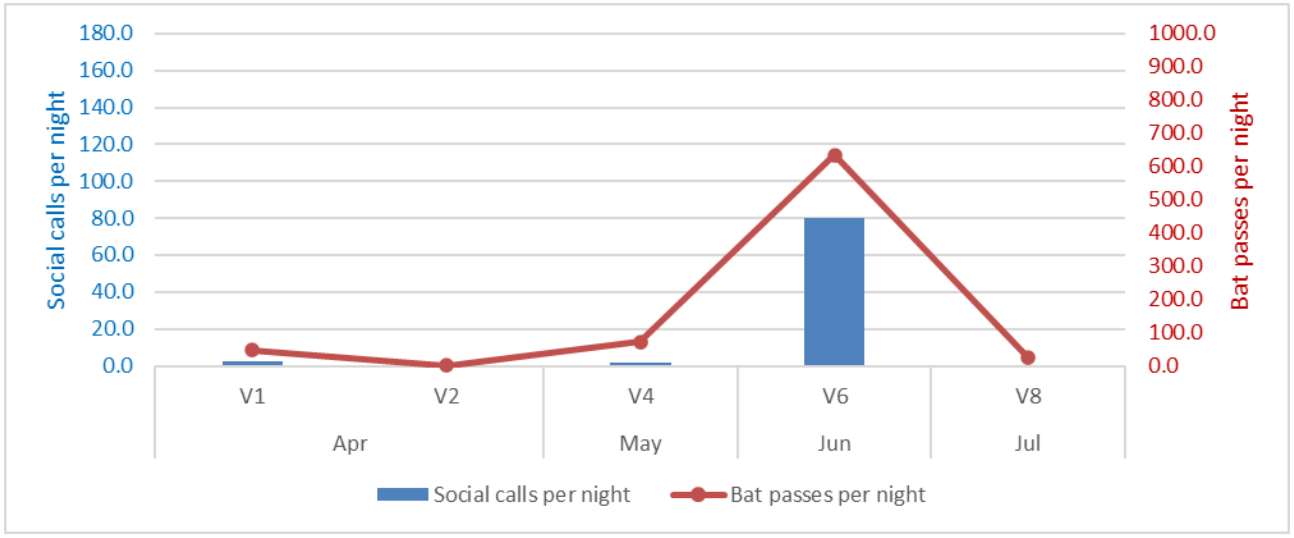
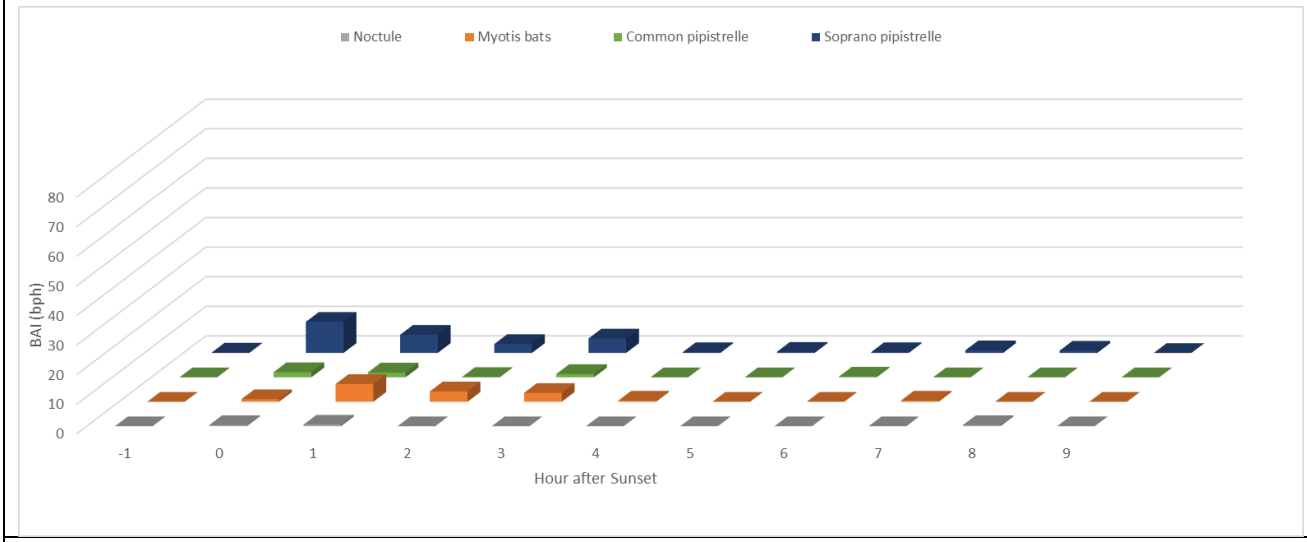


South, Static C:

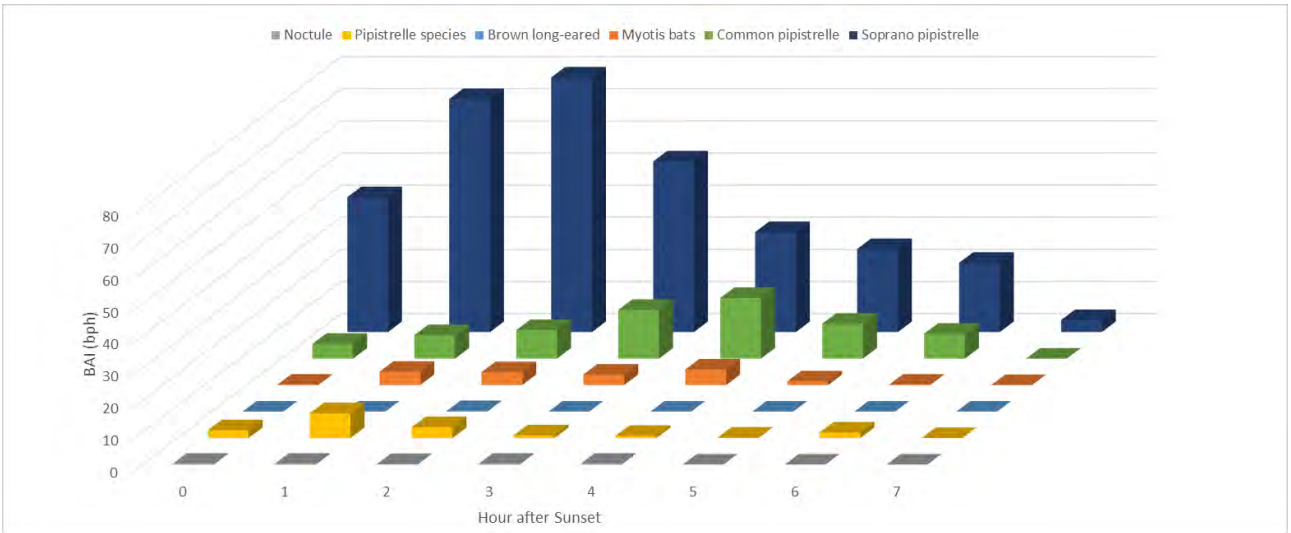


Average Nightly Activity Pattern for each Static Monitoring Locations and Visits (by species/group)

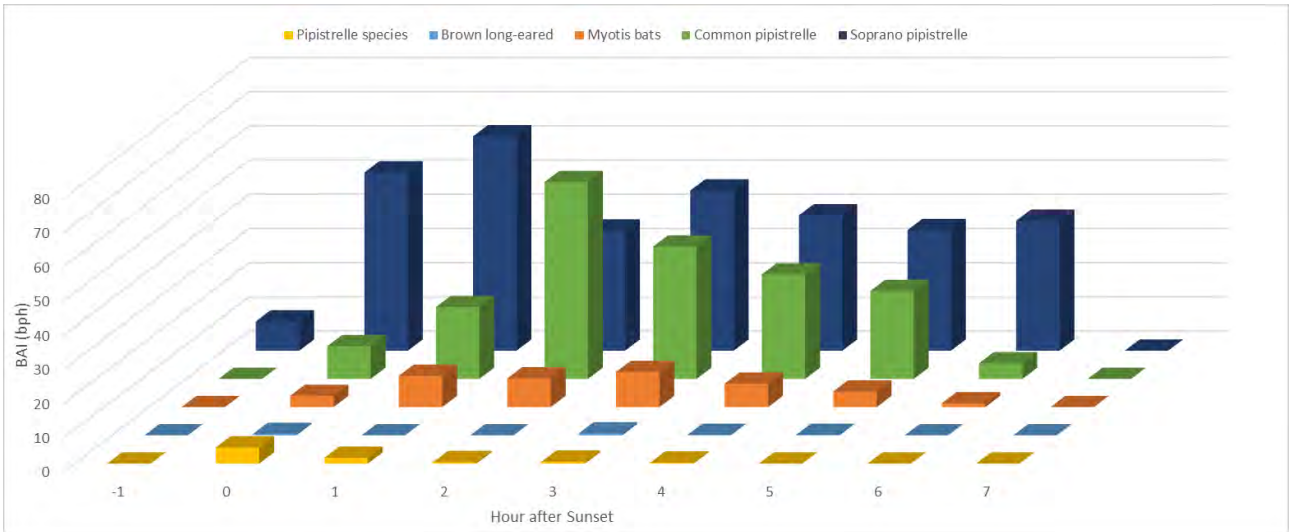
North_Static A_ (Visit 1):



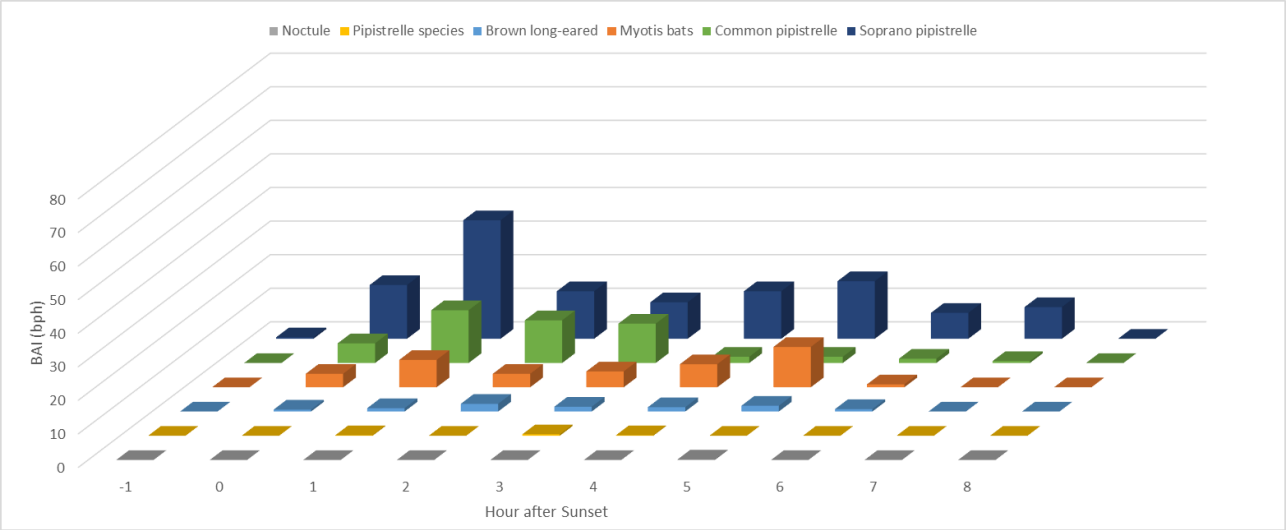
North_Static A_ (Visit 2):



