



Bat Conservation Trust



National Bat Monitoring Programme

Annual Report 2018



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Cover photo: Natterer's bat (Dale Sutton)

Introduction

The National Bat Monitoring Programme (NBMP) is an annual series of bat surveys undertaken by thousands of dedicated volunteers, which allow us to monitor changes in British bat populations. The data we collect are used by the Government and conservation organisations to monitor the health of our environment, inform policy and improve the conservation of bats.

This report provides population trends for 11 of Great Britain's 17 breeding bat species, derived from data collected up to and including summer 2018. Trends are provided at GB-level and also at UK and country-level where sufficient data are available. Trends are calculated for 11 species in England, four species in Scotland, seven species in Wales, one species in Northern Ireland and one species at UK level. This report also provides information on our survey methods.

The next set of bat population trends, incorporating data collected up to and including summer 2019, are due to be published in May 2020.

Official Statistics: These statistics have been produced to the high professional standards set out in the Code of Practice for Official Statistics¹.

This report was compiled by Philip Briggs, Katherine Boughey and David Williamson. Statistical analysis was completed by Steve Langton. The bat illustrations are by Tom McOwat.

The National Bat Monitoring Programme is run by the Bat Conservation Trust, in partnership with the Joint Nature Conservation Committee, and supported and steered by Natural England, Natural Resources Wales, Northern Ireland Environment Agency, and Scottish Natural Heritage. The NBMP is indebted to all volunteers who contribute data to the programme. Bat Conservation Ireland contributes Northern Ireland bat records collated by the Irish Bat Monitoring Programme which is funded by the National Parks and Wildlife Service of the Department of Arts, Heritage and the Gaeltacht, Republic of Ireland and Northern Ireland Environment Agency. Data are shared on the NBN Atlas and GBIF.

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¹ see <https://www.statisticsauthority.gov.uk/publication/code-of-practice/>

Summary of results

This report presents the results of the National Bat Monitoring Programme (NBMP) up to summer 2018.

The NBMP is a world-leading citizen science programme which produces population trends for British bat species. The information produced by the NBMP is used by Government and conservation bodies to inform evidence needs, address policy-relevant questions and provide metrics of bat population status, change and distribution.

Data from four 'core' NBMP surveys are used to produce population trends: Roost Count, Hibernation Survey, Field Survey and Waterway Survey.

Volunteers taking part in our four core surveys contributed approximately 17,036 hours of their time, representing an in-kind contribution to the NBMP of £251,537.

Since its inception in 1996, 6,718 sites have been surveyed as part of ongoing NBMP surveys. In 2018 1,907 sites were surveyed by 989 volunteers.

At present sufficient data are collected by the NBMP to produce population trends for 11 of Great Britain's 17 breeding bat species.

Of these species, all are considered to have been stable or to have increased since the baseline year of monitoring (1999 for most species).

Species considered to have increased in Great Britain in comparison to the baseline year are greater horseshoe bat, lesser horseshoe bat, Natterer's bat and common pipistrelle. The population trend for Natterer's bat should be treated with caution until the effect of this species' roost switching behaviour on the Roost Count trend is better understood.

Species considered to have been stable in Great Britain in comparison to the baseline year are Daubenton's bat, whiskered/Brandt's bat, soprano pipistrelle, noctule, serotine and brown long-eared bat. However, these findings should be treated with caution for several species:

- There is evidence from the Hibernation Survey that populations of Daubenton's bat may be increasing; further years of data are needed to assess the divergence between the Hibernation Survey and Waterway Survey trends.
- Serotine is encountered relatively infrequently during surveys. As such there is a high level of uncertainty associated with the serotine population trends, making population changes more difficult to detect for this species.
- Trends for whiskered/Brandt's bat combine data from two species with differing ecological requirements and potentially differing conservation status, and may also include records of a third cryptic species, Alcaho bat.

No species for which we produce population trends are considered to have declined significantly since the baseline year. For some species, trends calculated from Roost Count data are declining, however we believe these trends to be negatively biased by bat's 'roost switching' behaviour. These trends are not therefore considered a reliable measure of population change. We are currently investigating the causes of this negative bias and exploring ways to correct it.

While data from the National Bat Monitoring Programme indicates that populations of the bat species we monitor are stable or recovering, it should be remembered that these trends reflect relatively recent changes in bat populations (since 1999 for most species). It is generally considered that prior to this there were significant historical declines in bat populations dating back to at least the start of the 20th century. **This suggests that current legislation and conservation action to protect and conserve bats is being successful, and it is vitally important that this continues.**

Bat Monitoring in the UK

The National Bat Monitoring Programme (NBMP) is a citizen science programme run by the Bat Conservation Trust, in partnership with the Joint Nature Conservation Committee, and supported and steered by Natural England, Natural Resources Wales, Northern Ireland Environment Agency and Scottish Natural Heritage. We are extremely grateful to all the dedicated volunteers who have taken part in the NBMP since its inception in 1996, without whom the programme could not continue.

Effective conservation requires monitoring of underlying population trends to provide a detection system that can indicate population declines; to ensure scarce conservation resources are targeted towards sustaining bat populations and the habitats on which they depend; and also to inform policy.

The NBMP collects data to deliver this information and to enable us to understand more about the drivers of population change. The NBMP aims to deliver some of the key information needs for UK and country biodiversity strategies and Habitats Directive obligations.

Bats are widely distributed through the range of landscapes and habitats in the UK. A combination of their reliance on insect prey, sensitivity to prevailing weather conditions, dependence on a range of habitats and vulnerability to changed land and site management approaches, makes them valuable indicators of the health of the environment. Since 2008 NBMP data have contributed to the suite of UK biodiversity indicators² which are being used to help measure progress towards the Government's target of halting biodiversity loss.

Through continued development of new surveillance techniques, training approaches and volunteer recruitment, the NBMP has grown substantially in capacity since it was first established in 1996. It now delivers statistically robust trends for 11 of the UK's 17 breeding bat species at GB level, and we report country-level trends for 11 species in England, four species in Scotland, seven species in Wales, one species in Northern Ireland and also one species at UK level. For the majority of species we currently have insufficient data from Northern Ireland to provide trends to enable Northern Ireland or UK-wide trends to be calculated. Bat Conservation Ireland runs a number of bat monitoring schemes across Ireland and publishes Irish bat population trends and distribution data³.

Monitoring approaches

The NBMP is an integrated programme utilising a number of different survey methods. This approach means that for most species, bats are surveyed at more than one stage of their annual life cycle.

The four core monitoring surveys employed by the programme, their survey periods and site selection methods are summarised in Table 1. Data from these core surveys are used to produce species population trends. Table 1 also includes information on additional surveys which are currently running.

² See <http://jncc.defra.gov.uk/page-1824>

³ See <https://www.batconservationireland.org/>

Table 1. NBMP survey details

Survey	Species monitored	Start year	Survey period	Site selection, survey method and volunteer experience level required
<i>Core Surveys</i>				
Roost Count	greater horseshoe bat lesser horseshoe bat Natterer's bat common pipistrelle soprano pipistrelle serotine brown long-eared bat	1997 (Natterer's bat: 2000; brown long-eared bat: 2001)	6th - 25th June (lesser horseshoe: 9th May - 27th June; greater horseshoe: 7th - 21st July	Known roosts. Roost emergence counts. Anyone who knows of a roost they can count can take part.
Field Survey	noctule serotine common pipistrelle soprano pipistrelle	1998	1st July - 30th July	Stratified random 1km squares. Walked transect with heterodyne bat detector. Experience needed of using a heterodyne bat detector to identify the target species.
Waterway Survey	Daubenton's bat	1997	1st August - 30th August	EA River Habitat Survey sites. Walked transect with heterodyne bat detector. Experience needed of using a heterodyne detector to identify the target species.
Hibernation Survey	greater horseshoe bat lesser horseshoe bat Daubenton's bat Natterer's bat whiskered/Brandt's bat brown long-eared bat	1997	January/February (data also now included from December to March)	Known or potential hibernacula. Internal hibernacula survey. Appropriate bat survey class licence is required to take part.
<i>Other Surveys</i>				
Sunset/Sunrise Survey	Any species	2001	April - September	Beginners survey involving volunteers exploring an area of their choice and identifying bat presence and potential roost.
Woodland Survey	Barbastelle	2005	July - September	SAC sites for barbastelles (plus other woodlands surveyed up to 2010). Walked transect with broadband detector.
National Nathusius' Pipistrelle Project	Nathusius' pipistrelle	2014	Spring to autumn, avoiding key breeding period	Sites with known/likely Nathusius' pipistrelle presence. Harp trapping survey under project licence.

Robustness of monitoring

The robustness of data obtained from the different survey methods used in the NBMP will vary depending on how the data are collected. A sampling approach is used on all surveys with the assumption that trends occurring in sample sites reflect trends occurring in the general population. Theoretically this assumption is strongest when sample sites are chosen at random and where a proportion of sites do not contain the species of interest, such as for the Field Survey. Monitoring sites where the species of interest is not present can help identify if populations are expanding into new areas.

Field and Waterway Surveys

Field Survey volunteers are assigned a random-stratified 1km OS grid square to survey, close to where they live. Sites are stratified by ITE landclass to help ensure a representative sample of UK land classes. Waterway Survey sites are randomly selected from the network of Environment Agency River Habitat Survey sites. The random selection process includes sites where the species of interest may not occur at present but have the potential to do so in the future. This provides a means of assessing change in distribution as a result of population expansion as well as change in relative abundance.

Potential challenges to address include volunteers using different types of equipment and changes in prevalence of different models of equipment over time, volunteer turnover and differing volunteer experience. These are included as covariates in the data analyses to assess potential influence on the results. The covariates used are assessed periodically to ensure they remain appropriate.

Hibernation Survey

For the Hibernation Survey volunteers select a known or potential hibernation site to survey. This includes sites that are suitable for hibernating bats but have not previously been found to be occupied. This survey can therefore detect instances of bats moving into sites where they have not previously been recorded, as well as potential site abandonment. A potential issue with counts of bats carried out in hibernation sites is the relationship between the numbers of bats observed and the actual numbers of bats present is not well understood. Bats can hide in cracks and crevices and there is evidence that large numbers of bats can be present even when few are actually observed. However, if the proportion of bats seen remains constant over time at any given site, population trend conclusions will remain valid.

Roost Count

Roost Count sites are known roosts that are self-selected by surveyors. Roost Counts are most effective for monitoring population change when a high proportion of existing roosts are counted and when the species tends to be faithful to its roost site between years.

Many bat species will move between roost sites, either individually, in groups or as an entire roost. Bats may abandon a roost temporarily for several weeks, months or years before reoccupying it, or they may abandon it permanently. This is known as 'roost switching'. Roost switching may negatively bias Roost Count trends if monitoring ceases before a roost is reoccupied, as this results in a zero count being the final value entered into trend analysis for that roost, and therefore a negative site trend being included in trend analysis. It is also possible for a roost to 'split' into two or more smaller roosts if it outgrows its original site, which will negatively bias the trend if bats occupying the new site(s) are not included in the count.

Species which switch or split roosts more frequently, in greater numbers or for longer periods of time are likely to have more strongly biased Roost Count trends. Common and soprano pipistrelle show a high degree of roost switching and therefore Roost Count trends for these species should be treated with caution. However, species that are highly faithful to their roost sites, such as greater and lesser horseshoe bat, are likely to have less biased trends.

For these species Roost Count trends appear robust and are supported by evidence from other surveys. Research is underway to investigate potential sources of bias in the Roost Count dataset and options for correcting the trends to ensure they are robust (see Developments and Future Directions, page 67).

Population Trend Analysis

In order to produce a clear picture of the long-term trend for each species, GAMs (Generalised Additive Models) have been used to fit a smoothed line to each dataset, allowing for factors that could influence the means (e.g. bat detector make, temperature) where appropriate (see Barlow *et al.* 2015 for more details). These smoothed curves are quite robust against random variation between years, except at the ends of the series where annual fluctuations and extreme outliers can have an unacceptably large impact on the first and last few years. To counteract this problem, it is best not to use the first year of a survey as the baseline year (where the index equals 100) and in this report the year 1999 has been taken as the baseline year wherever possible. Most surveys start from 1997, although there are a few exceptions. The Field Survey starts from 1998, and some Hibernation Surveys and Roost Counts have earlier years of data for some species. Where these data are available and improve trend estimation, they have been included in the GAMs but as they comprise small amounts of data, the start year is still shown as 1997. In all cases, the estimate for the most recent year should be regarded as provisional and a dotted line is used on the graphs to indicate this.

The average annual percentage change is an approximation based on the assumption that the trend during the period considered is constant and linear. It is estimated by calculating the annual percentage change that would take the population from 100 in the base year to the index value in the current year.

The Generalised Additive Models (GAMs) are based on the method described by Fewster *et al.* (2000). These involve fitting a log-linear generalised linear model (i.e. a regression model with a logarithmic relationship to the explanatory variables and a Poisson error distribution) to the counts on each survey. A site term is fitted in the model to allow for differences in abundance between sites and the time trend is modelled using the GAM framework to fit a smoothed curve. These GAM models are essentially a more sophisticated version of a polynomial curve and are less likely to display misleading trends at the extremes of the data than a polynomial. The degree of smoothing is controlled by specifying the degrees of freedom for the smoothing process; this may vary between 1 (equivalent to a simple linear trend) and one less than the number of years (a 'saturated model' equivalent to fitting individual annual means). For the results presented here the degrees of freedom are generally set to the default value suggested by Fewster *et al.* (2000), which is 0.3 times the number of years. However, curves for different degrees of freedom are always checked to ensure that the model provides an appropriate degree of smoothing to the annual means without being unduly influenced by individual outlying years. The index values are derived from the fitted curve, taking the base year to be 100. Annual means from the saturated model are also shown on the graphs in order to give a visual impression of any deviations from the smoothed curve.

The other feature of these models is that confidence limits based on standard theory will not be valid due to temporal correlations. In addition, NBMP data suffer from other complications not present in the data examined by Fewster *et al.* (2000) which also invalidate the usual method of calculating confidence limits. Firstly the data are much more variable than would be expected from a Poisson distribution. This phenomenon, known as 'overdispersion', is very common in biological data, but is particularly extreme in these datasets. Fewster *et al.* (2000) suggest a negative binomial distribution might be an alternative but simulations suggest that, whilst it sometimes produces more precise results, this is not always the case. Secondly the repeat counts in each year add a further complexity to the correlation structure of the data. All these problems are avoided by using the bootstrap approach recommended by Fewster in which the model is fitted to a large number of new datasets created by resampling sites with replacement from the original sites. At least 400 bootstrap samples are used for each model to ensure robust 95% confidence limits. The same bootstrapping approach can be used to produce confidence limits to

other quantities of interest, including the short- and long-term assessments used in the Defra biodiversity indicators (<http://jncc.defra.gov.uk/page-4271>).

Data for Great Britain are weighted to allow for the different sampling rates in England, Scotland and Wales. This is achieved by weighting each site in proportion to the ratio of non-upland area to the number of sites surveyed for the relevant country, thus ensuring that each country contributes equally to the trends based on land area. Weighting is not applied to those species, such as serotine and horseshoe bats, which have a restricted range within the UK.

Overdispersion is a particular problem for the Field and Waterway Surveys, where a single bat repeatedly flying past the observer may give rise to a large count of bat passes. This results in wide confidence limits for Poisson or negative binomial GAM models and so we have instead presented results for a binomial model of the proportion of observation points on each survey where the species was observed. Apart from this difference in the response variable, the same GAM approach, with bootstrap confidence limits, is adopted. Simulations suggest that these binomial models have greater power to detect trends with the high levels of overdispersion seen in the Field and Waterway Surveys.

