Appendix A.8.8

Galway City Transport Project – Bat Acoustic Surveys: Summer – Autumn 2014 (Geckoella Ltd., 2015a)

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Consultants for ecology and geology

Galway City Transport Project
Bat Acoustic Surveys
Summer-Autumn 2014

Report date:	30th November 2014
Survey dates:	12th August to 4th November 2014
Commissioned by:	Scott Cawley Ltd.
Version:	Final Report – June 2015
Authorised by:	Andy King
Report author:	Kate Jeffreys
QA	Dr Fiona Mathews

Geckoella@gmail.com
Suite 323, 7 Bridge Street, Taunton, TA1 1TG.
Company number: 07219616

www.Geckoella.com
Skype: Geckoella
+44 (0)1392 762334

Summary

Geckoella Ltd. were commissioned by Scott Cawley Ltd. to carry out an acoustic bat survey to inform the Galway City Transport Project. The objectives of the survey were to establish the distribution of different species and gain indices of relative abundance of bats within the study area, as well as gathering information in particular on rare and notable species such as lesser horseshoe bat and Nathusius's pipistrelle bat. The static detectors were first deployed on 12th August 2014. In total, to 4th November, 266,539 identified bat passes have been collected across 24 sites. Sonogram analysis has recorded 7 species, with lesser horseshoe bats present at 14 sites (58%), and Nathusius's pipistrelle bat present at 20 sites (83%). There is a large variation in levels of bat activity between some of the sites. As expected based on their abundance elsewhere in Ireland and the UK, the majority of bat calls recorded are from Pipistrelle bat species, with soprano pipistrelles accounting for 221,301 (83%) of identified calls.

Acknowledgements

We thank the following contributors to the acoustic surveys, analysis and presentation: Dr. Fiona Mathews, Helen Saunders, Jana Prapotnikova, Tim Clark and the teams at Arup (Galway) and Scott Cawley Ltd.

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1 Introduction

1.1 Galway City Transport Project requires environmental baseline information in the scheme study area as part of the constraints study for the project. Information on bats is being collected as part of this process in accordance with local and European guidance and legislation (Kelleher & Marnell, 2006). Geckoella Ltd. was contracted by Scott Cawley Ltd. to carry out an acoustic bat survey to contribute to this baseline environmental information. This report presents findings to 4th November 2014.

1.2 Geckoella, in association with EcoPro and the University of Exeter, supplied static bat detectors, provided technical support, and carried out and presented the results of acoustic analyses including this report. Scott Cawley Ltd. and Arup carried out field deployment of the static bat detectors.

2 Methodology

2.1 The study area includes Galway and surrounding urban-fringe and farmland habitat, and totals approximately 6,350ha as shown in Figure 1.

2.2 Twenty-four sites for static detector deployment were selected across the site by Scott Cawley Ltd. to survey the bat species present at different locations, as well as to collect comparative data on species richness and general levels of bat activity (Figure 1). The static detectors used were SM2 or SM2+ bat detectors made by Wildlife Acoustics. They were set to record in .wac[1] format from ½ hour before dusk to ½ hour after dawn using settings as set out in Appendix B to determine when the unit would be triggered to record a potential bat call. The type of microphone (SMUX) was used for all detectors and they had all been calibrated within the previous 6 months to ensure that detector sensitivity and data collection was similar for all data included within the analysis.

2.3 'Bat passes' for the purposes of this survey are defined as a triggered recording of 2 or more bat pulses in a continuous sequence (Bat Conservation Trust, 2012). A single sound file can have bat passes from more than one species as well as calls from more than one bat of the same species. 'Survey nights' comprise the period beginning 30 minutes prior to sunset, and ending 30 minutes after sunrise during which a detector was deployed and recording bats at a particular site. Dates in this report relate to the date on which a survey night started, so that, for example, 17th September denotes the period from before sunset on the 17th through to past dawn on 18th September.

2.4 The sound files collected were converted from .wac format to .wav and zero crossing for sound analysis within Kaleidoscope Pro (KPro) software. This software can automatically sort sound files that contain only non-bat 'noise' from sound files that contain bat passes. The software can also 'tag' each call with a potential identification, according to similarities in call shape to archetypal call clusters within the database. This approach allows identification to genus level for *Myotis* species, and to species level for other bats found in Ireland[2]. Separation of *Myotis* species is complicated by the high degree of overlap between call characteristics. Appendix B summarises the accuracy levels of the sound analysis carried out both manually and through automatic classification for each species.

2.5 The call analysis was carried out using KPro by Mrs Kate Jeffreys MCIEEM CEnv, Ms Jana Prapotnikova MCIEEM and Mr Tim Clark GCIEEM with Dr. Fiona Mathews of Exeter University carrying out Quality Assurance (QA) for the data. This team is very experienced in the use of acoustic survey techniques for bats and has worked together, sharing files and experience in order to ensure consistency between analysis.

2.6 For species other than common or soprano pipistrelle, the tags were then checked and confirmed or corrected manually since automatic classification is not yet accurate enough to rely upon in isolation for most species (Waters & Barlow, 2013). The manual identification was carried out by comparison with call parameters as set out in Russ (2012) and Middleton et al. (2014). A quality assurance check by Dr Fiona Mathews of 3,540 calls found that the overall accuracy rate for manual identification of species

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[1] .wac is a format for sound files developed by [Wildlife Acoustics]

[2] The calls of different species of *Myotis* bats have overlapping parameters and hence resolution to species level is usually to a lower level of confidence as compared to other genus. *Myotis* calls were identified to genus level only to ensure a consistency of confidence across the analysis.

was 97.3% (Appendix B).

2.7 A mix of automated and manual identification was adopted for common and soprano pipistrelle bats. Files tagged as common or soprano pipistrelle during session 1 (12th August to 14th September) were checked manually and subject to quality assurance as set out above.

2.8 Passes tagged by KPro as either common or soprano pipistrelle bats from 15th September to 4th November were not checked manually in order to streamline the analysis of the other bat calls. The accuracy rate for KPro for these 2 species for this study has been calculated as 99% and 94% respectively. Where KPro made a mistake, passes wrongly identified as soprano pipistrelle were most likely to be common pipistrelle, and *vice versa*. All other passes were checked manually. Appendix B sets out the detail.

2.9 Where identified manually, in some cases, separation between common and soprano pipistrelle was not possible, due to maximum peak energy of the lowest frequency call in a series being between 49.95 and 50.14 kHz. In these cases, calls were ascribed to Pipistrellus spp. (PIPI-PIPY).

2.10 The survey period ran from 12th August to 4th November. The survey period has been split into three separate sessions as described in Table 1. Dates within each session have broadly comparable night periods and represent broadly equivalent stages in terms of the seasonal changes that bats undergo. These sessions run inclusively from 12th August to 14th September, 15th September to 12th October, and 13th October to 4th November. Graphs and tables within this report indicate the number of survey nights recorded by each detector within each survey session as 'n' (sample size) as set out below in Table 1. The number of nights worth of data included for analysis (n) varied between sites and sessions. This reflects differences in deployment dates. In addition, any data collected under non-optimum conditions, for example with regard to equipment performance, was excluded. This ensured that the data included within the analysis was comparable between sites.

Table 1 Bat acoustic survey dates for each site

Site / Session	12Aug-14Sep (34 nights)	15Sep-12Oct (28 nights)	13Oct-3Nov (22 nights)	All
S01	24	28	21	73
S02	14	28	21	63
S03	24	28	0	52
S04	31	28	21	80
S05	0	21	21	42
S06	0	14	21	35
S07	20	21	14	55
S08	26	25	14	65
S09	7	28	22	57
S10	28	28	21	77
S11	28	28	22	78
S12	34	28	21	83
S13	31	28	22	81
S14	14	28	22	64
S15	24	28	21	73
S16	34	28	21	83

Site	Session 12Aug-14Sep (34 nights)	15Sep-12Oct (28 nights)	13Oct-3Nov (22 nights)	All
S17	34	28	22	84
S18	7	28	22	57
S19	7	28	22	57
S20	33	28	21	82
S21	34	28	21	83
S22	0	21	21	42
S23	7	28	0	35
S24	7	24	21	52

2.11 Overall, the weather from 12th August to 4th November was similar to other years, and therefore suitable for collecting baseline data on bats in the Galway area. Appendix A provides more detail, with sub-optimal conditions for bat survey highlighted. Sub-optimal conditions for bat surveys are broadly described in BCT (2012). For the purposes of this study, they are definedby temperatures of less than 10^0 C, wind speeds equivalent to Beaufort score of 5 or more (fresh breeze), and/or significant rainfall. Out of 84 survey nights, the weather was sub-optimal on 3 nights during the Aug-Sep session, 6 nights for the Sep-Oct session, and 4 nights for the Oct-Nov session.

2.12 The standardised settings, units and approach across the 24 sites in the study area, combined with careful attention paid to appropriate siting and deployment to maximise calls collected for each site, allows for comparison of the species recorded and the general bat activity levels between different sites. This takes into account the limitations as well as the advantages in acoustic bat survey techniques (Weller, 2007; Sowler & Middleton, 2013; Stahlschmidt & Brühl, 2012). The data from some sites on some dates could not be included in the comparative analysis of bat activity levels because the static detectors, on post-deloyment testing, were found to be not collecting data as effectively as other detectors . All species records contributed to overall species richness scores for different sites. Appendix B describes which sites contributed to which set of results on which dates. Figures and graphs include 'n' for sample size for each static. This gives the number of survey nights within each session that contributed to the data.