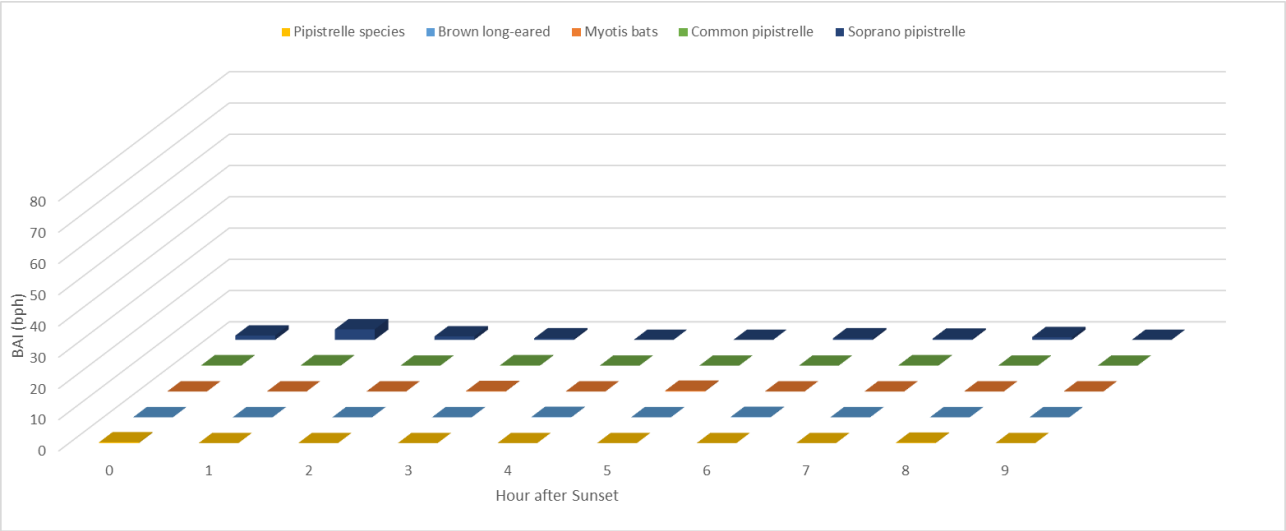
North_Static A_ (Visit 3):



North_Static A_ (Visit 4):



North_Static B_ (Visit 1):



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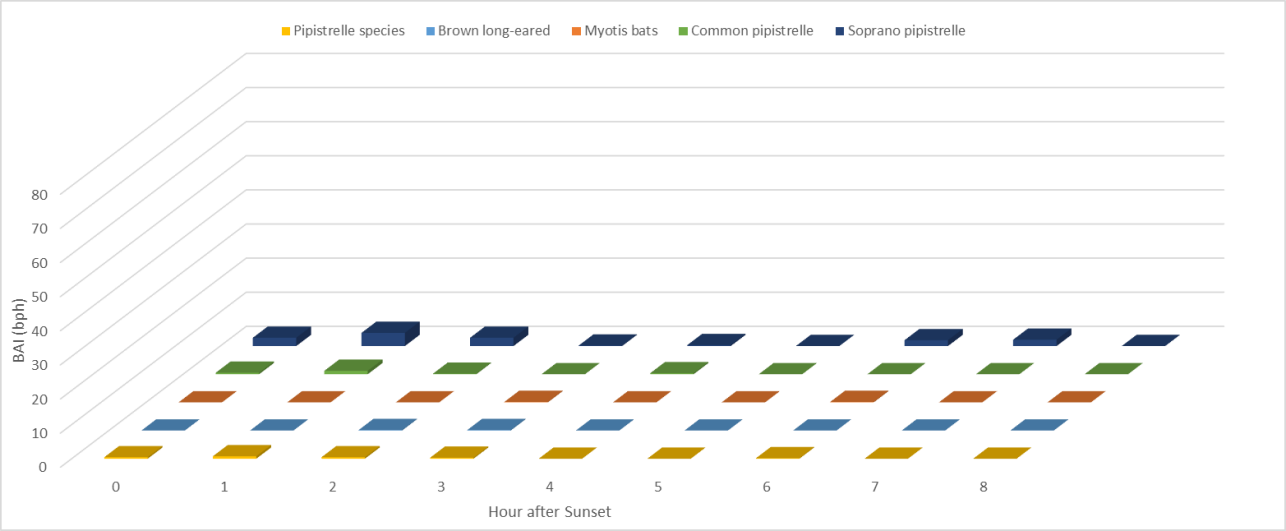

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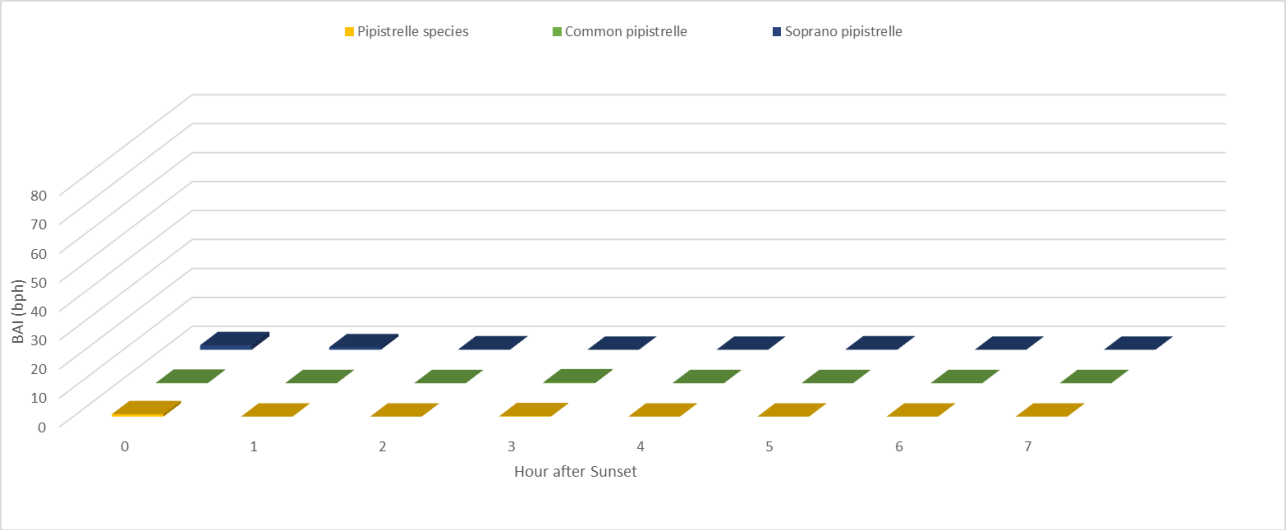

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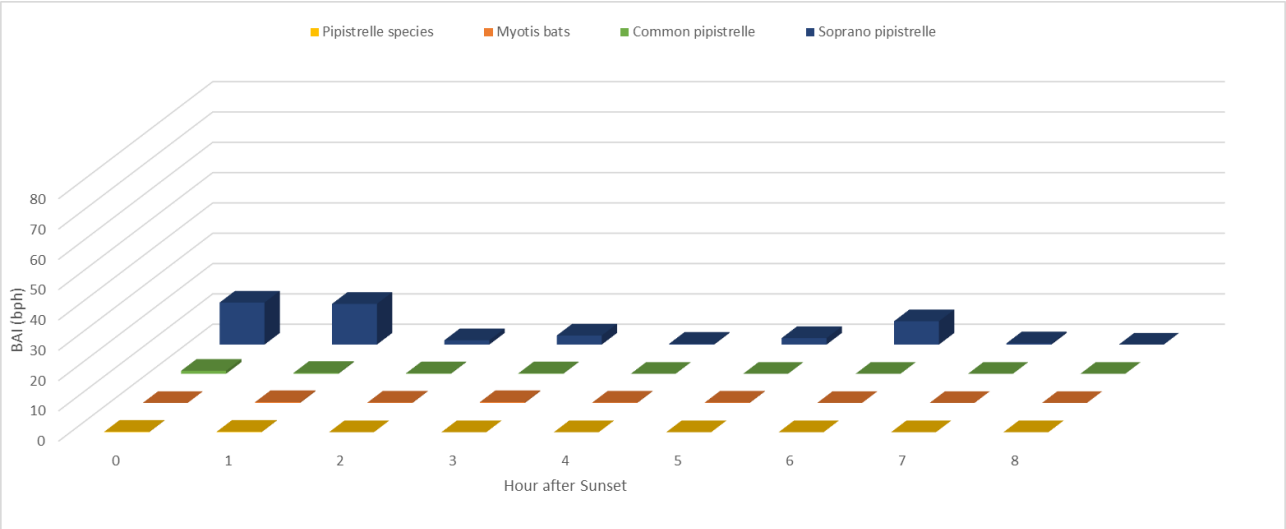
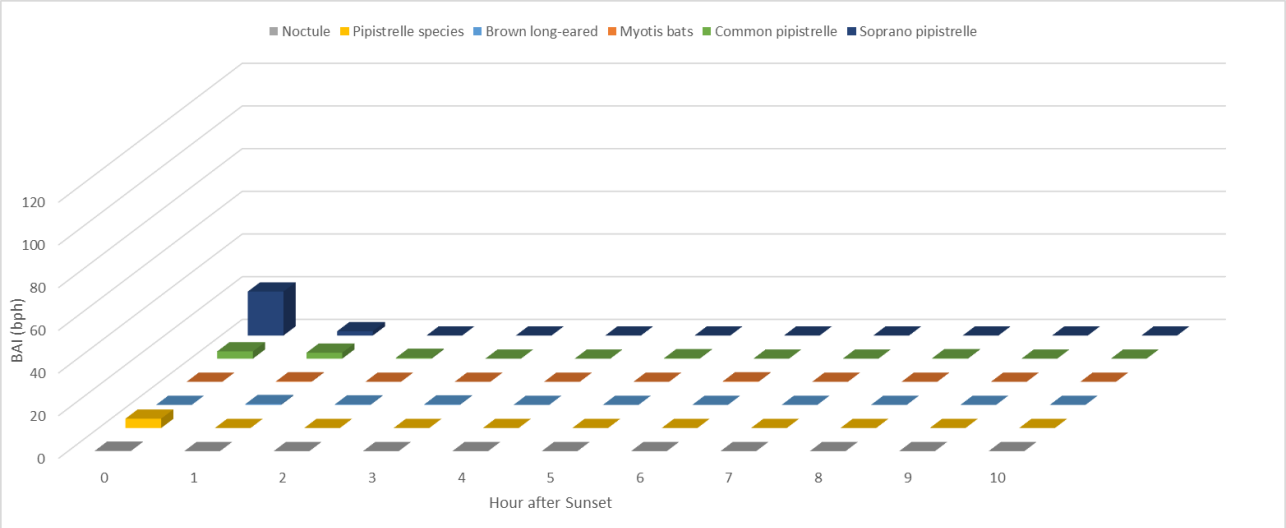


South_Static A_ (Visit 1):



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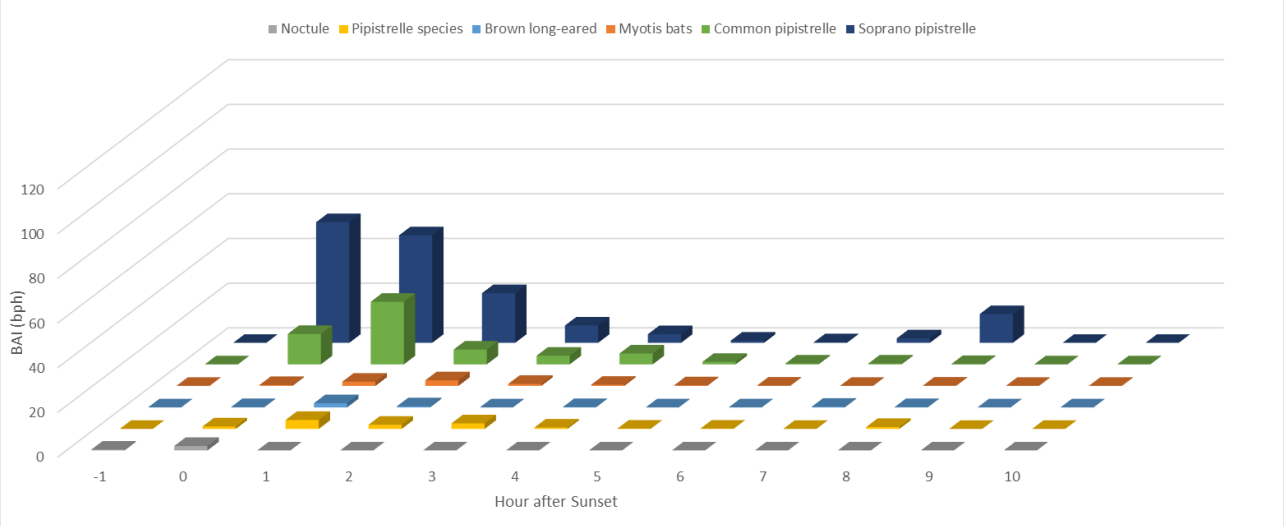