In order to test whether the smoothed curves differ between different countries or regions Fewster *et al.* (2000) suggest a deviance test. However, simulations have suggested that this test can produce too many significant results, and so the results presented here use a randomisation approach to obtain a probability value from the change in deviance.

Analyses were conducted in Genstat and in R (version 3.4).

Detecting population change

The purpose of the NBMP is to allow us to draw accurate conclusions about what is happening to our bat populations. We need to be able to identify any significant changes to these populations and, in particular, identify possible declines early on, so that swift conservation action can be taken.

The NBMP uses an 'alert' system which is aimed at identifying problems at an early stage. The alert system follows that used by the British Trust for Ornithology which identifies Red and Amber alerts for individual species population trends as follows:

Red alert: Severe decline of 50% or more over 25 years (equivalent to a 2.73% decline per year)

Amber alert: Moderate decline of between 25-49% over 25 years (equivalent to a 1.14% decline per year)

An assessment based on power analyses and the width of the confidence limits for the current trend estimates suggests that our sample sizes should be sufficient to detect both an Amber and Red Alert change.

Species coverage

The four core NBMP surveys currently provide sufficient data to produce GB-level population trends for 11 of the UK's 17 breeding bat species (Table 2), and country-level trends for 11 species in England, four species in Scotland, seven species in Wales and one species in Northern Ireland; a UK trend is produced for one species.

Trends are not produced within the NBMP for the remaining GB breeding species: Bechstein's bat, Alcaethoe bat, Nathusius' pipistrelle, Leisler's bat or barbastelle. In addition to these breeding species a single male greater mouse-eared bat is consistently recorded hibernating in South East England.

Information on the distribution of certain species is available from the Woodland Survey (barbastelle), National Nathusius' Pipistrelle Project and Bechstein's Bat Project (discontinued).

Table 2. Species coverage and data provision from each NBMP survey.

Species	Roost Count	Field / Waterway Survey	Hibernation Survey	
Greater horseshoe bat	✓		✓	
Lesser horseshoe bat	✓		✓	
Common pipistrelle	✓	✓	+	
Soprano pipistrelle	✓	✓	+	
Daubenton's bat		✓	✓	✓ = enough data collected for trend
Natterer's bat	✓		✓	
Whiskered/Brandt's bat			✓	
Noctule		✓		+ = recorded, but insufficient data to produce trend
Serotine	✓	✓		
Brown long-eared bat	✓		✓	
Bechstein's bat			+	
Alcathoe bat				
Nathusius' pipistrelle			+	
Leisler's bat		+ (NI only)		
Barbastelle			+	
Grey long-eared bat	+			

Bechstein's bat

This rare species is restricted to southern England and southern Wales. It is associated with semi-natural woodlands and is difficult to survey using standard methods as it produces low intensity echolocation calls which are difficult to pick up and identify on a bat detector, and it spends much of its time foraging high up in the canopy.

The Bechstein's Bat Project, which ran from 2007-2011, used survey techniques specifically designed for Bechstein's bat in order to establish baseline distribution data on this species from woodlands in southern England and South Wales, and to gather information to inform future conservation policy and woodland management.

Full details of the project, results and final report can be found on the Bechstein's Bat Project pages (www.bats.org.uk/our-work/national-bat-monitoring-programme/past-projects/bechsteins-bat-project). An article on the project and follow-on work was published in British Wildlife in 2013 (Barlow *et al.* 2013).

Greater mouse-eared bat

This species was declared extinct in the UK in 1990. However, a single juvenile male was found during a Hibernation Survey in southern England in winter 2002/2003 and has been recorded annually ever since.

Alcathoe bat

This species was first described in 2001 (von Helversen *et al.* 2001) and confirmed as a resident species in the UK in 2010 (Jan *et al.* 2010). It is likely under-recorded, but current knowledge suggests that it has a highly localised distribution, restricted to areas of North Yorkshire, Sussex, Surrey, Kent and Wiltshire. It is very similar in appearance to whiskered and Brandt's bats and these three species cannot be distinguished acoustically or visually during NBMP

surveys. However, based on current knowledge of this species' distribution, we believe it will be encountered too infrequently during monitoring of whiskered/Brandt's bats to include this species within the whiskered/Brandt's bat combined trend. We will review this as further data become available.

Leisler's bat

This species is uncommon but widespread throughout England, Wales and Scotland. It is more abundant in Northern Ireland, as Ireland is a stronghold for the species. It is a mobile species and individuals move between roosts regularly; it is primarily a woodland species, but will also use buildings for roosting, although few building roosts are known.

A modification of the Field Survey for Northern Ireland was introduced in 2008 to allow for monitoring of Leisler's bats. Three sites in Northern Ireland have been surveyed using this modified methodology to date. A larger sample size is required before these data can be used to calculate species population trends. The new British Bat Survey has potential for delivering monitoring data for this species in future (see Developments and future directions, page 68).

Survey coverage

UK site network

In total up to 2018, 6,718 sites have been surveyed as part of ongoing NBMP surveys (excluding the Sunset/Sunrise Survey where sites are less clearly defined). In 2018 NBMP volunteers completed surveys at 1,907 sites. This is a 0.9% decrease on the number of sites surveyed in 2017 (Table 3).

We also encourage new volunteers to get involved in the NBMP by taking part in our Sunset/Sunrise Survey. In 2018, 331 Sunset/Sunrise Surveys were completed by at least 297 volunteers. Twenty-eight bat roosts were located.

Value of the volunteer contribution to the NBMP

In 2018, 989 dedicated volunteers took part in the four core NBMP surveys (Figure 1). In 2018 volunteers taking part in our four core surveys contributed approximately 17,036 hours of their time, representing an in-kind contribution to the NBMP of £251,537⁴. The equivalent cost of these surveys if they were undertaken by professional ecologists would be £625,897⁵.

⁴ Volunteer contribution calculated using the daily rate given for unskilled and skilled volunteers by the Heritage Lottery Fund in their application guidance (Dec 2013), and assuming a 7.5 hour day.

⁵ Equivalent professional contribution calculated using the mid-point of the daily rate range for an Assistant Ecologist (lowest level of experience) and Ecologist given by CIEEM in their guidance to members, and assuming a 7.5 hour day.

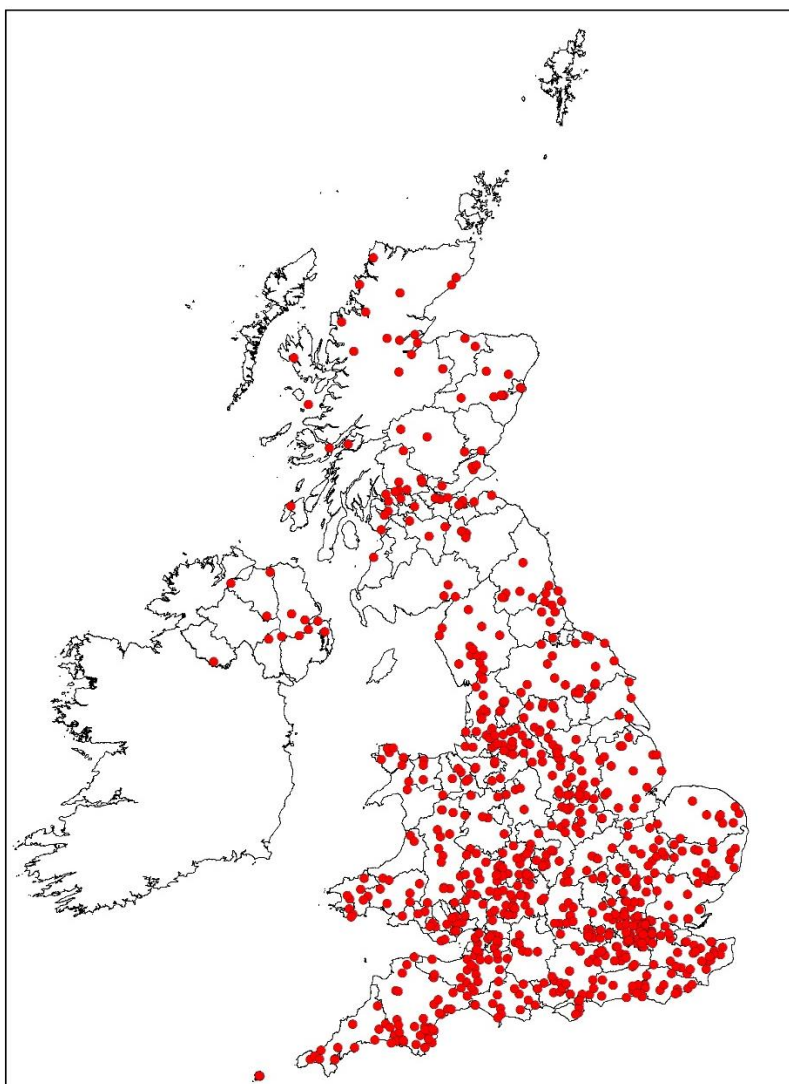


Figure 1. Distribution of NBMP volunteers who took part in the four core NBMP surveys in 2018.

Repeat sites

Eighty six percent of core survey sites (Field Survey, Waterway Survey, Roost Count and Hibernation Survey) surveyed in 2018 had been surveyed in at least one previous year (1,717 'repeat sites', table 3). This is a reduction from 93.5% in 2017.

Maximising the number of sites that are surveyed for at least two years is a priority for NBMP, as data from a site can only contribute to species trends when at least two years of data have been collected. However, adding new sites to the site network is also valuable for increasing the geographic coverage of sites contributing to the species population trends.

Table 3 shows for each survey the total number of sites surveyed to date, the number sites surveyed in 2018 and in the preceding year, and the proportion of sites surveyed in 2018 that has been surveyed in at least one year previously.

Table 3. UK NBMP survey coverage 2018

Survey type	Total sites surveyed to date	Total sites surveyed 2018	Total sites surveyed 2017	% change in sites surveyed from 2017 to 2018	% repeat sites 2018
Field Survey	956	223	204	9.3%	88.8%
Waterway Survey	1455	322	333	-3.3%	87.7%
Hibernation Survey	1245	510	553	-7.8%	94.3%
Roost Counts:					
Greater horseshoe bat	40	27	28	-3.6%	92.6%
Lesser horseshoe bat	370	199	194	2.6%	95.0%
Common pipistrelle	675	194	189	2.6%	86.1%
Soprano pipistrelle	521	163	161	1.2%	88.3%
Unidentified pip sp.	781	66	59	11.9%	84.8%
Natterer's bat	105	42	44	-4.5%	95.2%
Serotine	147	36	40	-10.0%	100.0%
Brown long-eared bat	234	65	61	6.6%	89.2%
Other species	137	44	42	4.8%	70.5%
All core surveys	6666	1891	1908	-0.9%	86.2%
Woodland Survey	52	16	16	0.0%	100.0%
All surveys	6718	1907	1924	-0.9%	90.4%

Country level site networks

The NBMP produces trends for Great Britain and at UK and country-level where sufficient data are available. Power analyses were completed for the NBMP in 2001, and from these it was recommended that a core of 30-40 sites need to be surveyed annually for any given survey to provide sufficient data for trends to be calculated that will detect changes in populations effectively (BCT, 2001). More recent power analysis has indicated that the sample size needed can vary between each species and survey. However, we use 30-40 sites as our initial target number of repeat sites at each geographical scale. Further power analysis would need to be carried out in order to more precisely assess the sample size needed at the country or regional scale for each species and survey method.

Survey coverage at country level is given in table 4. We are exceeding our basic target of 30 repeat sites in England for all surveys except for the greater horseshoe bat Roost Count. In Wales, we are exceeding this target for the Hibernation Survey and the lesser horseshoe bat Roost Count. In Scotland we are exceeding this target for the Waterway Survey. A power analysis commissioned by Scottish Natural Heritage further demonstrated that the trend for Daubenton's bat estimated from Waterway Survey data and the trends for common and soprano pipistrelle estimated from Roost Count data had low or medium levels of sample error and could therefore be considered statistically robust (although not necessarily free of bias, see Robustness of Monitoring). These trends are included in a Trend Note published by Scottish Natural Heritage in 2015 (SNH Commissioned Report No. 796). Here we present additional Scottish trends for common and soprano pipistrelle estimated from Field Survey data. Of the survey methods used to monitor common and soprano pipistrelle, the Field Survey is considered to most reliably reflect the underlying population trend. However, the number of Field Survey sites monitored in Scotland is small and therefore the confidence intervals associated with these trends are wide, reflecting a high degree of uncertainty. Increasing the number of Field Survey sites monitored in Scotland in the future is a priority. Aside from Daubenton's bat monitored

by the Waterway Survey, samples sizes in Northern Ireland are currently too small for species trends to be calculated.

Table 4. Country level NBMP survey coverage 2018. Number of sites surveyed, with number of repeat sites shown in brackets.

Survey type	England	Scotland	Wales	Northern Ireland	Channel Islands
Field Survey	192 (175)	18 (14)	8 (5)	1 (0)	4 (4)
Waterway Survey	237 (217)	34 (31)	18 (16)	33 (28)	0
Hibernation Survey	371 (353)	19 (17)	117 (109)	0	0
<i>Roost Counts:</i>					
Greater horseshoe bat	23 (21)	-	4 (4)	-	0
Lesser horseshoe bat	73 (66)	-	126 (123)	-	-
Common pipistrelle	155 (131)	21 (19)	17 (17)	1 (0)	0
Soprano pipistrelle	113 (99)	23 (21)	16 (15)	11 (9)	0
Pipistrelle sp.	46 (42)	10 (8)	6 (4)	4 (2)	0
Natterer's bat	37 (36)	3 (3)	1 (1)	1 (0)	0
Serotine	35 (35)	-	1 (1)	-	0
Brown long-eared bat	46 (41)	10 (10)	5 (5)	4 (2)	0
Total for all surveys	1328 (1216)	138 (123)	319 (300)	55 (41)	4 (4)

Survey coverage maps

These maps show the distribution of sites surveyed as part of the Field Survey, Waterway Survey, Hibernation Survey and Roost Count in 2018 (red circles) and also the distribution of sites surveyed for each survey to date (yellow circles).

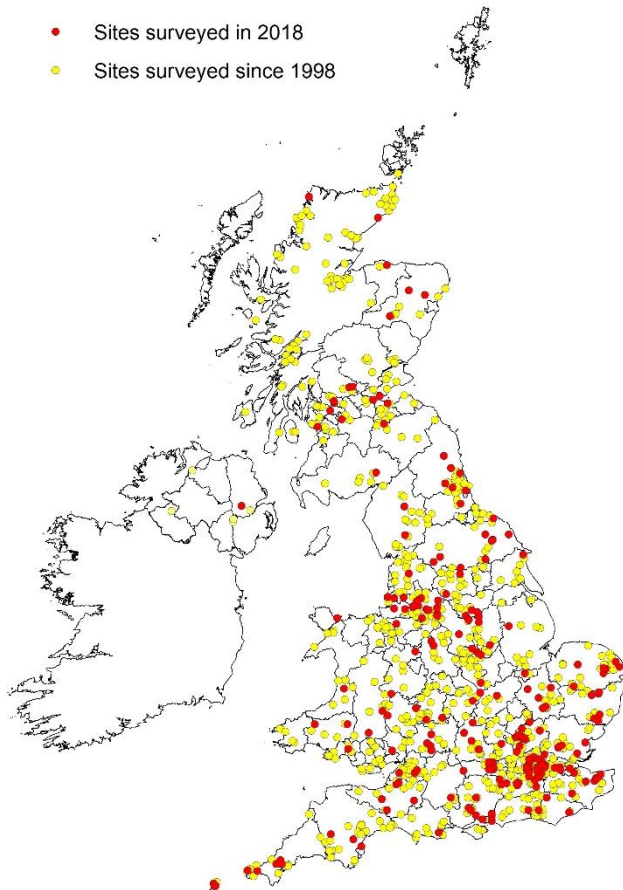


Figure 2. Distribution of Field Survey sites

In 2018, 223 sites were surveyed, representing 23.3% of the total number of Field Survey sites surveyed to date.

