



BAT CONSERVATION IRELAND

Irish Bat Monitoring Schemes: Daubenton's, Car-based & Woodland Bat Monitoring Northern Ireland

Annual Report for 2025

Clarke, D., Roche N., & Langton S. (2026)



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1.0 EXECUTIVE SUMMARY

This annual report provides information on Bat Conservation Ireland's monitoring schemes in Northern Ireland:

- Car-Based Bat Monitoring Scheme
- All Ireland Daubenton's Bat Waterway Monitoring Scheme
- Pilot Woodland Bat Monitoring Scheme

For detailed analysis of all-island data in 2025 see Roche *et al.* (2026).

The first systematic car-based bat monitoring system in Europe was devised for the Republic of Ireland (ROI) in 2003 by the Bat Conservation Trust (BCT, UK). The scheme has been administered by Bat Conservation Ireland (BCIreland) since 2004 with funding from the National Parks and Wildlife Service (NPWS) of the Department of Housing, Local Government & Heritage and the Northern Ireland Environment Agency (NIEA). The main aim of the scheme is to monitor roadside populations of common pipistrelle, soprano pipistrelle and Leisler's bat and to collect sufficient data to identify trends in these bat populations.

The method involves driving a known survey route at 24kmph with a bat detector clamped to the open window of the passenger door. Each survey route consists of 15, 1.6km transects, separated by a 3.2km gap to minimise the possibility of repeat encounters with the same bats. Recordings are analysed by BCIreland using Kaleidoscope Pro software. In Northern Ireland, routes have been mapped in five, 30km blocks. Surveys are carried out in July and August by trained volunteers. Volunteers are mainly Northern Ireland Bat Group members and interested volunteers with their team-mates.

All-island trends show that the trend lines for all three for the target species (common pipistrelle, soprano pipistrelle and Leisler's bat) are still increasing. We also looked at NI only trends for these species and, for common pipistrelles and Leisler's bats, these mirrored those of All-Ireland, albeit with much wider error bars. The one exception was soprano pipistrelles which saw a slight downturn in the trend in Northern Ireland in 2025. In 2025 in Northern Ireland, encounter rates for most species (bat passes per hour) were lower than the island-wide average. Nathusius' pipistrelles and Leisler's bats occurred in higher encounter rates in Northern Ireland compared with the rest of the island.

The All Ireland Daubenton's Bat Waterways Monitoring Scheme has been in operation in Northern Ireland since 2006 under Bat Conservation Ireland management. Since 2006, a total of 104 waterway sites have been surveyed in Northern Ireland. A small number of waterway surveys have also been on-going in Northern Ireland under the management of BCT, UK since their introduction of the survey since 1997.

All training completed in 2025 was online. BCIreland is required to survey a minimum of thirty waterways sites per year. In 2025, 31 waterway sites were surveyed. A total of 57 surveys were completed with 1,260 'sure' Daubenton's bat passes recorded on 29 of the 31 waterway sites surveyed.

Despite some variation in yearly estimates, the all-Island Daubenton's bat trend appears to be fairly stable from year to year with error bars consistently encompassing the baseline. Trend analysis was also undertaken for Northern Ireland data only. Over the duration of the monitoring programme, there has been a higher increase in the population trend for

Daubenton's bats in Northern Ireland compared to the Republic of Ireland and compared to the All-Ireland dataset. But the difference is not statistically significant.

For the second year running, woodland surveys took place in Northern Ireland in 2025 as part of the newly established All-Ireland Woodland Bat Monitoring Scheme. Fourteen woodland sites were surveyed to assess the presence and activity levels of whiskered bat and Natterer's bat, as well as other woodland bat species. Natterer's bat was present at ten of the 14 sites surveyed (71.4%) while whiskered bat was present at nine sites (64.3%). There were six sites (42.9% of the total) where both species were present. Out of the 14 sites, there were two sites (14.3%) where neither Natterer's bat nor whiskered bat was recorded.

2.0 INTRODUCTION

Bats in Northern Ireland are protected under the Conservation (Natural Habitats, etc) Regulations (Northern Ireland) 1995 and The Wildlife (Northern Ireland) Order 1985. The European Bats Agreement (EUROBATS) is an agreement under the Bonn Convention and Ireland and the UK are two of the 39 range states. Devising strategies for monitoring of populations of selected bat species in Europe is among the resolutions of EUROBATS. Ireland, including Northern Ireland, holds important European populations of Leisler's bat (*Nyctalus leisleri*) (Stebbing, 1988).

To fulfill international obligations under the Convention on Biological Diversity and Agenda 21 agreed in 1992, Local Biodiversity Plans must be devised. The 1992 global agreement requires signatory parties to "identify components of biodiversity ... and monitor, through sampling and other techniques, the components of biological diversity identified" (Article 7).

Scientifically rigorous methods of surveillance and monitoring are essential and require well-planned strategies to achieve statistically defensible results (Battersby, 2010). However, bats are difficult to monitor because they are nocturnal and difficult to identify when flying. In addition, individual species differ in their detectability (using bat detectors) and in their foraging and roosting strategies. Therefore, it is essential that appropriate methods of surveillance and monitoring are undertaken for specific species of bat (Battersby, 2010) and that the most appropriate method is chosen based on a general understanding of the roosting habitats, foraging behaviour, seasonal movements and the influence of environmental factors on local abundance and distribution (Kunz, 2003; Warren & Witter, 2002). Methods used to determine trends in bat populations can include foot-based bat detector surveys (e.g. BCT, 2011), car-based surveys (e.g. Roche et al., 2011)

or roost counts either at summer roosts (Warren & Witter, 2002) or hibernacula (Tuttle, 2003).

This report presents the results of two long-term monitoring schemes managed by BC Ireland, as well as a new pilot scheme that is currently being rolled out.

The All Ireland Daubenton's Bat Waterway Monitoring Scheme is a foot-based survey designed by BCT, UK to monitor the Daubenton's bat (*Myotis daubentonii*). This scheme has proven to be a suitable monitoring tool for this bat species and has been in place since 2006.

The second scheme, Car-based Bat Monitoring, aims to be the primary tool for monitoring roadside populations of common pipistrelles (*Pipistrellus pipistrellus*), soprano pipistrelle (*P. pygmaeus*) and Leisler's bat (*Nyctalus leisleri*) in Ireland. The protocol was initially devised and piloted by The Bat Conservation Trust (BCT) in 2003 as an initiative of The Heritage Council and undertaken in the Republic of Ireland (Catto et al., 2004). It is a peer-assessed monitoring tool for these three bat species (Roche et al., 2011). Other species are also recorded during the surveys. We also analyse trends in species that occur less commonly along the roadside transects including Nathusius' pipistrelle (*P. nathusii*) and *Myotis* species (which may include any or a combination of *M. daubentonii*, *M. nattereri* and *M. mystacinus*). The error bars surrounding the trends in these species are much wider, however, and should therefore be approached with a high degree of caution.

The third scheme that began with a pilot study in 2023, is the Woodland Bat Survey. This targets *Myotis nattereri* and *M. mystacinus*. These two species are not currently monitored under any schemes north or south of the border. In 2024, trial walking transects were carried out along newly mapped routes in a number of woodland sites in Northern Ireland. This scheme is discussed in Section 5.

2.1 Red and Amber Alerts

Monitoring and surveillance protocols need to be able to inform conservation bodies of the trends of the faunal group being investigated. Population trends are often used to identify species that require conservation measures (Dunn, 2002) and confirming a population decline can be used as a rationale to adopt or implement conservation measures. The degree of population decline is also considered to be a valuable evaluation tool with which to identify wildlife populations in trouble (Dunn, 2002). Rates of population change are regularly used as indicators of the conservation status of species e.g. the conservation alerts defined by The British Trust for Ornithology (BTO). The BTO has developed Alert Levels based on IUCN-developed criteria for measured population declines. Species are considered of high conservation priority (i.e. Red Alert) if their population declines by 50% or more over a 25-year period. Species are considered of medium conservation priority (i.e. Amber Alert) if there is a decline of 25-49% over 25 years (Marchant et al., 1997). A 50% and 25% decline over 25 years translates into an annual decline of 2.73% or 1.14% respectively. These Alerts are based on evidence of declines that have already occurred or can be predicted to occur based on statistically robust monitoring data that are sensitive enough to meet Alert Levels.

Monitoring data should be of sufficient statistical sensitivity (and better, if possible) to meet these Alert levels. In relation to the All-Ireland Daubenton's Bat Waterway Monitoring Scheme, the 2006-2008 Synthesis Report (Aughney et al., 2009) included power analysis to evaluate the number of waterway sites that need to be monitored to detect Red and Amber Alerts. Power Analysis indicated that if 150 to 200 waterway sites were surveyed each year, it should be possible to detect Red Alerts in around 6 years and Amber Alerts in 10 years. Results of Power Analysis also showed

that a core of 67-75 waterway sites surveyed twice annually and additional 25-33 sites randomly surveyed each year are required to determine Amber Alerts after 15.4 years.

In relation to The Car-based Bat Monitoring Scheme, Power Analysis undertaken on the 2003-2008 All-Ireland dataset confirmed that when 20 x 30km squares are surveyed twice annually a Red Alert decline can be detected within 8, 11 and 12 years for common pipistrelles, soprano pipistrelles and Leisler's bats, respectively (Roche et al., 2009). Amber Alerts take roughly twice as long to detect. This time frame is considered acceptable to meet Alert levels in a sufficient length of time.

3.0 DAUBENTON'S WATERWAYS SURVEY

3.1 Introduction

The All-Ireland Daubenton's Bat Waterways Monitoring Scheme is a project funded by the National Parks and Wildlife Service (NPWS) of the Department of Heritage, Housing and Local Government, Republic of Ireland and Northern Ireland Environment Agency (NIEA) Environment Fund. This scheme aims to be the primary tool for monitoring Daubenton's bats on the island of Ireland.

The All-Ireland Daubenton's Waterways Scheme has been carried out yearly since 2006 under the management of Bat Conservation Ireland.

3.1.1 Monitoring Daubenton's bats

This scheme follows a survey methodology devised by the Bat Conservation Trust (BCT UK). Narrow band, heterodyne detectors are used, so volunteers who conduct the survey are trained in the identification of Daubenton's bat prior to field work. Surveyors count the number 'bat passes' of this bat species for four minutes at each of the ten fixed points on linear waterways. All data collected for Northern Ireland by the All-Ireland Daubenton's Bat Waterways Monitoring Scheme also feeds into the BCT's UK reporting mechanisms.

This report summarises the main results for Northern Ireland from 2006-2025 with emphasis on the 2025 results. A sufficient number of waterway sites are now surveyed annually in Northern Ireland to allow trend analysis for this jurisdiction alone. For more details on all-island Daubenton's trends and details on variables affecting all-island Daubenton's activity and other results see Roche *et al.* (2026).

3.2 Methods

The All-Ireland Daubenton's Bat Waterway Monitoring Survey methodology is based on that currently used in BCT's UK National Bat Monitoring Programme (NBMP) (Anon, 2004). It is undertaken as an all-island survey.

In 2025 we developed and implemented a new online web form that was used to recruit volunteers. Previous surveyors were first given the opportunity to reclaim their site from 2024 using this new system. After a defined timeframe (once the first online training session had taken place), the opportunity was opened to all potential volunteers who had expressed interest in participating. In brief, volunteers were emailed a link to an interactive Google Map that provided locations and details of all available waterways sites. Volunteers were able to select their chosen waterway on the map and thus sign up for the scheme through submitting an online form. Once done, they were issued with an automatic email containing links to all documents relevant to the surveys and their specific site. Heterodyne bat detectors were also available for loan to volunteers who needed them for the surveys.

Surveyors undertake a daytime survey of their allocated sites to determine its safety and suitability for surveying. At the chosen site, ten points (i.e. survey spots) approximately 100m apart are marked out along a 1km stretch of waterway. The surveyors then revisit the site on two evenings in August and start surveying 40 minutes after sunset. At each of the ten survey spots, the surveyor records Daubenton's bat activity as bat passes for four minutes using a heterodyne bat detector and torchlight (Walsh *et al.*, 2001).

Bat passes are either identified as 'Sure' Daubenton's bat passes or 'Unsure' Daubenton's bat passes. A 'Sure' Daubenton's bat pass is where the surveyor, using a heterodyne detector, has heard the typical rapid clicking echolocation calls of a *Myotis* species and has also clearly seen

the bat skimming the water surface. Bat passes that are heard and sound like *Myotis* species but are not seen skimming the water surface may be another *Myotis* species. Therefore, these bat passes are identified as 'Unsure'. The number of times a bat passes the surveyor is counted for the duration of the four minutes. Therefore, counting bat passes is a measure of activity and results are quoted as the number of bat passes per survey period (No. of bat passes/40 minutes). Surveyors are also requested to record parameters including air temperature, weather data and waterway characteristics, such as width and smoothness.

Surveyors are asked to undertake the survey on two dates, one between the dates of 1st to 15th August (Survey 1, S1) and a repeat survey between the dates of 16th to 31st August (Survey 2, S2). On completion of surveys, survey forms are returned to BC Ireland for analysis and reporting. In 2025, we also developed a new online results submission form for volunteers to submit their results electronically.

3.2.1 Statistical Methods

Trend analysis was carried out with data from 2006-2025 using Poisson Generalised Linear Model (GLM) which is applied to the data with the results expressed as an index and 2007 used as the base year. This model, which includes both sure and unsure passes, has the maximum number of passes set to 48 and includes covariates. The covariates were determined using a binomial GLMM model. This trend method is used to facilitate comparison with BCT Daubenton's trend data from Britain.

Due to the much larger number of sites included, the All-Ireland trend is a much more robust dataset. However, Northern Ireland trend analysis was completed with the current 2006-2025 dataset.

3.3. Results

3.3.1 Training and Volunteer Participation: Northern Ireland 2025 & 2006-2025

In 2025 BC Ireland set up four online training courses via Zoom, for volunteers to participate in. These took place on 16th, 17th, 19th, and 22nd July 2025. Some other online training presentations and training aids were also available on the BC Ireland YouTube channel. A total of 65 volunteers participated in 2025 in Northern Ireland. Six new survey teams were recruited in 2025.