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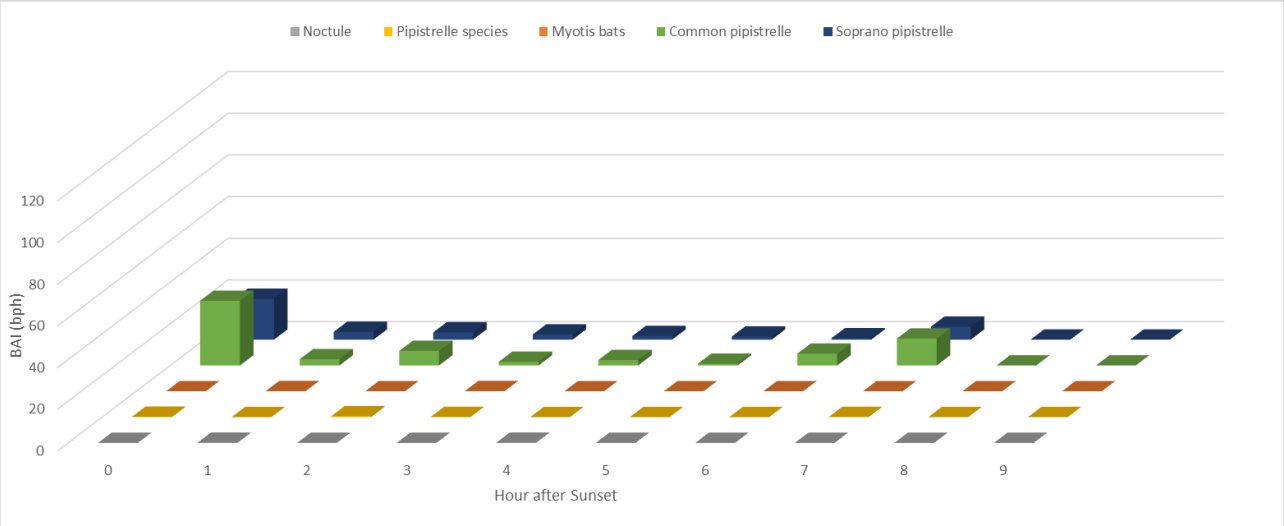

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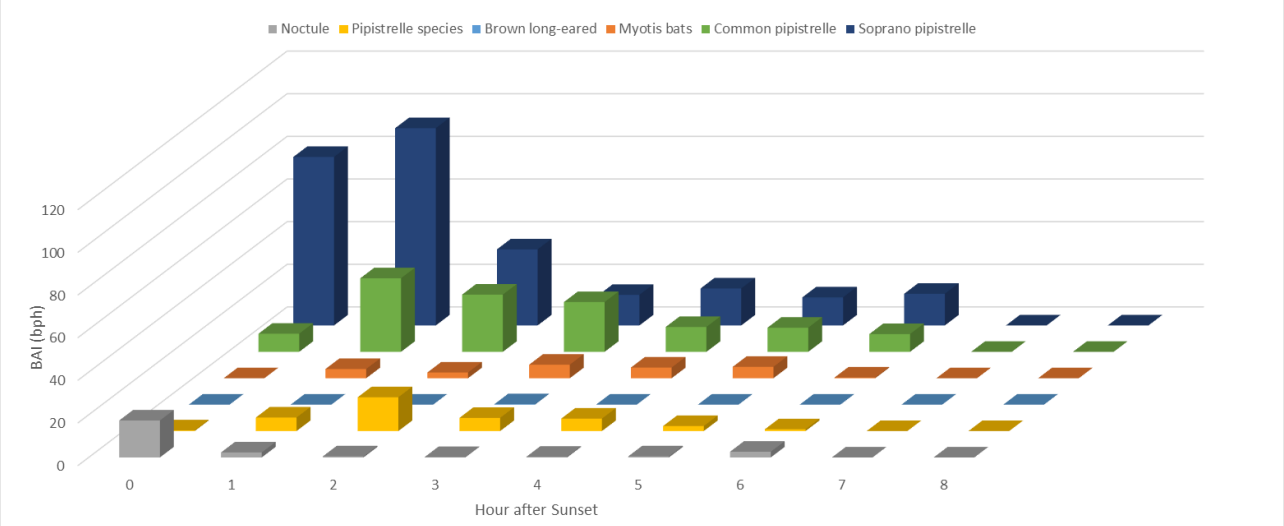
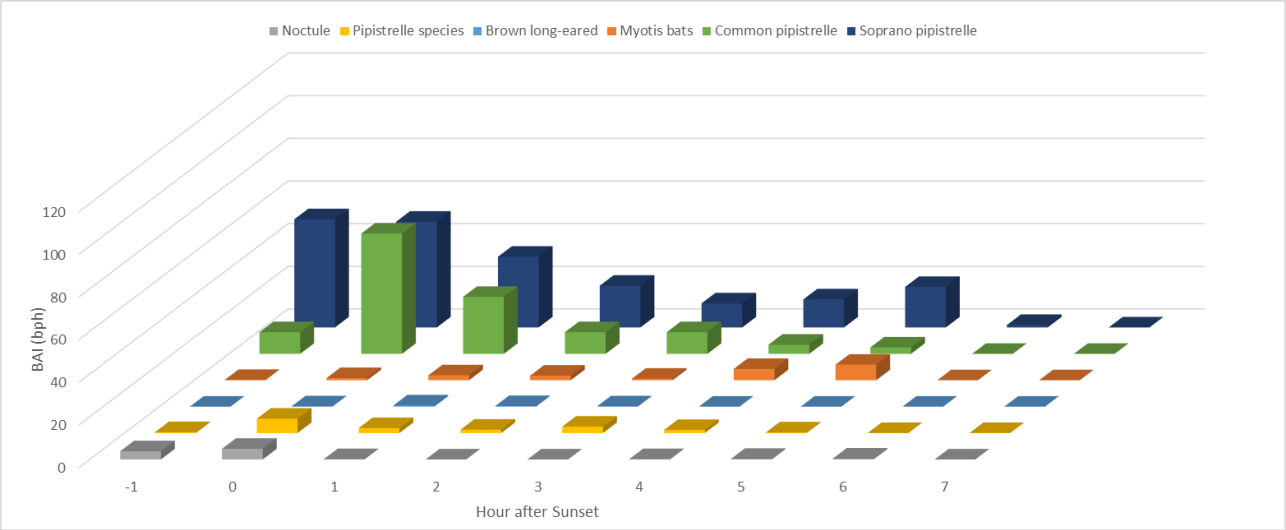
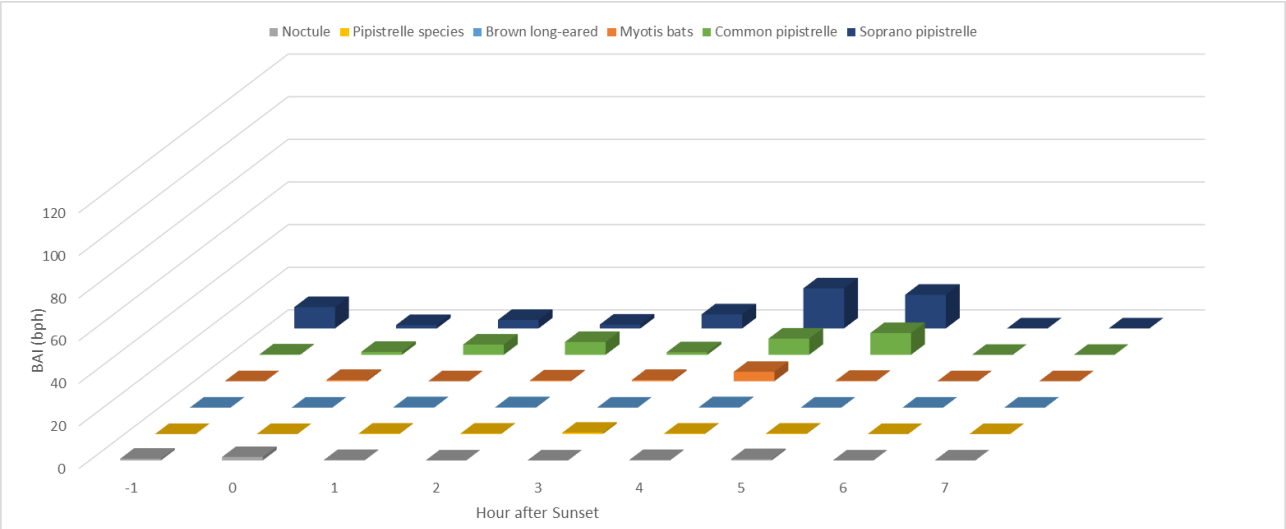


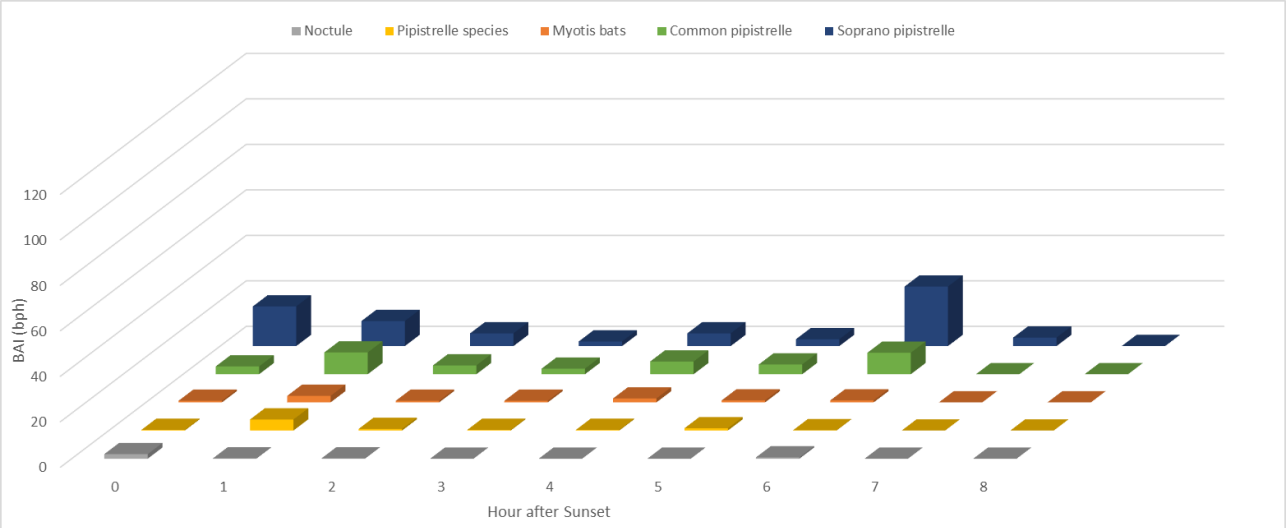
South_Static A_ (Visit 5):