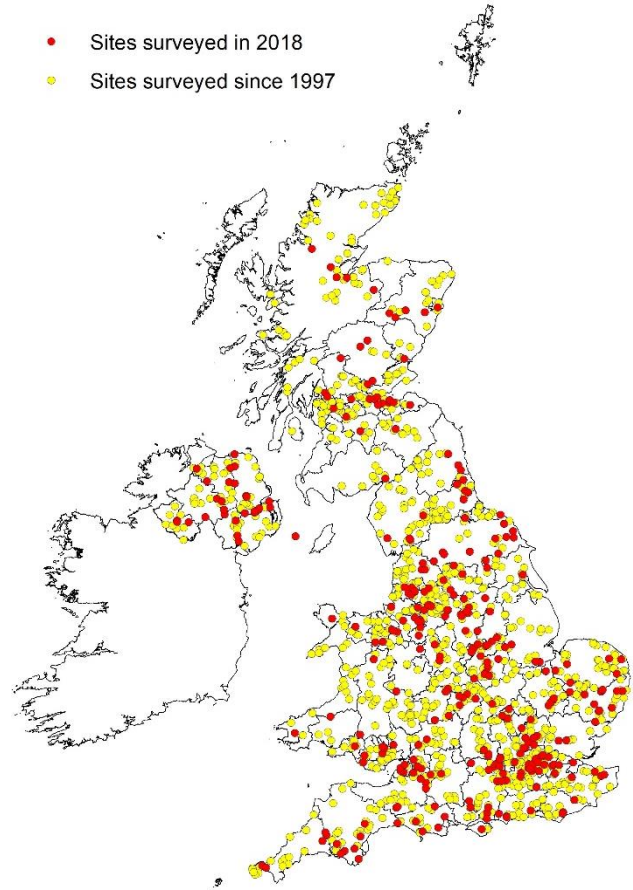


Figure 3. Distribution of Waterway Survey sites

In 2018, 322 sites were surveyed, representing 22.1% of the total number of Waterway Survey sites surveyed to date. Sites in Northern Ireland are monitored as part of the All-Ireland Waterway Survey, run by Bat Conservation Ireland.

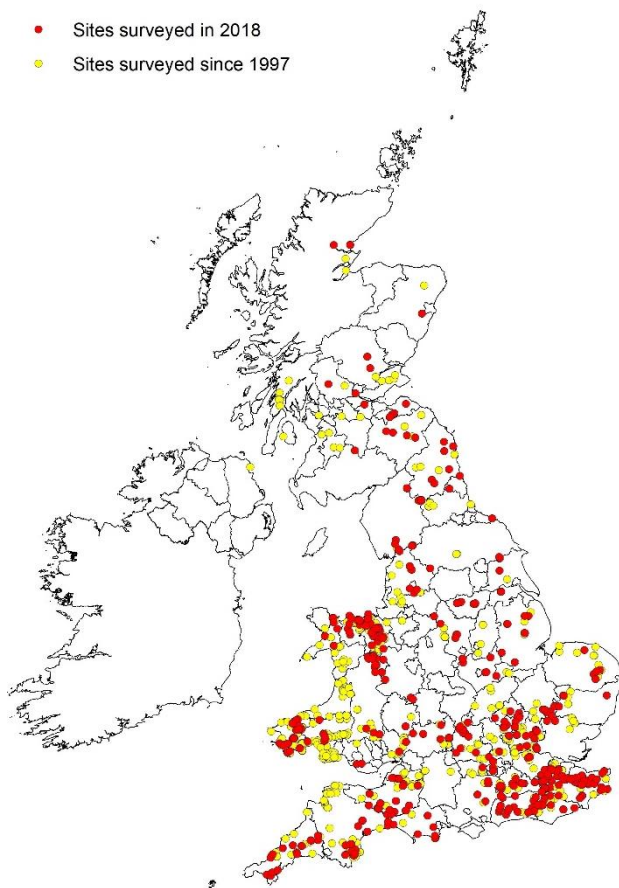


Figure 4. Distribution of Hibernation Survey sites

In 2018, 510 sites were surveyed, representing 41% of the total number of Hibernation Survey sites surveyed to date.

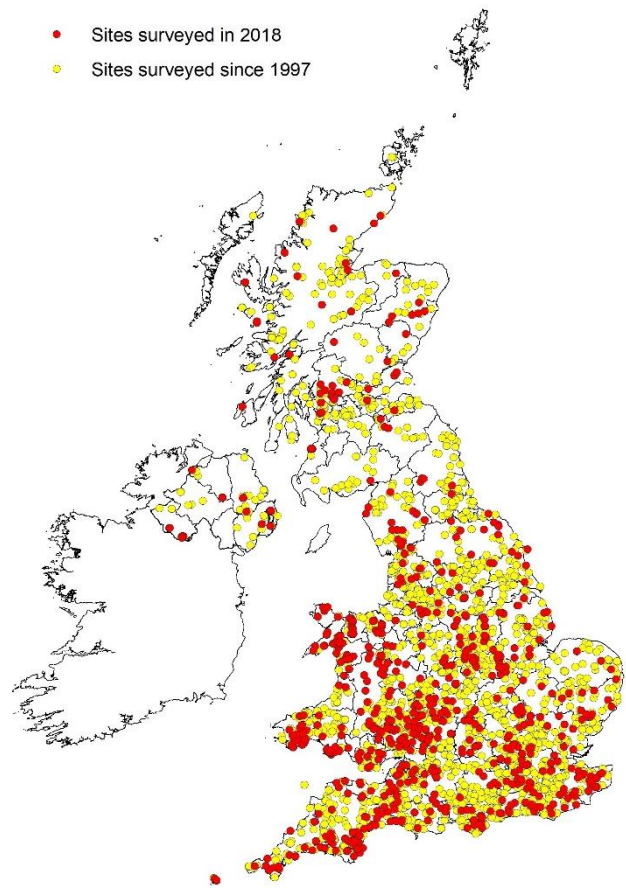


Figure 5. Distribution of all Roost Count sites

In 2018, 836 sites were surveyed, representing 27.8% of the total number of Roost Count sites surveyed to date.

Species Population Trends for Great Britain

Summary of species trends for Great Britain

The smoothed population indices derived from NBMP data in Great Britain to the end of 2018 are shown in Table 5. We are able to produce a UK trend for Daubenton's bat from the Waterway Survey as there are sufficient sites in Northern Ireland (data provided by Bat Conservation Ireland). For each species, the number of sites contributing to the 2018 trend calculations is shown, as well as an approximation of the average annual percentage change in the index since the baseline year. It should be noted, however, that the average annual percentage change makes assumptions about the data analysis and is only genuinely appropriate for those species for which the trend line appears to be linear.

For the remaining UK bat species (Bechstein's bat, Alcathoe bat, Leisler's bat, Nathusius' pipistrelle, barbastelle, grey long-eared bat and greater mouse-eared bat) there are insufficient data available at present to allow calculation of population trends.

In each species summary, population estimates from Mathews *et al.* 2018 are given at GB and country level where available. Each estimate has been given a reliability score based on the availability of data on roost density, roost size and sex ratio. A value of 1 indicates very poor reliability, and 4 indicates very good reliability.

Table 5. GB bat species population trends summary table

Species	Survey	No. sites trend analysis	Base year	Long-term trend (since base year) %	Average annual change %
Greater horseshoe bat	Hibernation	212	1999	193.8*	5.8
	Roost Count	36	1999	136.6*	4.6
Lesser horseshoe bat	Hibernation	326	1999	154.8*	5.1
	Roost Count	304	1999	74.9*	3.0
Daubenton's bat	Hibernation	421	1999	30.1*	1.4
	Waterway (GB)	832	1999	6.6	0.3
	Waterway (UK)	897	1999	7.5	0.4
Whiskered/Brandt's bat	Hibernation	245	1999	28.7	1.3
Natterer's bat	Hibernation	534	1999	98.1*	3.7
	Roost Count	85	2002	-14.7	-1.0
Common pipistrelle	Field	626	1999	90.9*	3.5
	Roost Count	510	1999	-65.0*	-5.4
Soprano pipistrelle	Field	624	1999	26.3	1.2
	Roost Count	401	1999	-55.9*	-4.2
Noctule	Field	623	1999	29.3	1.4
Serotine	Field	426	1999	-5.6	-0.3
	Roost Count	97	1999	-9.3	-0.5
Brown long-eared bat	Hibernation	461	1999	-8.7	-0.5
	Roost Count	159	2001	21.1	1.1

Notes: * indicates statistically significant result at 5% level. **Bold** indicates the method considered to be most statistically robust if two trends are produced.

Trends in context

These trends reflect relatively recent changes to bat populations since the 1990s. It is generally considered that prior to this there were significant historical declines in bat populations dating back to at least the start of the 20th century, although evidence is fragmented and few data were collected in a systematic way.

Summary of trends for England, Scotland, Wales and Northern Ireland

Population trends are produced at a country-level for England, Scotland, Wales and Northern Ireland for species and surveys where sufficient data are available. Tables 6-9 show a summary of the bat species trends at country level derived from NBMP surveys to the end of 2018. For each species, the number of sites contributing to the 2018 trend calculations is shown as well as an approximation of the average annual percentage change since the baseline year. It should be noted, however, that the average annual percentage change makes assumptions about the data analysis and is only genuinely appropriate for those species for which the trend line appears to be linear.

All species showed similar trends at GB and country-level with the following exceptions: The greater horseshoe bat Hibernation Survey trend showed a statistically significant increase at the GB scale and in England, but the increase was not significant in Wales; the Daubenton's bat Waterway Survey trend showed a statistically significant increase in both Scotland and Wales, and no significant change for England and Northern Ireland; the Daubenton's bat Hibernation Survey trend showed a significant increase at GB scale and in England, but in Scotland and Wales did not show a significant change from the baseline year; and the Natterer's bat Hibernation Survey trend showed statistically significant increases at the GB scale and in England and Wales, but no statistically significant change in Scotland.

England

Table 6. England bat species population trends summary table (results up to 2018)

Species	Survey type	No. sites trend analysis	Base year	Long-term trend (since base year) %	Average annual change %
Greater horseshoe bat	Hibernation	110	1999	220.1*	6.3
	Roost	31	1999	116.4*	4.2
Lesser horseshoe bat	Hibernation	153	1999	165.7*	5.3
	Roost	118	1999	106.2*	3.9
Daubenton's bat	Waterway	671	1999	-7.6	-0.4
	Hibernation	299	1999	31.4*	1.5
Whiskered/Brandt's bat	Hibernation	161	1999	35.2	1.6
Natterer's bat	Hibernation	375	1999	120.0*	4.2
	Roost	72	2002	-2.9	-0.2
Common pipistrelle	Field	512	1999	95.7*	3.6
	Roost	404	1999	-58.9*	-4.6
Soprano pipistrelle	Field	511	1999	14.7	0.7
	Roost	262	1999	-51.2*	-3.7
Noctule	Field	510	1999	2.2	0.1
Serotine	Field	390	1999	-6.1	-0.3
	Roost	95	1999	-12.4	-0.7
Brown long-eared bat	Hibernation	350	1999	-0.4	-0.02
	Roost	114	2001	3.4	0.2

Notes: * indicates statistically significant result at 5% level. **Bold** indicates the method considered to be most statistically robust if two trends are produced.

Scotland

Table 7. Scotland bat species population trends summary table (results up to 2018)

Species	Survey type	No. sites trend analysis	Base year	Long-term trend (since base year) %	Average annual change %
Daubenton's bat	Waterway	112	1999	28.5*	1.3
	Hibernation	21	1999	17.4	1.8
Natterer's bat	Hibernation	22	2011	-28.8	-4.7
Common pipistrelle	Field	67	1999	69.3*	2.8
	Roost	67	1999	-74.9*	-7.0
Soprano pipistrelle	Field	67	1999	35.4	1.6
	Roost	87	1999	-63.0*	-5.1

Notes: * indicates statistically significant result at 5% level. **Bold** indicates the method considered to be most statistically robust if two trends are produced.

Wales

Table 8. Wales bat species population trends summary table (results up to 2018)

Species	Survey type	No. sites trend analysis	Base year	Long-term trend (since base year) %	Average annual change %
Greater horseshoe bat	Hibernation	98	1999	134.5	4.6
Lesser horseshoe bat	Hibernation	172	1999	157.5*	5.1
	Roost	177	1999	68.1*	2.8
Daubenton's bat	Waterway	47	2000	49.8*	2.3
	Hibernation	95	1999	34.9	1.6
Whiskered/Brandt's bat	Hibernation	82	1999	-1.1	-0.1
Natterer's bat	Hibernation	136	1999	72.0*	2.9
Soprano pipistrelle	Roost	52	2002	-61.0*	-5.7
Brown long-eared bat	Hibernation	85	1999	71.8	2.9

Notes: * indicates statistically significant result at 5% level. **Bold** indicates the method considered to be most statistically robust if two trends are produced.

Northern Ireland

Daubenton's bat is the only species for which we currently have a sufficient sample size to enable a statistically robust trend to be produced for Northern Ireland. Most of the data are from the All-Ireland Waterway Survey which has been run by Bat Conservation Ireland since 2008.

Further information on how bats are faring in Ireland can be found on the Bat Conservation Ireland website (www.batconservationireland.org/).

Table 9. Northern Ireland bat species population trend summary table (results up to 2018)

Species	Survey type	No. sites trend analysis	Base year	Long-term trend (since base year) %	Average annual change %
Daubenton's bat	Waterway	64	2008	20.6	1.9

Notes: * indicates statistically significant result at 5% level.



Greater horseshoe bat trends | Great Britain

Rhinolophus ferrumequinum

Summary of survey results for Great Britain

Trends from both the Hibernation Survey and Roost Count show a significant increase in the smoothed population index since the baseline year. Overall the **population of greater horseshoe bat in Great Britain is considered to have increased since 1999**.

Population trends are also calculated for greater horseshoe bat at a country-level for England and Wales. This species is not found in Scotland.