3.3.2 Waterway Sites Surveyed in Northern Ireland

A total of 31 waterway sites were surveyed in Northern Ireland in 2025, the majority of which were located in County Antrim (Table 3.1). Waterway sites surveyed in 2025 were distributed throughout five counties, with no sites surveyed in Co. Fermanagh (Figure 3.1).

In 2025 a total of four canals (six waterway sites) and 15 rivers (25 waterway sites) were surveyed. The Lagan Canal had three waterway sites surveyed along its length and the River Lagan had four.

Table 3.1. Total number of registered waterway sites surveyed in each county in Northern Ireland (2006-2025) and the number of sites surveyed for each of those counties in 2024.

Counties	2006-2025	2025
Derry	17	4
Antrim	30	14
Armagh	9	1
Down	13	6
Fermanagh	10	0
Tyrone	25	6

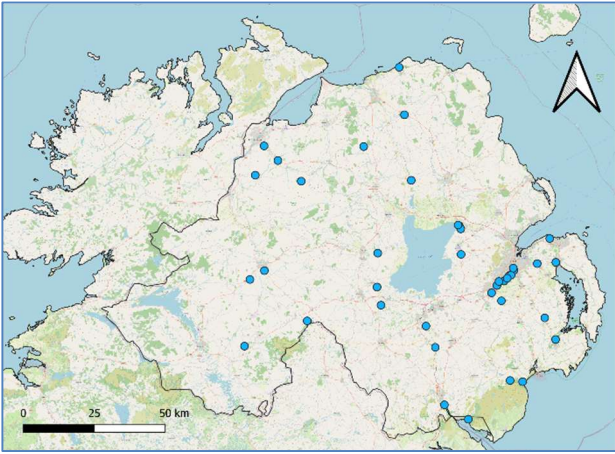


Figure 3.1. Location of waterway sites surveyed in Northern Ireland as part of the All-Ireland Daubenton's Bat Waterway Monitoring Scheme in 2025 (QGIS).

Of the 104 waterways sites that have been surveyed in Northern Ireland, no waterway site has been surveyed each year since 2006 (Figure 3.2). Over the 20 years of the scheme, most sites (71 waterway sites, 68%), have been surveyed for six or fewer years. Waterway sites surveyed for two years or more are included in population trend analysis. On a county-by-county basis, County Tyrone has the highest number of sites that have been only surveyed once (32%, n=8).

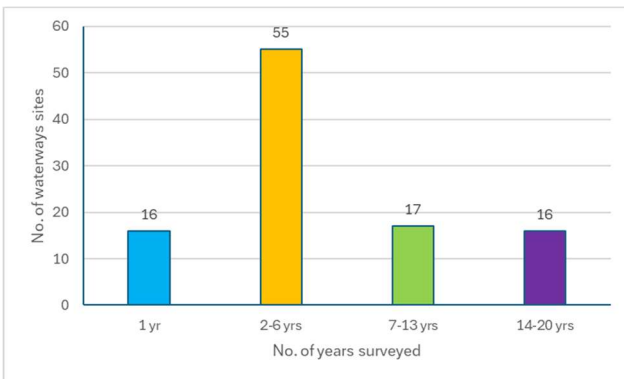


Figure 3.2. Total number of years each waterway site has been surveyed in Northern Ireland as part of the All-Ireland Daubenton's Bat Waterway Monitoring Scheme in 2006-2025, n = 104.

Table 3.2. Number of years each waterway site has been surveyed as part of the Northern Ireland Daubenton's Bat Monitoring Scheme.

No. of Years	No. of waterway sites
1	16
2	10
3	17
4	12
5	7
6	9
7	3
8	2
9	3
10	2
11	2
12	3
13	2
14	2
15	3
16	6
17	3
18	2
19	0
20	0

As of 2025, 88 (84.6%) of the 104 waterways sites that have been surveyed in Northern Ireland have at least two years of survey data (Figure 3.3). This represents 15.5% of the total number of waterway sites on the island with at least two years of survey data.

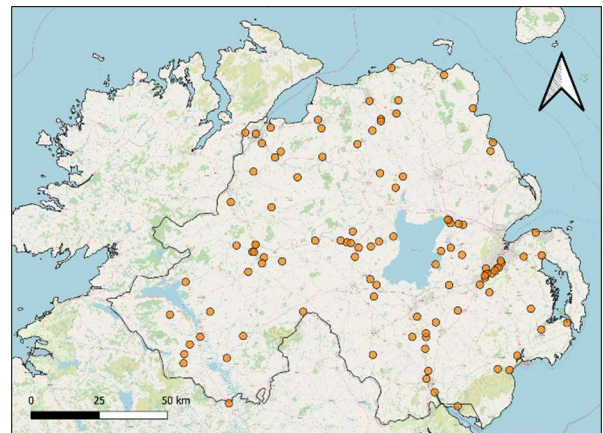


Figure 3.3. Location of all waterway sites surveyed in Northern Ireland during the 2006-2025 period (QGIS).

There are 645 waterway sites in the All-Ireland dataset and, on average, only a third of these are surveyed annually. Many sites in the full dataset have only been surveyed for one year (n=73 waterways, 11.3%). This is similar for Northern Ireland with 16 waterway sites (15.4%) surveyed for one year only. BCIreland encourages new survey teams to take on "old" waterway sites in order to strengthen the data.

3.3.3 Completed Surveys 2025

A total of 57 completed surveys from 31 Northern Ireland waterway sites were returned to BC Ireland in 2025, the same number as in 2024. For Survey 1 (1st – 15th August) 29 surveys were completed and 28 surveys were completed in Survey 2 (16th – 30th August). Waterway sites with repeated surveys (i.e. surveys completed in both sampling periods S1 and S2) provide more robust data for monitoring. In 2025, 26 repeated surveys (83.9% of waterway sites) were completed.

In 2025, 'Sure' Daubenton's bat passes were recorded on 29 Northern Ireland waterway sites (93.5%) (see Figure 3.4).

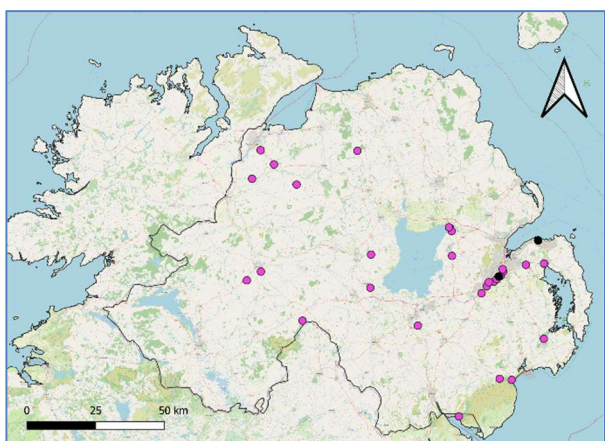


Figure 3.4. Waterway sites where Daubenton's bats were recorded as being present (pink circles) or absent (black circles) in Northern Ireland in 2025 (QGIS).

At each of the 10 survey spots volunteers record Daubenton's bat activity for four minutes, generating 40 minutes of data per completed survey. In total, 1,260 'Sure' Daubenton's bat passes and 268 'Unsure' Daubenton's bat passes were recorded during 70 hours and 58 minutes of surveying in Northern Ireland. The mean number of 'Sure' Daubenton's bats passes per survey in Northern Ireland in 2025 was 21.7 and was lower than the mean number of passes per survey in 2024 (n=25.6). The 2025 Northern Ireland mean number of passes was also lower than the 2025 All-Ireland average (n=43.5).

For a full breakdown of all of the descriptive results recorded for 2025 and for the 2006-2025 dataset see Table 1, Appendix 1.

3.3.4 Bat Records & Robustness of Dataset

All bat records derived from the Daubenton's Bat Waterway Monitoring Scheme for Northern Ireland were sent to the BCT and CEDaR in January 2025.

3.3.5 Trends – Poisson GLM

To assess trends, a Poisson Generalised Linear Model (GLM) was applied to the data with the results expressed as an index and 2007 used as the base year. Just one of the models is reported here, the model that includes both sure and unsure passes, with a maximum of 48 passes per spot. This particular model is chosen to facilitate comparison with data from the BCT. A total of 566 waterway sites that were surveyed for two years or more are included in this analysis in 2025. Waterway sites only surveyed for one year do not contribute to information on trends and are therefore omitted from the analysis.

On an All-Ireland level there has been a fluctuating trend since 2006, with levels having troughed in 2008 and 2013-2014. A peak was observed in 2011 and then again 2015-2017. In the subsequent years until 2023 there was a slight dip in the trend, but as of 2025 this has levelled out to show a relatively stable trend. On average the numbers of passes recorded in 2025 were higher than 2024, and these were higher compared to most of the last six years. In 2025, the highest number of survey sites were sampled since the beginning of the scheme with 256 sites surveyed. The smoothed index is currently 3.83% above the 2007 base year value which is equivalent to a mean 0.21% annual increase, although this increase is not considered significant as confidence intervals still encompasses the baseline index (Figure 3.5).

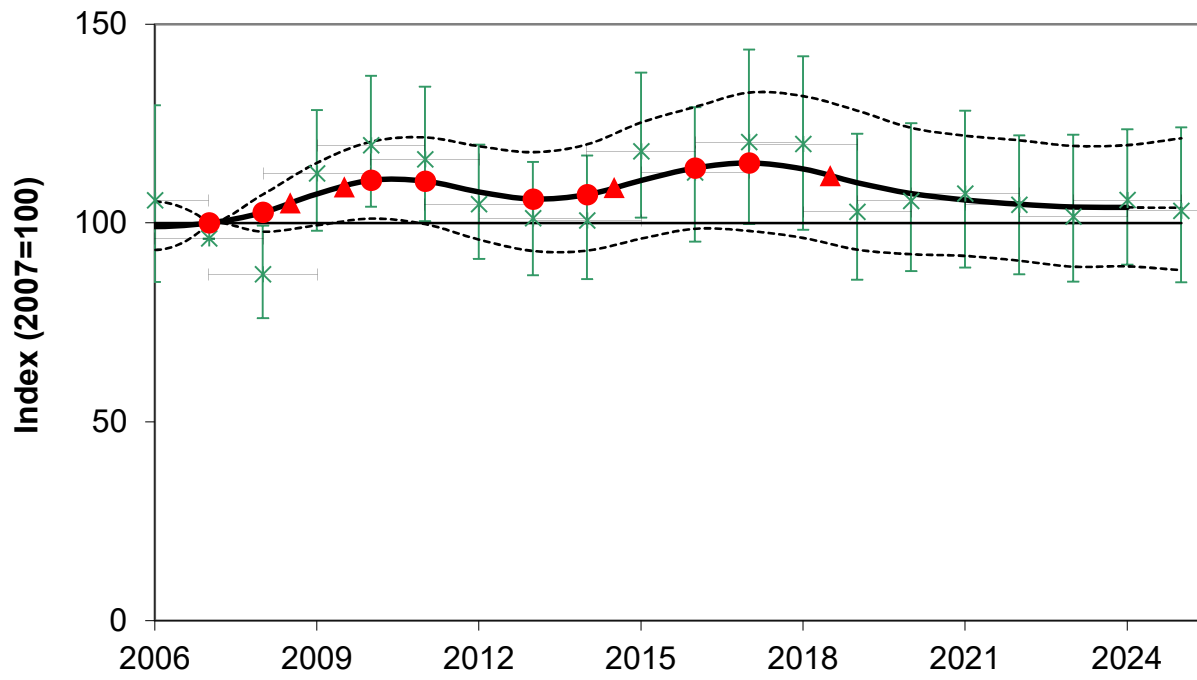


Figure 3.5. Results of Daubenton's bat Poisson GAM/GLM trend including both sure and unsure passes, with covariates, for All-Ireland data. Green points are estimated annual means and are shown to illustrate the variation about the fitted line. Red circles indicate significant ($P < 0.05$) change points, where the slope of the smoothed trend line changes. Red triangles indicate that the difference in the smoothed index between consecutive years is statistically significant ($P < 0.05$). See appendices for accompanying table.

Table 3.3. Poisson GAM results with 95% confidence limits for Daubenton's bats (2006-2025). Covariates include survey start time, surveyor skills and degree of smooth water as recorded by survey teams.

Year	Sites	Surveys	Mean	Smoothed		95% conf limits		Unsmoothed		95% conf limits	
				Index	s.e.	Lower	Upper	Fitted	s.e.	Lower	Upper
2006	114	206	54.24	99.12	3.10	93.24	105.35	109.64	10.84	89.14	133.57
2007	173	306	48.50	100.00	0.00	100.00	100.00	100.00	0.00	100.00	100.00
2008	159	270	40.37	102.68	2.42	97.83	107.21	91.05	6.28	80.01	103.30
2009	181	310	50.89	107.35	4.05	99.44	115.14	116.34	8.07	101.99	132.37
2010	196	357	58.50	110.77	5.05	101.12	120.43	123.49	8.59	108.06	140.92
2011	219	387	59.04	110.52	5.64	99.75	121.54	119.95	8.32	104.39	138.25
2012	217	397	52.13	107.83	6.02	95.85	119.31	108.62	7.69	94.94	123.67
2013	224	408	48.72	106.03	6.36	92.98	117.82	105.14	7.34	90.82	119.27
2014	243	452	45.13	107.14	6.78	93.07	119.78	104.56	7.89	89.83	120.95
2015	246	454	50.37	110.69	7.26	96.07	125.28	121.92	9.30	105.33	141.74
2016	244	440	49.73	113.82	7.80	98.56	129.19	116.61	8.92	99.24	133.09
2017	224	391	52.01	115.12	8.37	98.02	132.80	124.24	11.05	103.68	147.54
2018	234	405	50.29	113.59	8.54	96.26	131.91	123.74	11.12	102.26	145.83
2019	233	410	42.57	110.16	8.30	93.31	128.29	106.72	9.23	89.70	126.39
2020	230	409	43.37	107.44	8.10	92.16	123.95	109.45	9.73	91.88	129.03
2021	227	417	44.12	105.82	8.05	91.75	121.96	111.31	10.09	92.76	132.19
2022	242	438	48.08	104.71	7.97	90.53	120.81	108.46	9.44	91.05	125.96
2023	243	435	45.61	104.06	7.86	89.03	119.38	105.52	9.61	89.17	126.15
2024	246	459	46.99	103.93	7.91	89.11	119.59	109.65	8.85	93.48	127.55
2025	253	474	46.10	103.83	8.62	88.16	121.30	106.97	9.93	89.03	128.00

3.3.6 Country Trend Models

A trend model for Northern Ireland was investigated separately. The trend analysis was completed for data from Northern Ireland (n=86 waterway sites) separately from the All-Ireland dataset using the Poisson model, with both sure and unsure passes (max 48 per spot), with covariates. For Northern Ireland, the smoothed trend showed an increase in the initial years, followed by a decline since 2018. Overall, there has been increase of 15.77%, which represents a yearly increase of 0.82% since

the baseline year, 2007 (Figure 3.6, Table 3.4). Although the index value is greater for Northern Ireland in comparison to that for the Republic of Ireland (n=480 waterway sites), the confidence limits are wide due to the relatively small sample size. Also, values are not significantly different using a randomisation test between the two datasets. For the Republic of Ireland data, the smoothed trend indicates an increase of 3.05%, which represents a yearly increase of 0.17% since the baseline year in 2007.