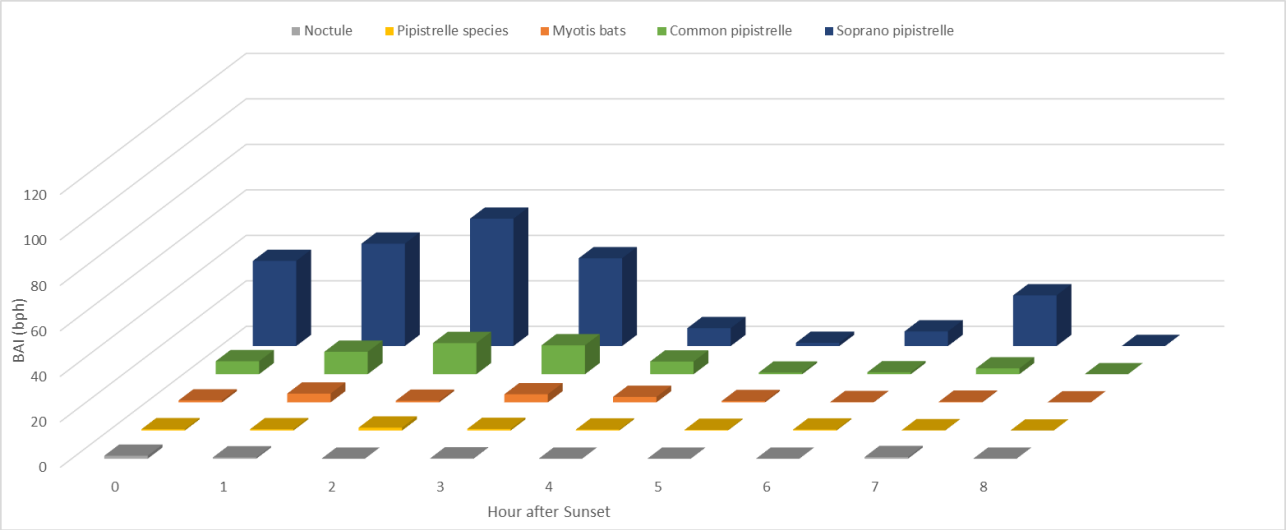
South_Static A_ (Visit 6):



South_Static A_ (Visit 7):



South_Static A_ (Visit 8):



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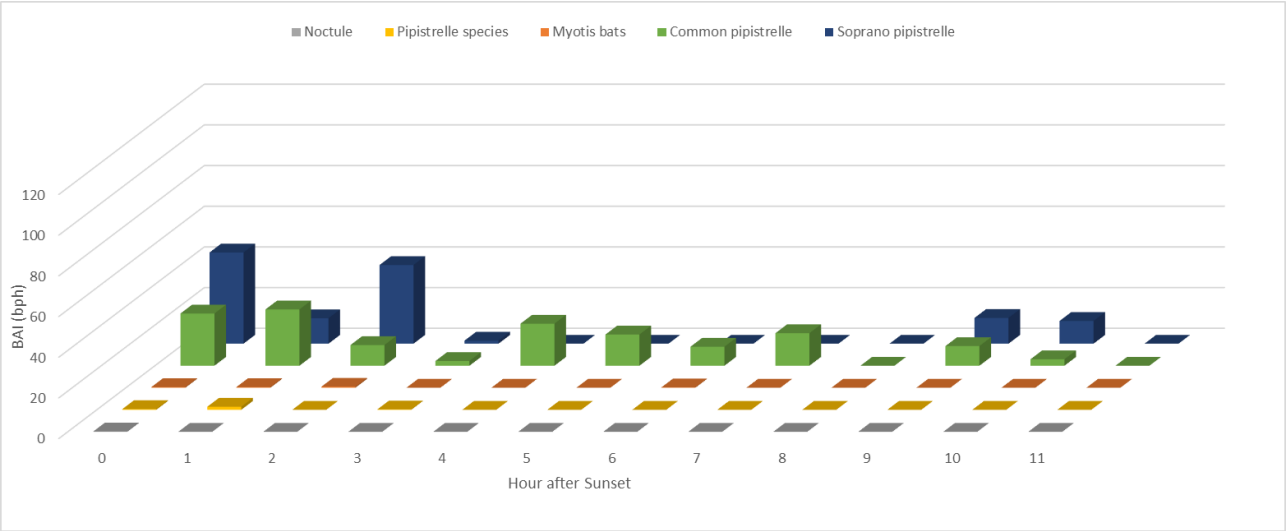

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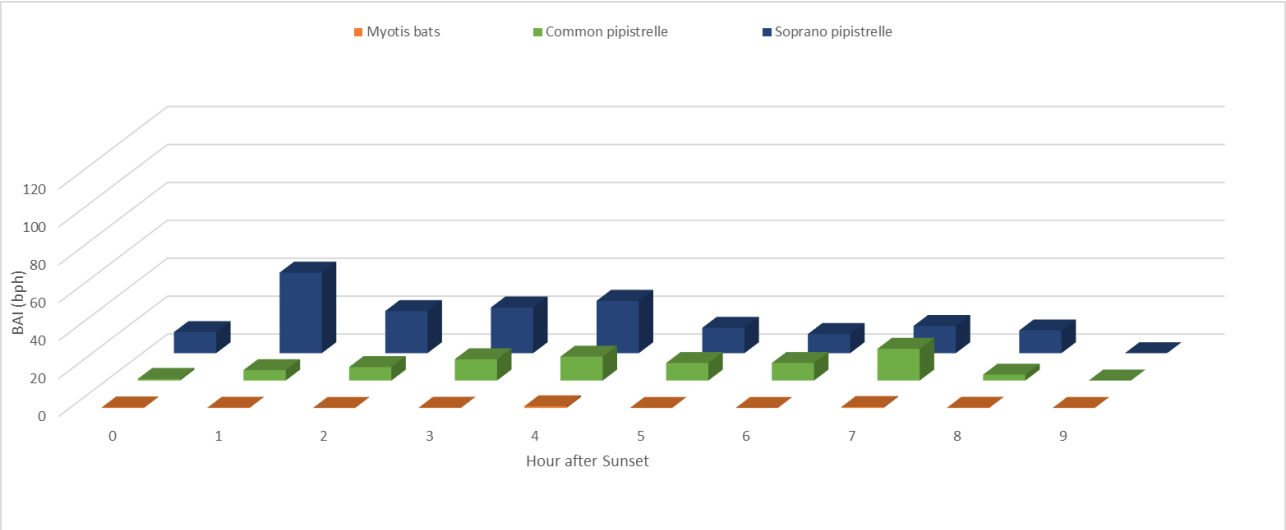

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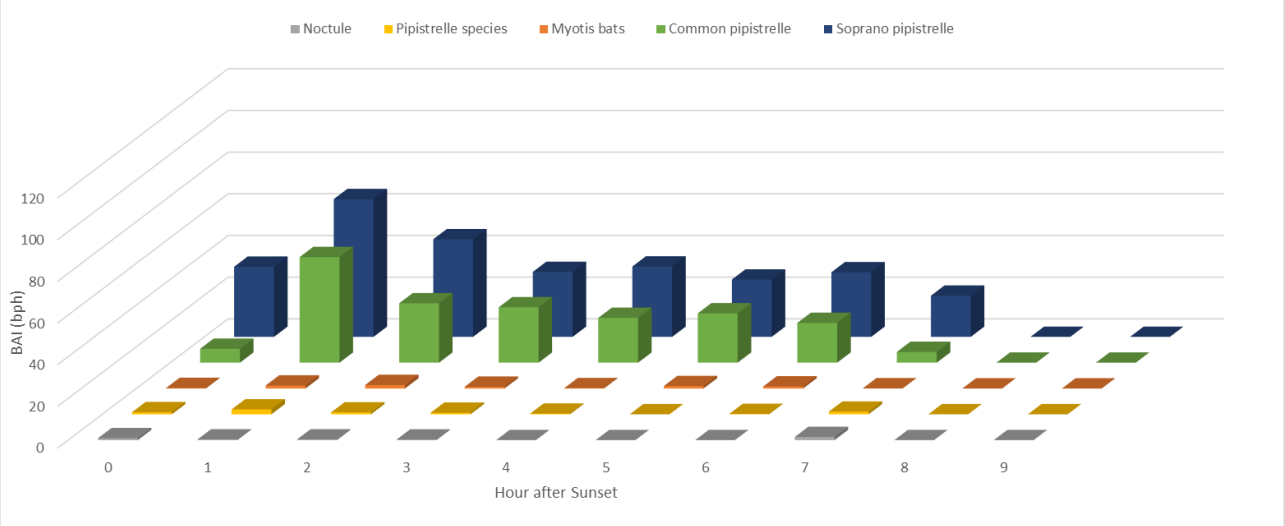

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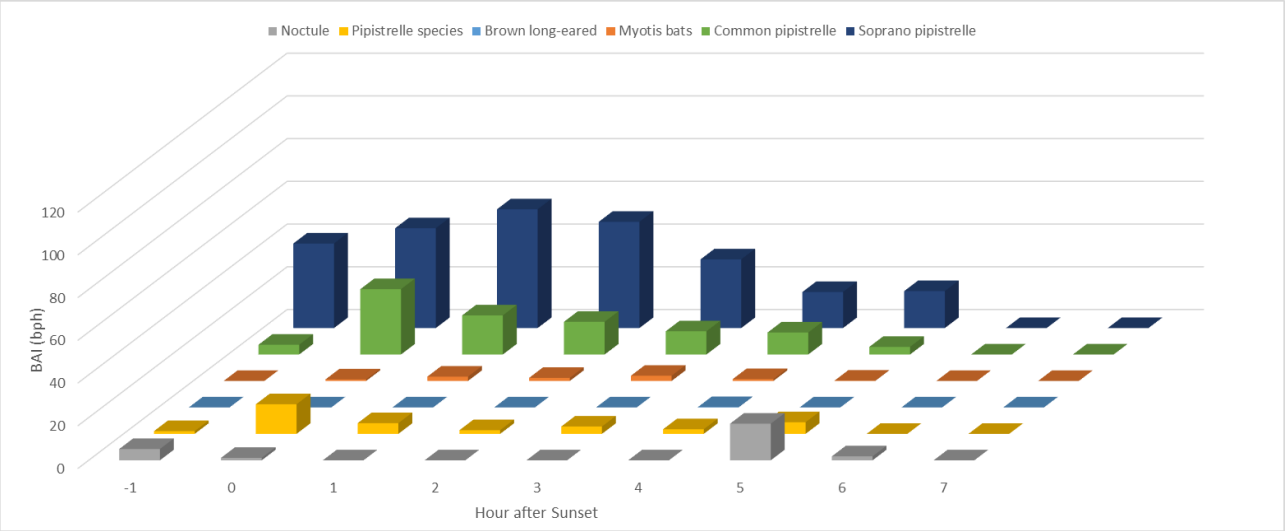