Hibernation Survey

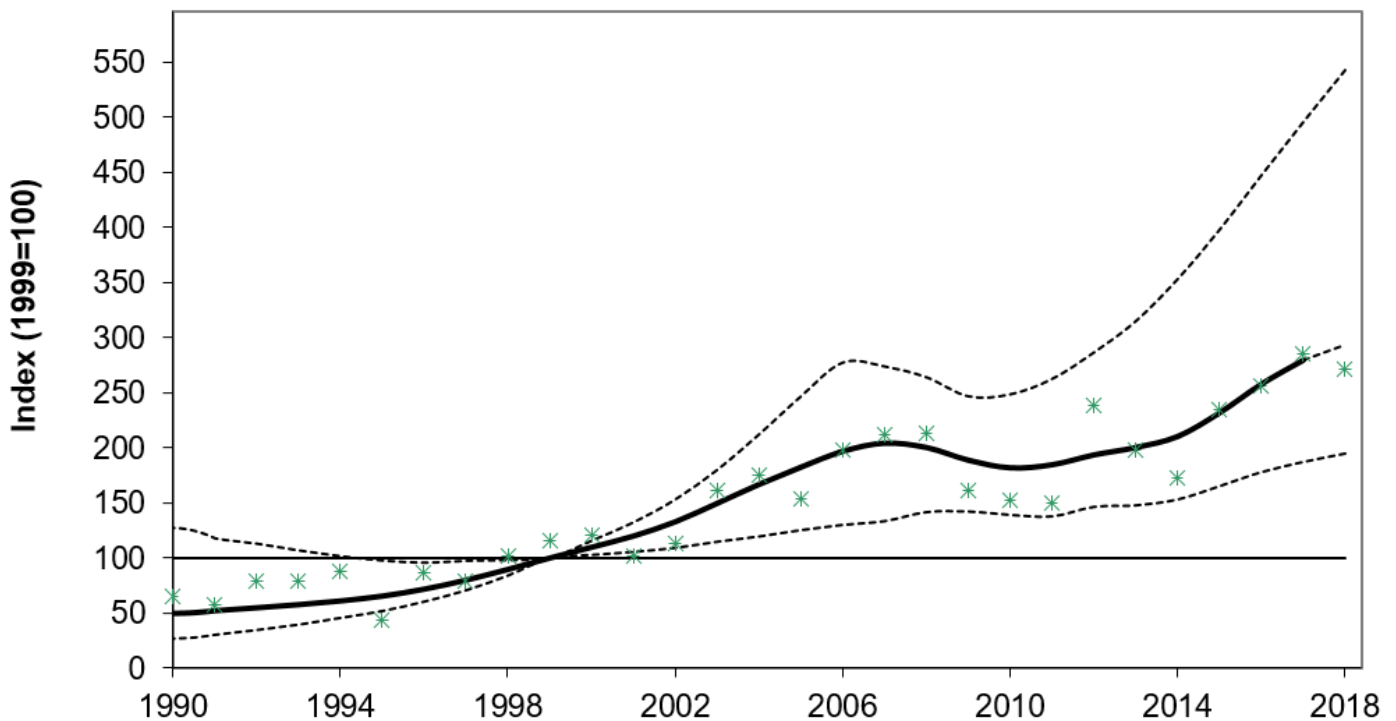


Figure 6. GB index of greater horseshoe bat population from Hibernation Surveys, showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 193.8% above the 1999 base year value, equivalent to an annual increase of 5.8%. The value of the smoothed index has fluctuated since the 1999, however it has always been significantly higher than the baseline value. Overall there has been a **significant increase in the smoothed index since 1999**.

From all years for which data are available (1990-2018), counts from 212 sites contribute to the overall trend analysis (sites surveyed in two or more years with greater horseshoe bat recorded in at least one year).

Roost Count

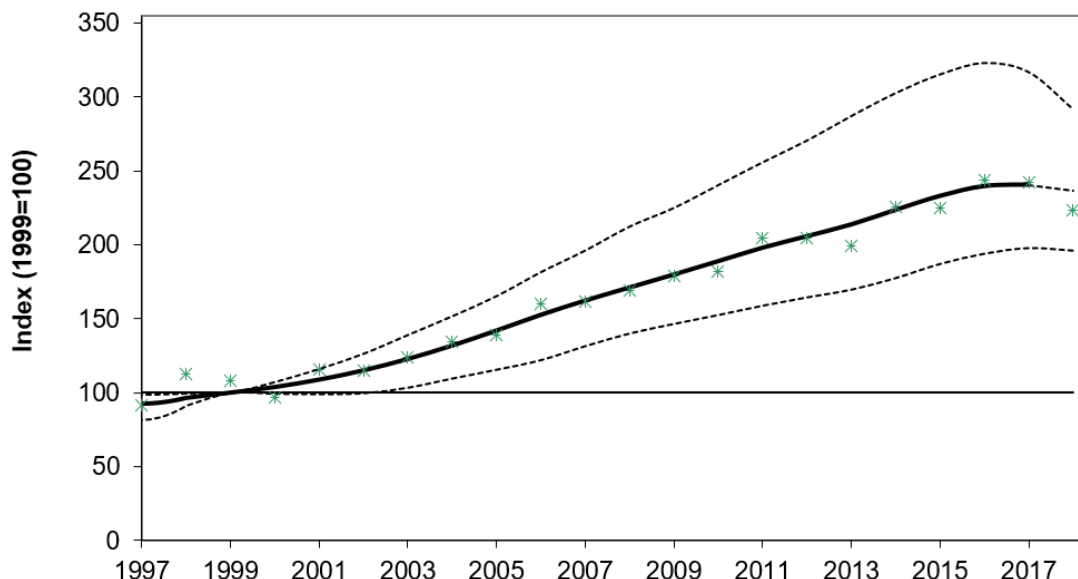


Figure 7. GB index of greater horseshoe bat population from Roost Counts showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 136.6% above the 1999 base year value, equivalent to an annual increase of 4.6%. The smoothed index increased consistently between 1999 and 2016, however in recent years this rate of increase has slowed and the provisional value of the smoothed index in 2018 shows it starting to fall. We believe the vast majority of GB greater horseshoe bat maternity roosts are monitored as part of the NBMP, however this still represents a relatively small number of roosts. As such a large change at a single roost in 2018 has had a disproportionate effect on the value of the smoothed index. Further years of monitoring are required to establish whether this change will be reflected across other sites monitored. Overall there has been a **significant increase in the smoothed index since 1999**.

Data from 36 sites surveyed between 1997 and 2018 contribute to the trend analysis (sites surveyed in at least two years).

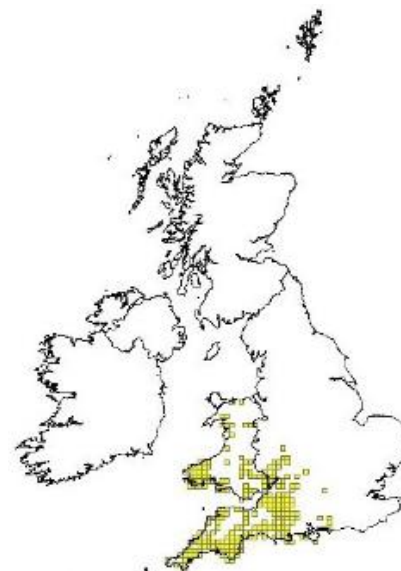
Distribution and abundance

The greater horseshoe bat is rare in the UK with a distribution restricted to south-west England and south Wales. It is absent from Scotland and Northern Ireland.

Population estimate

Country	GB	England	Wales	Scotland	N.Ireland
Number (plausible intervals in brackets)	12,900 (9,210 – 18,500)	10,200 (7,280 – 14,600)	2,700 (1,930 – 3,850)	N/A	N/A
	Reliability score = 4				
Source	Mathews et al. 2018				

Distribution of greater horseshoe bat in the UK
(Map taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)





Greater horseshoe bat trends | England

Hibernation Survey

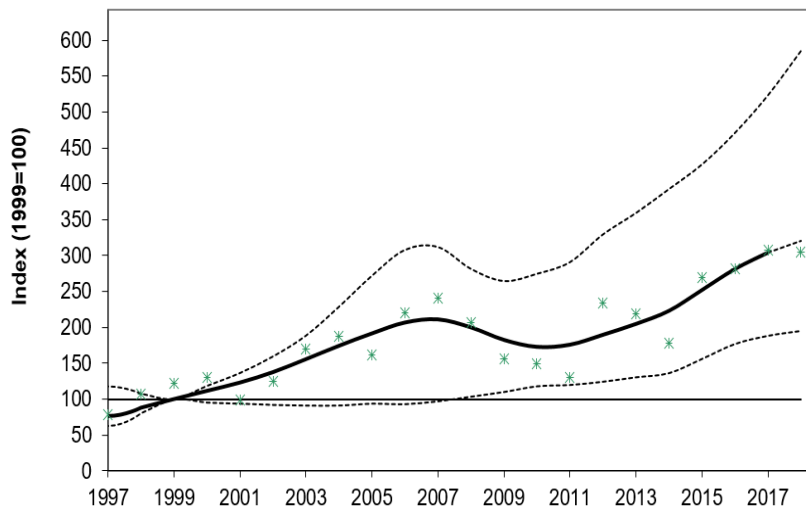


Figure 8. England index of greater horseshoe bat population from the Hibernation Survey

The smoothed index is currently 220.1% above the 1999 base year value, equivalent to an annual increase of 6.3%. It fluctuated between 1999 and 2011, but more recently it has been increasing steadily. The smoothed index has been significantly higher than the baseline year since 2008, and overall there has been a **significant increase in the smoothed index since 1999**.

From all years for which data are available (1990-2018), counts from 110 sites contribute to the trend analysis in England (sites surveyed in two or more years with greater horseshoe bat present in at least one year).

Roost Count

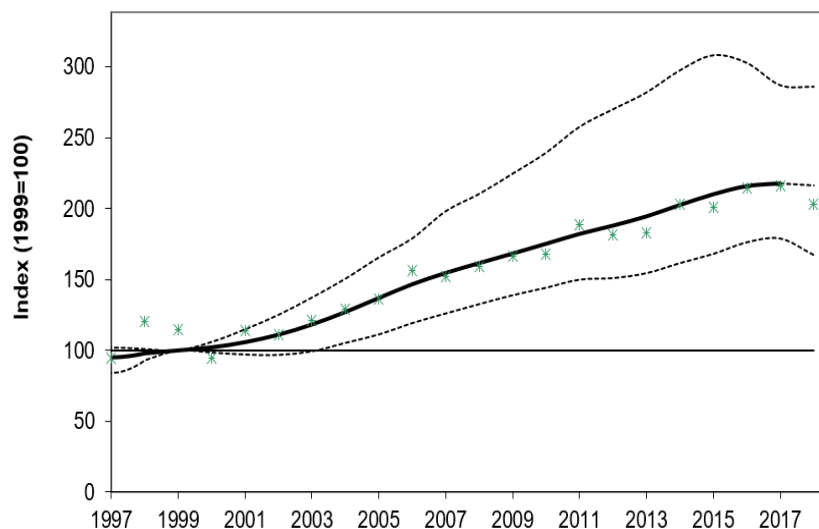


Figure 9. England index of greater horseshoe bat population from the Roost Count

The smoothed index is currently 116.4% above the 1999 base year value, equivalent to an annual increase of 4.2%. The trend closely reflects that pattern seen at GB level - the smoothed index increased consistently between 1999 and 2016, however in recent years this rate of increase has slowed and the provisional value of the smoothed index in 2018 shows it starting to fall.

We believe the vast majority of greater horseshoe bat maternity roosts in England are monitored as part of the NBMP, however this still represents a relatively small number of roosts. As such a large change at a single roost in 2018 has had a disproportionate effect on the value of the smoothed index.

Further years of monitoring are required to establish whether this change will be reflected across other sites monitored. Overall there has been a **significant increase in the smoothed index since 1999**.

From all years for which data are available (1997-2018), counts from 31 sites contribute to the trend analysis in England (sites surveyed in at least two years).

Note: The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Greater horseshoe bat trends | Wales

Hibernation Survey

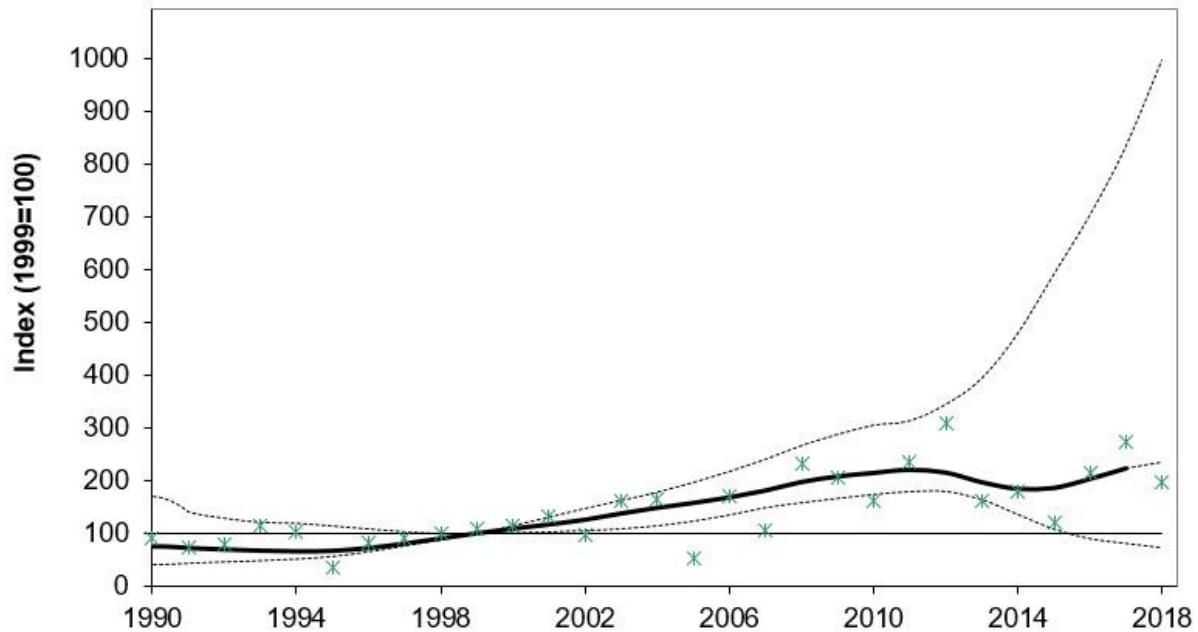


Figure 10. Wales index of greater horseshoe bat population from Hibernation Surveys showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

In Wales the smoothed index is currently 134.5% above the 1999 base year value, equivalent to an annual increase of 4.6%. The value of the smoothed index increased steadily between 1999 and 2011, but in recent years has started to fluctuate. It was significantly higher than the baseline year between 2000 and 2015, however since 2011 the precision of the trend has reduced markedly and as a result **the smoothed index is no longer significantly different from the baseline year.**

From all years for which data are available (1990-2018) counts from 98 sites contribute to the trend analysis in Wales (sites surveyed in two or more years with greater horseshoe bat present in at least one year).



Lesser horseshoe bat trends | Great Britain

Rhinolophus hipposideros

Summary of survey results for Great Britain

Trends from the Hibernation Survey and Roost Count survey both show a significant increase in the smoothed index since the baseline year. **The population of lesser horseshoe bat in Great Britain is considered to have increased since 1999.**

Population trends are also calculated for lesser horseshoe bat at a country-level for England and Wales. This species is not found in Scotland.