2.13 Acoustic surveys have inherent species-specific bias. For example, quiet bats such as brown long-eared bats may only be recorded if they pass close to the bat detector. The calls of horseshoe bats are not only quiet but also highly directional, further decreasing the probability of detection. Meanwhile, loud bats such as Leisler's may be recorded at some distance. For this reason, the number of calls of different species may not be indicative of relative abundance of those species at a single site.

2.14 The following measures are presented in the results:

- Species richness (Table 2)
- Relative levels and ranges of bat activity between different sites, and between different survey sessions (Figures 2A-2C)
- Relative levels of bat activity for different bat species between different sites, and between different survey sessions (Figures 3A-C, Figures 4A-C)
- Map showing relative levels of lesser horseshoe and Nathusius's pipistrelle bats at different sites (Figures 5A-B)

2.15 The following species abbreviations are used in this report:

MYsp	a bat of the genus *Myotis*
NYLE	*Nyctalus leisleri* Leisler's bat
PLAUR	*Plecotus auritus* brown long-eared bat
PINA	*Pipistrellus nathusii* Nathusius's pipistrelle
PIPI	*Pipistrellus pipistrellus* common pipistrelle
PIPY	*Pipistrellus pygmaeus* soprano pipistrelle
PIPI-PIPY	a bat which is either PIPI or PIPY (call character does not allow further resolution)
RHHI	*Rhinolophus hipposideros* lesser horseshoe bat

Limitations to survey

2.16 Data from survey-nights that last different lengths of time, have different weather, or are at a different time of year to each other may not be directly comparable since all these factors affect bat behaviour. The limitations that this introduces into the dataset in terms of making comparisons between sites was minimised by splitting the overall survey period into three survey sessions. The dates within each session would be sufficiently similar in night length and season to enable comparison. The number of survey nights within each session was maximised where practical, to reduce variation in the dataset due to changes in the weather, and to improve confidence in average values. A minimum of 7 nights per site was used for all comparisons in this report; usually much more data than this was collected. Table 1 gives the number of survey nights in each session for each detector.

2.17 Inter-site variation in the effectiveness of each bat detector was reduced through the standardisation of settings for data collection and analysis, and through chosing the best location for bats in each setting, to maximum the number of passes and species recorded. Detectors and the data they collected were checked weekly. Any data potentially compromised through equipment failure or other reasons was excluded from the comparative analysis. However, all bat passes contributed to species-richness counts for particular sites, because a 'positive' record is valid, even if the detector is not collecting data at its maximum potential.

3 Results

Species Richness

3.1 Table 2 lists the species recorded at each site surveyed between 19th and 29th August. This shows that 9 sites had 7 species, 8 sites had 6 species, and 5 sites had 5 species recorded.

3.2 *Myotis*, Leisler's and common and soprano pipistrelle bats were recorded at every site. Brown long-eared bat was recorded at 18 sites (75%), but this common bat may be under-recorded due to its quiet calls. Lesser horseshoe bats were recorded at the fewest number of sites (14, 58%).

Table 2. Species recorded at sites across Galway City

Site	n	MYsp	NYLE	PINA	PIPI	PIPY	PLAUR	RHHI	Total species
S01	73	Y	Y	Y	Y	Y	Y	Y	7
S02	63	Y	Y	Y	Y	Y	Y	Y	7
S03	52	Y	Y	N	Y	Y	Y	N	5
S04	80	Y	Y	Y	Y	Y	Y	Y	7
S05	42	Y	Y	Y	Y	Y	N	Y	6
S06	35	Y	Y	Y	Y	Y	Y	Y	7
S07	55	Y	Y	Y	Y	Y	Y	N	6
S08	65	Y	Y	Y	Y	Y	Y	Y	7
S09	57	Y	Y	Y	Y	Y	Y	N	6
S10	77	Y	Y	N	Y	Y	N	Y	5
S11	78	Y	Y	N	Y	Y	Y	Y	6
S12	83	Y	Y	Y	Y	Y	N	N	5
S13	81	Y	Y	Y	Y	Y	Y	Y	7
S14	64	Y	Y	Y	Y	Y	Y	N	6
S15	73	Y	Y	Y	Y	Y	Y	Y	7
S16	83	Y	Y	Y	Y	Y	Y	N	6
S17	84	Y	Y	Y	Y	Y	Y	N	6
S18	57	Y	Y	N	Y	Y	Y	N	5
S19	57	Y	Y	Y	Y	Y	N	Y	6
S20	82	Y	Y	Y	Y	Y	N	N	5
S21	83	Y	Y	Y	Y	Y	Y	Y	7
S22	42	Y	Y	Y	Y	Y	Y	Y	7
S23	35	Y	Y	Y	Y	Y	N	N	5
S24	52	Y	Y	Y	Y	Y	Y	Y	7
Total		24	24	20	24	24	18	14	

Bat Activity

3.3 Figures 2A-2C show the average number of bat passes per site for each of the three sessions (Aug-Sep, Sep-Oct, Oct-Nov), as well as the inter-quartile and the full range of bat passes for each site. This illustrates the variation in bat passes between different nights at the same site, as well as general variation between different sites.

3.4 Box plots are created from a set of five numbers: the median, the 25th percentile or lower quartile, the 75th percentile or upper quartile, the minimum data value, and the maximum data value. The horizontal line in the middle of the box is the median of the measured values, the upper and lower sides of the box are the upper and lower quartiles, and the bars at the end of the vertical lines are the data minimum and maximum values.

3.5 Figures 2A-C show that some sites had generally more calls than other sites. For example, S06, S08, S20 and S21 have higher numbers of calls more often than other sites such as S09, S15 or S18. These sites often had occasional nights with very large numbers of calls, with S03, S06, S08, and S20 all having nights with over 2,000 bat passes.

Species breakdown by site for each session

3.6 Soprano pipistrelle bats were by far the most common species recorded, with 221,301(83%) of identified calls. Figures 3A-C show the number of common and soprano pipistrelle bat passes recorded on average per night for each site for each of the 3 sessions.

3.7 Site S06 had the highest average number of soprano pipistrelle calls. This in part is derived from occasional nights with extremely high numbers of calls as described in 3.5 above. Site S20 had the largest average number of common pipistrelle calls per night. S03 and S14 also had relatively higher levels of common pipistrelle activity.

3.8 Figures 4A-C show the number of bat passes for species other than soprano or common pipistrelle recorded on average per night for each site for each of the 3 sessions. This shows that S06 and S21 had regular activity from a range of species other than common and soprano pipistrelle bat. Conversely, sites S10 and S23 had relatively low levels of bat activity for these other species.

3.9 Rare and notable species comprise lesser horseshoe and Nathusius's pipistrelle bat. Figures 5A and 5B map the average number of passes per site for these two species, showing where these bats were most regularly recorded. Sites S6, S5 and S21 had the most lesser horseshoe bat records. Site with higher numbers of Nathusius's pipistrelle bat calls included S20, S16, S21 and S06. However, the species was also occasionally recorded at other sites across the proposed scheme area.

4 Discussion and Analysis of Results

4.1 Figure 1 shows the location of static detectors across the proposed scheme area. Comparing these with the graphs of relative activity (2A-C, 3A-C, 4A-C) suggests that sites close to the River Corrib have both high levels or bat acitivity, and a wide range of species. Figure 5B suggests that the River Corrib is of particular importance also for Nathusius's pipistrelle bat, although this species was also recorded away from the river.

4.2 There is a known maternity roost for lesser horseshoe bats at Menlo Castle. Sites close to this roost recorded relatively higher numbers of calls for this species (e.g. S06, S21, S05). A static at S02 picked up more lesser horseshoe calls per night in Oct-Nov than during the other survey sessions. This may possibly reflect a seasonal change in behaviour.

4.3 S20 regularly recorded the highest levels of activity and the widest range of species (with the exception of lesser horseshoe bat). The location within a 'green corridor' surrounded by the expanding city of Galway may well be of significance and worthy of further investigation.

4.4 Brown long-eared bats are common, but were not regularly recorded during the survey. This may be because they have relatively quiet calls, leading to under-recording. Sites which tended to have a higher average number of brown long-eared calls per night included S21, S15 and S4

4.5 *Myotis* bats were found across the proposed scheme area. S07 regularly had higher rates of *Myotis* passes than some of the other sites. S07 is located close to a known roost for Daubenton bats *Myotis daubentonii* (Geckoella, 2014). The relatively high numbers of *Myotis* calls at S14 may be indicative of a nearby roost. S21 also had a lot of *Myotis* calls, as well as calls of a range of other species indicating an important area for bats.