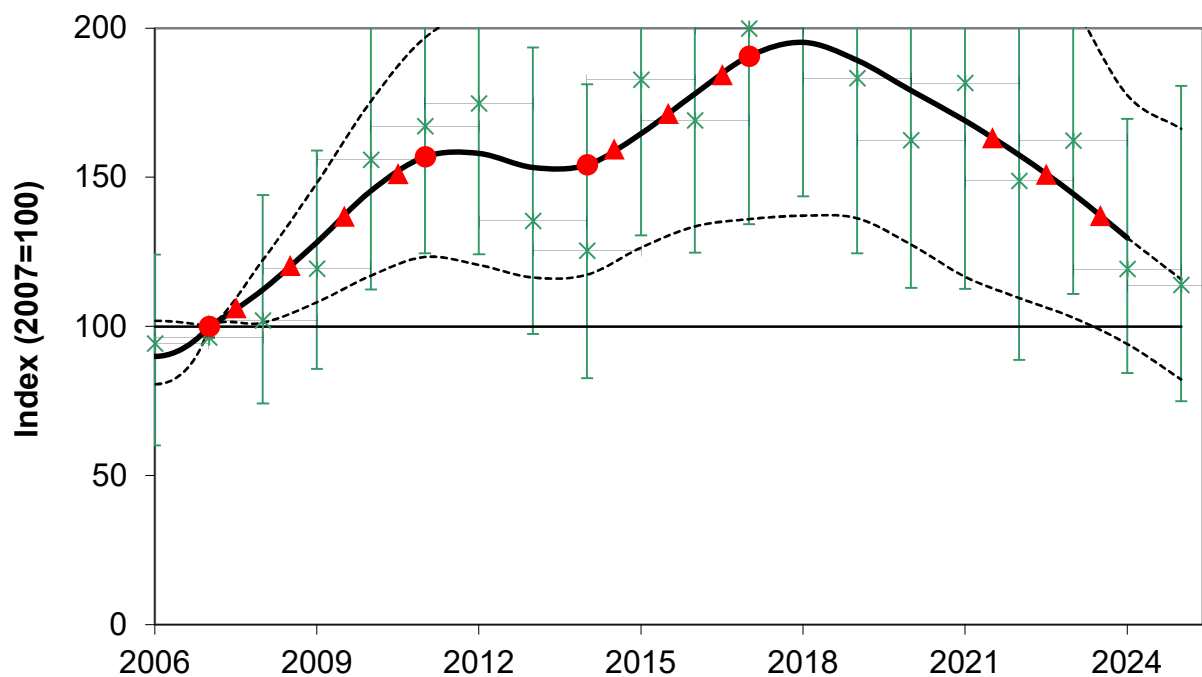


Figure 3.6. Northern Ireland results of Poisson GAM model (max 48 'sure' and 'unsure' passes), with covariates (survey start time, surveyor skills and degree of smooth water as recorded by survey teams), shown with 95% confidence limits. Green points are estimated annual means and are shown to illustrate the variation about the fitted line.

Table 3.4. Northern Ireland Poisson GAM results with 95% confidence limits for Daubenton's bats (2006-2025). Covariates include survey start time, surveyor skills and degree of smooth water as recorded by survey teams.

Year	Sites	Surveys	Smoothed			95% conf limits		Unsmoothed		95% conf limits	
			Mean	Index	s.e.	Lower	Upper	Fitted	s.e.	Lower	Upper
2006	12	24	34.92	89.93	5.61	80.62	101.90	97.93	17.99	63.85	127.81
2007	18	30	38.73	100.00	0.00	100.00	100.00	100.00	0.00	100.00	100.00
2008	25	44	44.73	112.43	5.61	101.25	122.34	105.71	18.06	77.96	147.76
2009	31	50	48.22	128.32	10.61	108.13	148.12	123.04	18.82	89.51	162.69
2010	32	58	51.14	145.50	14.92	117.05	175.56	159.49	26.69	116.17	221.41
2011	41	78	57.29	156.88	18.33	123.31	196.82	170.77	25.84	128.23	229.35
2012	36	64	61.05	158.00	20.50	120.63	205.49	178.40	29.62	127.89	243.82
2013	31	59	40.93	153.27	21.01	116.41	203.17	139.00	22.03	101.19	197.21
2014	34	65	37.26	154.19	21.94	117.37	204.91	129.09	24.15	86.45	184.87
2015	35	69	55.64	164.67	24.69	126.44	222.39	186.35	36.77	134.24	275.31
2016	32	61	48.48	178.09	28.37	133.57	246.88	172.69	30.16	128.44	243.21
2017	33	54	58.17	190.59	32.56	135.98	266.73	203.52	39.90	137.98	302.96
2018	32	60	50.65	195.25	34.94	137.15	277.50	223.03	45.43	147.31	323.31
2019	34	61	42.43	189.21	34.34	136.27	273.47	186.95	42.08	128.24	295.67
2020	34	57	36.89	179.04	33.29	127.44	265.73	166.08	32.18	116.71	246.48
2021	32	58	33.88	168.94	33.05	116.63	245.44	185.31	44.94	116.38	307.42
2022	28	55	30.98	157.45	30.84	109.54	231.67	152.43	38.62	92.51	241.92
2023	29	54	37.30	144.49	26.32	102.96	207.70	166.00	34.69	114.58	247.53
2024	28	52	30.94	129.70	22.37	94.13	177.55	122.93	22.88	88.15	173.32
2025	31	57	27.09	115.77	21.95	82.24	166.24	117.57	28.08	78.67	184.33

3.4 Discussion

3.4.1 Volunteer Uptake in Northern Ireland

Thirty survey teams (with a minimum two individuals per team), undertook the survey in 2025 in Northern Ireland. There had been a reduction of teams participating from Northern Ireland since 2011. This decline was successfully reversed in 2015 and participation has remained relatively consistent over the past ten years. Six new teams were recruited in 2025, compared to five new teams in 2024.

While a core group of survey teams have participated in the programme since the early years, there is still a need for a continued recruitment drive since a certain percentage of volunteers are lost to the survey every year. Since the Covid-19 pandemic, all recruitment training events have taken place online. For the most part this has worked very well and has continued to at least maintain the numbers of volunteers taking part in the scheme, which is reassuring. There may be the need however, to revisit conducting periodic in-person training events in Northern Ireland if participation rates decrease in future years.

In addition, BCIreland continues to work closely with the Lagan Valley Volunteers, which has proven very successful over the years with management of six volunteer teams in County Antrim completed by the volunteer co-ordinator. In 2018, a new link was formed with the Lagan Valley Rivers Trust and this continued in 2025.

3.4.2 Survey Coverage in 2025 in Northern Ireland

A total of 57 surveys were completed at 31 waterways sites, exactly the same

numbers as in 2024. The waterway sites were located in all counties in Northern Ireland except Fermanagh, with the largest coverage in County Antrim. The County Antrim coverage is primarily a consequence of BCIreland working closely with the Lagan Valley Volunteers, who surveyed six waterway sites in 2025 and have consistently participated in the scheme for many years.

The data collected is more robust when waterway sites are surveyed for two or more years. Therefore, waterway sites with only one survey year completed over the duration of the scheme will continue to be targeted for re-surveying in 2025 (n=16 waterway sites). This aim has been actioned in the last few years and as a result, the number of waterways sites only surveyed for one year was reduced again in 2025.

3.4.3 Dataset & Distribution in Northern Ireland

The 2025 dataset consisted of 1,260 'Sure' Daubenton's bat passes. Daubenton's bat was recorded on the majority of the waterway sites surveyed in 2025, thus re-confirming this species' wide distribution on linear waterways across Northern Ireland. A similar widespread distribution of this species was also reported by the BCT NBMP where Daubenton's bats were recorded from northern Scotland to southern England (www.bats.org.uk). This monitoring scheme continues, therefore, to make a considerable contribution to our knowledge of the distribution range of Daubenton's bat.

The large dataset currently held by BCIreland for this species is a potentially useful source of mapping information on a county, river catchment and river level. Such representation may prove useful for future county planning and conservation work in relation to waterways.

The dataset for Northern Ireland now stands at 104 waterway sites surveyed over the 20 years of the scheme. However, waterway sites need to be surveyed more consistently from year to year to provide statistically robust data. No waterway site has been surveyed in each of the 20 years of the scheme. A continued effort will be undertaken in 2026 to survey waterway sites that have only been surveyed once in the 20 years of the scheme (n=16 sites). Repeat surveys improve the statistical power of the data and increase the ability to detect trends.

3.4.4 Yearly Trends

While across the island Daubenton's bat activity has decreased slightly since the

survey began in 2006, this decrease is not considered significant. More recently, the trend from 2016-2025 has been relatively stable overall.

As sufficient data is now being collected on an annual basis, separate trend analysis for Northern Ireland has been completed annually since 2017. Over the duration of the monitoring programme, there has generally been a greater increase in the population trend for Daubenton's bats in Northern Ireland compared to the Republic of Ireland but the differences are not significant.

4.0 CAR-BASED BAT MONITORING

4.1 Introduction

This project aims to be the primary tool for monitoring roadside populations of common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*P. pygmaeus*) and Leisler's bat (*Nyctalus leisleri*) in Ireland. The protocol was initially devised and piloted by The Bat Conservation Trust (BCT) in 2003 as an initiative of The Heritage Council and undertaken in the Republic of Ireland (Catto et al., 2004). Funding was provided by the Northern Ireland Environment Agency (NIEA) from 2006 to carry out surveys within Northern Ireland as part of an overall All-Ireland survey for the two countries, managed by Bat Conservation Ireland (BCIreland). Data from the Northern Ireland surveys are specifically the subject of this report. Within the context of monitoring aims, i.e. to use monitoring data to detect Amber and Red Alert declines of selected populations, the data collected from Northern Ireland alone would not be sufficient to provide statistically robust data. However, we report on the NI-only trends in this report.

The present report summarises the main results for Northern Ireland in the period 2006-2025 with some of the specific results for 2025.

4.1.1 What is a Car-based Bat Monitoring Scheme?

This protocol is a method of monitoring bats while driving. Monitoring is carried out using a bat detector which picks up the ultrasonic (high pitched) echolocation calls made by bats and converts them to a frequency audible to the human ear. From 2003 to 2019, time expansion detectors were used. These detectors essentially make short recordings of a

broad range of ultrasound and replay the sounds at a slower speed. All sounds were recorded to minidisks initially, and from 2012, smartphones were used to record bat detector sounds and georeferencing information.

From 2016 to 2019 a new type of bat detector was phased into the survey. Batlogger M (Elekon Electronics) full spectrum detectors record snapshots of ultrasound on a continuous basis along with GPS data, and all data is stored on the device's SD card. This removes the requirement for a secondary recording device.

Batloggers were first trialled in small numbers in 2016 and were then used in increasing numbers each year, each time in tandem with Tranquillity detectors. This meant that sufficient data had been collected from 2016 to 2019 to allow a full swap over to Batloggers alone in 2020 and these devices have been used since then.

The monitoring is carried out along mapped routes with 15 transects each within five 30km x 30km survey squares in Northern Ireland. Each transect along the route is driven at a prescribed speed (15mph).

Training of two new teams in Northern Ireland in 2025 was carried out via Zoom and the equipment boxes were posted to volunteers.

4.1.2 Overall Aims of Car-Based Bat Monitoring Scheme

1. Provide a method of monitoring that can be implemented by relatively few surveyors and that does not require highly trained individuals.
2. Provide a method of data collection that is
 - objective
 - easily repeatable
 - cost effective.

3. Ensure sufficient data is collected that will allow early recognition of Red and Amber Alert declines in certain Irish bat species' populations.
4. The species targeted for monitoring are:
 - common pipistrelle
 - soprano pipistrelles
 - Leisler's bat
5. Nathusius' pipistrelle (*P. nathusii*) is not encountered in sufficiently high numbers to allow robust monitoring of its populations, nonetheless this species is recorded by the survey and we produce a trend index, albeit with very wide confidence intervals.
6. *Myotis* bats, i.e. Daubenton's, Natterer's and whiskered bats (*Myotis daubentonii*, *M. nattereri* and *M. mystacinus*) are not identified to species level and are recorded in very low numbers. Nonetheless, we produce a trend index for this species group which is the subject of discussion in this report.
7. Record other vertebrate wildlife during survey periods.
8. To extrapolate information on bat activity within survey squares to determine 'hotspot' areas, and/or areas of high bat diversity.

4.2 Methods

This Car-based Bat Monitoring Scheme was designed by the BCT in 2003. To date much bat monitoring work has been done in other countries by foot-based trained volunteers (e.g. the UK National Bat Monitoring Programme (NBMP)). In Ireland, however, a lack of trained bat workers in Ireland meant that such monitoring work was not feasible until relatively recently. The car-based method ensures that large areas can be covered in one night and the use of a time-expansion or full spectrum detector means that volunteers do not need to be skilled in bat

identification to collect the data accurately.

Training of surveyors has been carried out in summer prior to Survey 1 each year. In 2025 two new Northern Ireland teams were trained in via Zoom. Issues and queries from teams were discussed via Zoom, email or WhatsApp prior to the survey.