Hibernation Survey

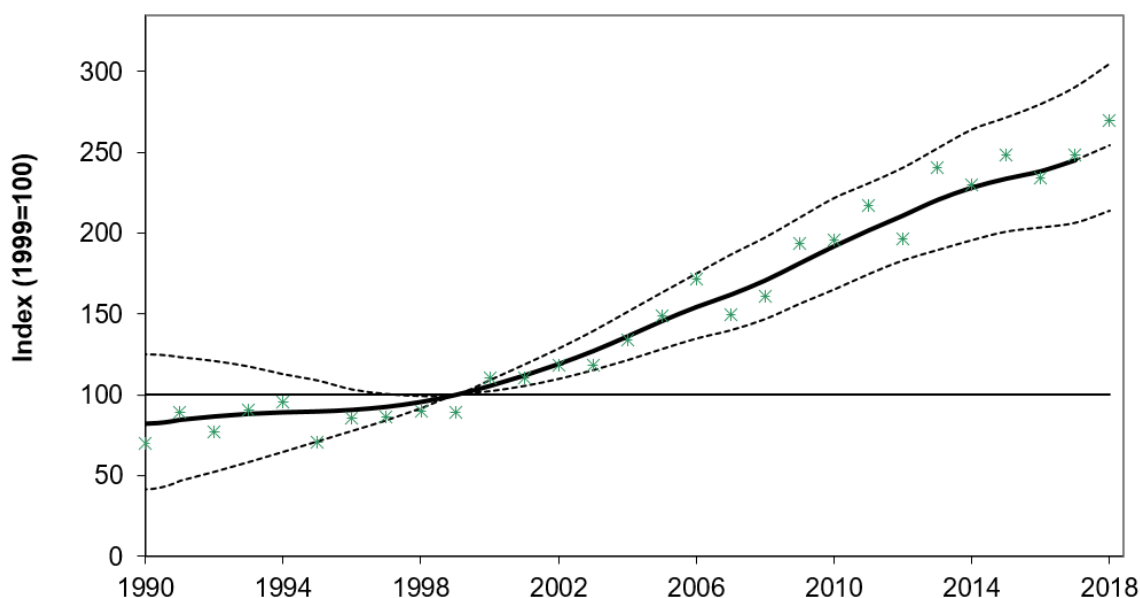


Figure 11. GB index of lesser horseshoe bat population from Hibernation Surveys showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 154.8% above the 1999 base year value, equivalent to an annual increase of 5.1%. It has increased consistently since the baseline year and there has been a **significant increase in the smoothed index since 1999.**

A total of 326 sites contribute to the overall trend analysis (sites surveyed in more than one year and with lesser horseshoe bat present in at least one year).

Roost Counts

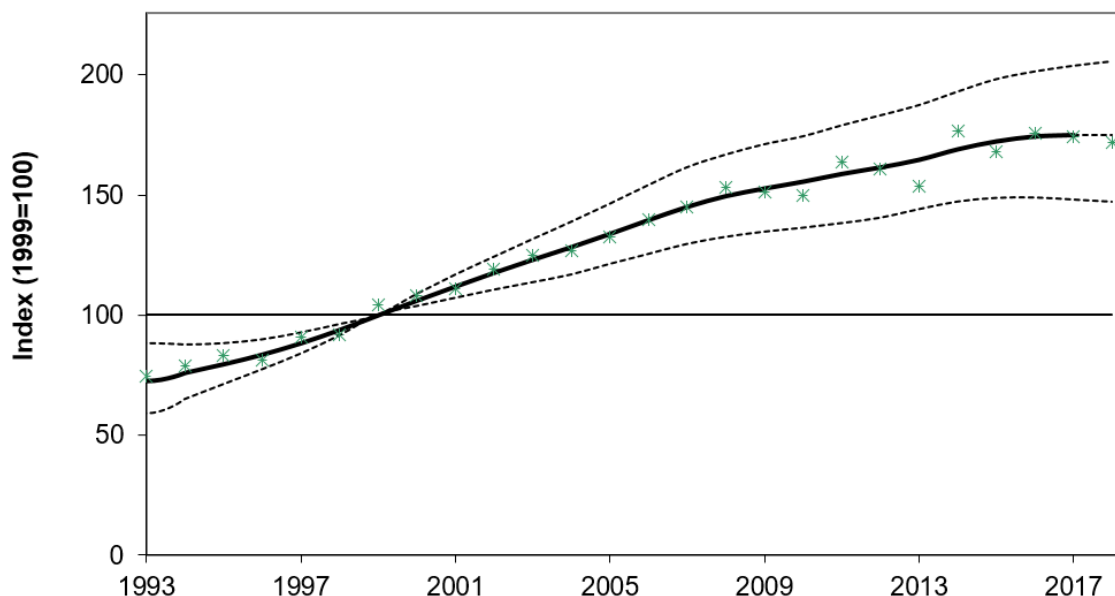


Figure 12. GB index of lesser horseshoe bat population from Roost Counts showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 74.9% above the 1999 base year value, equivalent to an annual increase of 3.0%. It increased every year between 1999 and 2016, however the rate of increase slowed over that period and since 2016 the smoothed index has been relatively stable. Overall there has been a **significant increase in the smoothed index since 1999**.

Data from 304 sites surveyed between 1993 and 2018 contribute to the overall trend analysis (sites surveyed in more than one year).



Population estimate

Country	GB	England	Wales	Scotland	N.Ireland
Number (Plausible intervals in brackets)	50,400 (36,000 – 72,000).	19,400 (13,900 – 27,700)	30,900 (22,000 – 44,100)	N/A	N/A
Source	Mathews <i>et al.</i> 2018				

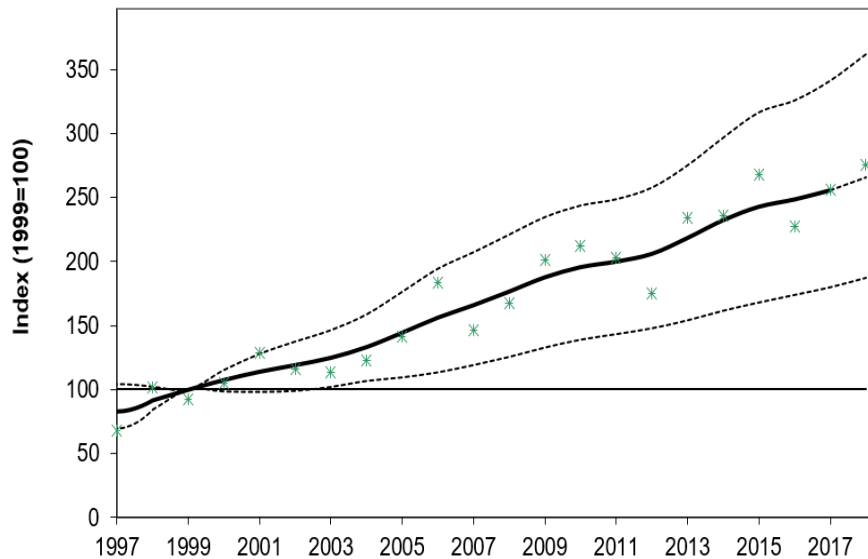
Distribution of lesser horseshoe bat in the UK
(Map taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Lesser horseshoe bat trends | England

Hibernation Survey

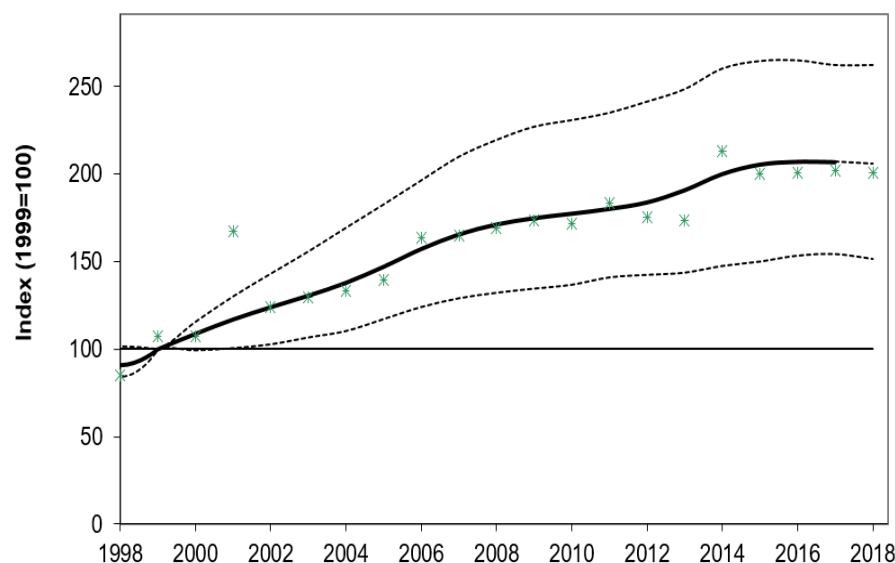


The smoothed index is currently 165.7% above the 1999 base year value, equivalent to an annual increase of 5.3%. It has increased every year since the baseline year although the rate of increase has varied. Overall there has been a **significant increase in the smoothed index since 1999**.

From all years for which data are available (1990-2018), counts from 153 sites contribute to the trend analysis in England (sites surveyed in more than one year and with lesser horseshoe bat present in at least one year).

Figure 13. England index of lesser horseshoe bat population from the Hibernation Survey

Roost Count



The smoothed index is currently 106.2% above the 1999 base year value, equivalent to an annual increase of 3.9%. It increased every year between 1999 and 2015, although the rate of increase varied. Since 2015 the smoothed index has been relatively stable. Overall there has been a **significant increase in the smoothed index since 1999**.

Data from 118 sites contribute to the trend analysis in England (sites surveyed in more than one year).

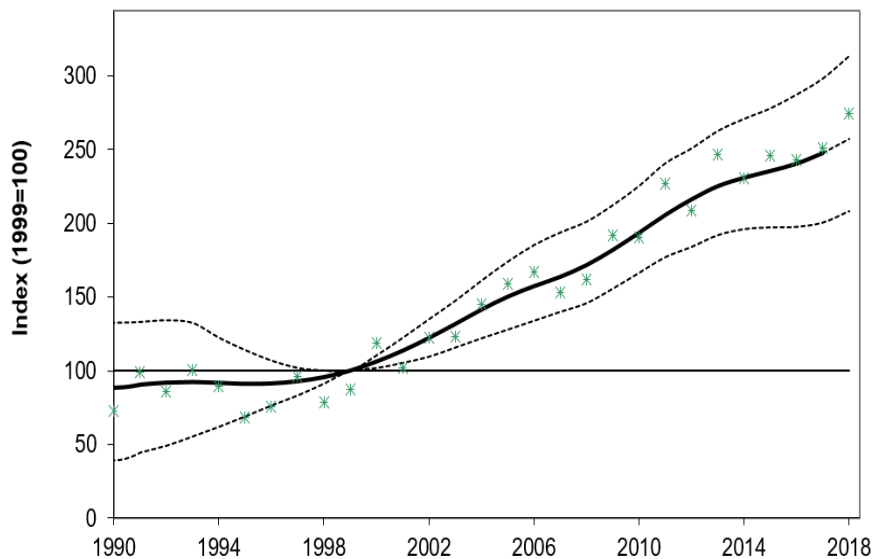
Figure 14. England index of lesser horseshoe bat population from the Roost Count

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Lesser horseshoe bat trends | Wales

Hibernation Survey

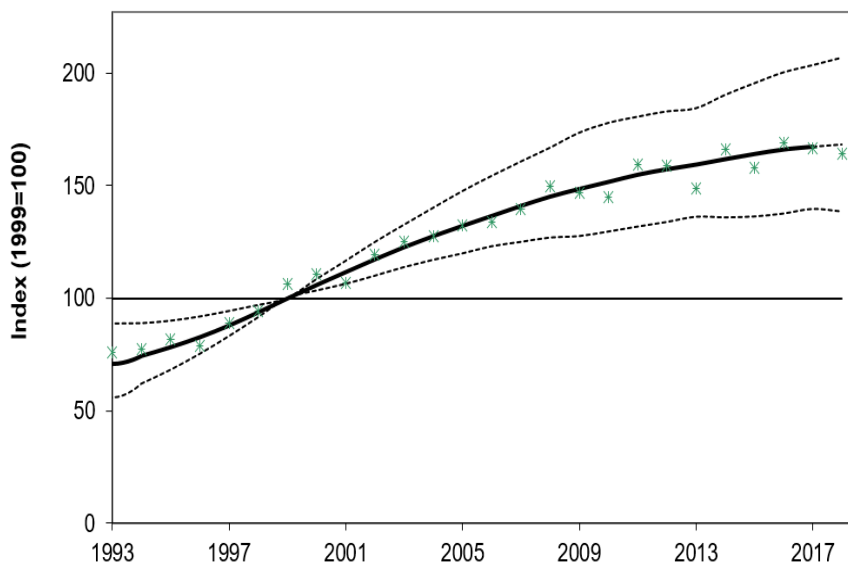


The smoothed index is currently 157.5% above the 1999 base year value, equivalent to an annual increase of 5.1%. It has increased consistently since the baseline year and overall there has been a **significant increase in the smoothed index** since 1999.

From all years for which data are available (1990-2018), counts from 172 sites contribute to the trend analysis in Wales (sites surveyed in two or more years with lesser horseshoe bat present in at least one year).

Figure 15. Wales index of lesser horseshoe bat population from the Hibernation Survey

Roost Counts



The smoothed index is currently 68.1% above the 1999 base year value, equivalent to an annual increase of 2.8%. It has increased every year since 1999, however the rate of increase has slowed over this period. Overall there has been a **significant increase in the smoothed index since 1999**.

Data from 177 sites contribute to the trend analysis in Wales (sites surveyed in at least two years).

Figure 16. Wales index of lesser horseshoe bat population from the Roost Count

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Daubenton's bat trends | Great Britain

Myotis daubentonii

Summary of survey results for Great Britain

For Daubenton's bat the Waterway Survey shows no overall trend since the baseline year of monitoring, whereas the Hibernation Survey trend has increased significantly from 2013 onwards. Of the two surveys, the Waterway Survey is considered to be a more accurate measure of population change (see Robustness of Monitoring page 8), **therefore the population of Daubenton's bat in Great Britain is considered to have been stable since 1999**, although the divergence between the two trends will continue to be monitored as further years of data become available.

Population trends are also produced for Daubenton's bat at a country-level for England, Scotland, Wales and Northern Ireland, and for United Kingdom.

Hibernation Survey

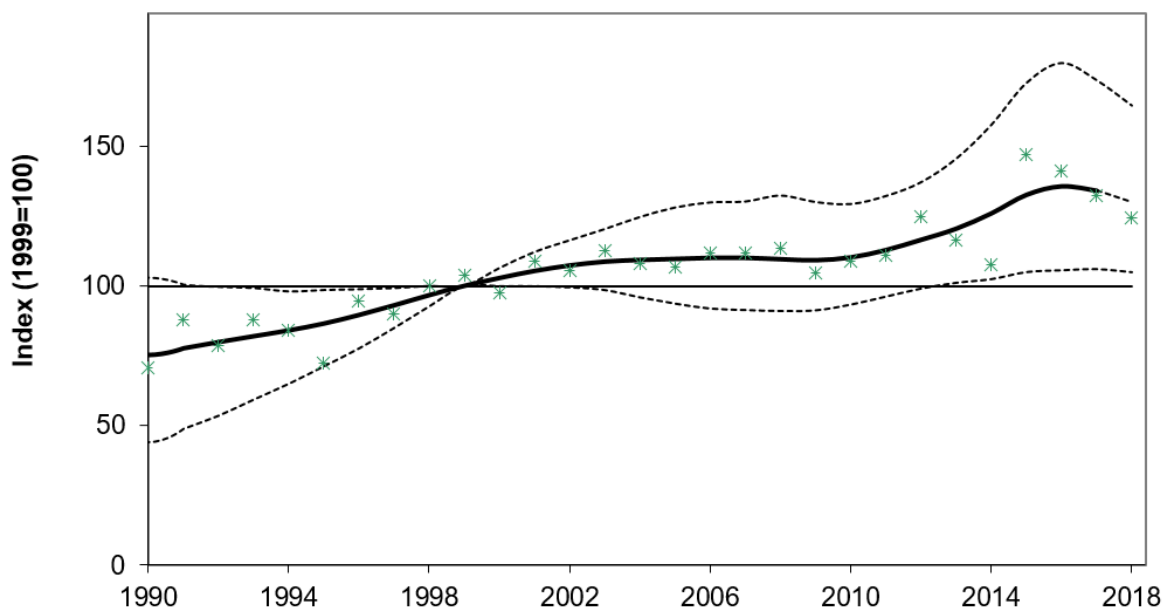


Figure 17. GB index of Daubenton's bat population from the Hibernation Survey, showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 30.1% above the 1999 base year value, equivalent to an average annual increase of 1.4%. It was relatively stable between 1999 and 2010, then from 2010 began to increase, becoming significantly higher than the baseline year in 2013. The index fell slightly between 2016 and 2018, however it remains significantly higher than the baseline year, and overall there has been a **significant increase in the smoothed index since 1999**.