5 Bibliography

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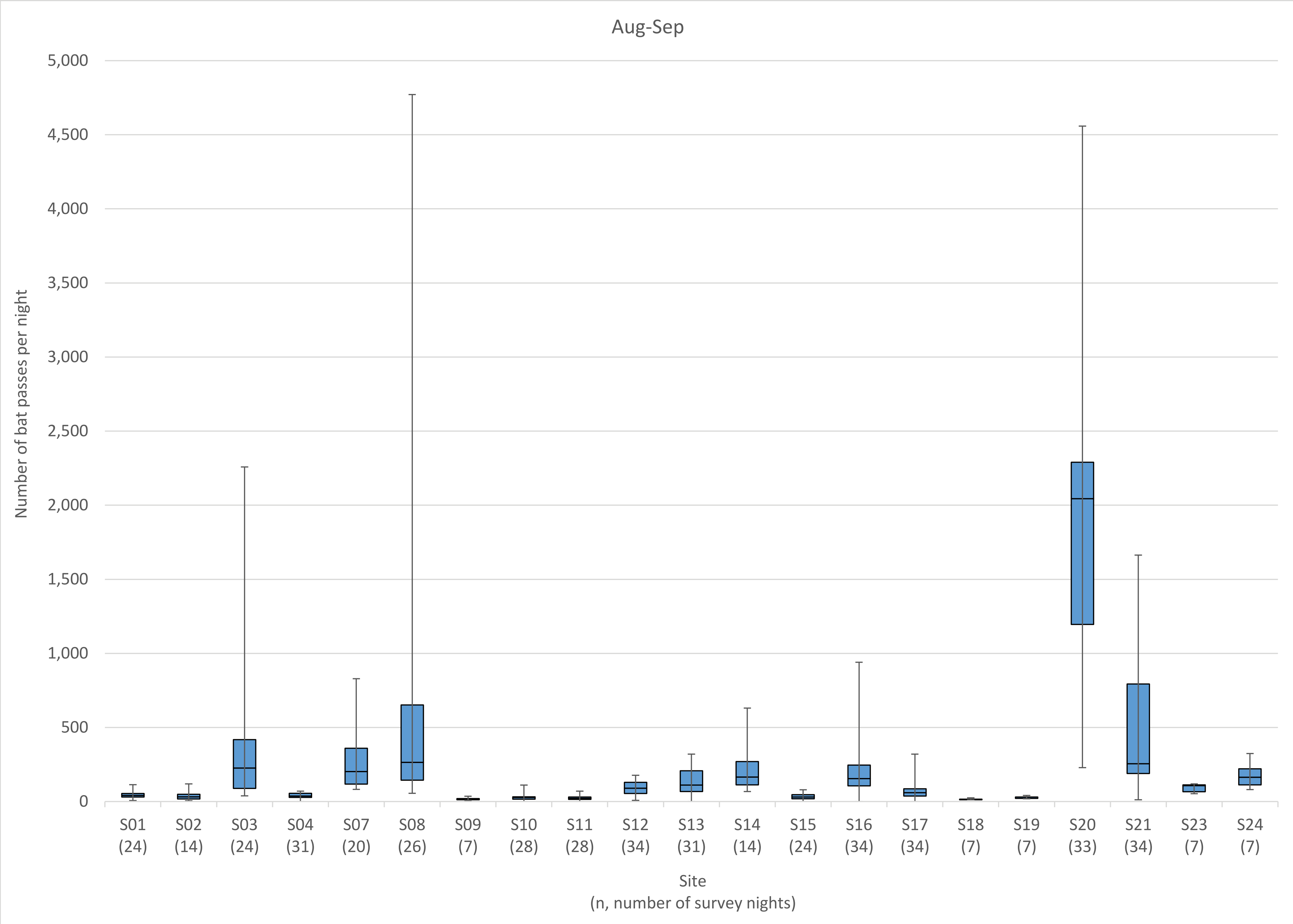
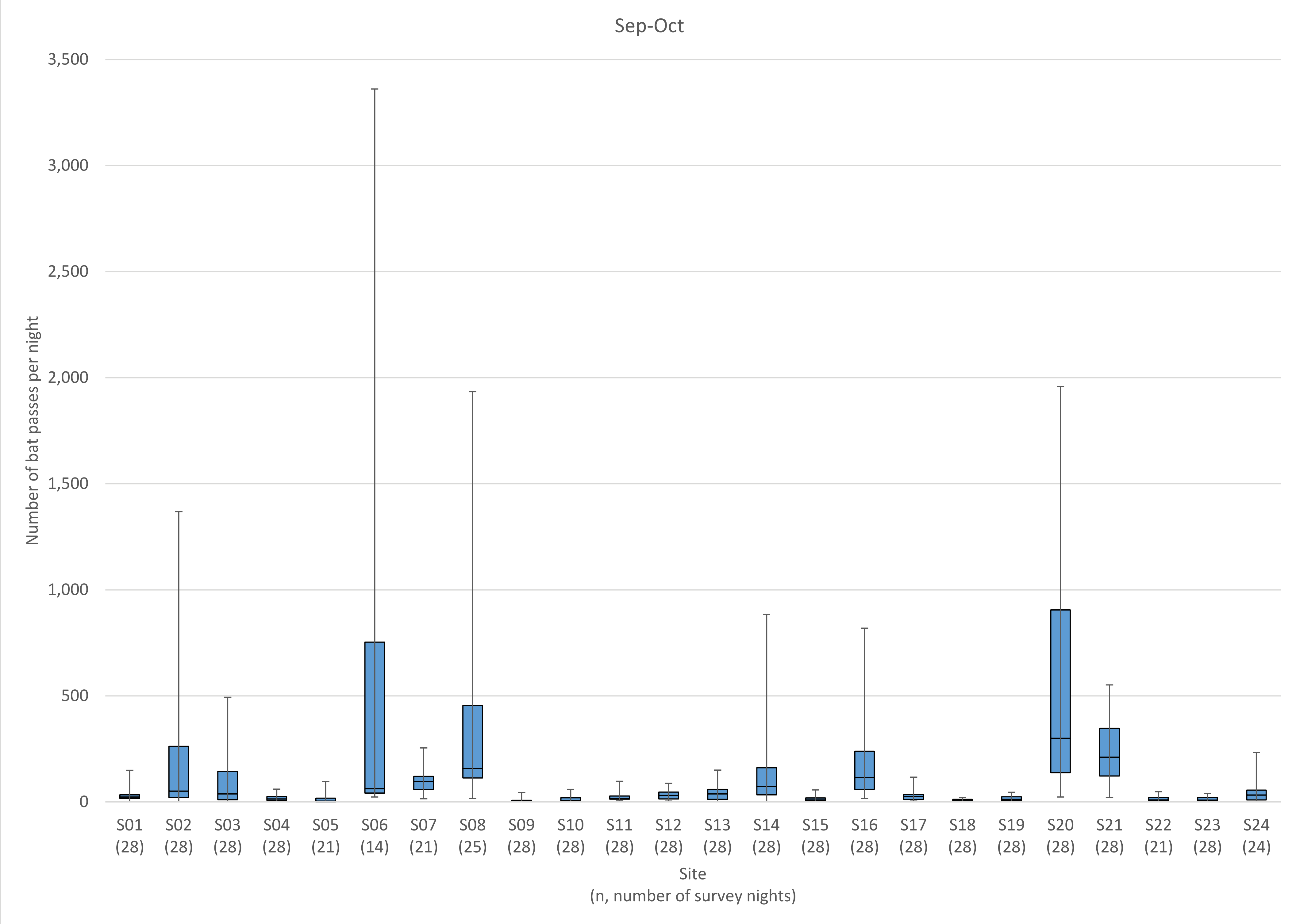
Figure 1. Proposed Scheme Area and acoustic bat detector sites