Starting 45 minutes after sundown, surveyors drive a mapped route within a defined 30km **Survey Square**. The survey routes cover 15 x 1.609km (1 mile) **Monitoring Transects** each of which is separated by a minimum distance of 3.2km (2 miles). Surveyors are asked to carry out the survey on two dates, one in mid to late July (Survey 1, S1) and one in early to mid-August (Survey 2, S2). Each of the 1.609km transects is driven at 24km (15 miles) per hour while continuously recording using a Batlogger M detector.

While all routes were mapped between 2005 and 2009 some adjustments were made to the H13 survey route in August 2025. This was done following discussion with the new survey team due to concerns over health and safety as this route took too long to drive at night.

In 2025 all surveyors across the island were provided with Batlogger M full spectrum detectors. The Batloggers are pre-loaded with parameters for the survey. Surveyors are asked to affix the detector to the clamp so that the microphone is facing out of the window and slightly to the rear of the car in the same direction as the former set up (time expansion Tranquility detector). The Batlogger records audio and GPS location data to the device's SD card. Surveyors switch the Batlogger on to record at the start of each transect and switch it off at the end. The result is a folder containing multiple matched audio (.wav) and GPS (.xml) files for each survey evening.

The survey coordinator requests that problems arising during the survey season are communicated to BC Ireland so that back up survey teams can be arranged if possible.

On completion of surveys, data is forwarded to BC Ireland for analysis. Teams were strongly advised to make a backup copy prior to posting the SD card or to upload the data to a Dropbox folder which was provided to them for the survey. In this way, we hoped to prevent loss of survey data due to SD cards becoming corrupted or lost in the post.

Data from Batloggers were analysed using Wildlife Acoustics Kaleidoscope Pro software (both automated and manual settings). At present, manual identifications from Kaleidoscope are being used for all data and trend analysis.

We will continue to assess automated analysis methods and at some point may retrospectively analyse all data when automated identification is considered to be sufficiently high enough quality.

Data from Batloggers were gathered into Excel spreadsheets imported to BC Ireland's purpose-built Car-based Bat Monitoring MySQL database.

For the purposes of providing volunteer feedback, spreadsheets listing bat species, date, time, location and accuracy were uploaded to Google Maps and bat locations were pinned to a map for each route, with icons of differing colour and shape denoting a particular bat species.

In 2025 training videos continued to be available at the Bat Conservation Ireland YouTube channel.

4.2.1 Analysis

For overall yearly trends of the island-wide populations a Generalised Linear Model with Poisson error distribution is applied to the data. Covariates are used to account for differences between the two detector types. For Nathusius' pipistrelles, however, trends are analysed using a binomial model of presence/absence data.

With regard to separate Northern Ireland-only trends, Northern Ireland is problematic because there are only five squares with data, and less in some years. In the past we have dealt with this by using individual one mile transects as the replicates for the bootstrapping process. This was done due to doubts about the reliability of bootstrapping with small numbers of squares, but is not ideal. In 2023 we explored whether reliable bootstrap confidence limits can be obtained using the standard approach with just five squares. This was done by producing 1000 sets of simulated data for five sites over 15 years for both common and soprano pipistrelles, using a modified version of the programs used in 2009 for the power analyses for the Animal Conservation paper (Roche *et al.*, 2011). Results were good, with 95% confidence limits containing the true index value around 93% of the time. This standard method was applied, using 30km squares as replicates, in analyses for common and soprano pipistrelles, and Leisler's bats in Northern Ireland alone.

For Northern Ireland the models were initially run with the usual base year (i.e. 2006, except for brown long-eared which is 2010), but the confidence limits were wide because the 2006 data is at the start of the series when only three squares were surveyed in Northern Ireland. Using 2010 as the base instead gives tighter confidence limits. The results for NI-only and All-Ireland are presented in this report.

4.2.2 Other Vertebrates

Other vertebrates were also recorded by surveyors. From 2006, surveyors were asked to note all vertebrates including cats on their record sheets. In addition, observers had the facility to record whether each specimen was living or dead and whether each was observed during or after the driven transect. This means that recorders were observing living and dead vertebrates, other than bats, for approximately 43 miles (69km) on each survey evening.

4.3 Results

4.3.1 Volunteer Uptake in Northern Ireland

Since 2007 between 10 and 13 volunteers have carried out the car survey each year. Surveys are carried out in five 30 x 30km squares. The squares cover parts of Counties Fermanagh/Tyrone, Antrim, Down and Derry (see Figure 4.1).

In 2025, 10 surveyors who are members of Northern Ireland Bat Group (NIBG), Bat Conservation Ireland and interested volunteers, along with their team partners,

surveyed all five routes in Northern Ireland. All squares were surveyed twice.

4.3.2 Survey Coverage in 2025 in Northern Ireland

Approximately 240km of monitoring transects were covered in Northern Ireland in 2025. The sound recordings made by the Northern Ireland survey teams were of very high quality. In 2025, approximately 552km of roads were surveyed for vertebrates other than bats (vertebrate sightings are noted along the entire route driven and therefore include the distances in between transects).

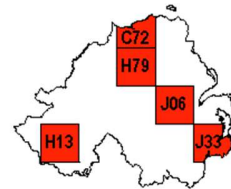


Figure 4.1: Locations of Survey Squares, surveyed for bats in Northern Ireland as part of the Car-based Bat Monitoring Scheme. Red squares were successfully surveyed twice in 2025.

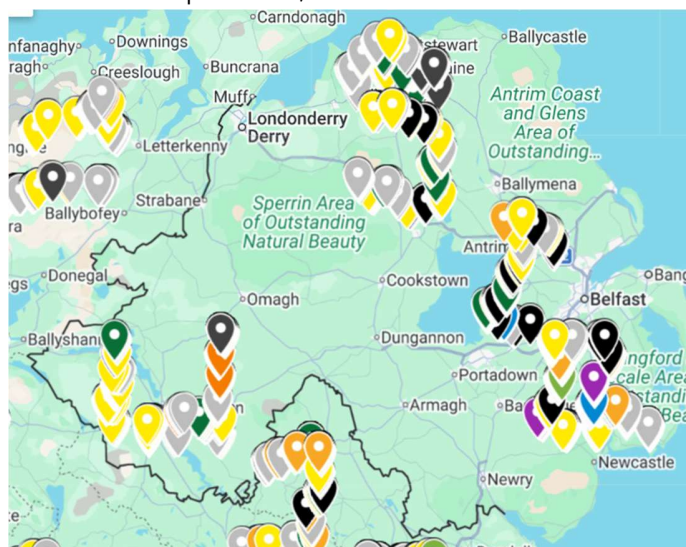


Figure 4.2: Locations of bat records from the car-based bat monitoring scheme in Northern Ireland, 2025, Batlogger Detectors. Map produced using Google Maps.

4.3.3 Roadside Bat Species in 2025 in Northern Ireland

A pie-chart illustrating overall proportions of bat species encountered in Northern Ireland in 2025 is shown in Figure 4.3. Figure 4.4 shows the same breakdown, but for the entire island. The proportion of passes per species varies somewhat between the

whole island and Northern Ireland. For example, Leisler's bats and Nathusius' pipistrelles account for a greater proportion of bat passes in Northern Ireland, while the proportion of common pipistrelles encountered is lower in Northern Ireland than in the island as a whole.

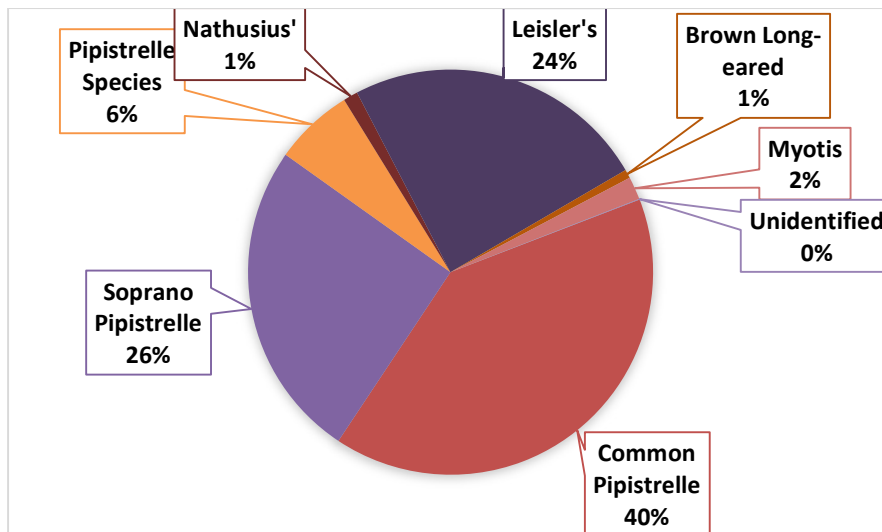


Figure 4.3: Proportion of bat species encountered during the 2025 survey from ten surveys in Northern Ireland using Batlogger detectors. Total number of encounters n=1,745. Excepting social calls of Leisler's bats and brown long-eared bats, which are unlikely to be mistaken for those of other species, bat social calls were noted during sonogram analysis but are not included in the above pie chart or in any statistical analyses

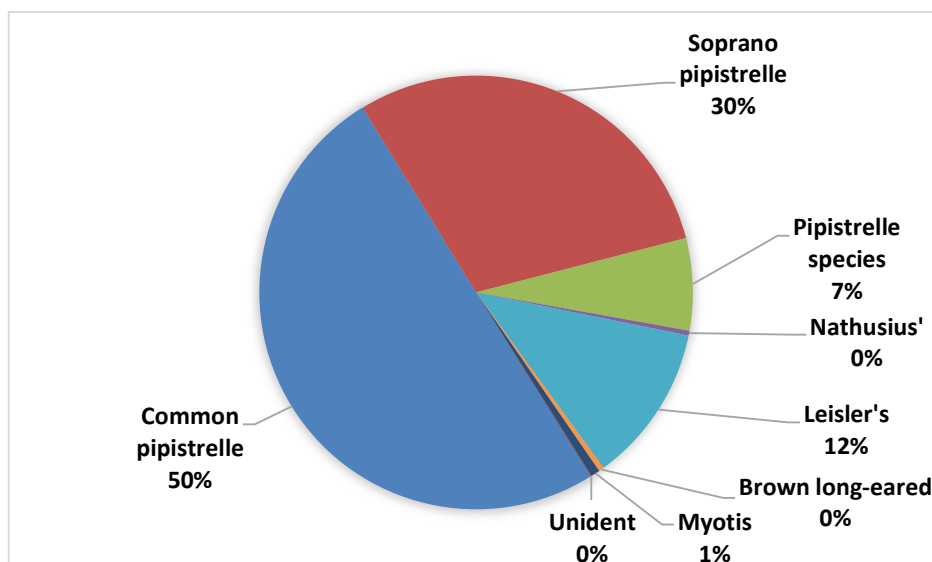


Figure 4.4: Proportion of bat species encountered (Batlogger Detectors) during the survey of the entire island of Ireland in 2025. Total number of bat encounters n=14,440. Excepting social calls of Leisler's bats and brown long-eared bats, which are unlikely to be mistaken for those of other species, bat social calls are not included in the above pie chart or in any statistical analyses.

A detailed break-down of Batlogger detector results for each survey square in Northern Ireland in 2025, not corrected to number of bat encounters per hour or per square, is shown in Table 4.1. Average encounter rates (per hour) for Northern Ireland in 2025, in comparison with the

whole island are shown in Table 4.2. While encounter rates for some bat species in Northern Ireland are typically lower than the island-wide average, in 2025 average encounter rates were higher here for Nathusius' pipistrelles and Leisler's bats.

Table 4.1: All bat encounters from Northern Ireland car-based bat monitoring survey squares, 2025.

Square – Survey	Transects	Common pip *	Soprano pip*	Unknown pip*	Nath pip*	Leisler's bat	Brown long-eared	Myotis species	All bats
C72_1	15	37	17	5		52			111
C72_2	15	30	32	3		34			99
H13_1	15	86	56	15	2	20		7	187
H13_2	15	119	82	22	1	57		3	284
H79_1	15	50	37	7		28	2	1	125
H79_2	15	58	27	13	1	15	1		115
J06_1	15	26	35	3	3	58			125
J06_2	15	7	25	2	2	39			75
J33_1	15	155	77	19	11	83	1	10	356
J33_2	15	133	57	22		37	8	11	268
TOTAL		701	445	111	20	423	12	32	1745

*Common pip: common pipistrelle (*Pipistrellus pipistrellus*); Soprano pip: soprano pipistrelle (*P. pygmaeus*); Unknown pip: Unknown pipistrelle; Nath pip: Nathusius' pipistrelle (*P. nathusii*)

Table 4.2: Average bat encounter rates (per hour) in 2025 in each Northern Ireland survey square, for Northern Ireland as a whole (n=9), and the whole island (n=52).

	Common pip *	Soprano pip*	Unknown pip*	Nath pip*	Leisler's bat	Brown long-eared	Myotis spp.	All bats
C72	34.28	23.88	4.16	0.00	44.53	0.00	0.00	106.86
H13	80.75	54.26	14.55	1.22	29.66	0.00	4.09	184.95
H79	44.72	26.42	8.31	0.42	17.71	1.24	0.41	99.22
J06	12.50	22.92	1.91	1.91	37.04	0.00	0.00	76.28
J33	122.65	56.90	17.56	4.52	50.49	3.96	8.99	265.07
Northern Ireland	58.98	36.88	9.30	1.61	35.89	1.04	2.70	146.48
<i>All-Ireland</i>	117.92	70.35	16.72	0.77	27.38	0.90	1.54	235.71

*Common pip: common pipistrelle (*Pipistrellus pipistrellus*); Soprano pip: soprano pipistrelle (*P. pygmaeus*); Unknown pip: Unknown pipistrelle; Nath pip: Nathusius' pipistrelle (*P. nathusii*)

As in previous years, the overall common pipistrelle encounter rate recorded from Northern Ireland squares in 2025 (58.98hr⁻¹) was lower than the island-wide average (117.92hr⁻¹) (See Table 4.2).