From all years for which data are available (1990-2018) counts from 421 sites contribute to the overall trend analysis (sites surveyed in two or more years with Daubenton's bat present in at least one year).

Waterway Survey

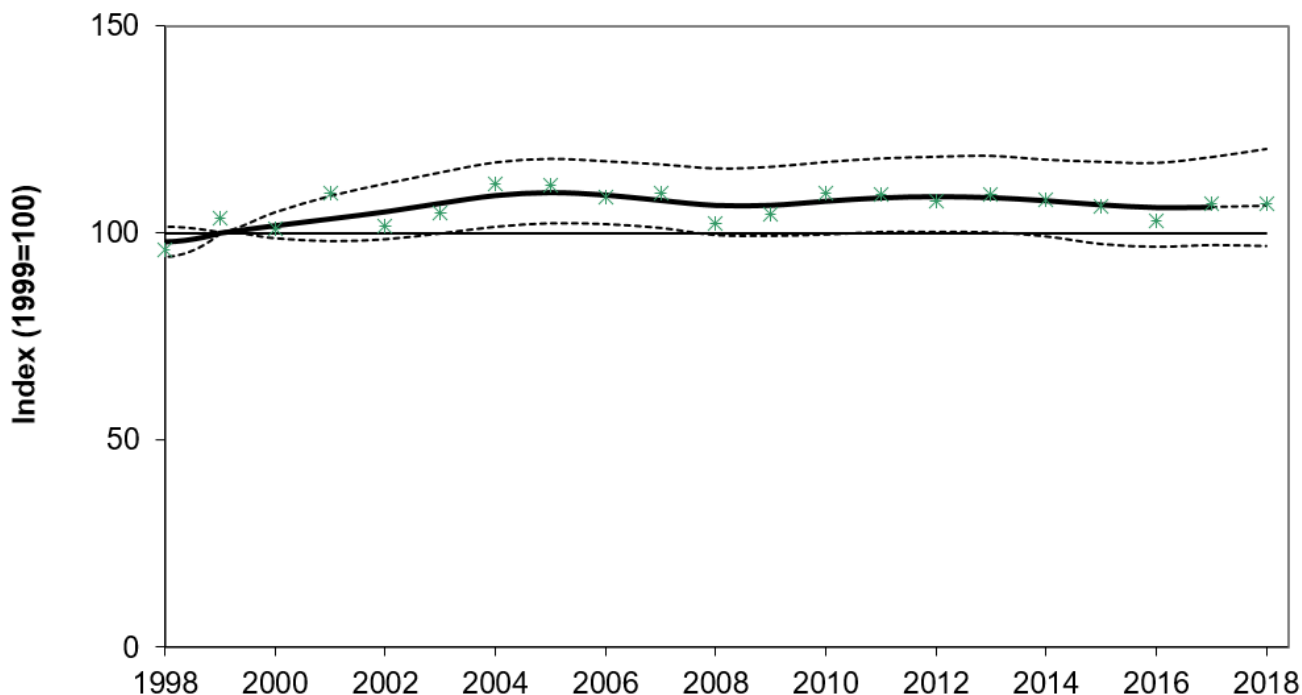
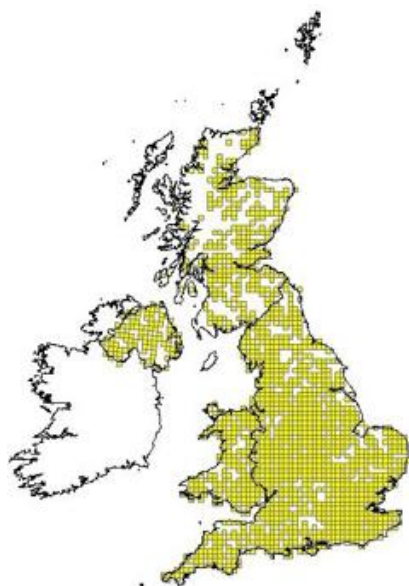


Figure 18. GB index of Daubenton's bat population from the Waterway Survey, showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 6.6% above the 1999 base year value, equivalent to an average annual increase of 0.3%. It has been relatively stable since 1999, sitting close to or slightly above the baseline. The index has been significantly higher than the baseline year between 2003 and 2007, and again between 2011 and 2013, although overall the smoothed index is **not significantly different from the 1999 base year value**.

Data from 832 sites surveyed between 1998 and 2018 contribute to the GB trend.



Population estimate					
Country	GB	England	Wales	Scotland	N.Ireland
Number (plausible intervals in brackets)	1,030,000 (27,000 – 4,440,000)	682,000 (18,100 – 2,950,000)	108,000 (2,860 – 466,000)	235,000 (6,220 – 1,020,000)	410,000
	Reliability score = 1				
Source	Mathews <i>et al.</i> 2018				Russ 1999

Distribution of Daubenton's bat in the UK
(Map taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)



Daubenton's bat trend | United Kingdom

Waterway Survey

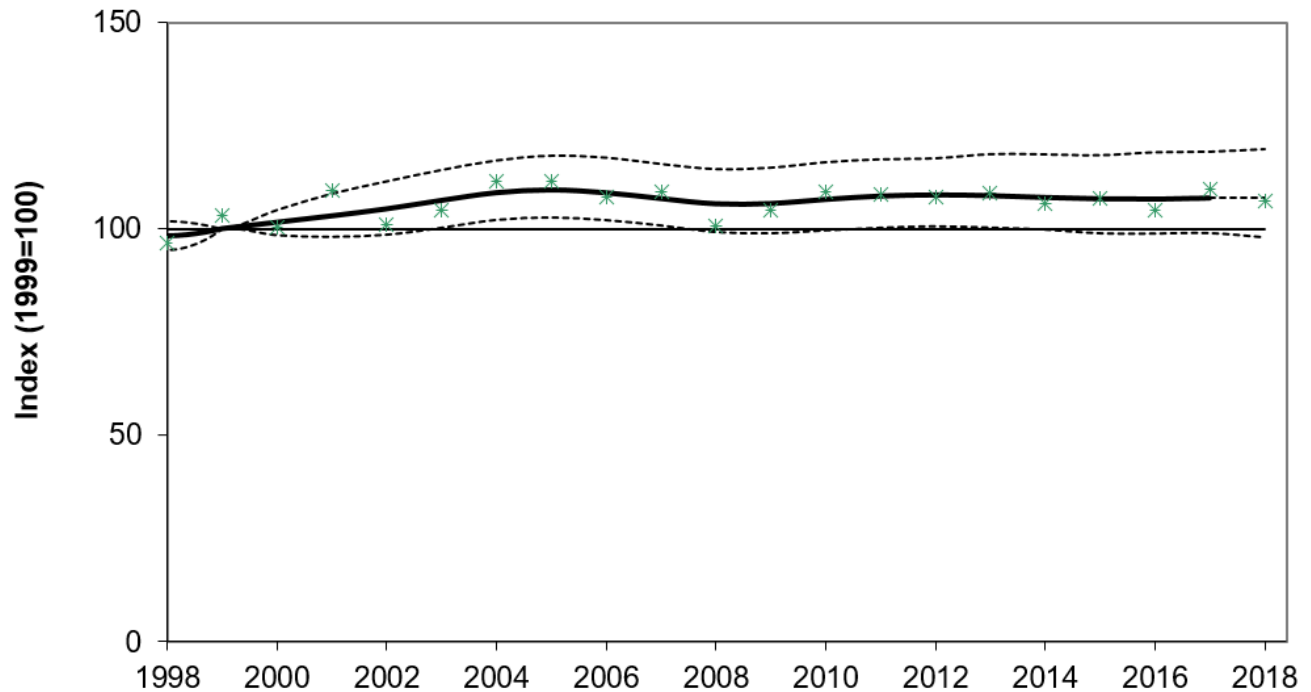


Figure 19. United Kingdom index of Daubenton's bat from the Waterway Survey showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 7.5% above the 1999 base year value, equivalent to an annual increase of 0.4%. It has been relatively stable since 1999, sitting close to or slightly above the baseline. Overall the smoothed index is **not significantly different from the 1999 base year value**.

Data from 897 sites contribute to the trend analysis in the United Kingdom.



Daubenton's bat trends | England

Hibernation Survey

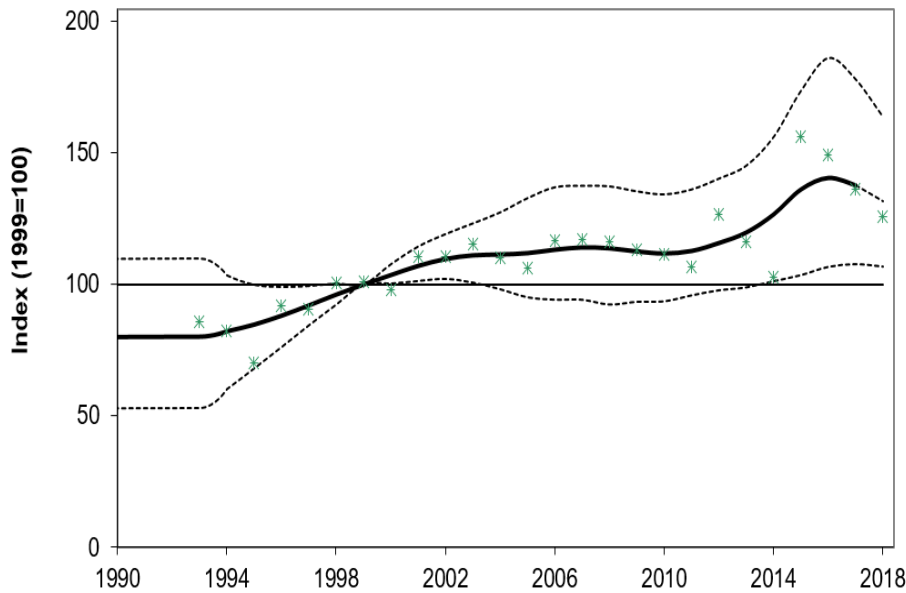


Figure 20. England index of Daubenton's bat population from the Hibernation Survey

The smoothed index is currently 31.4% above the 1999 base year value, equivalent to an annual increase of 1.5%. It was relatively stable between 1999 and 2010, then from 2010 began to increase, becoming significantly higher than the baseline year in 2014. The index fell slightly between 2016 and 2018, however it remains significantly higher than the baseline year, and overall there has been a **significant increase in the smoothed index since 1999**.

From all years for which data are available (1993-2018), counts from 299 sites contribute to the trend analysis in England (sites surveyed in two or more years with Daubenton's bat present in at least one year).

Waterway Survey

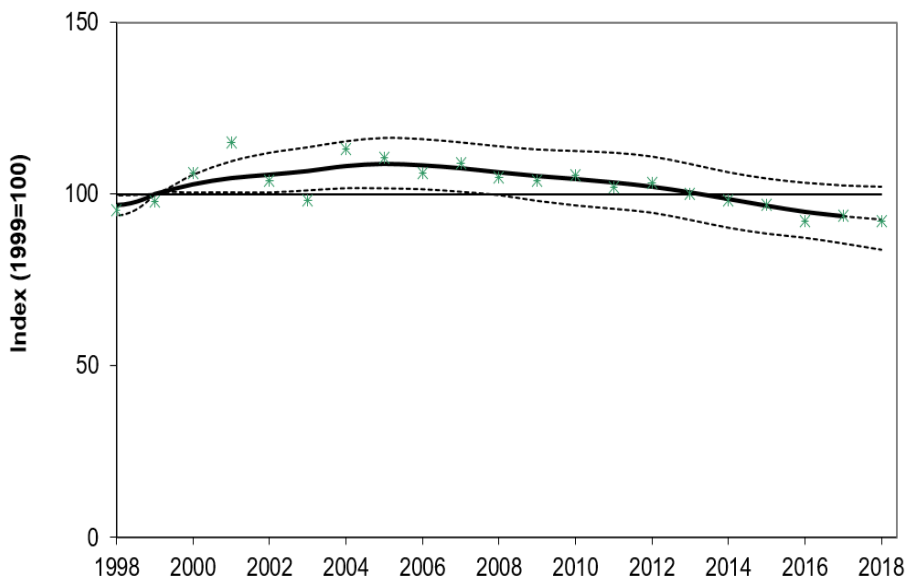


Figure 21. England index of Daubenton's bat from the Waterway Survey

The smoothed index is currently 7.6% below the 1999 base year value, equivalent to an annual decrease of 0.4%. The smoothed index increased between 1999 and 2005, and was significantly higher than the baseline year between 2000 and 2006. The smoothed index has gradually declined since 2005, although overall it is **not significantly different from the 1999 base year value**.

Data from 671 sites contribute to the trend analysis in England.

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Daubenton's bat trends | Wales

Hibernation Survey

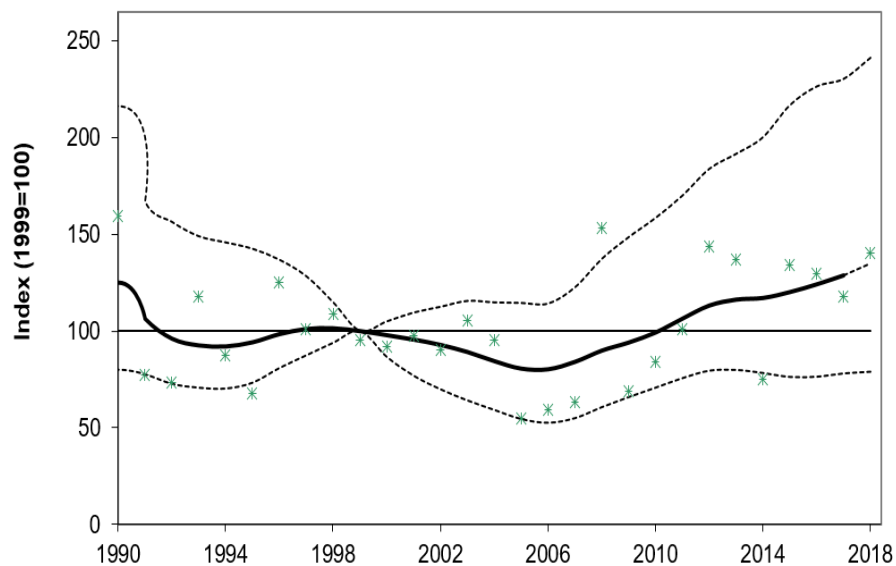


Figure 22. Wales index of Daubenton's bat population from Hibernation Surveys

The smoothed index is currently 34.9% above the 1999 baseline value, equivalent to an annual increase of 1.6%. The smoothed index fell between 1999 and 2006, then increased in every year since apart from 2014. However, the smoothed index has not differed significantly from the baseline in any year, and overall there has been overall it is **not significantly different from the 1999 base year value**.