Figure 2A Box plot showing bat passes per site



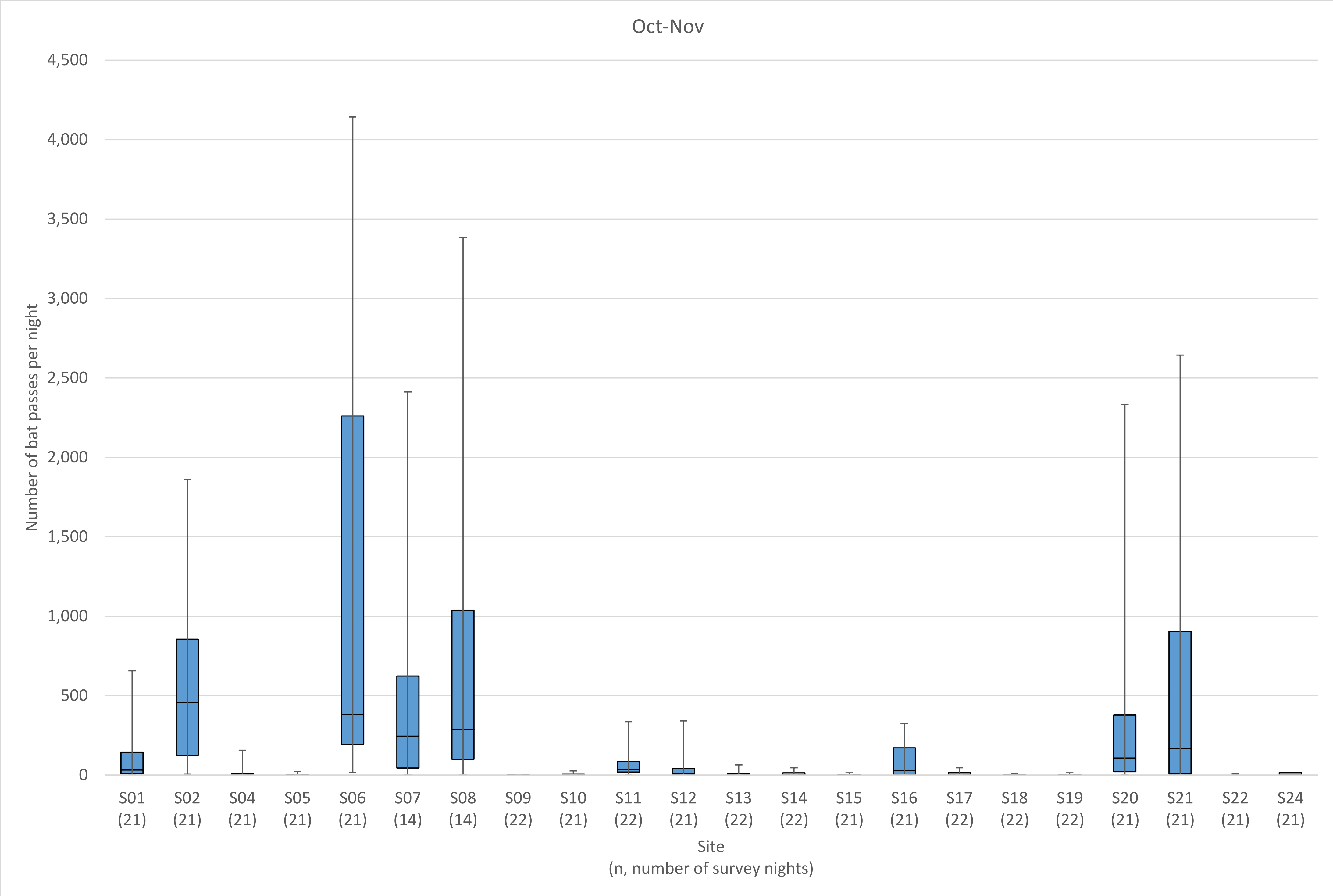
The box illustrates the median and inter-quartile rage; the vertical line shows the full range of the data.

Figure 2B Box plot showing bat passes per site



The box illustrates the median and inter-quartile rage; the vertical line shows the full range of the data.

Figure 2C   Box plot showing bat passes per site



The box illustrates the median and inter-quartile rage; the vertical line shows the full range of the data.