The average encounter rate for soprano pipistrelles for Northern Ireland (36.88hr⁻¹) was also lower than the island-wide average (70.35hr⁻¹).

Encounter rates with Leisler's bat have been variable over the years and Northern Ireland's encounter rate of 35.89hr⁻¹ in 2025 was slightly higher than the island-wide average of 27.38hr⁻¹.

While Nathusius' pipistrelles were absent from Car-based Bat Monitoring survey recordings in Northern Ireland in 2008, in

2009 this species was recorded from three Northern Irish 30km squares. It has been recorded in Northern Ireland every year since then, generally in one or two survey squares, one of which usually includes J06. Survey square J06 is situated along the eastern shores of Lough Neagh. In 2025 Nathusius' pipistrelle was recorded from H13, H79, J06 and J33.

4.3.4 Bat Records

All bat records derived from the Car-based-bat Monitoring Scheme for Northern Ireland have been forwarded to the BCT and CEDaR, as in previous years.

4.3.5 Roadside Bat Trends

The following graphics for both all-island and Northern Ireland roadside bat trends from both Tranquility and Batlogger detectors are derived from Poisson GLM models with GAM smoothing (for common pipistrelle, soprano pipistrelle, Leisler's bat and *Myotis* spp.) and a covariate for detector type.

The trend for Nathusius' pipistrelle (all-Ireland), however, is a binomial GLM

model (also with a covariate for detector) based on the proportion of one mile transects passes of this species.

A Northern Ireland-only trend (Poisson GLM) is shown for three species: common pipistrelle, soprano pipistrelle and Leisler's bats, although the error bars for Leisler's bats are extremely wide. Trends for remaining species in Northern Ireland alone are not provided due to the very wide confidence limits.

As can be seen from the graphs (Figures 4.5-4.10), common pipistrelles, soprano pipistrelles and Leisler's bats significantly increased during the monitoring period (2003-2024) across the island of Ireland. The trends for Northern Ireland show similar levels of increase for all three species, albeit with much wider error bars. In the case of soprano pipistrelle, the lower error bar of the NI-only trend currently encompasses the baseline which indicates that the increasing trend cannot be considered significant. Lower error bars for common pipistrelle and Leisler's bat both exceed their 2010 baselines and increases of those species are therefore considered significant.

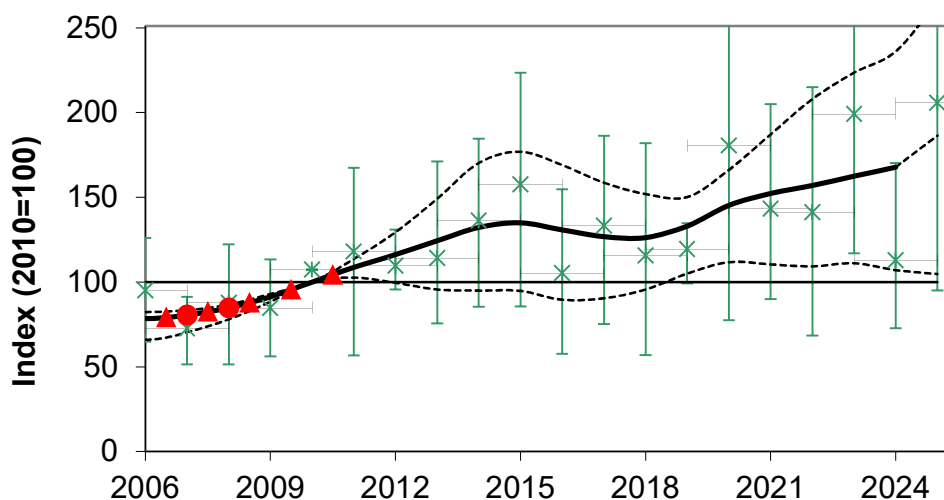


Figure 4.5: Results of the GAM/GLM model for **common pipistrelle, Northern Ireland** only. Points are estimated annual means derived from the Generalised Linear Model (GLM) and the bars are 95% bootstrapped confidence limits. The heavy black line is the fitted Generalised Additive Model (GAM) curve with 95% confidence limits

shown by the lighter black lines. Both Tranquility and Batlogger data are included, with a covariate for detector to adjust for their different sensitivities. The response variable is the number of snapshots/soundfiles with the species present. The log of total survey time is used as an offset. The end of the smoothed trend is shown with a broken line to illustrate uncertainty for 2024-2025 and the possibility that the slope will change with coming years' data. Red circles indicate significant ($P < 0.05$) change points, where the slope of the smoothed trend line changes. Red triangles indicate that the difference in the smoothed index between consecutive years is statistically significant ($P < 0.05$).

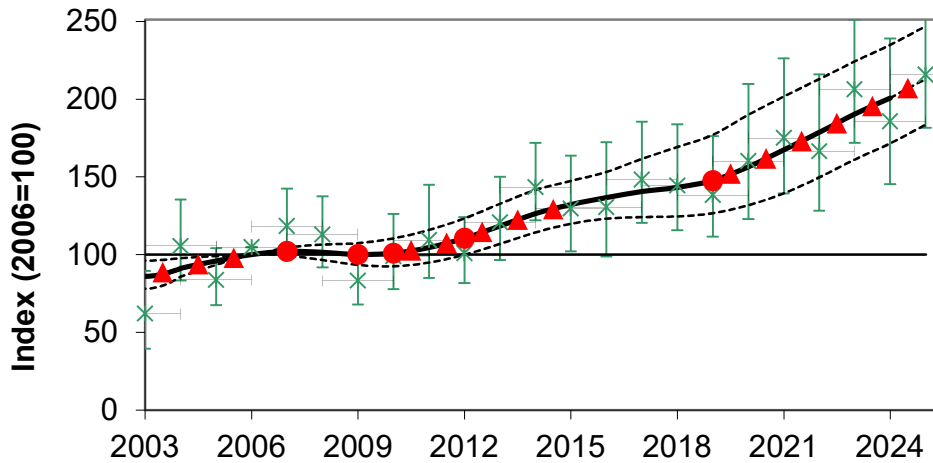


Figure 4.6: Results of the GAM/GLM model for **common pipistrelle, all-Ireland**. Points are estimated annual means derived from the Generalised Linear Model (GLM) and the bars are 95% bootstrapped confidence limits. The heavy black line is the fitted Generalised Additive Model (GAM) curve with 95% confidence limits shown by the lighter black lines. Both Tranquility and Batlogger data are included, with a covariate for detector to adjust for their different sensitivities. The response variable is the number of snapshots/soundfiles with the species present. The log of total survey time is used as an offset. The end of the smoothed trend is shown with a broken line to illustrate uncertainty for 2024-2025 and the possibility that the slope will change with coming years' data. Red circles indicate significant ($P < 0.05$) change points, where the slope of the smoothed trend line changes. Red triangles indicate that the difference in the smoothed index between consecutive years is statistically significant ($P < 0.05$).

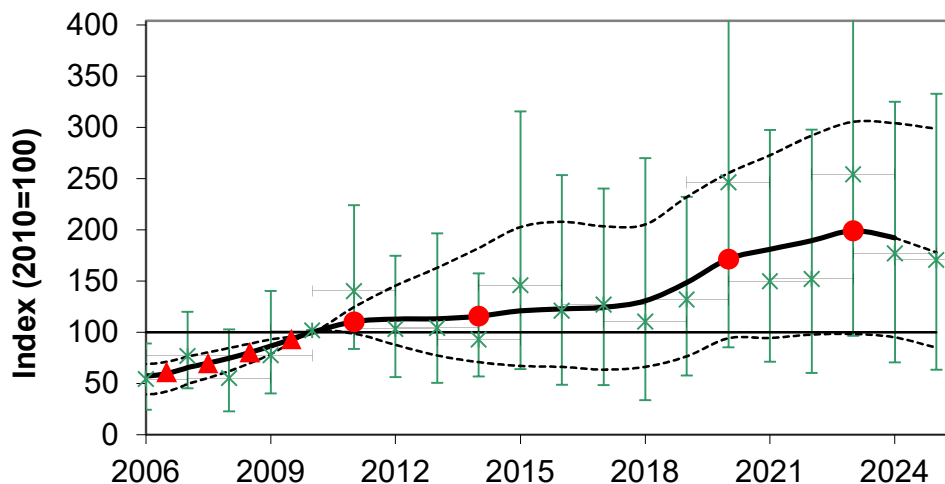


Figure 4.7: Results of the GAM/GLM model for **soprano pipistrelle, Northern Ireland only**. Points are estimated annual means derived from the Generalised Linear Model (GLM) and the bars are 95% bootstrapped confidence limits. The heavy black line is the fitted Generalised Additive Model (GAM) curve with 95% confidence limits shown by the lighter black lines. Both Tranquility and Batlogger data are included, with a covariate for detector to adjust for their different sensitivities. The response variable is the number of snapshots/soundfiles with the

species present. The log of total survey time is used as an offset. The end of the smoothed trend is shown with a broken line to illustrate uncertainty for 2024-2025 and the possibility that the slope will change with coming years' data. Red circles indicate significant ($P < 0.05$) change points, where the slope of the smoothed trend line changes. Red triangles indicate that the difference in the smoothed index between consecutive years is statistically significant ($P < 0.05$).

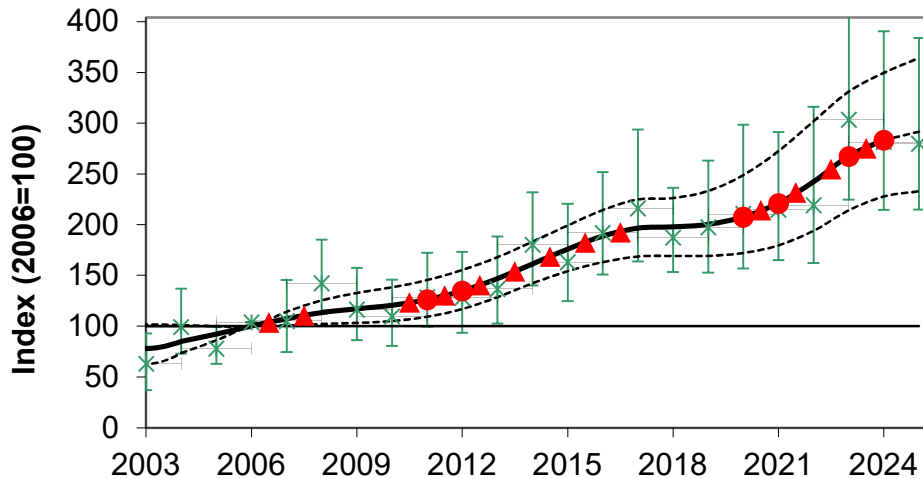


Figure 4.8: Results of the GAM/GLM model for **soprano pipistrelle all-Ireland**. Points are estimated annual means derived from the Generalised Linear Model (GLM) and the bars are 95% bootstrapped confidence limits. The heavy black line is the fitted Generalised Additive Model (GAM) curve with 95% confidence limits shown by lighter black lines. Both Tranquility and Batlogger data are included, with a covariate for detector to adjust for their different sensitivities. The response variable is the number of snapshots/soundfiles with the species present. The log of total survey time is used as an offset. The end of the smoothed trend is shown with a broken line to illustrate uncertainty for 2024-2025 and the possibility that the slope will change with coming years' data. Red circles indicate significant ($P < 0.05$) change points, where the slope of the smoothed trend line changes. Red triangles indicate that the difference in the smoothed index between consecutive years is statistically significant ($P < 0.05$).

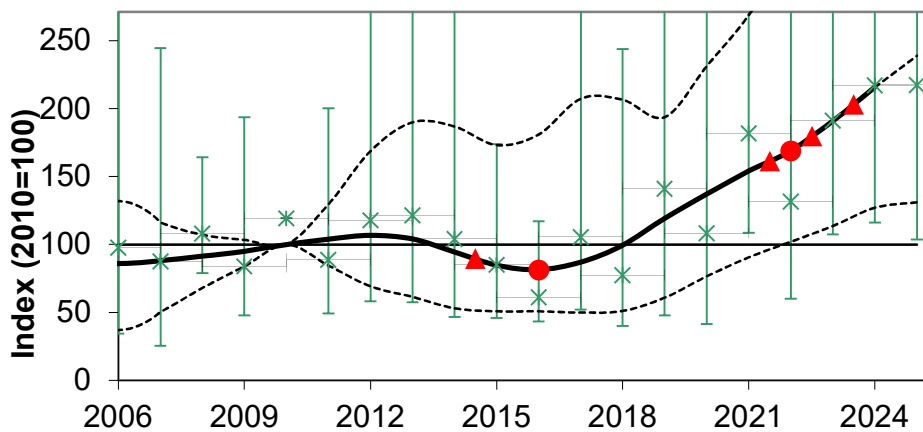


Figure 4.9: Results of the GAM/GLM model for **Leisler's bat, Northern Ireland only**. Points are estimated annual means derived from the Generalised Linear Model (GLM) and the bars are 95% bootstrapped confidence limits. The heavy black line is the fitted Generalised Additive Model (GAM) curve with 95% confidence limits shown by the lighter black lines. Both Tranquility and Batlogger data are included, with a covariate for detector to adjust for their different sensitivities. The response variable is the number of snapshots/soundfiles with the species present. The log of total survey time is used as an offset. The end of the smoothed trend is shown with a broken line to illustrate uncertainty for 2024-2025 and the possibility that the slope will change with coming years' data. Red circles indicate significant ($P < 0.05$) change points, where the slope of the smoothed trend line changes. Red

triangles indicate that the difference in the smoothed index between consecutive years is statistically significant ($P < 0.05$).