From all years for which data are available (1990-2018), counts from 95 sites contribute to the trend analysis in Wales (sites surveyed in two or more years with Daubenton's bat recorded in at least one year).

Waterway Survey

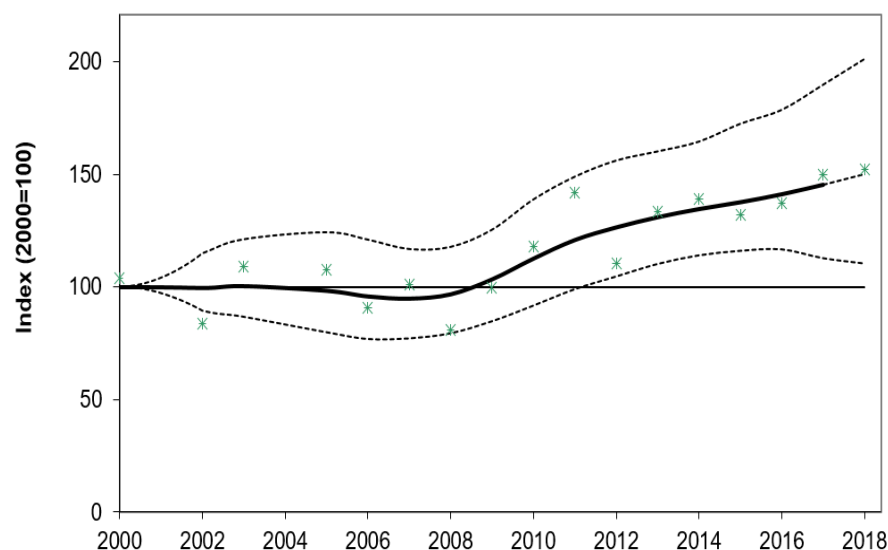


Figure 23. Wales index of Daubenton's bat population from the Waterway Survey

The smoothed index is currently 49.8% above the 2000 baseline value, equivalent to an annual increase of 2.3%. It was relatively stable between 2000 and 2009, and then has increased in every year since, becoming significantly higher than the baseline in 2012. Overall there has been a **significant increase in the smoothed index since 2000**.

Data from 47 sites contribute to the trend analysis in Wales.

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Daubenton's bat trends | Scotland

Hibernation Survey

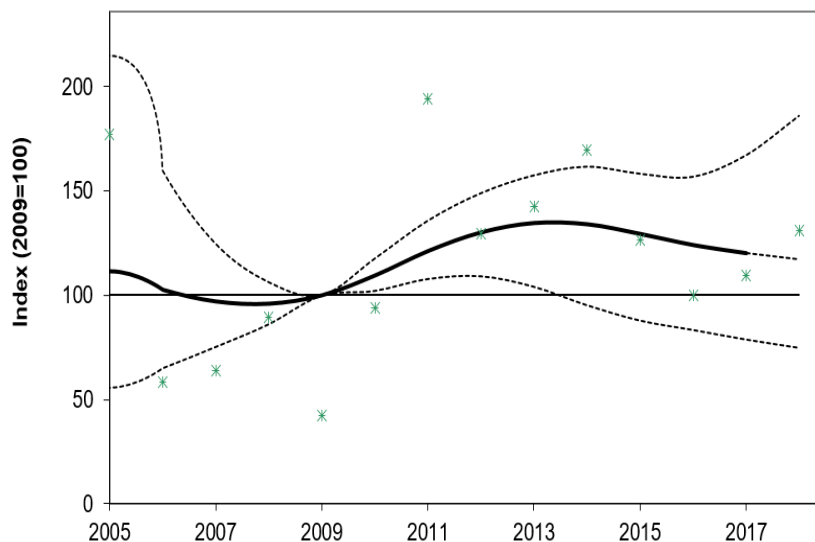


Figure 24. Scotland index of Daubenton's bat population from the Hibernation Survey

The smoothed index is currently 17.4% above the 2009 base year value, equivalent to an annual increase of 1.8%. Between 2009 and 2013 the smoothed index was significantly higher than the baseline, however since 2013 it has been falling and is no longer significantly different from the baseline year. Overall the smoothed index is **not significantly different from the 2009 base year value**.

From all years for which data are available (2005-2018), counts from 21 sites contribute to the trend analysis in Scotland (sites surveyed in two or more years with Daubenton's bat recorded in at least one year). This is fewer sample sites than would be ideal to produce trends and as such the results may be unreliable.

Waterway Survey

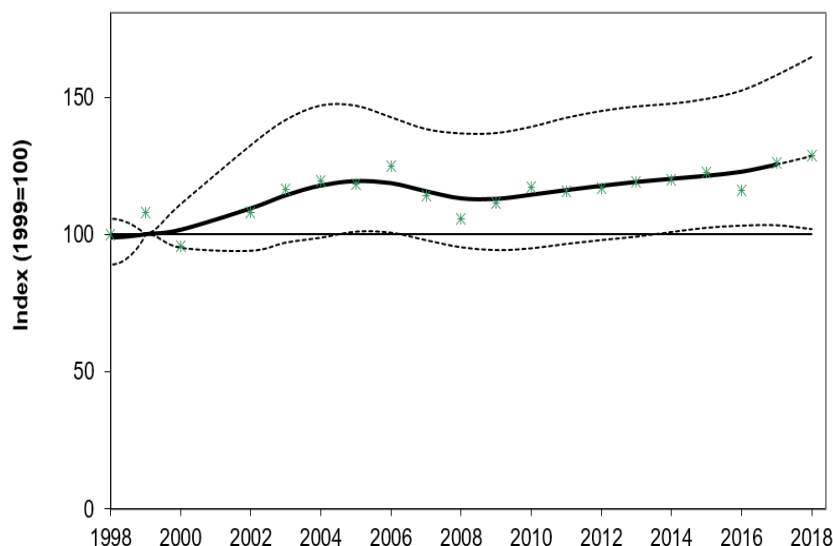


Figure 25. Scotland index of Daubenton's bat population the from Waterway Survey

The smoothed index is currently 28.5% above the 1999 base year value, equivalent to an annual increase of 1.3%. It increased between 1999 and 2005, fell slightly between 2005 and 2008, then since 2008 has been increasing again. Overall has been a **significant increase in the smoothed index since 1999**.

Data from 112 sites contribute to the trend analysis in Scotland.

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Daubenton's bat trend | Northern Ireland

Waterway Survey

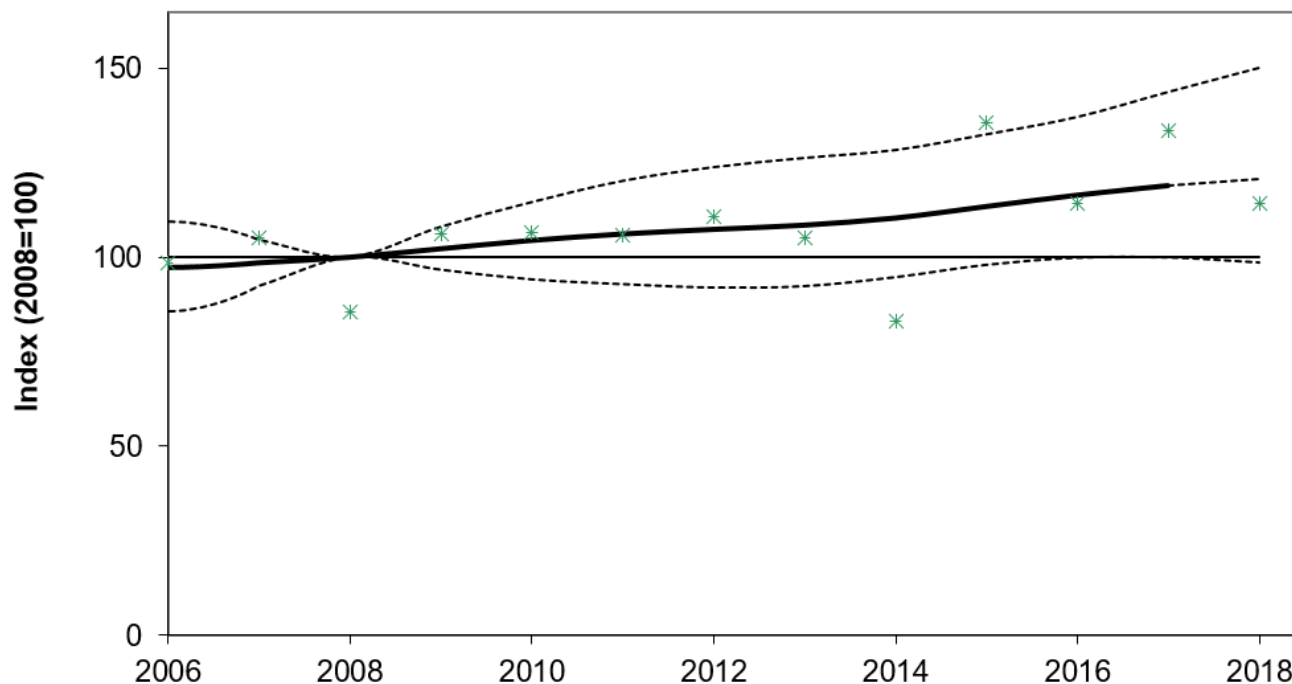


Figure 26. Northern Ireland index of Daubenton's bat population from the Waterway Survey showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 20.6% above the 2008 base year value, equivalent to an annual increase of 1.9%. It has increased steadily since the start of monitoring, although it has not differed significantly from the baseline in any year. Overall the smoothed index is **not significantly different from the 2008 base year value**.

Data from 64 sites contribute to the trend analysis in Northern Ireland. The majority of data are from sites surveyed as part of the All-Ireland Waterway Survey which is run by Bat Conservation Ireland with funding from the National Parks and Wildlife Service and the Northern Ireland Environment Agency.



Whiskered/Brandt's bat trends | Great Britain

Myotis mystacinus / brandtii

Summary of survey results for Great Britain

The trend from the Hibernation Survey shows no significant change in the smoothed index since the baseline year. **Populations of whiskered and Brandt's bat combined are considered to have been stable in Great Britain since 1999.** However, this trend should be interpreted with caution as it combines data from two species with differing ecological requirements and potentially differing conservation status. This uncertainty has been compounded by the discovery of Alcahoie bat in the UK in 2010, a third cryptic species in this species group. It is likely under-recorded, but current knowledge suggests that it has a highly localised distribution, restricted to areas of North Yorkshire, Sussex, Surrey, Kent and Wiltshire. Based on current knowledge of this species' distribution, we believe it will be encountered too infrequently during monitoring of whiskered/Brandt's bats to include this species within the whiskered/Brandt's bat combined trend. We will review this as further data become available.

A combined population trend is produced for these species due to the difficulty of separating them with confidence in the field. Trends are also produced for England and Wales.

Hibernation Survey

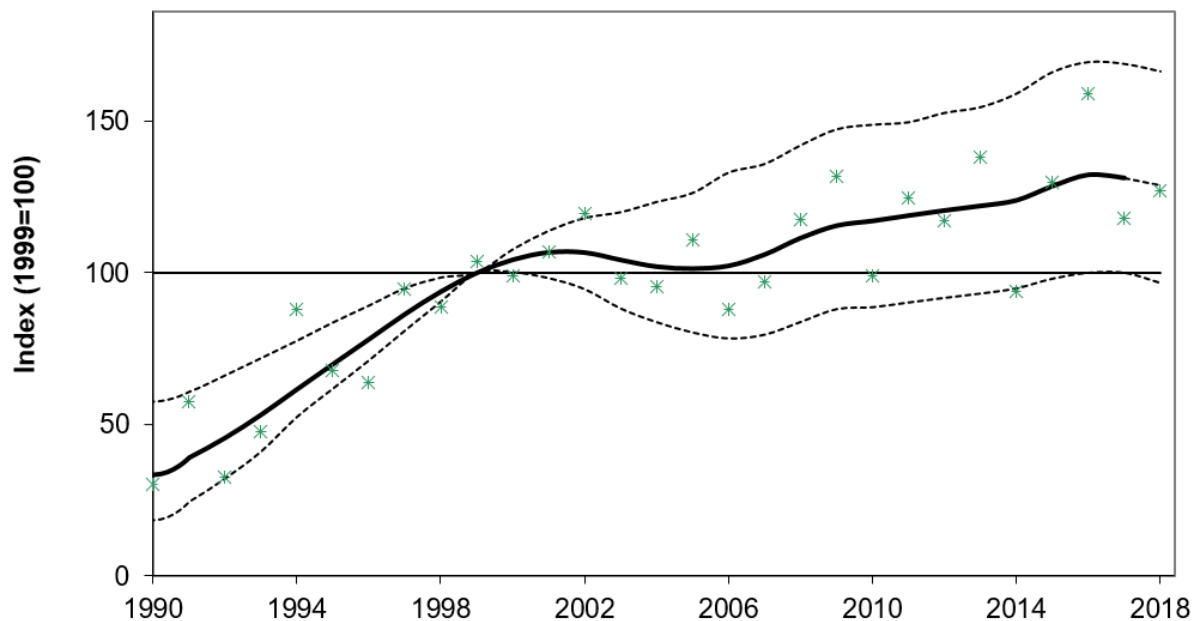


Figure 27. GB index of whiskered/Brandt's bat population from Hibernation Surveys showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 28.7% above the 1999 base year value, equivalent to an annual increase of 1.3%. Between 1999 and 2004 the smoothed index fluctuated, before increasing every year from 2004 to a peak in 2016. Between 2016 and 2017 the smoothed index was significantly higher than the baseline year, however since 2016 it has been falling and is no longer significantly higher than the baseline. Overall the smoothed index is **not significantly different from the 1999 base year value.**

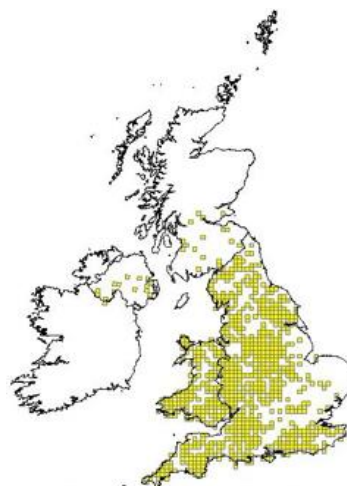
From all years for which data are available (1990-2018), counts from 245 sites contribute to the trend (sites surveyed in two or more years with whiskered/Brandt's bat recorded in at least one year).

Distribution and abundance

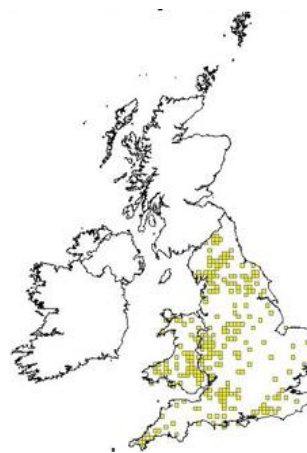
The two species are uncommon but widespread in England and Wales. Whiskered bat is rare in Scotland and Northern Ireland. There are only a few records of Brandt's bat in Scotland and this species is absent from Northern Ireland.