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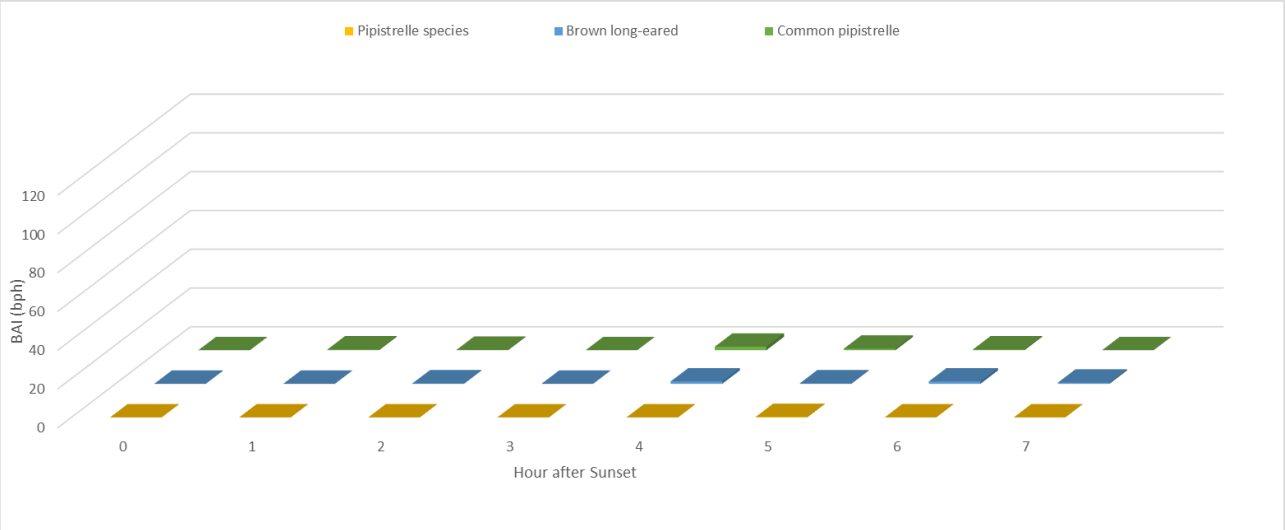

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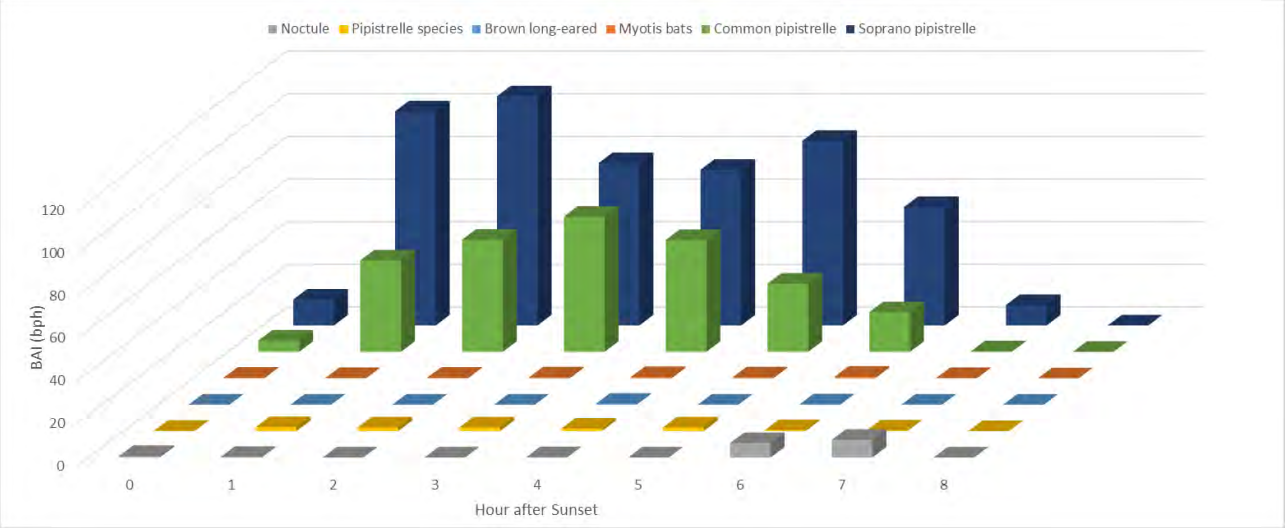

South_Static B_ (Visit 8):

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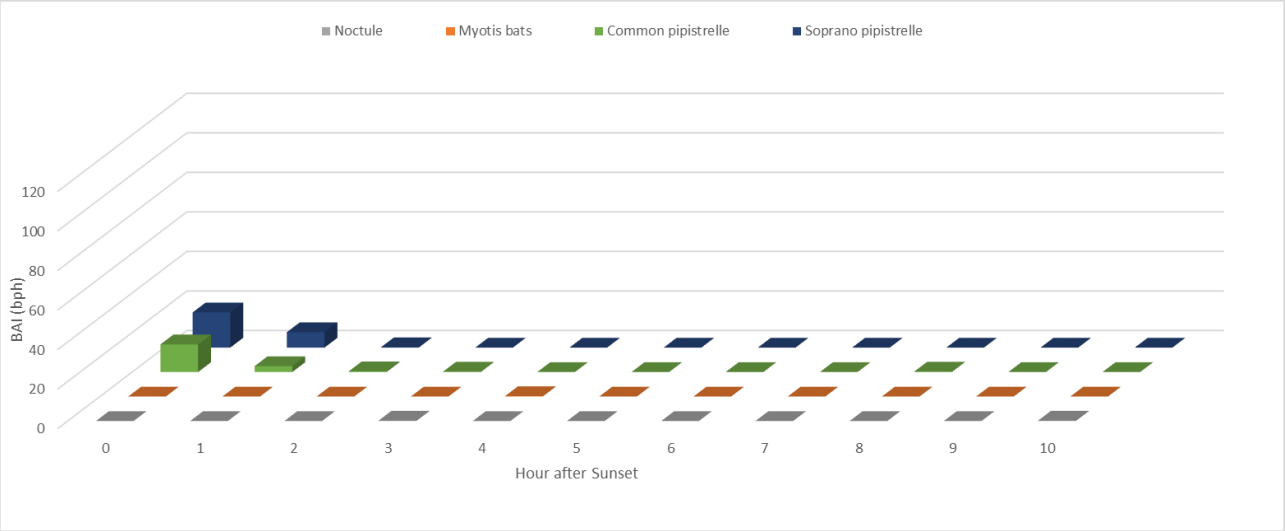

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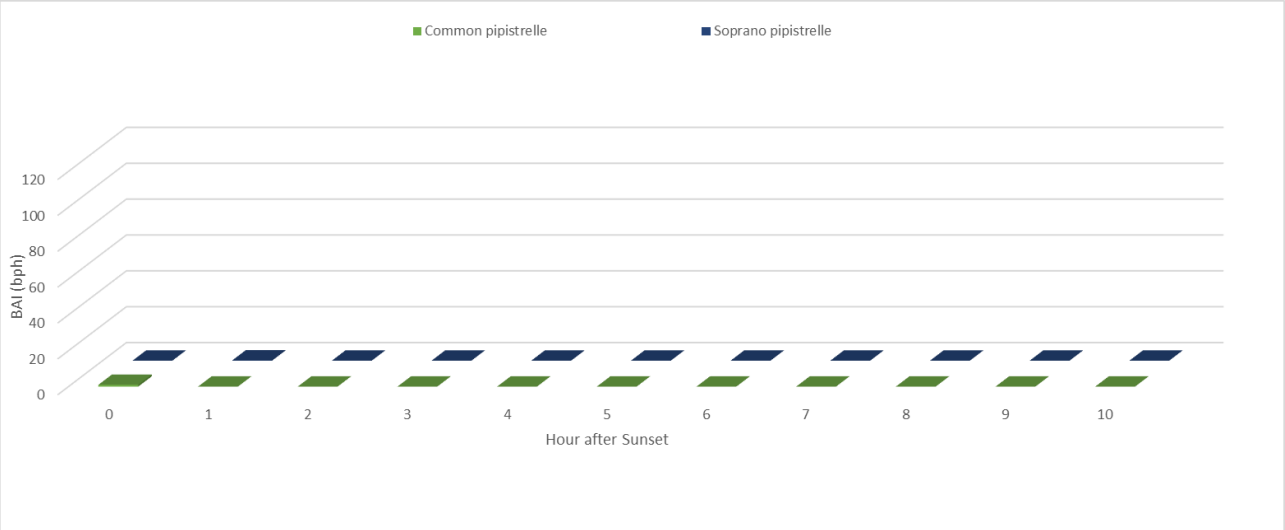

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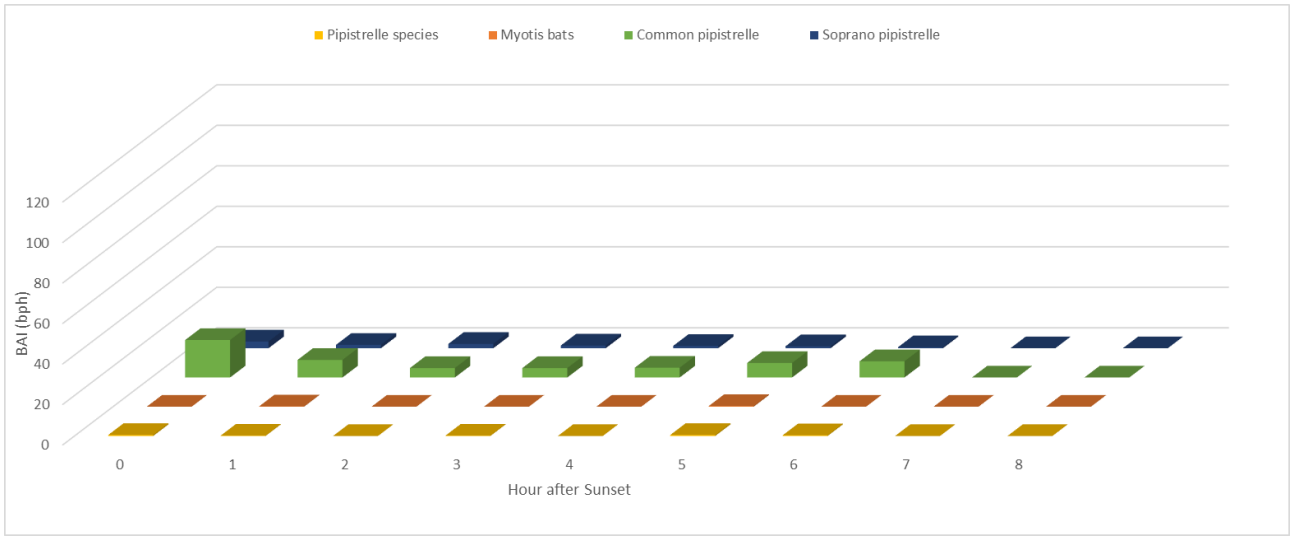

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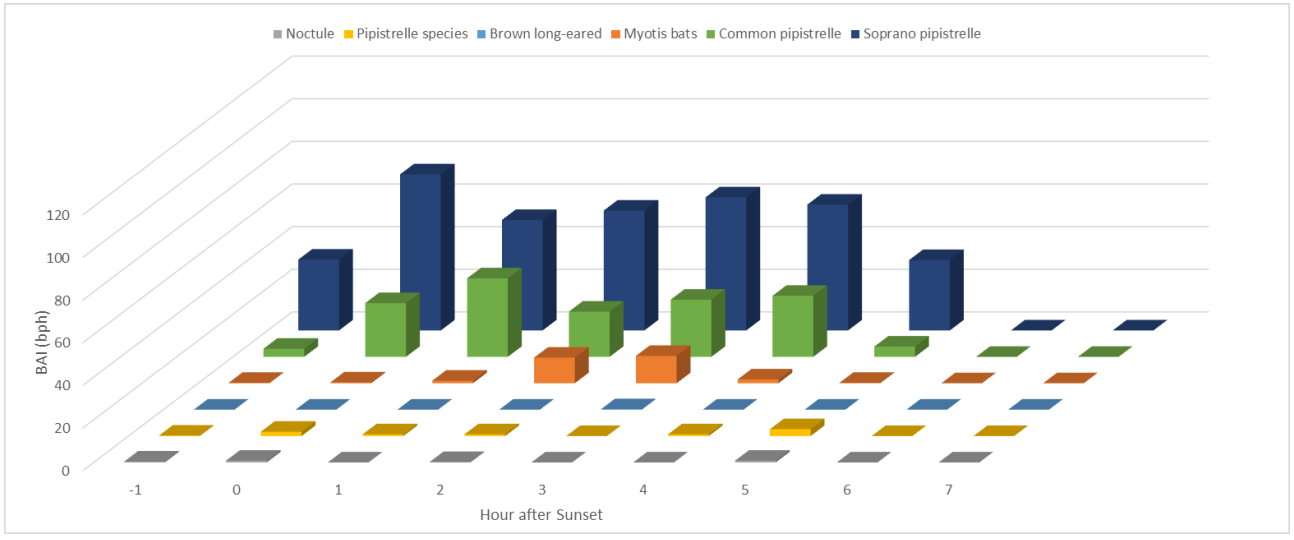