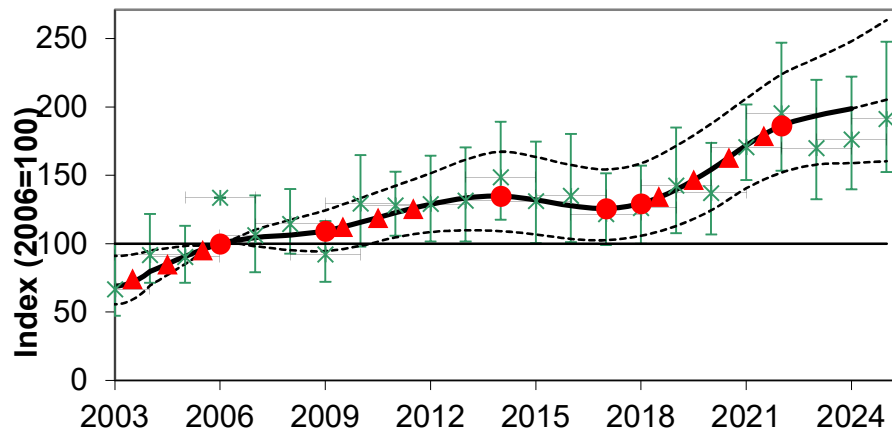


Figure 4.10: Results of the GAM/GLM model for **Leisler's bat all Ireland**. Points are estimated annual means derived from the Generalised Linear Model (GLM) and the bars are 95% bootstrapped confidence limits. The heavy black line is the fitted Generalised Additive Model (GAM) curve with 95% confidence limits shown by the lighter black lines. Both Tranquillity and Batlogger data are included, with a covariate for detector to adjust for their different sensitivities. The response variable is the number of snapshots/soundfiles with the species present. The log of total survey time is used as an offset. The end of the smoothed trend is shown with a broken line to illustrate uncertainty for 2024-2025 and the possibility that the slope will change with coming years' data. Red circles indicate significant ($P < 0.05$) change points, where the slope of the smoothed trend line changes. Red triangles indicate that the difference in the smoothed index between consecutive years is statistically significant ($P < 0.05$).

Nathusius' pipistrelle (Figure 4.11) appeared to be significantly increasing until 2020. The trend line changed at that point, however, and has since been decreasing. Error bars are particularly wide for Nathusius' pipistrelle, due to the low number of records for the species.

Relatively few encounters with *Myotis* spp. are recorded every year. Nonetheless the

use of the Batlogger has resulted in reduced error bars for this species group index. The decline we observed in this species group for six years running, levelled out a little in 2022 and the higher yearly estimates from 2023 to 2025 means that upper error bars now encompass the baseline, see Figure 4.12.

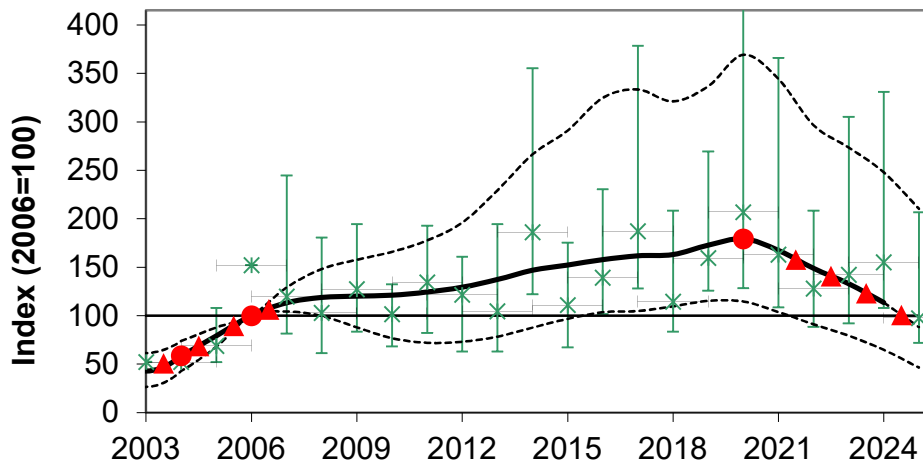


Figure 4.11: Results of Binomial GLM modeling for proportion of transects with **Nathusius' pipistrelle** present, **all-Ireland**. The black line is the smoothed GAM curve, with 95% confidence limits shown by the lighter black lines. Points are estimated annual means and are shown to illustrate the variation about the fitted line. The end of the smoothed trend is shown with a broken line to illustrate uncertainty for 2024-2025 and the possibility that the slope will change with coming years' data. Red circles indicate significant ($P < 0.05$) change points, where the slope of the smoothed trend line changes. Red triangles indicate that the difference in the smoothed index between consecutive years is statistically significant ($P < 0.05$).

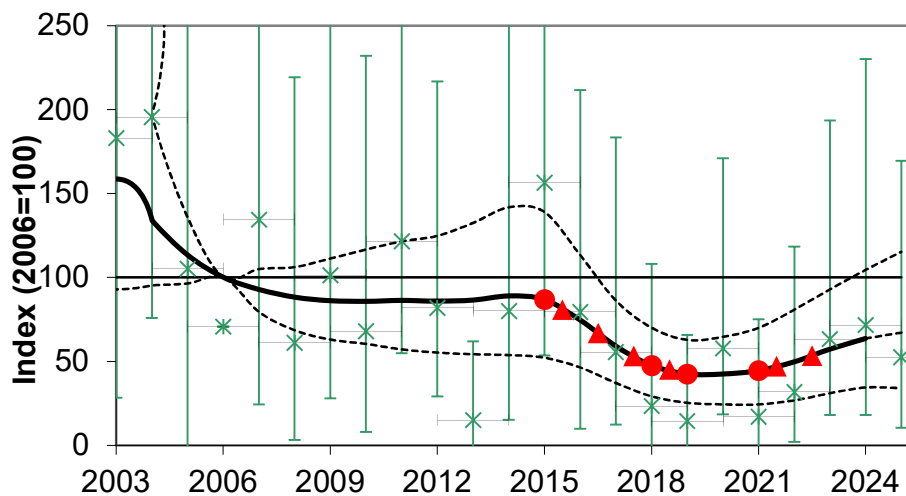


Figure 4.12: Results of the GAM/GLM model for **Myotis spp.** passes per survey, **all-Ireland**. Points are estimated annual means derived from the Generalised Linear Model (GLM) and the bars are 95% bootstrapped confidence limits. The heavy black line is the fitted Generalised Additive Model (GAM) curve with 95% confidence limits shown by the lighter black lines. Both Tranquility and Batlogger data are included, with a covariate for detector to adjust for their different sensitivities. The response variable is the number of snapshots/soundfiles with the species present. The log of total survey time is used as an offset. The end of the smoothed trend is shown with a broken line to illustrate uncertainty for 2024-2025 and the possibility that the slope will change with coming years' data. Red circles indicate significant ($P < 0.05$) change points, where the slope of the smoothed trend line changes. Red triangles indicate that the difference in the smoothed index between consecutive years is statistically significant ($P < 0.05$).

4.3.6 Other Vertebrates on Roadsides in Northern Ireland in 2025

Domestic cats were the most frequently encountered vertebrate species during the car surveys (n=70, 60%). Foxes were the second most frequently encountered

species (n=7, 10%). Other species recorded were badgers (n=6), dogs (n=6) and a number of rabbits, deer, one frog and two hedgehogs. Seven dead vertebrates were recorded by surveyors in Northern Ireland in 2025. These included rabbits, rat, hare, cat, badger and hedgehog.

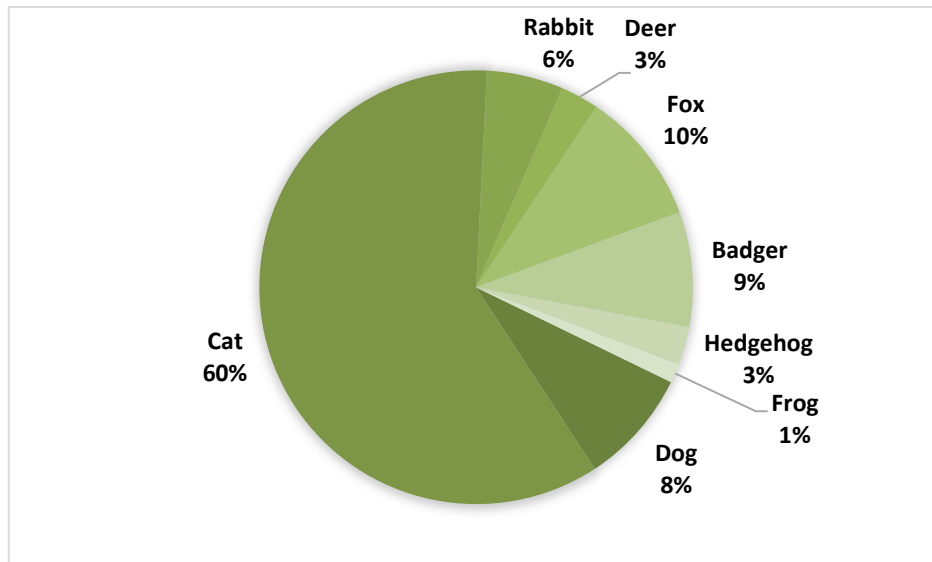


Figure 4.13: Living vertebrates, other than bats, observed during car-based bat monitoring surveys in Northern Ireland, 2025, n=70 from ten surveys.

4.4 Discussion

Car-based Bat Monitoring surveys have been successfully carried out in Northern Ireland from 2006 to 2025. We trained in two new Northern Irish survey teams in 2025 via Zoom.

While yearly encounter rates vary widely, in general, common pipistrelles are usually recorded less frequently in Northern Ireland than on the island as a whole. Since the common pipistrelle is more abundant towards the centre and south of the island (e.g. see Lundy *et al.* 2011), lower encounter rates with this species may be anticipated in the north. This may be due to cooler climate and/or differing habitat types in northern parts of the island. The all island trend for common pipistrelle has been one of steady

increases. In the medium term (12 years since 2013), the common pipistrelle has increased on an all-island basis by 5.1% per annum, while in Northern Ireland the increase has been 4.9% per annum.

Average roadside encounter rates of soprano pipistrelles in Northern Ireland vary somewhat but, on the whole, tend to be roughly similar to island-wide levels. The soprano pipistrelle has increased significantly since the start of the survey – its all-island roadside population increased by 98.7% from 2013-2025, a per annum increase of 6.4%. The Northern Ireland only trend has been similar over the past 12 years, albeit slightly slower with a 3.9% per annum increase.

Nathusius' pipistrelles are recorded more often in Northern Ireland than the island-

wide or Republic of Ireland average. Nathusius' pipistrelle was recorded from squares J06, H79, H13 and J33 in Northern Ireland in 2025. The species has been recorded in square J06 in most years of the survey. This survey route is situated close to Lough Neagh which is considered the stronghold for the species. Nathusius' pipistrelle is not specifically targeted by this monitoring scheme due to its overall low encounter rate. However, a binomial model of Nathusius' encounters for the whole island is used (e.g. see Roche *et al.*, 2013). Nathusius' pipistrelle showed an increasing trend in the early years of the survey. This then stabilized somewhat and has recently shown a decrease so the error bars again encompass the baseline (despite correcting for the change in bat detector type).

Numbers of Leisler's bats increased significantly from 2003 to a peak in 2014 and then declined from 2015 to 2018. However, 2019 to 2024 saw a resumption of an increasing trend. Over the past 12 years (2013-2025) the all Ireland roadside population of Leisler's bats has increased by 53.9%, or 3.7% per annum. In Northern Ireland the species has also been increasing, albeit at a higher rate. Over the past 12 years in Northern Ireland Leisler's bats increased by a total of 130% or 7.2% per annum.

Over the 22 years of the survey (2003-2025) the Myotis bat composite index (all-Ireland) has declined by 3.8% per annum. However, this decline has recently levelled out and the more recent, six year trend (2019-2025), has been upwards at a rate of 7.9% per annum.

5.0 WOODLAND BAT MONITORING

5.1 Introduction

Woodland bat species, namely the *Myotis* species Natterer's bat (*Myotis nattereri*) and whiskered bat (*Myotis mystacinus*), comprise an important portion of the Irish bat fauna. These species rely mainly on woodland habitat for foraging opportunities (Smith and Racey, 2008). Brown long-eared bats (*Plecotus auritus*) are also strongly associated with woodlands and deciduous trees (Swift 1998; Murphy, Greenaway and Hill, 2012).

In 2023, BCIreland conducted a pilot woodland monitoring scheme targeting these species. We received a funding commitment through the DAERA Environment Fund towards this project. However, we were notified of the funding too late to undertake field work in Northern Ireland. Instead, we focused on carrying out the pilot scheme in ROI along with collecting reference echolocation call data for a call library across the island, including sites in Northern Ireland.

Ten sites were surveyed during the 2023 pilot. These were located in counties Cavan (four sites), Kildare (one site), Meath (one site), and Wicklow (four sites). At each of these sites we used five of passive (static) bat detectors left in situ recording all night for up to five nights on three separate survey periods (June, July and August). Simultaneously, we carried out post-sundown walking transects in each woodland while using Anabat Scout bat detectors once in each month of June, July and August.

The primary objectives of the pilot scheme were to trial the use of these two different survey methods to

- (i) compare their effectiveness in surveying the woodland species of

interest (mainly Natterer's bat and Whiskered bat, but also Brown-long eared bat)

- (ii) to compare the statistical power of the two methods in detecting declines in bat activity at amber and red alert levels of decline (25% and 50% decline in activity levels, respectively),
- (iii) assess the general feasibility of proceeding with an All-Ireland version of the scheme using either survey method.

Following detailed analysis of the time, costs and data resulting from each of these methods we decided to proceed using the walking transect method for the surveys conducted in 2024.

In 2024 and 2025, we expanded the scheme to include new sites in the ROI as well as establishing several sites in Northern Ireland.

5.2 Methods

5.2.1 Site selection

Woodlands were selected based on a number of requirements which included habitat suitability, public access, suitable walking routes/trails and the potential availability of survey teams in the area. In relation to the site characteristics, some of the more specific criteria included the following:

- (i) That the site was a well-established woodland (natural broadleaved woodland is preferable, but non-native species such as conifer stands could be included) with about 4km of a walking track/route. A walking loop is preferable where possible so that the same ground does not have to be repeated during the transect. This is

not always possible depending on the layout of individual sites.

- (ii) There should be at least one stopping point that is adjacent or close to either agricultural/open pasture or open grassland habitat. These are important foraging areas for Natterer's bat.