Figure 3A Average numbers of common or soprano bat passes per site

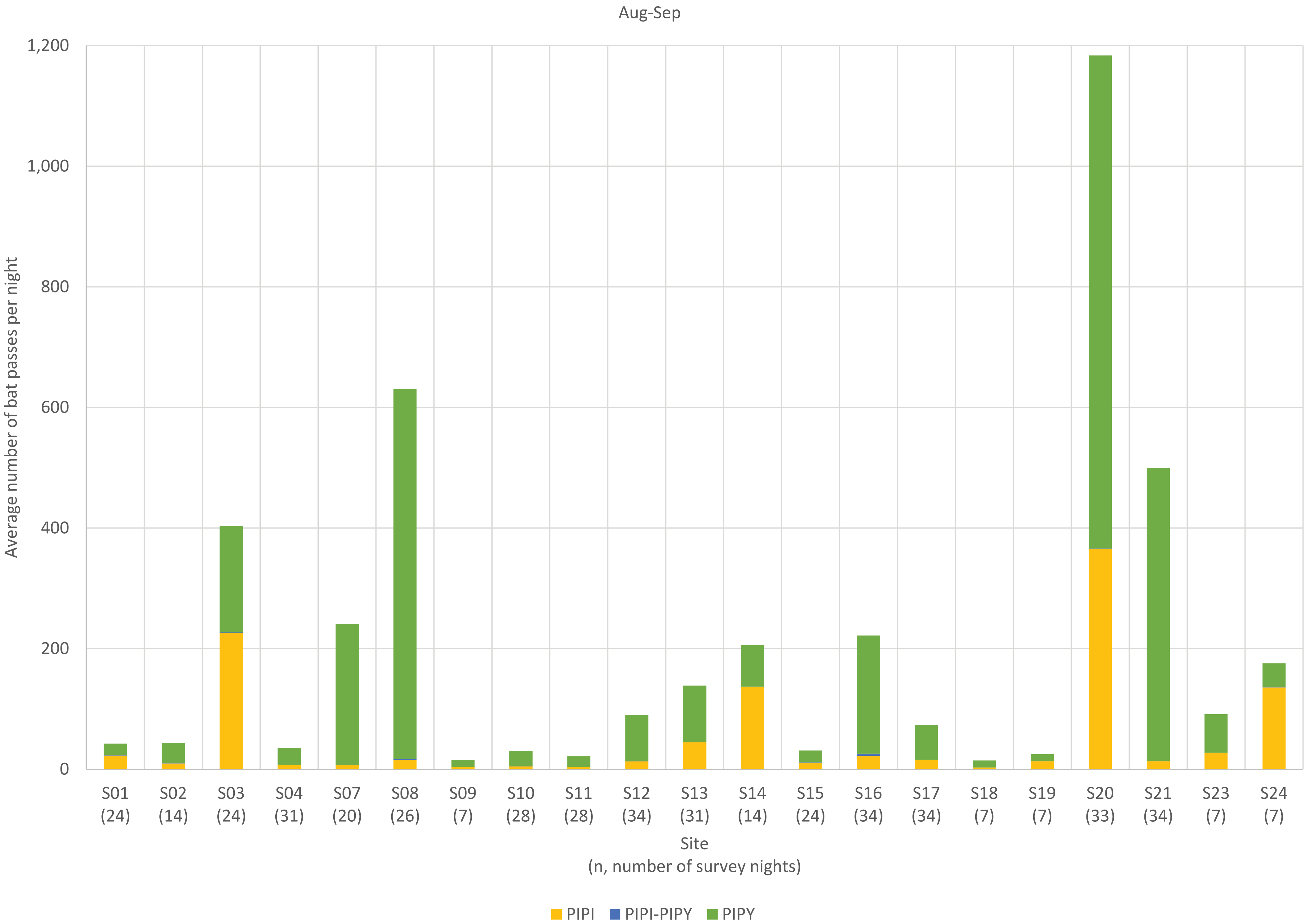


Figure 3B Average numbers of common or soprano pipistrelle bat passes per site

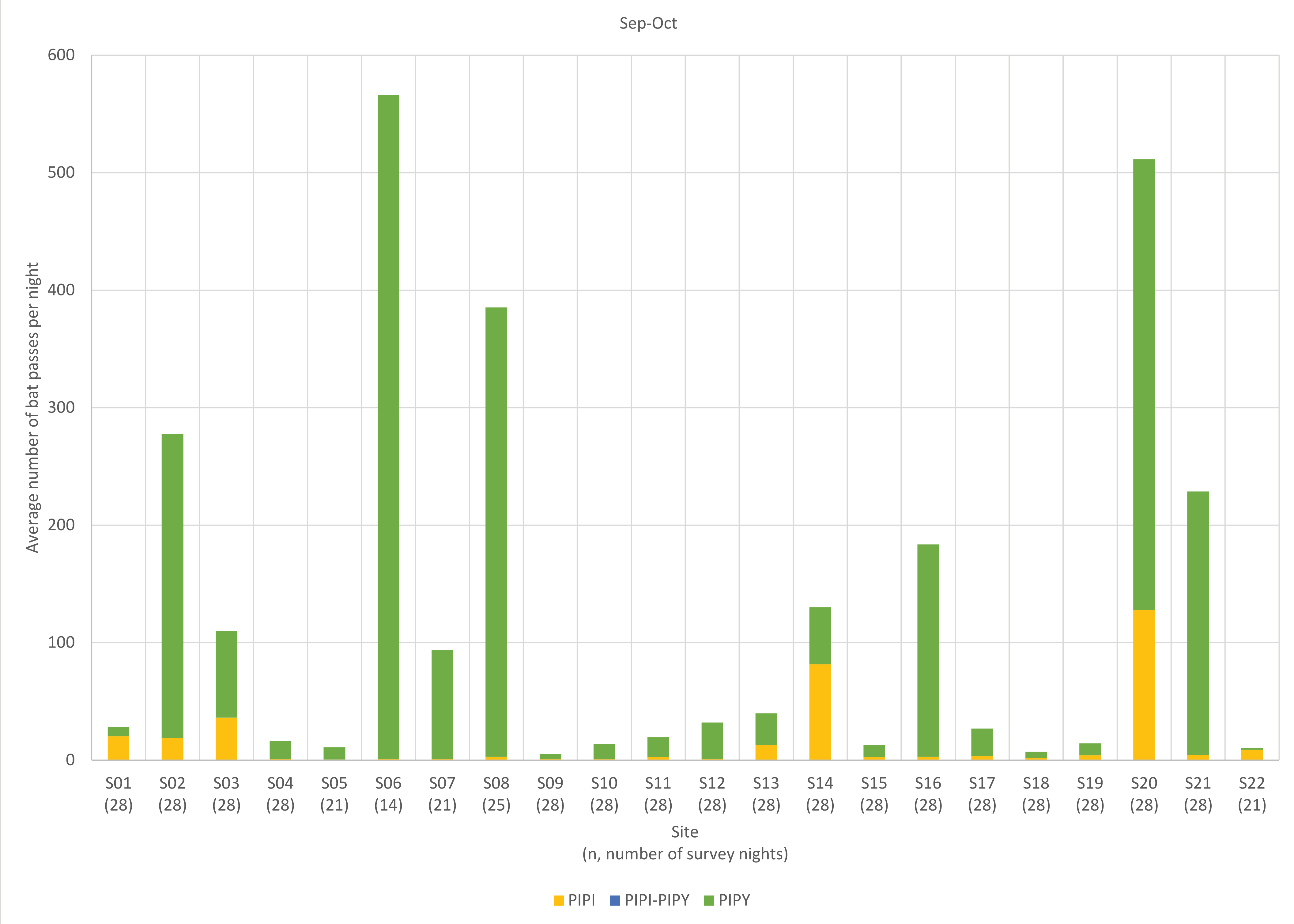


Figure 3C Average numbers of common or soprano pipistrelle bat passes per site

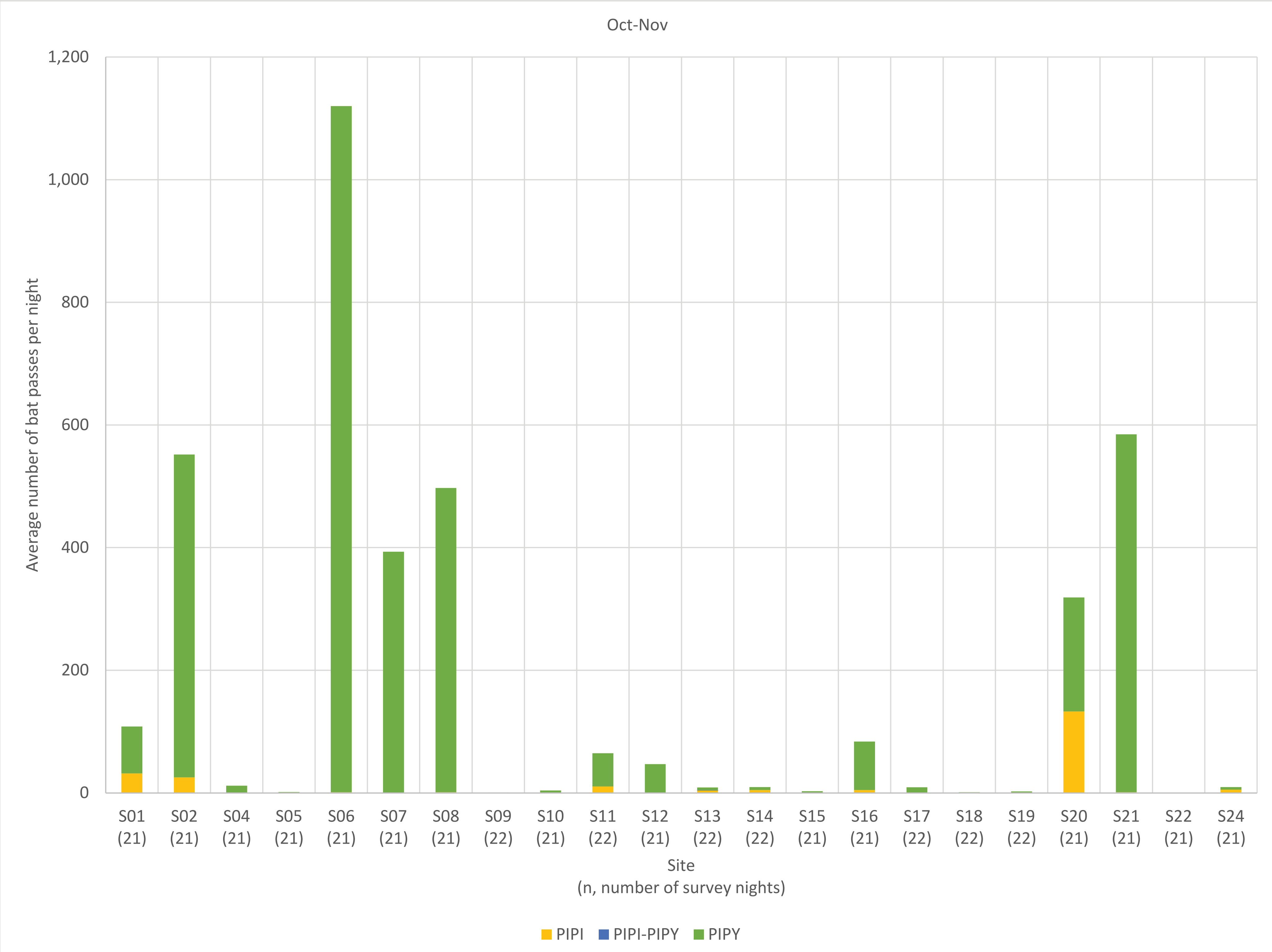