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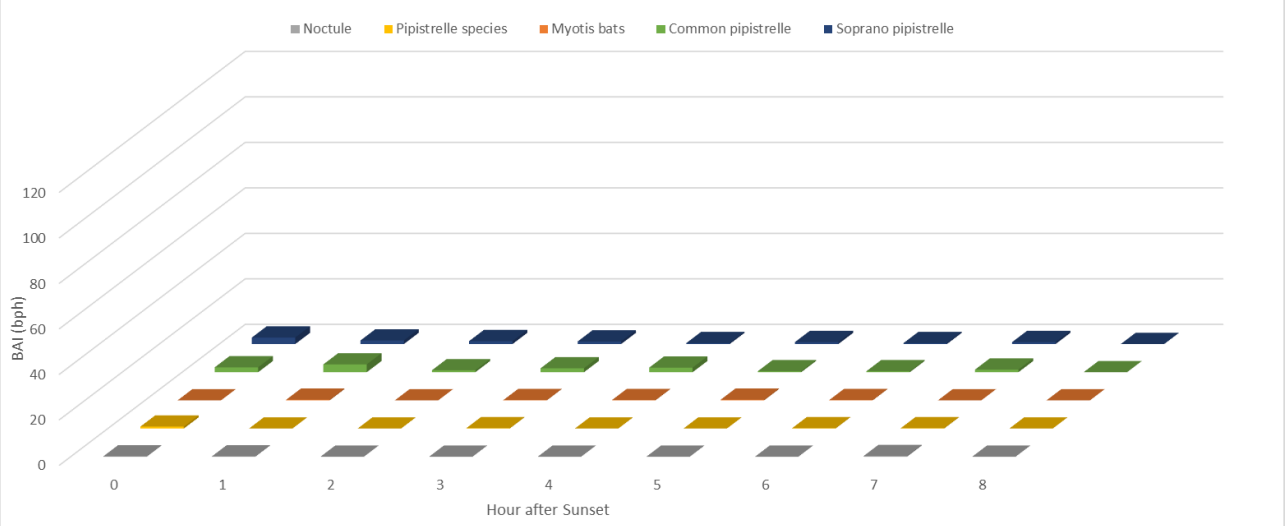
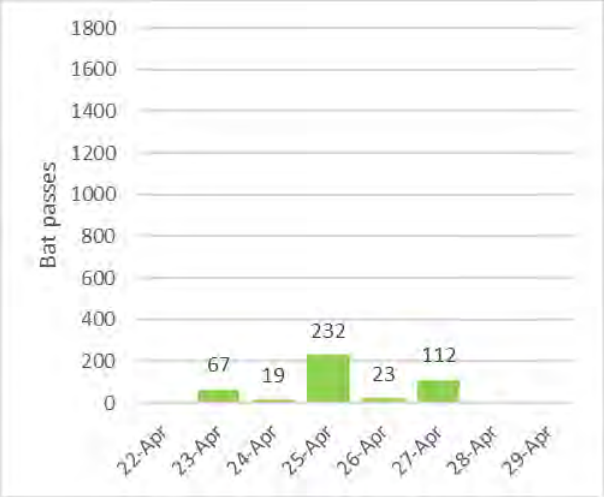


Nightly Bat Activity for each Static Monitoring Locations and Visits (bat passes)

North_Static A (Visit 1):



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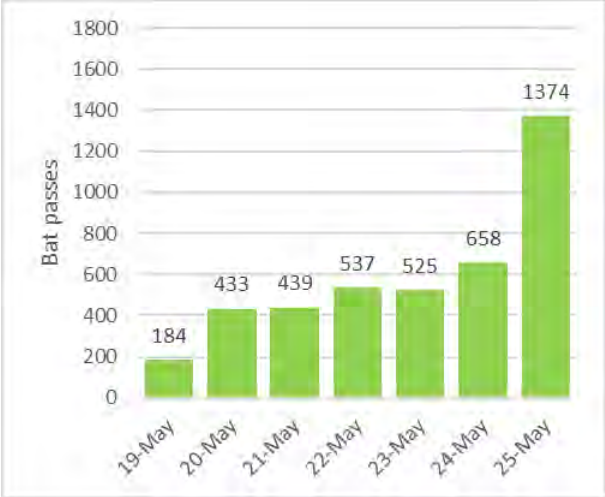

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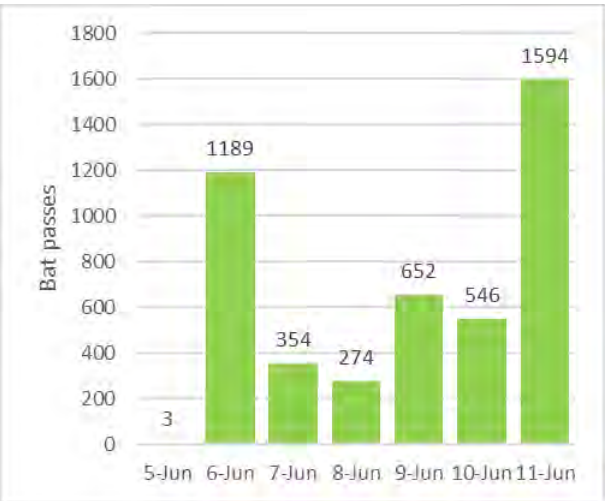

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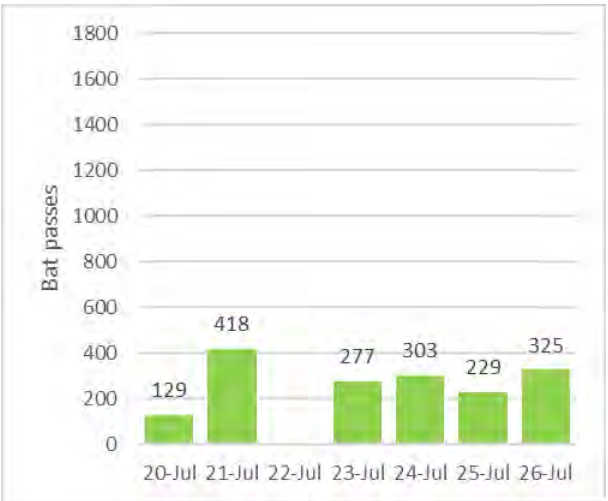

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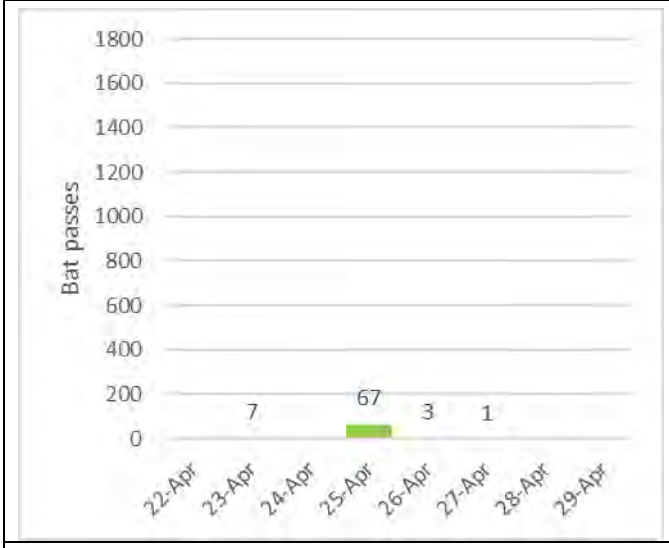

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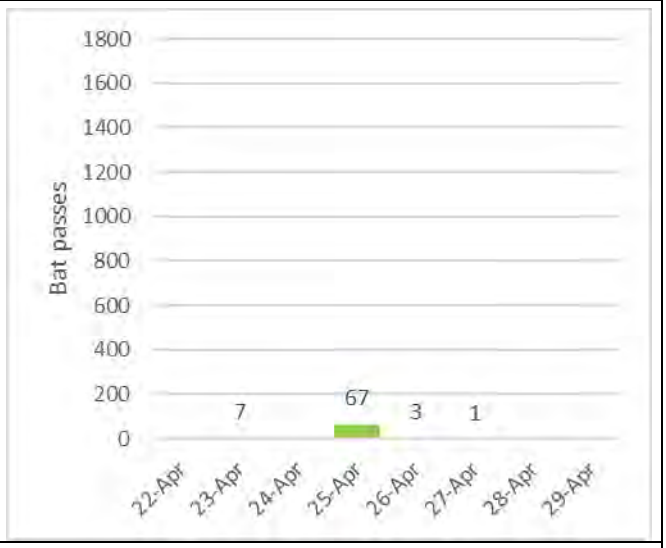

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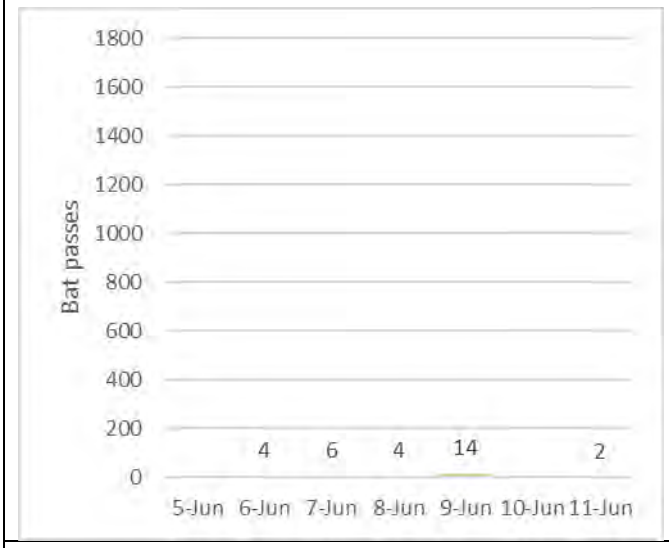

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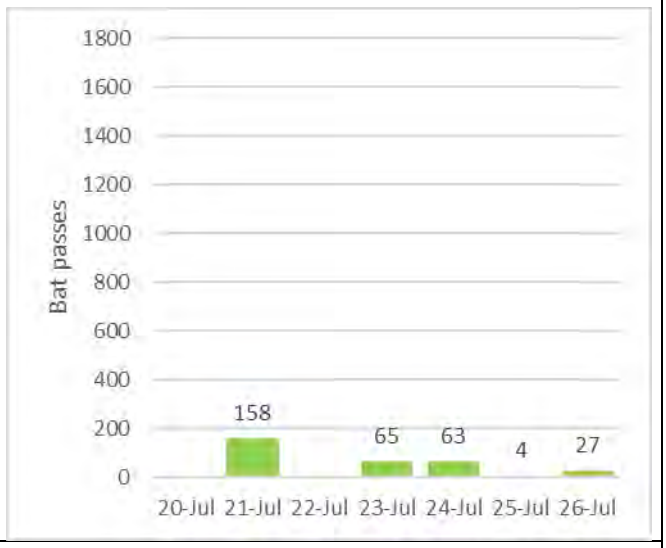
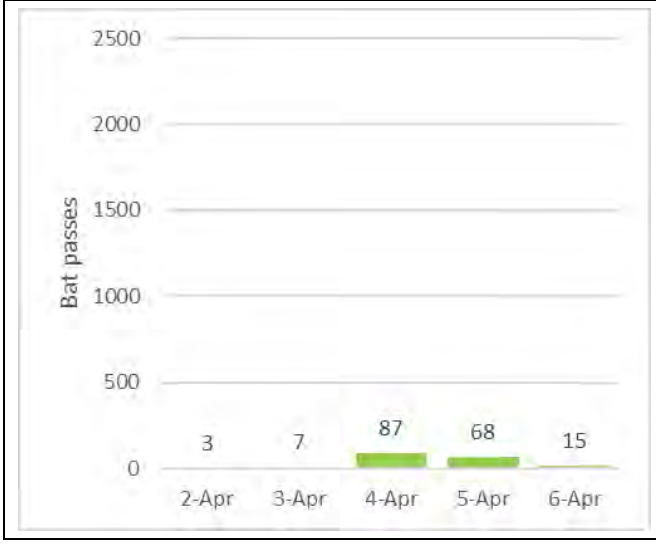