With these criteria in mind, sites were provisionally selected based on recommendations from people who possessed local knowledge of sites. This was subsequently followed up by the scheme coordinator with some GIS work to devise a potential walking route for the surveys. Then, a site visit was conducted to walk the survey route and, if it was suitable, to designate the survey stopping points (outlined in Section 5.2.3). Where site visits by the scheme coordinator were not possible either due to time constraints or large travelling distances involved, the walking route was set out by the volunteer who would be conducting the survey, while liaising closely with the scheme coordinator and adhering to the route selection criteria. Once sites were selected for the scheme, detailed documents that included site maps and descriptions of the walking routes were created by the scheme coordinator for each site.

5.2.2 Volunteer recruitment and training

Volunteers were recruited mainly by advertising the scheme on BC Ireland's social media channels, but also through liaising with staff such as the Biodiversity Officers at various Local Authorities in the ROI, and also the NPWS (ROI). In NI, volunteers were mainly recruited through the involvement of organisations including the National Trust, the Woodland Trust and Northern Ireland Bat Group. In the case of the National Trust and Woodland Trust, some of the selected sites for the scheme

were actively managed by these organisations, so volunteers based at these sites were already very familiar with the sites in question.

Most volunteers were trained online via Zoom during the months of May-June 2025, but in the case of the National Trust volunteers training was in person on the 5th June 2025. Following training, volunteers were provided with access to a folder with survey files (e.g. site description, survey protocol, and survey sheets) as well as a secure folder to which they could upload the raw recorded files from the monitoring device. Bat detectors were loaned to volunteers for the duration of the survey period (June-August) and were delivered either via courier/post or given to volunteers in person. In addition to the detectors, volunteers also received (where applicable) reflectors for marking the start, end and all of the survey stopping points along the walking route.

5.2.3 Monitoring

A walking route of approximately 4km in length is mapped in each woodland. These transects include five stopping points, each representative of different types of habitats in the woodland. At each woodland site at least one of the stopping points is at an interface between agricultural or grassland landscape and woodland edge to increase the likelihood of detecting Natterer's bat.

The device used for walking transects is an Anabat Scout (Titley Scientific), which is a full spectrum bat detector. Transects consist of walking at a pace of approx. 3.4km an hour along the walking route with the detector turned on. At each of the five stopping points, surveyors stop for a period of five minutes, rotating themselves and the detector to face in different directions.

Walking transects typically take 1.5hrs to complete. Transects were carried out twice of the course of the summer with

one survey conducted in each of the months of June and July in most cases.

All recorded data from each Anabat Scout device was processed using Kaleidoscope Pro software. For more detailed information about the protocol used to analyse these data, see the final report 'All-Ireland Woodland Bat Monitoring Scheme: Report for 2025 (Clarke, Langton and Roche, 2026).

5.2.4 Statistical power analysis

The power analyses described in Section 5.3.2 use a simulation approach, broadly based on that used to estimate the power of car-based monitoring in Ireland (Roche et al., 2011) and NBMP surveys in Great Britain (Barlow et al. 2015). Briefly, this involves calculating the variance of the transformed data, then using these variances to produce a large number of simulated datasets with a variety of levels of change over a 25-year period (in this case red and amber alert levels). 'Amber' refers to a population decline of 1.41% p.a. (25% over 25 years), while 'red' refers to a population decline of 2.73% p.a. (50% over 25 years). A Poisson GAM model is then fitted to each dataset using the method described by Fewster (2000), changing the number of sites and years considered in order to determine the numbers required to detect change with 80% power.

5.3 Results

5.3.1 Overall Results

A total of 40 sites were surveyed across the island as part of the All-Ireland Woodland Bat Monitoring Scheme in 2025. This consisted of 26 sites in the ROI and 14 in NI. Sixteen sites that were surveyed in the Republic of Ireland in 2024 were re-surveyed in 2025, along with ten new sites located in counties Kilkenny (two sites),

Limerick (two sites), Offaly (two sites), Donegal (two sites), Meath (one site) and Louth (one site). One site that was surveyed in 2024 (Dún na Rí, Co. Cavan) was not accessible in 2025 due to storm damage that had occurred earlier in the year and was not surveyed. In Northern Ireland, all of the nine sites surveyed in 2024 were resurveyed in 2025, in addition to five new sites in 2025 which were located in Derry (one site), Tyrone (one site), Down (one site) and Antrim (two sites). A full table of the site locations and individual results for each site can be found in Appendix 1.

Table 5.1 shows a summary of the total number of audio files recorded for each species of interest in the survey. In addition to Natterer's bat and whiskered bat, we also assessed the presence of other bat species including Daubenton's bat, Brown long eared bat and a 'Myotis' category. This latter category consisted of audio files that were clear enough to be identified as belonging to one of the myotis species of bat, but which did not have enough information present within the call structure to make a definitive species confirmation.

Table 5.2 also shows a comparison of annual means for each species as the mean number of audio files per transect recorded in the 2023, 2024 and 2025 surveys.

Table 5.1. Overall number of files from each species of interest recorded during the All-Ireland Woodland Bat Monitoring Scheme in 2025.

Species	No. of files	% of sites
Whisk	228	82.5
Natt	186	70.0
Daub	284	70.0
Myotis spp.	393	87.5
BLE	117	70.0

Table 5.2. Mean no. of audio files per transect recorded in the 2023, 2024 and 2025 surveys.

Yr	N		Mean audio files per transect				
	Sites	Surv	daub	natt	whisk	Myo	BLE
2023	10	29	2.31	2.41	3.62	2.72	2.34
2024	26	72	8.11	2.74	5.47	5.04	1.49
2025	40	79	3.59	2.35	2.89	4.97	1.48

There are some noticeable differences in the results between the years, in particular for whiskered bat and Daubenton's bat. For both species, the mean number of calls per transect were higher in 2024 than either 2023 or 2025. Conversely, the mean number of audio files containing Natterer's bat and brown long eared bat activity was generally very similar between the years. There was a large increase in the mean number of Myotis spp. calls per transect in 2024 (5.04 files per transect) compared to 2023 (2.72 files per transect) but in 2025 was very similar to the previous year at with a mean of 4.97 files per transect.

There has also been differences in the mean number of audio files recorded for the species between the months and years (Figure 5.1) There are signs of an interaction between year and month of Daubenton's bat and whiskered bat, with the latter being highly significant ($F=4.09$ with 4 and 76 d.f., $P=0.005$) due to the July mean being much higher than June in the first two years, whereas this is reversed in 2025.

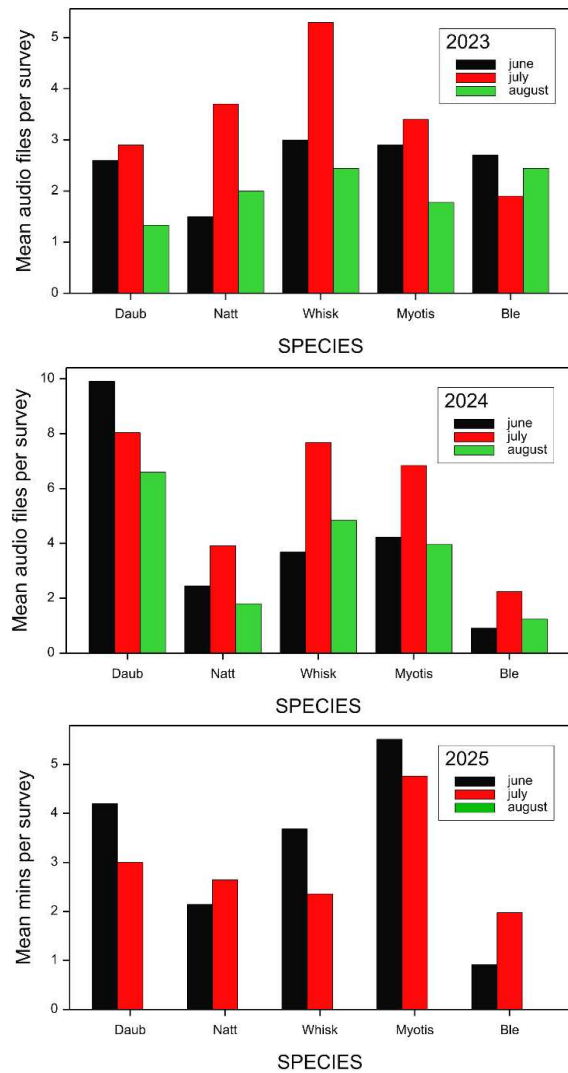


Figure 5.1: mean numbers of audio files per survey recorded in each month in 2023, 2024 and 2025.

5.3.2 Power analysis results

Results in Table 5.3 show the number of years taken to detect amber or red level alerts (i.e. a 25% or 50% decline over 25 years) with 80% power. Results are for two surveys per year at each site, at approximately monthly intervals.

Results are shown in Table 5.3 in terms of the number of years taken to detect amber or red level alerts (i.e. a 25% or 50% decline over 25 years) in populations of Natterer's bat and whiskered bat with 80% power. Similarly, amber and red alert parameters for the other woodland

species of interest were also calculated and are shown in Table 4. The figures for 50 sites are the most important to consider, as the number of sites surveyed is now approaching this level. Amber alerts are more evasive, with at least 25 years needed to detect them. However, an amber alert is a very gentle decline of only just over 1% per year on average.

Table 5.3. Number of years taken for walked transects to detect change with 80% power using various numbers of sites.

species change	Natterer's Bat		Whiskered bat	
	Amber	red	amber	red
N sites				
10	>25	>25	>25	>25
20	>25	20	>25	21
50	>25	14	>25	14
75	22	12	23	12
100	21	10	20	11

5.3.3 Northern Ireland Results

Either whiskered or Natterer's bat calls were recorded at most of the sites surveyed in Northern Ireland in 2025. Both whiskered and Natterer's bat were recorded at six of the 14 sites surveyed (42.9%), while three sites recorded the presence of Natterer's bat only and three sites recorded whiskered bat only. There were two sites where neither whiskered nor Natterer's bat were recorded. A map of these results is displayed in Figure 5.2.

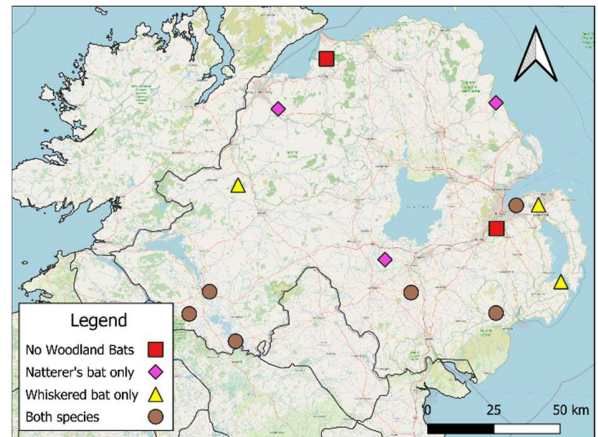


Figure 5.2. Woodland sites surveyed in NI in 2025. Brown circles indicate sites where both whiskered and Natterer's bats were recorded, pink diamonds represent sites where only Natterer's bat was recorded and yellow triangles represent sites where only whiskered bats were recorded. Red squares indicate sites where neither species were recorded.

A breakdown of the different target species in terms of how many audio files were recorded and the percentage of sites in NI that these were found at, is displayed below (Table 5.4).

Table 5.4. The number of audio files and the percentage of sites that these were found at during the woodland bat monitoring scheme in NI in 2025.

Species	No. of files	% of sites
Whisk	59	64.3
Natt	86	71.4
Daub	189	78.6
<i>Myotis</i> spp.	212	92.9
BLE	38	64.3

5.4 Discussion

Given the paucity of information regarding the status of woodland bat species in Ireland, there is an urgent need to establish an island-wide annual monitoring scheme for woodland bats. Woodland coverage across the island of Ireland is low compared to other European countries, standing at approximately 11.6% in the ROI (Forest Statistics Ireland, 2023) and approximately 8.7% in Northern Ireland (Northern Ireland Woodland Register and Basemap, 2020) with only a

small portion of this in both scenarios comprising of broadleaf or mixed broadleaf-conifer. This means that suitable roosting and foraging habitat for these species is likely to be already limited, further illustrating the need to adopt a comprehensive monitoring scheme focussing on these species in representative woodlands across the island.

Since 2023, we have expanded the All-Ireland Woodland Bat Monitoring Scheme in each survey year. As of 2025 there are 40 sites included in the scheme, with 26 located in the Republic of Ireland and 14 located in Northern Ireland. This has been a very positive step in attaining better survey coverage of woodland bats across the island. Two new bat groups in Co. Offaly and Co. Louth were established in 2025, both of which contributed directly to this scheme by putting forward sites and volunteers which was a wonderful development. We also had a lot of assistance from other organisations in Northern Ireland in 2025 including the National Trust, the Woodland Trust and Northern Ireland Bat Group. These organisations contributed significantly to the selection of sites and the recruitment of volunteers. This has been key to the successful rollout of the scheme and the delivery of survey objectives in Northern Ireland so far.

Although it is too early to predict trends for the target species, it is at least encouraging to see the relatively widespread presence of woodland bats at the monitoring sites. A higher number of audio files containing whiskered bat was recorded in 2025 than for Natterer's bat, a result that was also reflected in the data collected in 2023 and 2024 (see Table 5.2). Although the mean number of audio files containing Natterer's bat has remained relatively consistent between survey years, there was a rather large reduction in the mean number of audio files containing

whiskered bat activity in 2025 (mean 2.89 files per transect) compared to 2024 (5.04 files per transect). Similarly, for Daubenton's bat the mean number of files per transect was 3.59 in 2025 compared to 8.11 in 2024. There was also a shift in 2025 in relation to the timing of peak whiskered bat and Daubenton's bat activity, with highest mean number of files being recorded in June in 2025, in contrast to July in both 2023 and 2024.

In the case of Daubenton's bat, some of the difference in the mean number of audio files may be explained by the survey design approach adopted in 2025. For new sites recruited in 2025, there was a concerted effort made to avoid routes in woodlands that were located adjacent to waterways whenever possible. This was specifically done for the purpose of reducing the likelihood of recording a high volume of Daubenton's bat calls. This was an issue at some sites surveyed in 2024 where the sheer number of Daubenton's obscured the presence of other bat calls in the recorded sonograms. Therefore, it is likely that some of the reduction in the number of files containing Daubenton's bat activity was a result of this effort. On the other hand, the mean number of audio files from the *Myotis* spp. category in 2025 (4.97 files per transect) remained very similar to that of the same category from 2024 (5.04 files per transect). Similarly, the mean number of files containing brown long-eared bat calls in 2025 (1.48 files per transect) was almost identical to that of 2024 (1.49 files per transect).