Figure 4A Average numbers of other bat passes per site

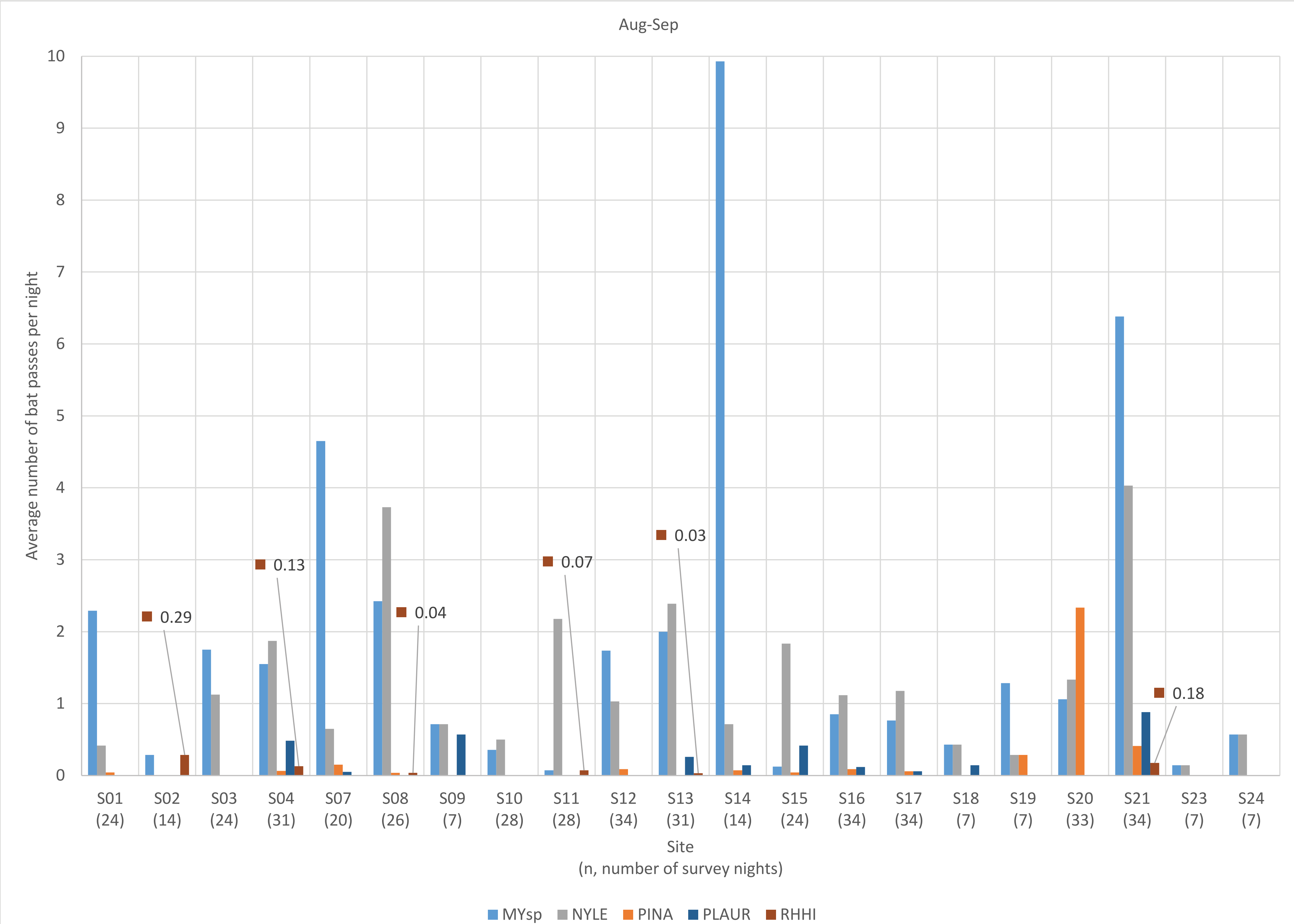


Figure 4B Average numbers of other bat passes per site

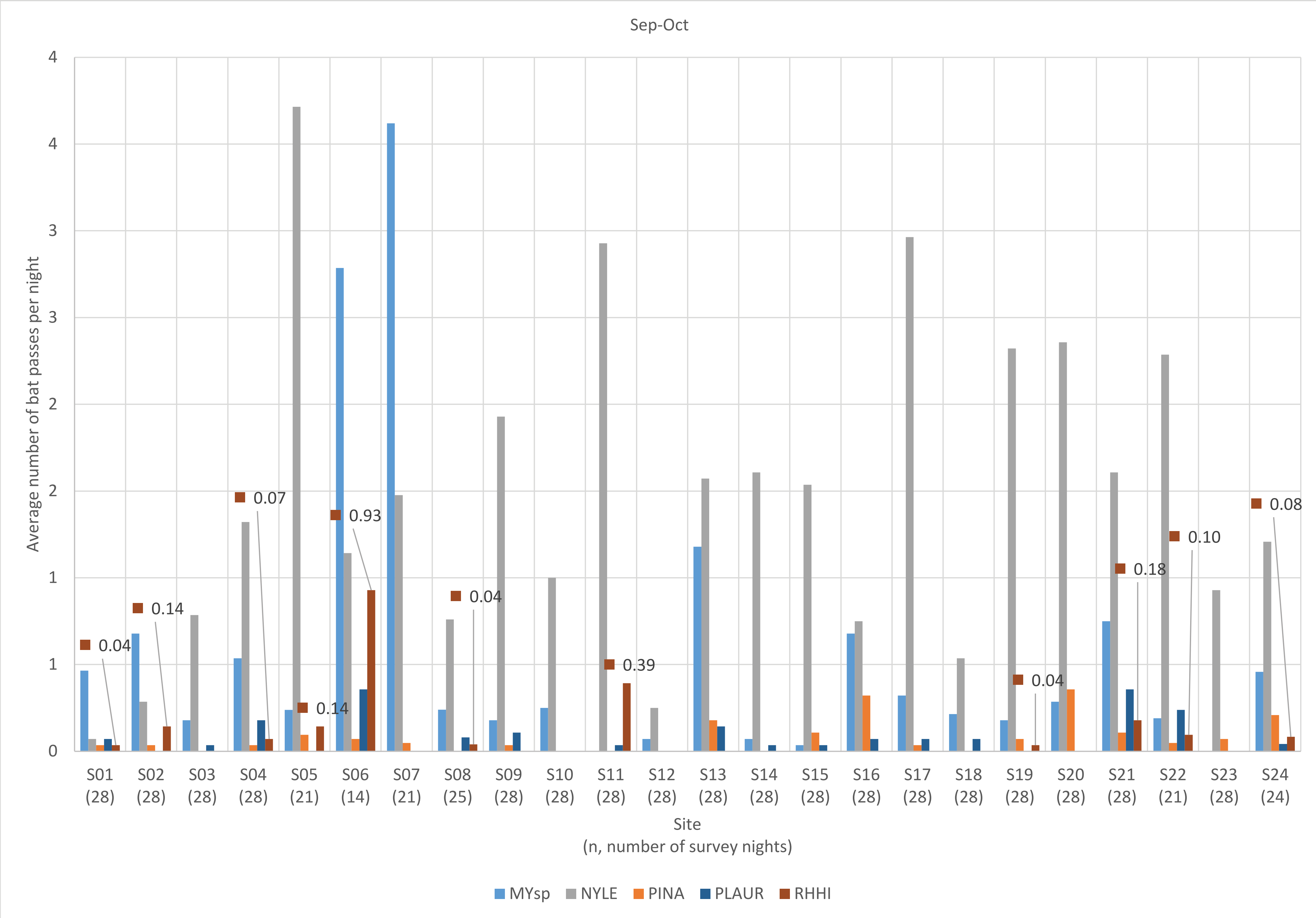


Figure 4C Average numbers of other bat passes per site

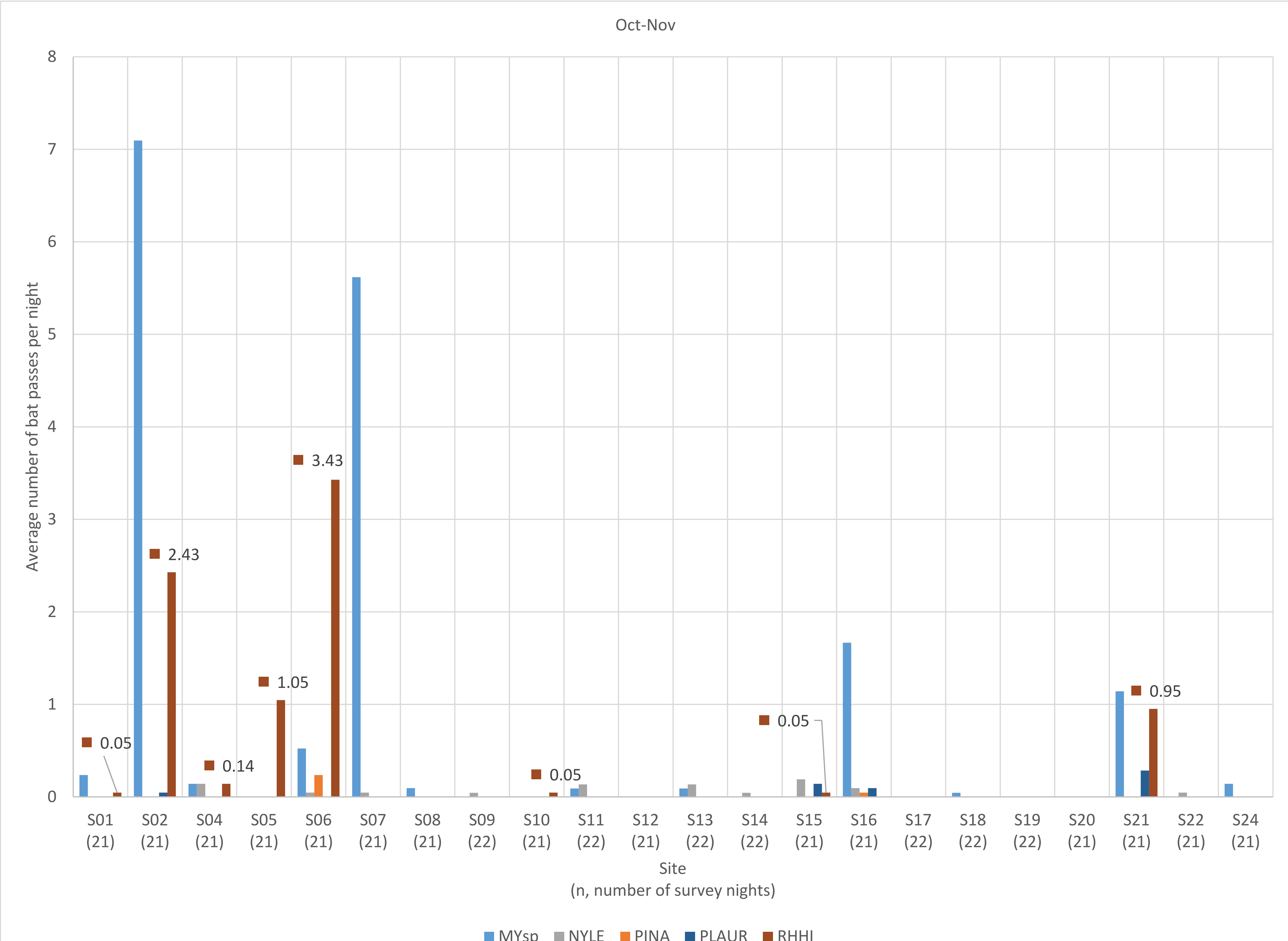
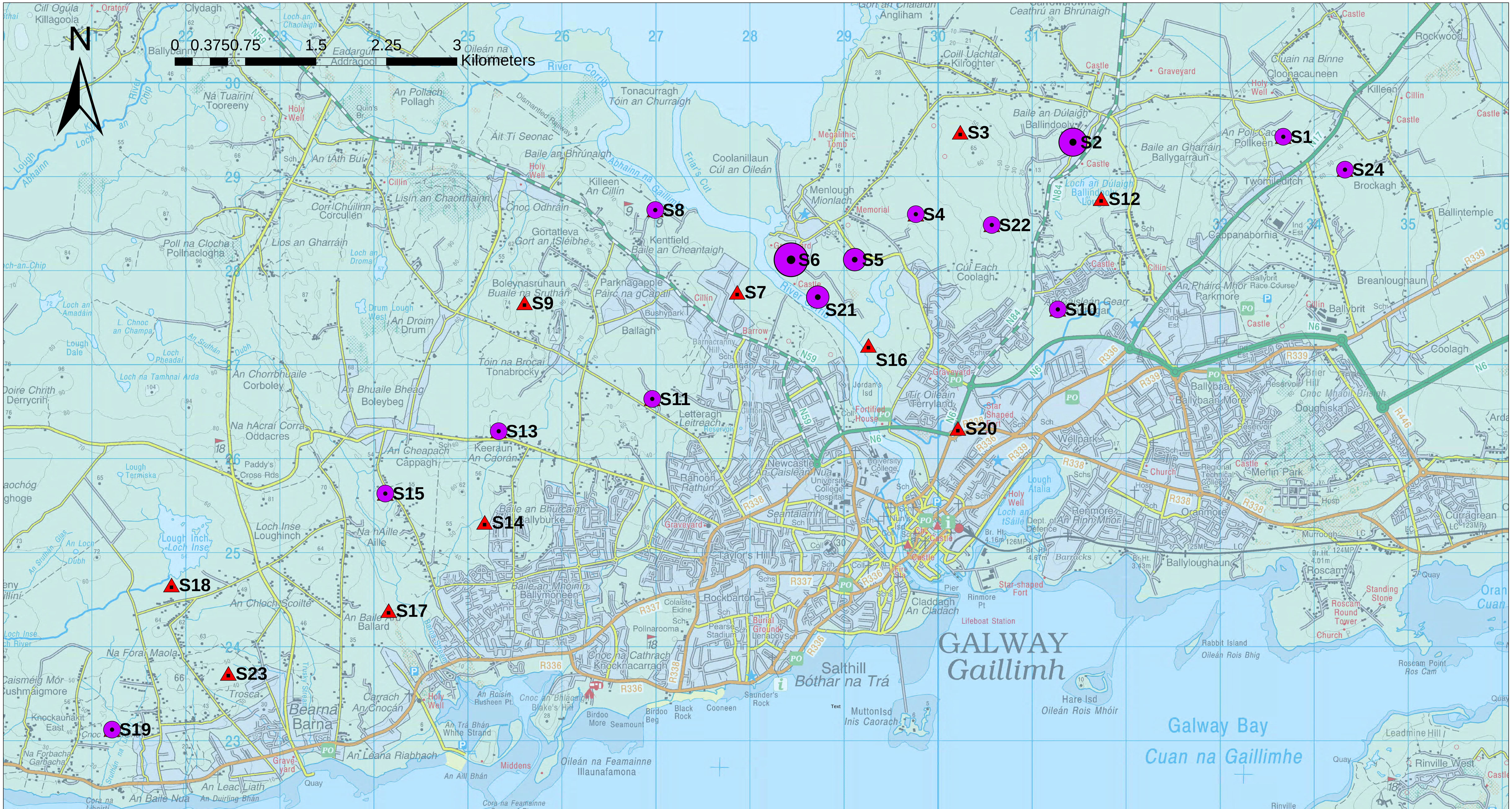