South_Static A (Visit 1):



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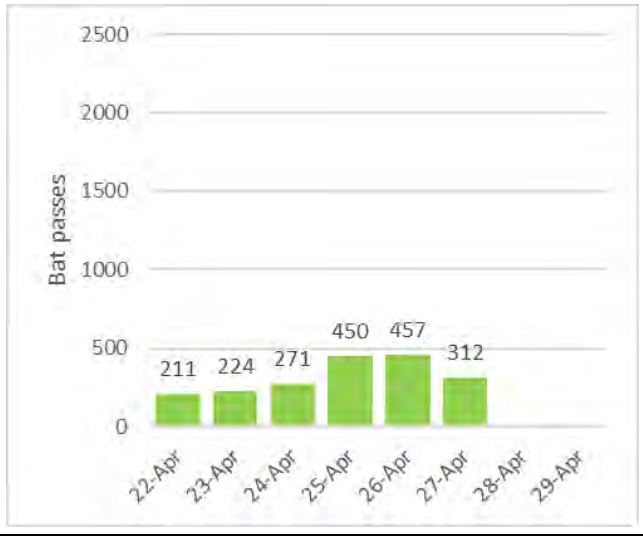

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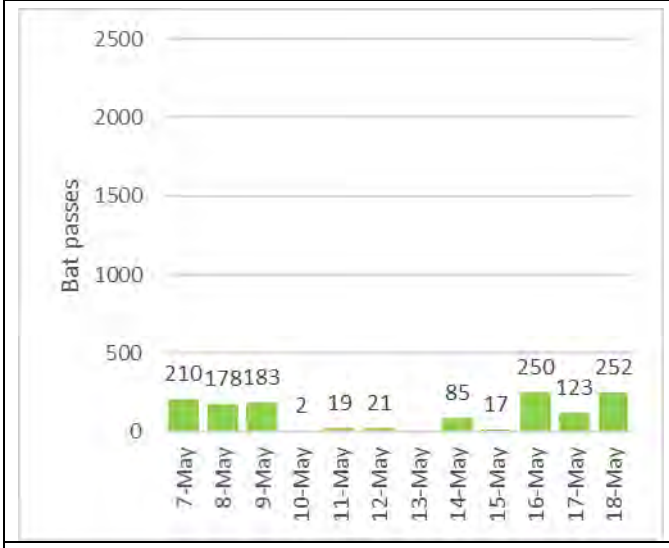

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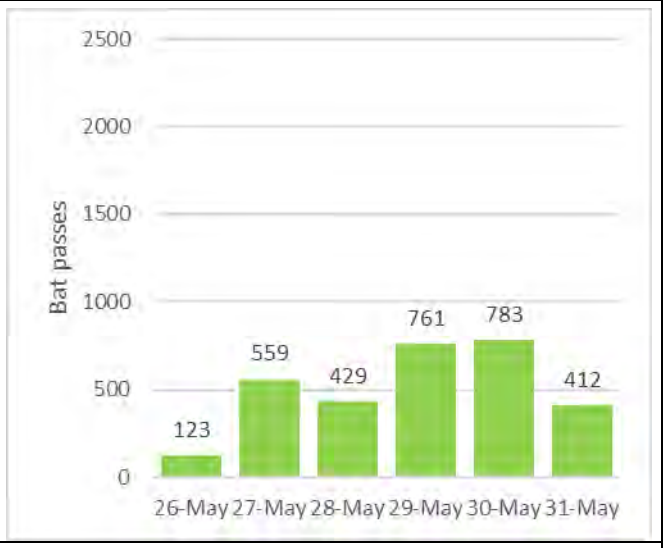
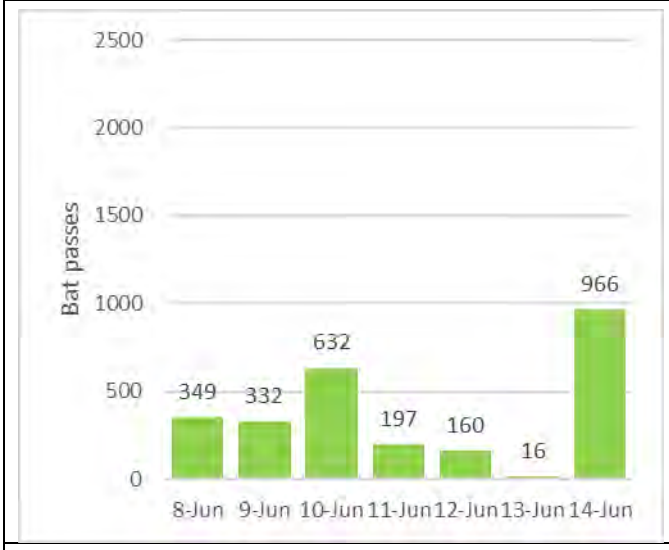


South_Static A (Visit 5):



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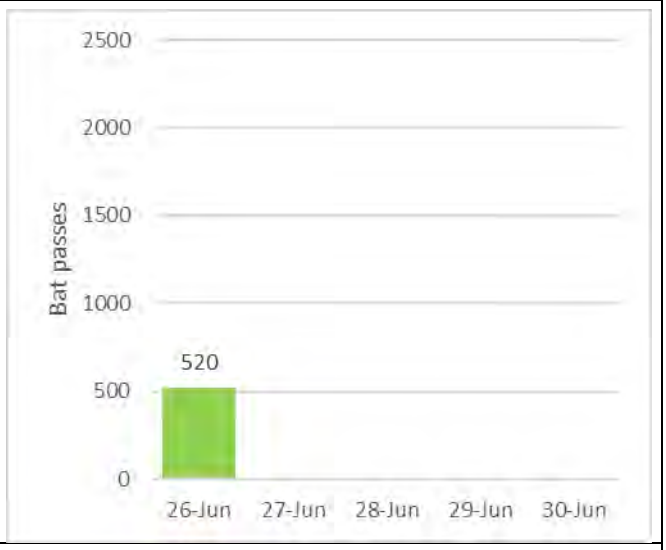
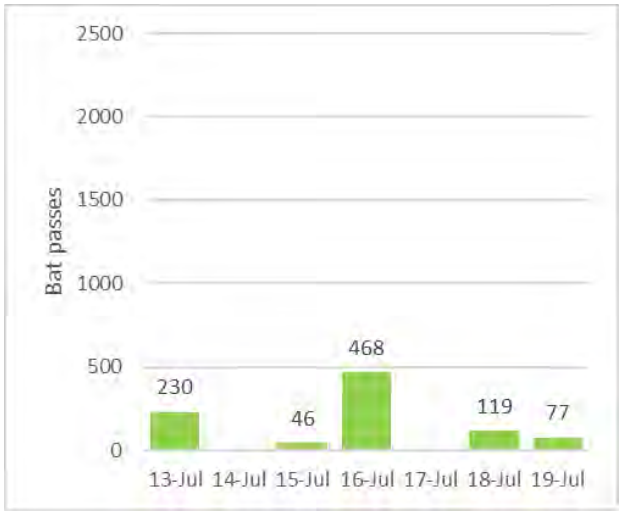
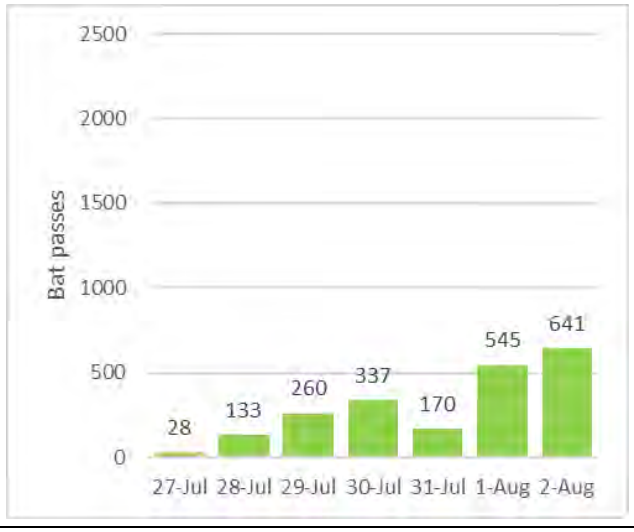


South_Static A (Visit 7):



South_Static A (Visit 8):



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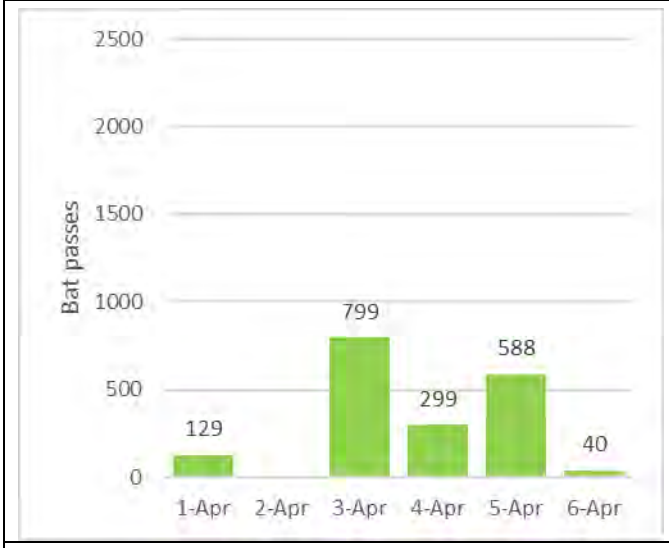

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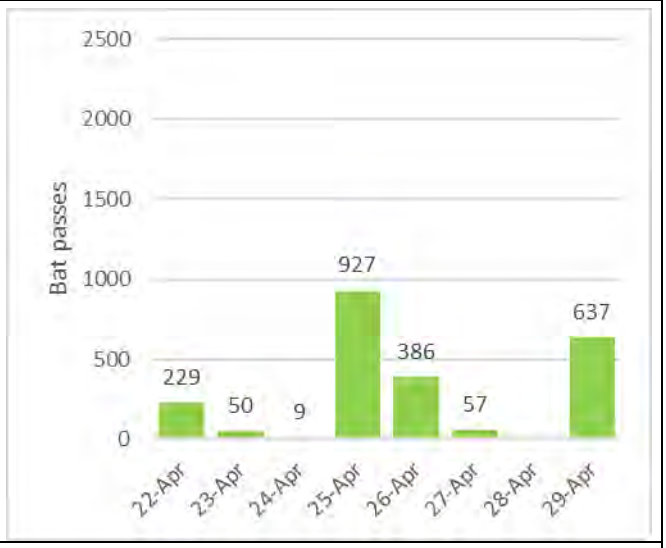