Although the number of survey nights remained similar between 2024 and 2025 (72 nights in 2024 compared to 79 nights in 2025), there are differences in the nature of the data being compared. In 2025, two surveys were carried out over two months instead of three surveys over three months, as in 2024. In addition, 14 entirely new sites were added to the scheme in 2025. Therefore, these variables could be

influencing the results. However, any artefacts of the data analysis arising from this will be resolved in time as a larger number of the same sites are monitored consistently. Additionally, year to year variation is generally present in most datasets and, in practice, at least five years of data are usually needed before a consistent trend can be demonstrated, except in the most extreme population crashes.

Habitat type or quality have not been assessed during the surveys so far, but this is something that will be added to the scheme in future surveys as we approach the projected final number of 70-75 sites to be included in the scheme. Although the relationship between woodland composition and bat presence or activity is likely to be complex, it would be worthwhile to use some form of habitat grading criteria that may show a relationship between woodland habitat characteristics and bat activity in Ireland over time.

Regarding power analysis and amber and red alert levels, in 2024 we only had a small number of sites that had been visited in more than one year, leading to imprecise estimates in site by year variation (i.e. the degree to which sites vary from year to year). As of 2025 we now have many more repeat sites, with 20 visited in two years and six visited in all three years. This gives much better variance estimates for use in the power simulations and has altered some of the estimates of the number of years to detect trends. The estimates are unlikely to change much further as more data is collected, so there will be no great need to repeat these power calculations from next year.

It should be remembered that the power analysis simulations are based on the simplistic assumption of a linear decline that is uniform across the island of Ireland. In practice any decline is likely to vary

geographically and be non-linear, so larger sample sizes are preferable to ensure detection of significant population change that is confined to a particular area, or a particular type of habitat. As power analysis is not an exact science in these complex ecological situations, results should be interpreted as providing a general indication as to whether the survey design is adequate, without putting too much stress on exact values.

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8.0 GLOSSARY

Bootstrapping

This is a method for estimating the sampling distribution of an estimator by resampling with replacement from the original sample. In the context of population indices the resampling is done for entire sites and ensures that confidence limits and significance levels are unaffected by any temporal correlation in the data. It also allows for the effects of 'overdispersion' which occurs when data are more variable than expected from a Poisson distribution.

Covariate

This is a variable that is possibly predictive of the outcome under study. A covariate may be of direct interest or be a confounding variable or effect modifier.

Doppler Effect

Apparent change in frequency of a sound (measured in kilohertz, kHz) as a result of movement, either of the source or the observer. The apparent frequency of a sound increases as the source of the sound moves towards an observer or the observer move towards it and decreases as the source moves away from an observer or the observer moves away from it.

GLM

Generalised Linear Model: a generalisation of ordinary regression and analysis of variance models, allowing a variety of different error distributions and different link functions between the response variable and the explanatory variables. The models used here have a Poisson error distribution and a logarithmic link.

GAM

Generalised additive model: these models allow a smooth, non-parametric curve to be fitted to an explanatory variable, within a GLM. In estimating population indices they are used to smooth out year-to-year variation (Fewster *et al.* 2000).

Offset

A covariate with a fixed slope of 1.0, in this case implying that the total count doubles if the number of recording intervals doubles.

Poisson Distribution

The Poisson distribution is a discrete probability distribution. It expresses the probability of a number of events occurring in a fixed time if these events occur with a known average rate, and are independent of the time since the last event. It is frequently used as the basis of statistical models of counts of organisms or events.

Power Analysis

Analysis of the power (probability) to reject a false null hypothesis. A test with high power has a large chance of rejecting the null hypothesis when this hypothesis is false. In the case of the present project the null hypothesis would state that there is no decline in bat populations. Power is measured as a percentage, and greater power reflects the increased likelihood of detecting a declining trend (as outlined for Red or Amber Alerts). The power analysis carried out for the present project is one-tailed (i.e. examines a declining trend only) at $P=0.05$ (which is equivalent to $P=0.1$ for a two sided test).

REML

Restricted (or residual) maximum likelihood (REML) is a method for fitting linear mixed models. In contrast to conventional maximum likelihood estimation, REML can produce unbiased estimates of variance and covariance parameters. This method assumes the data are normally distributed.

9.0 APPENDIX 1

All-Ireland Daubenton's Bat Waterway Survey

Note: All waterway site results received by February 2025 were submitted for analysis. Similarly, waterway sites received late from previous years of monitoring will have been added, subsequently, to the dataset for future analysis. Consequently, the totals for each year will differ from previous reports.

Summary statistics

Table 1: basic stats shown by year and country. The final column refers to surveys with either sure or unsure Daubenton's passes. All values are per completed survey of 10 spot counts. Excludes surveys outside days 205-250.

a) Northern Ireland

Year	n complete surveys	mean sure	mean unsure	all	All (max 48 per spot)	% surveys with bats	% spots with bats
2006	26	28.0	20.0	48.0	47.8	84.6	52.7
2007	37	32.6	10.1	42.7	41.5	94.6	59.2
2008	52	33.2	11.1	44.2	43.6	96.2	56.3
2009	63	36.9	9.0	45.9	45.5	93.7	58.7
2010	70	39.6	8.3	47.9	46.3	87.1	53.9
2011	84	49.3	10.8	60.0	58.5	91.7	61.4
2012	64	53.4	11.0	64.4	61.0	92.2	62.5
2013	63	29.6	10.0	39.7	38.8	87.3	54.0
2014	69	31.7	8.3	40.0	36.6	92.8	48.7
2015	72	52.6	7.8	60.4	58.4	86.1	62.4
2016	61	43.3	6.5	49.9	48.5	93.4	58.0
2017	56	47.6	11.0	58.6	55.4	96.3	64.3
2018	67	43.3	8.8	52.1	50.3	87.9	57.9
2019	63	35.2	8.3	43.4	42.3	93.7	58.3
2020	57	32.1	4.8	36.9	36.9	93.0	54.9
2021	58	29.6	4.6	34.2	33.9	91.4	51.9
2022	55	26.0	4.9	31.0	31.0	87.3	50.5
2023	58	32.6	5.0	37.6	36.9	97.8	57.1
2024	57	25.6	4.8	30.4	30.4	87.0	42.4
2025	57	21.7	4.1	25.8	25.6	90.0	46.8
All years	1189	37.4	8.3	45.6	44.3	91.2	56.0

b) All Ireland

Year	n complete surveys	mean sure	mean unsure	all	All (max 48 per spot)	% surveys with bats	% spots with bats
2006	252	47.6	21.3	68.8	57.8	93.2	59.1
2007	382	41.6	7.7	49.3	47.4	91.6	54.8
2008	311	37.7	7.0	44.7	42.5	90.7	53.1
2009	375	45.8	8.1	53.9	50.8	90.5	55.2
2010	402	51.7	9.3	60.9	57.8	93.8	61.6
2011	409	51.6	10.4	62.1	59.0	93.9	62.4
2012	399	44.0	9.6	53.6	51.9	93.2	58.9
2013	416	41.7	8.2	50.0	47.8	89.6	54.7
2014	474	40.2	8.1	48.3	44.2	89.9	52.9
2015	467	44.5	8.2	52.7	49.9	91.0	56.7
2016	442	45.8	7.9	53.7	49.5	89.4	56.1
2017	416	47.2	8.7	55.9	50.8	91.8	57.2
2018	426	45.9	7.0	52.9	49.2	88.0	54.3
2019	426	37.4	6.9	44.4	42.5	89.2	51.9
2020	415	38.8	6.1	44.9	43.3	92.0	52.4
2021	418	38.4	7.0	45.4	44.1	90.4	52.2
2022	439	44.1	8.1	52.2	47.8	89.7	54.2
2023	446	39.2	8.7	47.8	44.4	93.6	56.1
2024	466	48.1	10.8	58.9	56.0	91.1	63.9
All years	7781	43.6	8.6	52.2	49.0	91.1	56.1

10.0 APPENDIX 2

Woodland	Grid Ref.	WT Date	No. of audio files with the following bat species				
			Natt	Whisk	Daub	Myo	BLE
Ardress House, Co. Armagh	H 91327 55851	18/06/2025	4	0	0	3	0
		30/07/2025	34	0	0	6	1
Ballykeefe, Co. Kilkenny	S 40780 50888	17/06/2025	5	1	1	3	0
		28/07/2025	0	1	0	0	0
Balrath, Co. Meath	N 98783 64123	19/06/2025	0	0	0	1	0
		21/07/2025	0	0	0	0	0
Baronscourt Est, Co. Tyrone	H 36400 82699	26/06/2025	0	4	8	19	3
		31/07/2025	0	4	14	3	7
Binevenagh, Co. Derry	C 68399 29442	10/06/2025	0	0	0	0	0
		24/07/2025	0	0	0	0	0
Castle Coole, Co. Fermanagh	H 26094 43099	20/06/2025	1	1	4	6	0
		24/07/2025	1	0	3	1	3
Castle Lough, Co. Cavan	N 66296 97616	11/07/2025	2	3	13	0	2
Castle Ward, Co. Down	J5713149454	13/06/2025	0	0	2	0	0
		18/07/2025	0	4	0	1	9
Castlewellan, Co. Down	J 33244 36983	31/07/2025	2	1	16	7	0
		14/08/2025	0	0	10	0	2
Clandeboy Est., Co. Down	J 47812 77652	15/06/2025	0	0	10	2	0
		25/07/2025	0	1	9	2	1
Clara Vale, Co. Wicklow	T 17888 92149	18/06/2025	4	6	0	3	4
		29/07/2025	5	5	0	4	2
Clare Glen, Co. Armagh	J 01325 43780	19/06/2025	1	2	11	11	0
		13/07/2025	4	7	0	12	0
Clonad Wood, Co. Offaly	N 32484 19045	15/06/2025	2	1	0	5	0
		27/07/2025	0	2	0	1	0
Crom Est., Co. Fermanagh	H 35943 24644	30/06/2025	6	16	27	29	1
		31/07/2025	3	5	10	17	4

Woodland	Grid Ref.	WT Date	No. of audio files with the following bat species				
			Natt	Whisk	Daub	Myo	BLE
Curraghchase, Co. Limerick	R 41271 49289	28/06/2025	0	0	0	1	3
		29/07/2025	3	1	2	2	3
Dartrey, Co. Monaghan	H 62538 18220	07/07/2025	2	2	0	7	0
		30/07/2025	4	0	7	5	5
Deerpark, Co. Cavan	N 59433 86979	11/07/2025	6	9	1	11	2
		31/07/2025	2	2	1	5	1
Deputy's Pass, Co. Wicklow	T 23455 90159	12/06/2025	2	48	3	12	0
		23/07/2025	1	5	0	3	8
Derrycassin, Co. Longford	N 30475 86135	29/06/2025	8	2	2	11	1
		30/07/2025	2	5	4	3	0
Donadea, Co. Kildare	N 83618 32727	16/06/2025	3	11	1	6	6
		24/07/2025	4	4	3	4	0
Drumboe Wood, Co. Donegal	H 14578 94958	25/06/2025	0	0	6	0	0
		14/07/2025	1	1	1	7	0
Faughan Valley, Co. Derry	C 50923 10848	14/06/2025	0	0	11	3	0
		15/07/2025	11	0	8	14	0
Florence Court, Co. Fermanagh	H 18506 34756	19/06/2025	2	7	7	42	2
		27/07/2025	9	5	9	27	4
Glenarm Forest, Co. Antrim	D3094514703	29/06/2025	3	0	24	2	0
		29/07/2025	3	0	5	2	0
Glendalough, Co. Wicklow	T 13011 96499	24/06/2025	9	0	2	4	1
		24/07/2025	0	1	0	3	3
Glenveagh, Co. Donegal	C 02782 21416	24/06/2025	0	0	0	0	0
		29/07/2025	0	1	0	4	2
Hazelwood Forest, Co. Sligo	G7225934424	10/06/2025	3	1	0	3	1
		11/07/2025	0	3	0	5	0
Jeninstown Wood, Co. Kilkenny	S 47979 64506	10/06/2025	4	3	0	2	1
		28/07/2025	1	3	0	2	8
Killinthomas, Co. Kildare	N 66109 21512	07/06/2025	0	0	0	0	0
		23/07/2025	1	0	0	0	0
Killykeen Forest, Co. Cavan	H 35311 06436	13/06/2025	0	2	4	1	0
		03/07/2025	0	0	0	0	0
Littlewood, Co. Meath	N 97406 75671	10/06/2025	0	1	0	0	1
		10/07/2025	0	0	0	0	1
Minnowburn, Co. Antrim	J 32553 68384	09/07/2025	0	0	0	2	0
		14/08/2025	0	0	1	0	0

Woodland	Grid Ref.	WT Date	No. of audio files with the following bat species				
			Natt	Whisk	Daub	Myo	BLE
Newcastle West, Co. Limerick	R 27707 33906	20/06/2025	0	1	0	2	2
		18/07/2025	0	5	0	7	4
Newcastle Wood, Co. Longford	N 18231 57080	17/06/2025	6	0	4	4	3
		24/07/2025	0	2	0	4	1
Redburn Country Park, Co. Antrim	J 39584 77164	17/06/2025	2	2	0	1	1
		26/07/2025	0	0	0	0	0
Rossmore, Co. Monaghan	H 65406 31501	28/06/2025	2	0	1	2	0
		30/07/2025	0	2	2	3	1
Tomnafinnoge, Co. Wicklow	T 02089 70670	17/06/2025	8	5	5	6	1
		16/07/2025	7	10	3	17	7
Townley Hall, Co. Louth	O 03725 76111	27/06/2025	0	5	7	3	0
		25/07/2025	0	1	12	7	3
Tullynisk House, Co. Offaly	N 06123 07197	14/06/2025	0	9	5	6	1
		18/07/2025	3	2	3	2	1
Union Wood, Co. Sligo	G 69136 29100	24/06/2025	0	1	2	0	0
		30/07/2025	0	2	0	0	0