Figure 5a. Map: Lesser horseshoe bat passes per night at each site



Key

Statics where Lesser Horseshoe Bats detected

Site of Other Static Bat Detector

Mean No. of Passes per Night

- Less than 0.17
- 0.17 to 0.60
- 0.61 to 0.94
- More than 0.94

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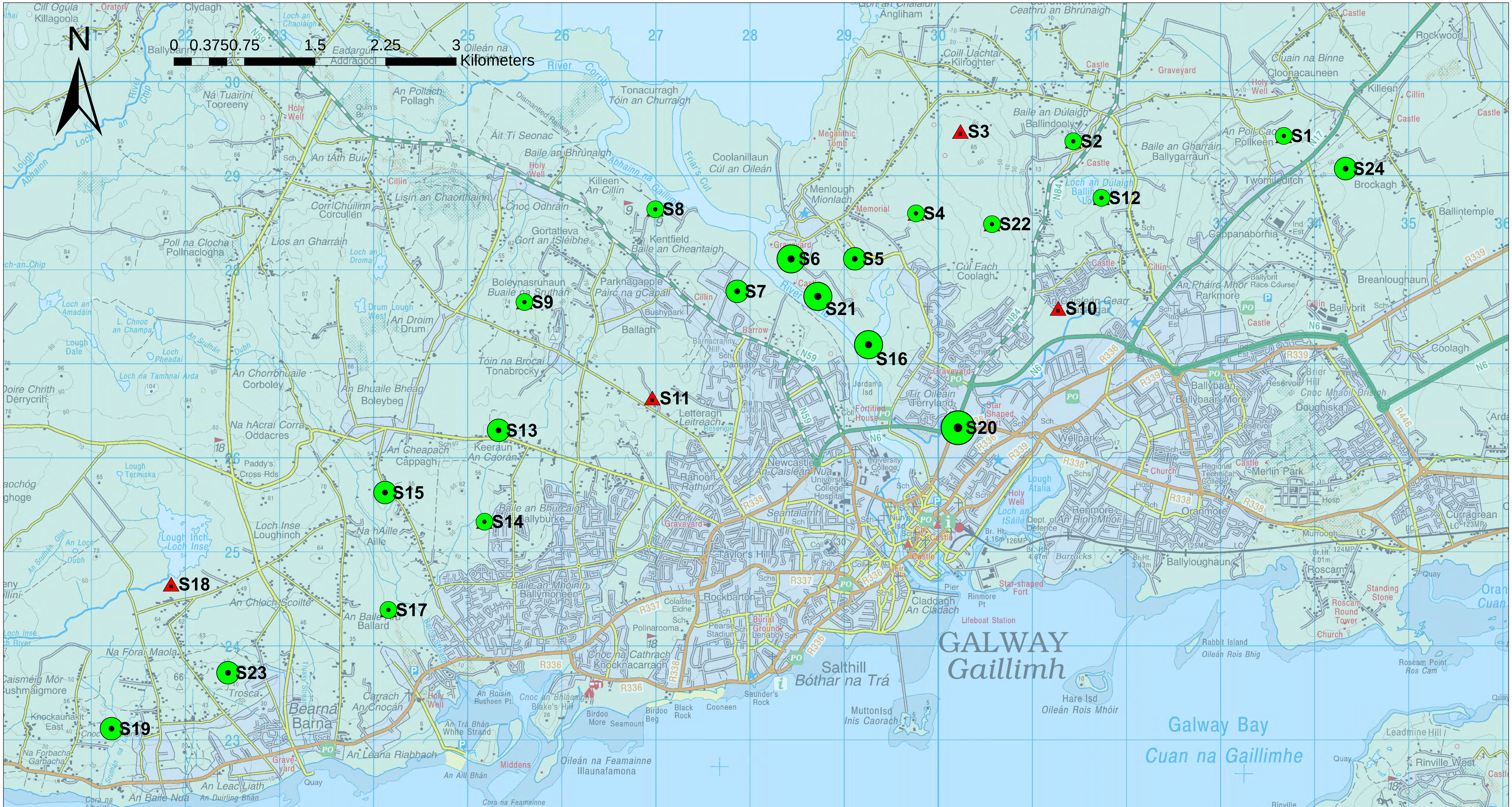
Values provided are mean average bat passes per survey nights.
Surveys took place between 12th August and 4th November.
(Number of survey nights varied between sites, see Figures 2A-C and Appendix B).

Figure 5b. Map: Nathusius's pipistrelle bat passes per night at each site



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Key

Statics where Nathusius's Pipistrelles detected

Site of Other Static Bat Detector

Mean No. of Passes per Night

Less than 0.04

0.04 to 0.10

0.11 to 0.20

More than 0.20

Values provided are mean average bat passes per survey nights.
Surveys took place between 12th August and 4th November.
(Number of survey nights varied between sites, see Figures 2A-C and Appendix B).

Appendix A: Bat acoustic survey session dates and weather

The weather from August – November 2014 was broadly typical for Galway and did not pose a significant constraint to survey. Warm, humid, calm weather is good for flying invertebrates and hence good for bat foraging. Data highlighted in blue represents sub-optimal conditions, comprising temperatures of less than 10ºC, wind speeds equivalent to Beaufort score of 5 or more (Fresh breeze), and/or significant rainfall.

AUGUST - SEPTEMBER						
S	M	T	W	T	F	S
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14						

34 nights
3 sub-optimal

SEPTEMBER - OCTOBER						
S	M	T	W	T	F	S
	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12						

28 nights
6 sub-optimal

OCTOBER - NOVEMBER						
S	M	T	W	T	F	S
	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4				

22 nights
4 sub-optimal

Survey nights' run from dusk til dawn, whereas the weather data represents 24hr periods from midnight til midnight. None-the-less this data gives an indication of general weather conditions at the time of survey.

Data on General Weather during 24hr period produced under license from Weather Underground.

http://www.wunderground.com/personal-weather-station/dashboard?ID=ICOGALWA2#history/s20140805/e20140812/mweek

Weather Station ID: ICOGALWA2. Station Name: Oranmore
Latitude / Longitude: N 53 ° 16 ' 28 '', W 8 ° 55 ' 45 '', Elevation: 0. City: Oranmore, State: Co.Galway
Hardware: Davis VP2(24h FARS), Software: meteohub, Owner: Private