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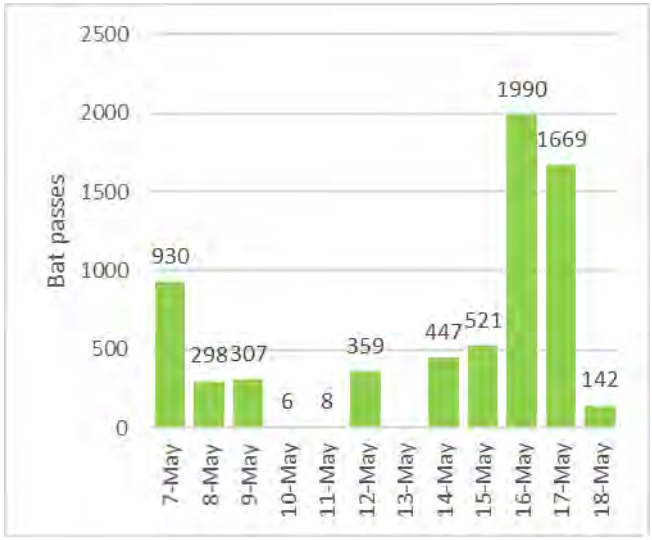

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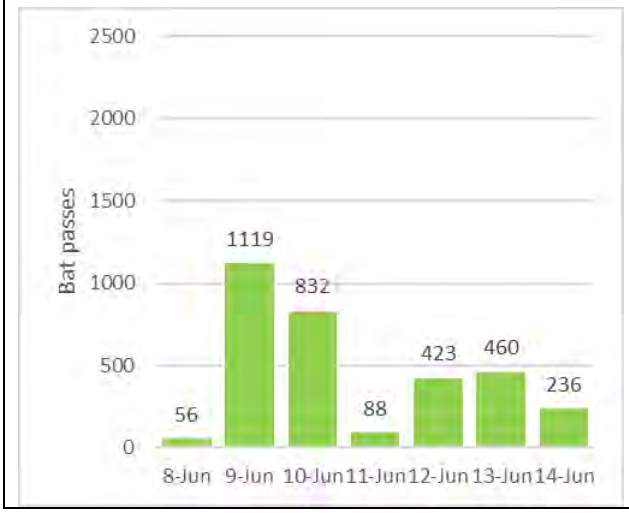

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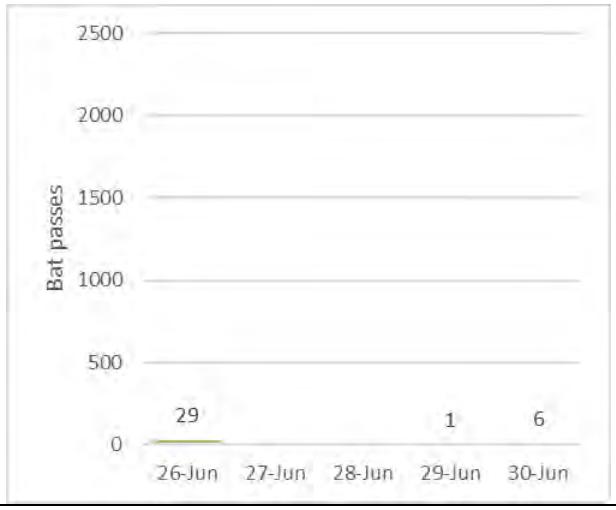

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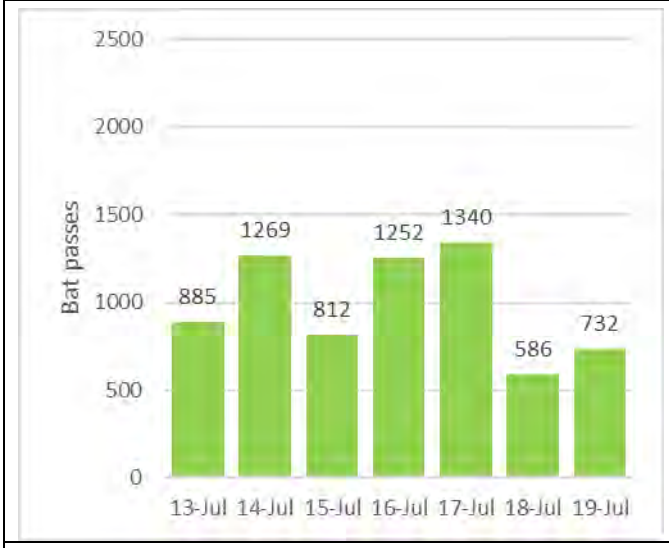	No data
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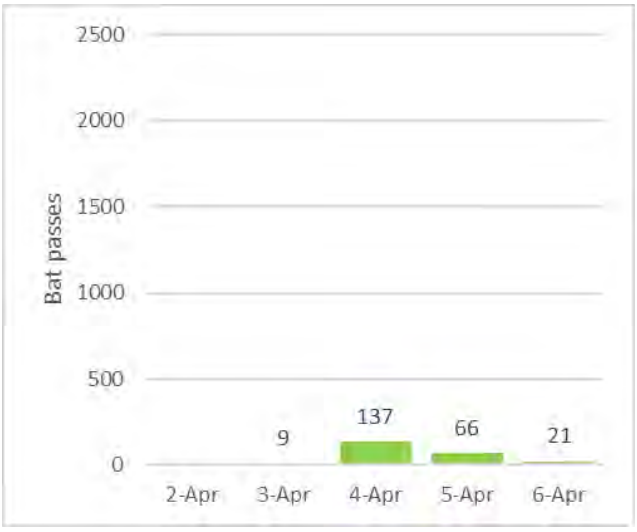	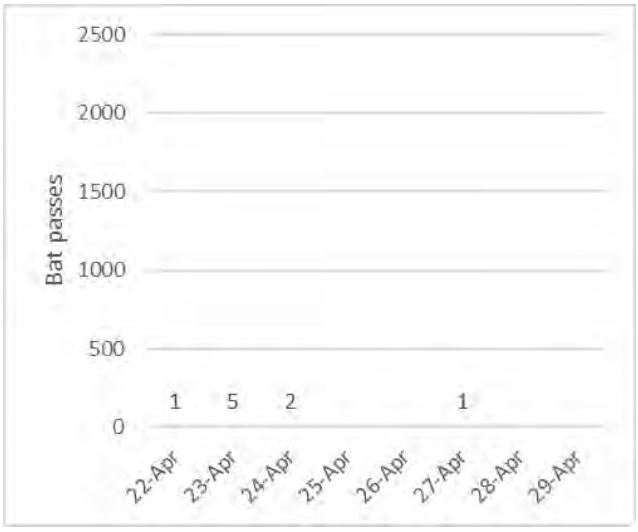
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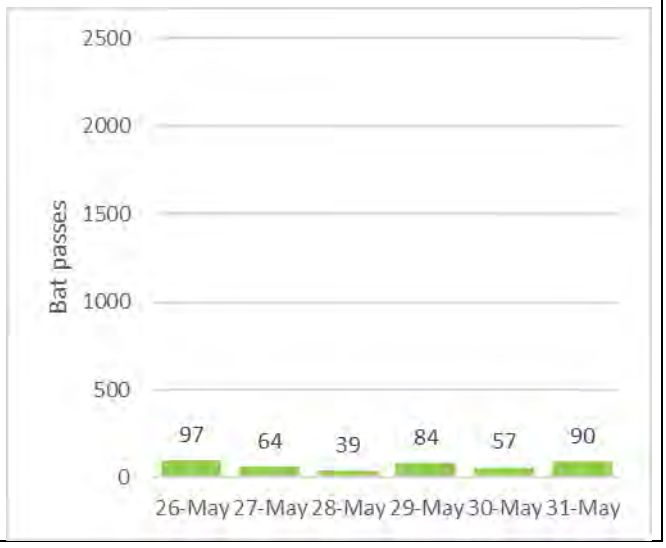
No data	

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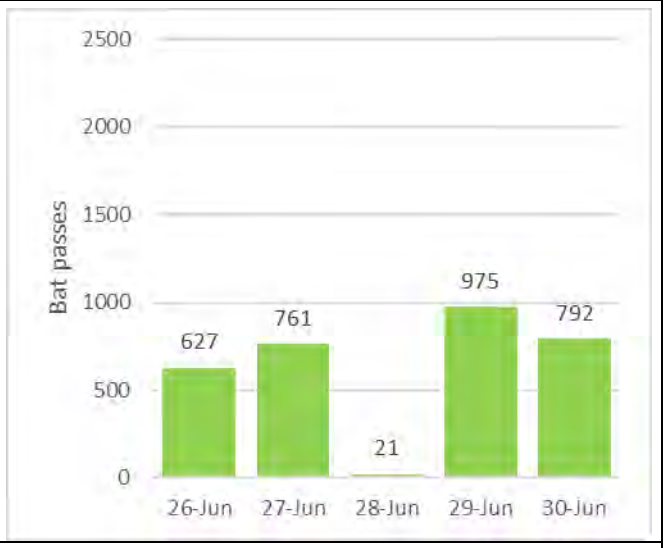
No data	
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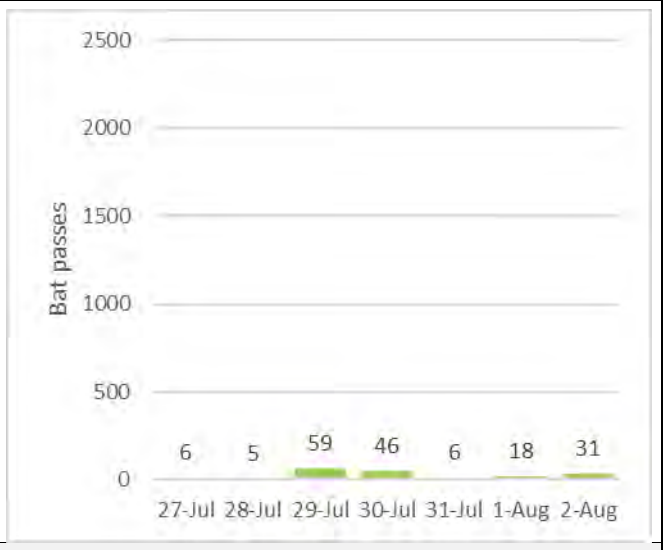
No data	

5 Summary

Transects

North (Transect 2; moderate potential) recorded in total three species; common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*) and brown long-eared (*Plecotus auritus*). The peak BIA (combined species) was recorded on Visit 2 (26/05).

South (Transect 1; high potential) recorded in total five species/groups; common pipistrelle, soprano pipistrelle, brown long-eared, noctule (*Nyctalus noctula*) and M*yotis* species. The peak BIA (combined species/group) was recorded on Visit 7 (06/07).

Common pipistrelle was the highest BIA for both north and south transects (combined visits). The BIA for soprano pipistrelle was also similarly high for south transect (combined visits).

North transect recorded a lower BIA, and lower species diversity than south transect which is consistent with the lower bat suitability the route was assigned.

Statics

Across all visits, North static A and South statics A to C recorded a total of six species/groups; noctule, *Myotis* species, common pipistrelle, soprano pipistrelle, brown long-eared and Pipistrelle species. With the exception of brown long-eared, North static B also recorded the same species. The peak bat passes (combined species) per night was not the same across each static location in either the north or south static locations. Peak social calls was recorded on the same

night for North static A and B; Visit 2. Comparing north statics, static A recorded the most bat calls. Comparing south statics, static B recorded the most bat calls.

In general, peak BIA across all species versus hours after sunset was variable. Particular patterns of note include the consistent BIA peaks shortly close to sunset and again at sunrise for South Static A across multiple visits (Visit 2,3,6-8) for soprano pipistrelle. This could indicate the presence of a nearby summer roost for the species.

Peak BIA versus date was not the same across each static location in either the north or south.

Overall, northern statics recorded lower numbers of passes and social calls than southern transects which is consistent with the lower bat suitability the route was assigned.

It is important to note that high BIA and high bat passes do not necessarily indicate more individual bats but could also indicate a higher frequency of passes of the same individual bat.

References

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