Details of static acoustic bat detector deployment location and dates

Site	Serial number	Model	Microphone	Date deployment	Date collection	Easting	Northing	Habitat	Picture ref
S01	G14373	SM2BAT+	SMX-US	15/08/2014	03/11/2014	533677	729426	Woodland edge, Hawthorn	100-0062
S02	10495	SM2BAT+	SMX-US	12/08/2014	03/11/2014	531440	729368	Woodland edge, field boundary	S2.jpg
S03	13775	SM2BAT+	SMX-US	15/08/2014	03/11/2014	530241	729475	Hedgerow adjacent to limestone pavement, Ash tree	100-0063
S04	6810	SM2BAT	SMX-US	15/08/2014	03/11/2014	529768	728602	Hedgerow, woodlan edge, Hazel tree	100-0060
S05	6364	SM2BAT	SMX-US	12/08/2014	03/11/2014	529118	728118	Edge of woodland, on tree beside grassland	S5.jpg
S06	6337	SM2BAT	SMX-US	15/08/2014	29/09/2014	528441	728118	Woodland edge, Ash tree	100-0061
S06	TBC	TBC	SMX-US	29/09/2014	03/11/2014	528441	728118	Woodland edge, Ash tree	20140929_161131_S6
S07	6343	SM2BAT	SMX-US	12/08/2014	03/11/2014	527869	727772	Woodland edge, Sw corner of field, through bushes into clearing on left	100-0049
S08	16688	SM2BAT+	SMX-US	08/09/2014	03/11/2014	527015	728644	Woodland edge, by pond	[similar]
S08	12995	SM2BAT	SMX-US	20/08/2014	08/09/2014	527015	728644	Woodland edge, by pond	20.08.14.18.01
S09	17003	SM2BAT+	SMX-US	08/09/2014	04/11/2014	529824	727484	Rough grassland	[similar]
S09	6215	SM2BAT	SMX-US	21/08/2014	08/09/2014	529824	727484	Rough grassland	21.08.14.17.17
S10	9617	SM2BAT+	SMX-US	12/08/2014	03/11/2014	531278	727590	Hawthorn hedgerow field boundary (part)	100-0052
S11	6359	SM2BAT	SMX-US	12/08/2014	04/11/2014	526966	726637	Hedgerow, edge of path	100-0048
S12	3609	SM2BAT	SMX-US	12/08/2014	03/11/2014	531740	728766	Edge of scrub, field boundary	100-0051
S13	13110	SM2BAT+	SMX-US	15/08/2014	04/11/2014	525332	726294	Lough edge, Willow tree	100-0059
S14	16769	SM2BAT+	SMX-US	08/09/2014	04/11/2014	525182	725328	Scrub, pasture	[similar]
S14	11737	SM2BAT	SMX-US	21/08/2014	08/09/2014	525182	725328	Scrub, pasture	21.08.14.16.44
S15	6335	SM2BAT	SMX-US	15/08/2014	03/11/2014	524126	725632	Edge of lake, Hawthorn tree	100-0058
S16	6570	SM2BAT	SMX-US	12/08/2014	03/11/2014	529264	727206	Hedgerow. Hawthorn tree, end of hedge	100-0055, 100-0056
S17	6283	SM2BAT	SMX-US	12/08/2014	04/11/2014	524162	724385	Woodland edge	100-0047
S18	16724	SM2BAT+	SMX-US	08/09/2014	04/11/2014	521872	724606	Lake, bog/heath	[similar]
S18	6115	SM2BAT	SMX-US	20/08/2014	08/09/2014	521872	724606	Lake, bog/heath	20.08.14.18.49
S19	16975	SM2BAT+	SMX-US	03/09/2014	04/11/2014	521372	723143	Small field with gorse and fern, pockets of exposed rock. Hedgerow, scrub and rough grassland.	IMG_7885 - S19
S20	6198	SM2BAT	SMX-US	12/08/2014	03/11/2014	530216	726323	River bank, Ash tree	100-0053, 100-0054
S21	6330	SM2BAT	SMX-US	12/08/2014	03/11/2014	521372	723143	Hazel tree in hedgerow	S21.jpg
S22	16753	SM2BAT+	SMX-US	08/09/2014	03/11/2014	530424	728432	Back of Lackagh Quarry, limestone	20141006_123325_S22
S23	17004	SM2BAT+	SMX-US	03/09/2014	04/11/2014	522419	723682	Small field with gorse, pockets of exposed rock. Scrub, rough grassland.	IMG_7911 - S23
S24	6131	SM2BAT	SMX-US	20/08/2014	08/09/2014	534339	724082	Scrub / plantation	20.08.14.16.43
S24	16675	SM2BAT+	SMX-US	08/09/2014	03/11/2014	534339	724082	Scrub / plantation	20140929_100947_S24

Total number of bat passes for each static acoustic bat detector across 24 sites in Galway

Site	MYsp	NYLE	PINA	PIPI	PIPI-PIPY	PIPY	PLAUR	RHHI	Grand Total
S01	73	12	2	1,785	24	2,281	2	2	4,181
S02	172	8	1	1,199	4	18,774	1	59	20,218
S03	47	49		6,440	16	6,288	1		12,841
S04	66	98	3	249	9	1,551	20	9	2,005
S05	5	78	2	10		253		25	373
S06	50	17	6	39		31,408	5	85	31,610
S07	287	45	4	169	9	14,881	1		15,396
S08	71	116	1	499	29	35,940	2	2	36,660
S09	10	60	1	65		202	7		345
S10	17	42		172	2	1,162		1	1,396
S11	4	146		424	1	2,149	1	13	2,738
S12	61	42	3	486	12	4,441			5,045
S13	97	121	5	1,848	12	3,756	12	1	5,852
S14	141	56	1	4,305		2,430	3		6,936
S15	4	91	4	344	7	816	14	1	1,281
S16	83	61	13	943	119	13,386	8		14,613
S17	35	123	3	633	11	2,812	4		3,621
S18	10	18		74		252	3		357
S19	14	67	4	225		399		1	710
S20	43	110	87	18,448	4	41,616			60,308
S21	262	182	17	606		35,067	46	31	36,211
S22	4	49	1	188		40	5	2	289
S23	1	27	2	250		730			1,010
S24	18	33	5	1,811	6	667	1	2	2,543
Grand Total	1,575	1,651	165	41,212	265	221,301	136	234	266,539

Quality Assurance Results for bat acoustic surveys, Galway.

Comparing results of original ID of 3,540 bat passes with identification by Dr. Fiona Mathews, Exeter University

FM ID: rows	Original ID: columns																	
	Column Labels																	
Row Labels	MY-PL	MYsp	noise	NYLE	NYLE-EPSE	PINA	PIPI	PIPI-PIPY	PIPI-PIPY-PIPY	PIPY	PIPY, query PLAUR	PIPY-Mysp	PIPY-NYLE	PIPYsoc	query	RHHI192	soc	Grand Total
MY-PL	1																	1
MYsp		19																19
NoID																	1	1
noise			3															3
NYLE				52	1										1			54
PINA						4												4
PIPI							107	9		1								117
PIPI-PIPY							3	60	6	33				1				103
PIPY							2	30		3184		1	1	1				3219
PIPY-Mysp										2	1	2						5
PIPY-Mysp, NYLE										1								1
PIPY-NYLE										2			8					10
RHHI192																3		3
Grand Total	**1**	**19**	**3**	**52**	**1**	**4**	**112**	**99**	**6**	**3223**	**1**	**3**	**9**	**2**	**1**	**3**	**1**	**3540**

Category		%
Agreed	3443	97.3%
during final check would	8	0.2%
Mis-identified as PIPY when PIPI, or vice versa	80	2.3%
Mis-identified to different species	9	0.3%

Accuracy measures for Common and Soprano Pipistrelle ID by Kaleidoscope Pro.

This study carried out manual identification of Common and Soprano Pipistrelle calls for the survey session Aug-Sep 2014.
For the survey sessions Sep-Oct and Oct-Nov, Kaleidoscope Pro was relied upon without manual checking for calls tagged as either common or soprano pipistrelle.
Data published by the manufacturers of the acoustic bat detectors (Wildlife Acoustics, www.wildlifeacoustics.com) is reproduced below.
These illustrate the accuracy of the programme and hence the implications for the Galway study of relying on KPro for tagging common and soprano pipistrelle calls.
99% and 94% of calls tagged by KPro as common and soprano pipistrelle are tagged correctly. Where tagged incorrectly, 0% were tagged as a species other than common or soprano pipistrelle.

Kaleidoscope 2.0.5 United Kingdom Classifiers - Wildlife Acoustics Test Results. Published by Wildlife Acoustics (www.wildlifeacoustics.com).

	UNITED KINGDOM CLASSIFIERS 2.0.5 (sensitive setting)																Testing	
RECORDINGS	BABA	EPSE	MYBR	MYDA	MYNA	NYLE	NYNO	PINA	PIPI	PIPY	PLAUR	RHFE	RHHI	RHHI192	NoID	Correct	N Files	N Calls
BABA	52%	3%		1%				1%	5%	8%	2%				28%	72%	93	676
EPSE		81%		2%		4%	3%				2%				8%	88%	128	2,177
MYBR			57%	14%							21%				7%	62%	14	132
MYDA	2%		8%	64%				5%	3%	2%	3%				14%	75%	64	1,040
MYNA	1%	1%	3%	5%	28%		5%		3%		4%				49%	55%	75	662
NYLE		7%				52%	14%				1%				26%	71%	92	1,058
NYNO		11%				10%	52%								27%	71%	1,904	20,420
PINA	1%							93%		2%					4%	96%	139	2,147
PIPI									84%	1%					15%	99%	16,774	187,743
PIPY									5%	79%					17%	94%	4,349	45,101
PLAUR		4%			1%				1%		30%				63%	81%	145	396
RHFE												85%		10%	6%	90%	317	4,678
RHHI													78%		22%	100%	859	4,848
RHHI192										9%		15%		63%	14%	73%	2,332	24,765
															Mean correct	80%	27,285	295,843
True Positive Rate	52%	81%	57%	64%	28%	52%	52%	93%	84%	79%	30%	85%	78%	63%	Mean TPR	64%		
Positive Predictive Value	92%	76%	85%	74%	95%	79%	70%	94%	83%	79%	46%	85%	100%	86%	Mean PPV	82%		