Population estimate

Country	GB	N. Ireland
Whiskered bat numbers	Not available (plausible intervals not available)	24,000
Brandt's bat numbers	Reliability score = 0	does not occur
Source	Mathews <i>et al.</i> 2018	Russ 1999



Whiskered bat



Brandt's bat

Distribution of whiskered bat and Brandt's bat in the UK

(Maps taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)



Whiskered/Brandt's bat trend | England

Hibernation Survey

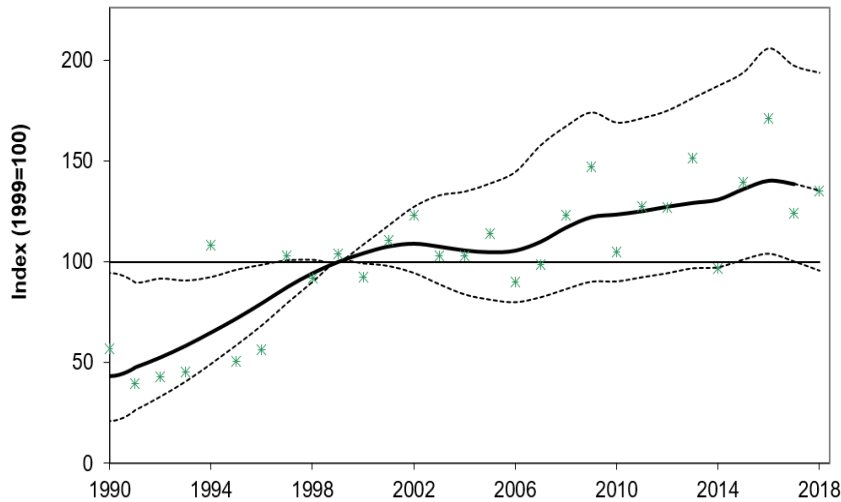


Figure 28. England index of whiskered/Brandt's bat population from the Hibernation Survey

The smoothed index is currently 35.2% above the 1999 base year value, equivalent to an annual increase of 1.6%. Between 1999 and 2006 the smoothed index fluctuated, before increasing every year from 2006 to a peak in 2016. Between 2015 and 2017 the smoothed index was significantly higher than the baseline year, however since 2016 it has been falling and is no longer significantly higher than the baseline. Overall the smoothed index is **not significantly different from the 1999 base year value**.

From all years for which data are available (1990-2018), counts from 161 sites contribute to the trend analysis in England.



Whiskered/Brandt's bat trend | Wales

Hibernation Survey

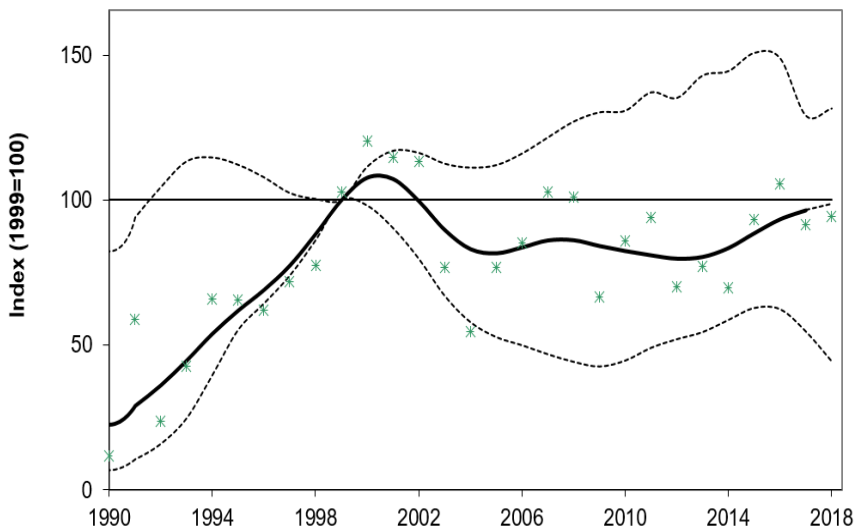


Figure 29. Wales index of whiskered/Brandt's bat population from the Hibernation Survey

The smoothed index is currently 1.1% below the 1999 base year value, equivalent to an annual decrease of 0.1%. It has fluctuated considerably since the baseline year, however it has not differed significantly from the baseline in any year. Overall the smoothed index is **not significantly different from the 1999 base year value**.

From all years for which data are available (1998-2018), counts from 82 sites contribute to the trend analysis in Wales (sites surveyed in two or more years with whiskered/Brandt's bat recorded in at least one year).

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Natterer's bat trends | Great Britain

Myotis nattereri

The trend from the Hibernation Survey shows a significant increase in the smoothed index since the baseline year, while the trend from the Roost Count shows no significant change. As Natterer's bats switch roosts frequently (see Robustness of Monitoring, page 8), the Hibernation Survey is believed to be a more accurate measure of population change for this species. **We therefore consider that the population of Natterer's bat in Great Britain has increased since 1999. However, this finding should be treated with caution until the effect of this species' roost switching behaviour on the Roost Count trend is better understood.**

Population trends are also produced for Natterer's bat at a country-level for England, Scotland and Wales.

Hibernation Survey

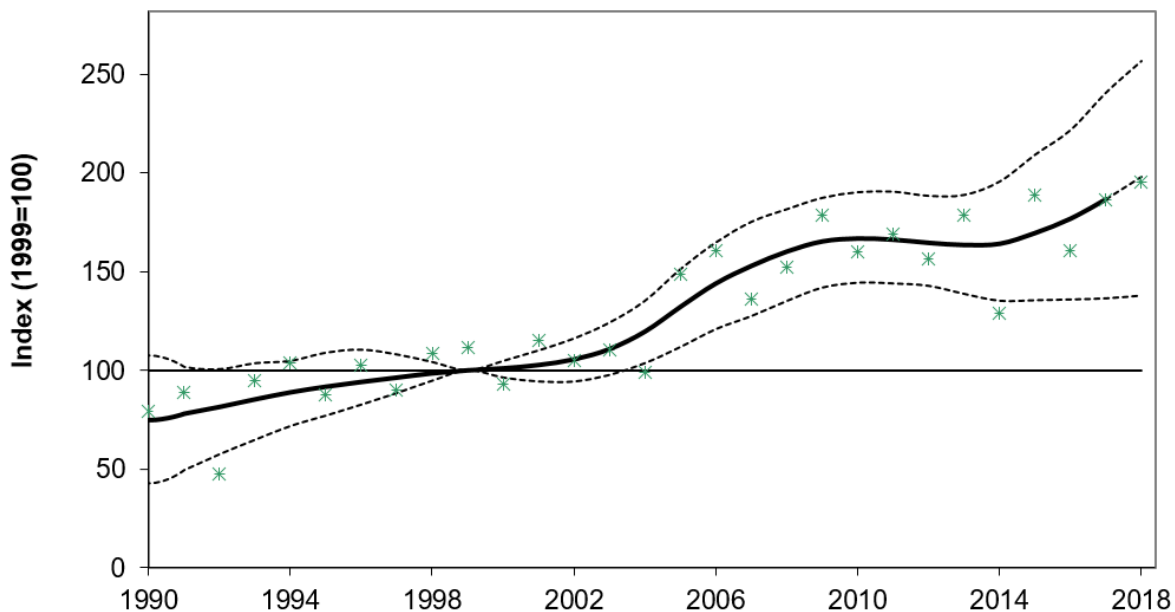


Figure 30. GB index of Natterer's bat population from the Hibernation Survey showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 98.1% above the 1999 base year value, equivalent to an average annual increase of 3.7%. It increased between 1999 and 2010, was relatively stable between 2010 and 2014, before increasing again between 2014 and 2018. It has been significantly higher than the baseline year since 2004, and overall there has been a **significant increase in the smoothed index since 1999.**

From all years for which data are available (1990-2018), counts from 534 sites contribute to the overall trend analysis (sites surveyed in two or more years with Natterer's bat recorded in at least one year).

Roost Count

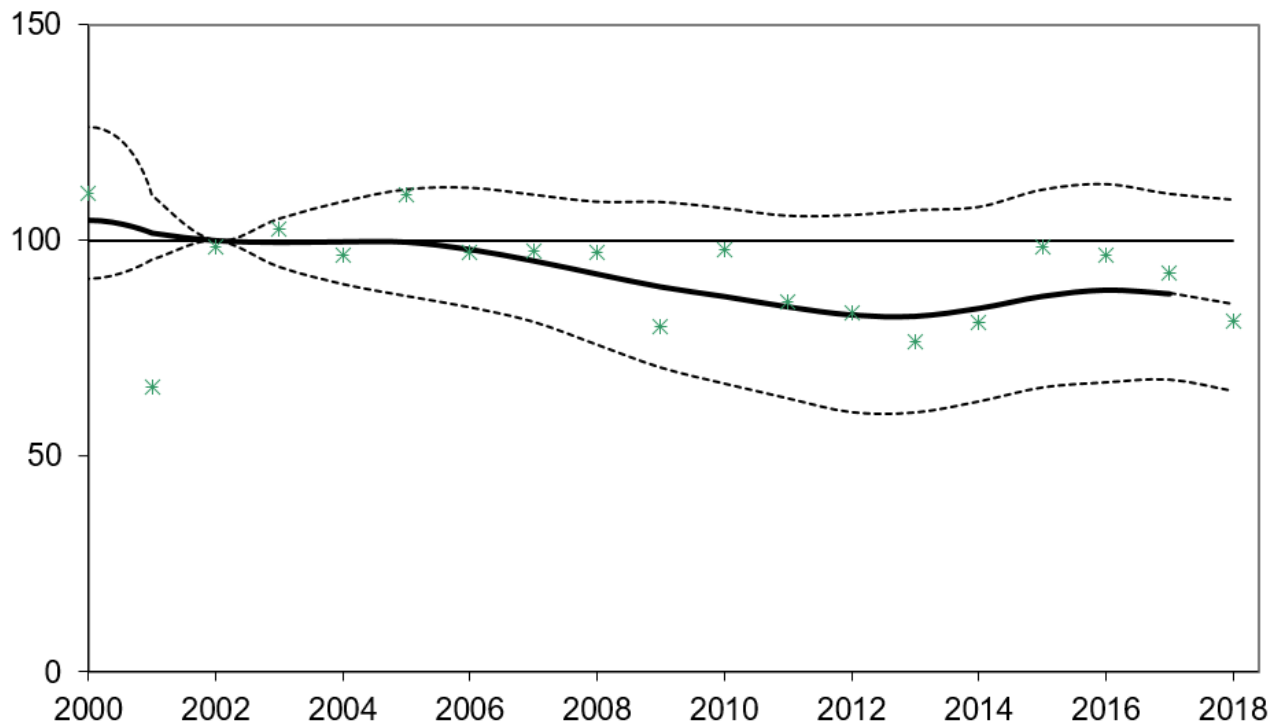
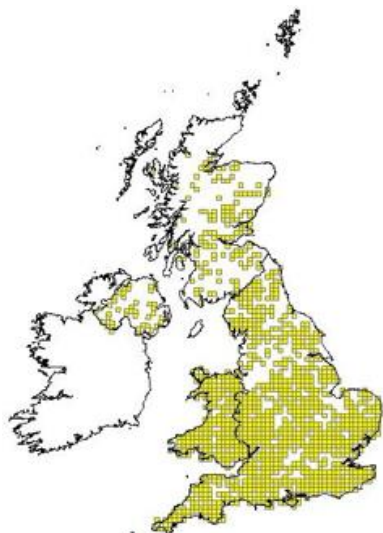


Figure 31. GB index of Natterer's bat population from Roost Counts showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 14.7% below the 2002 base year value, equivalent to an annual decrease of 1.0%. In the three years following the baseline year the smoothed index was stable, before declining gradually between 2002 and 2013. Since 2013 the smoothed index has fluctuated, however in no year has it differed significantly from the baseline year and overall the smoothed index is **not significantly different from the 2002 base year value**.

Data from 85 sites contribute to the overall trend analysis from 2000-2018. The baseline year used to calculate this trend has been set at 2002 as very few roosts of this species were counted in earlier years.



Population estimate

Population estimate					
Country	GB	England	Wales	Scotland	N. Ireland
Number	Plausible intervals in brackets				48,000
Extrapolated from mixed habitat	414,000 (15,000–2,630,000)	321,000 (11,700 – 2,040,000)	52,000 (1,900 – 332,000)	41,000 (1,490 – 260,000)	
Extrapolated from woodland	973,000 (510,000–1,360,000)	654,000 (343,000 – 911,000)	148,000 (77,700 – 206,000)	171,000 (89,700 – 238,000)	
	Reliability score = 2				
Source	Mathews <i>et al.</i> 2018				Russ 1999

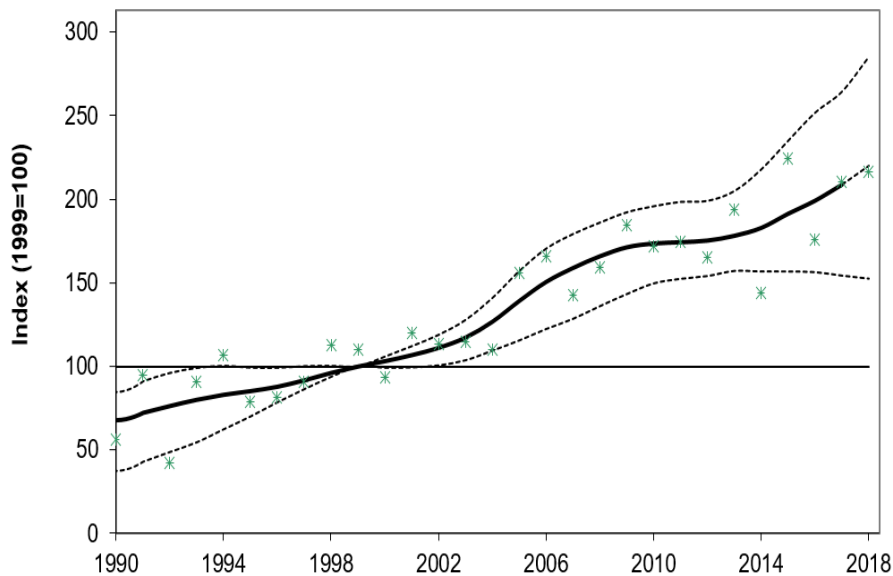
Distribution of Natterer's bat in the UK

(Map taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)



Natterer's bat trends | England

Hibernation Survey

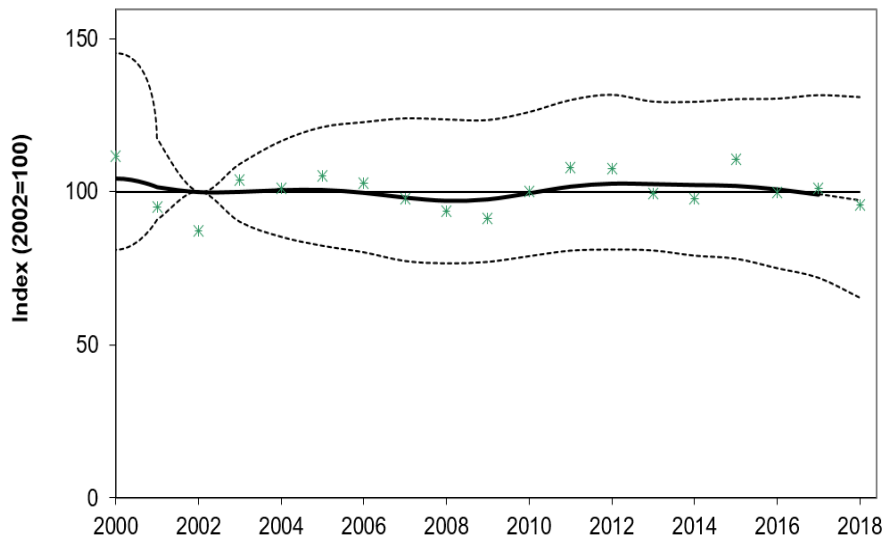


The smoothed index is currently 120.0% above the 1999 base year value, equivalent to an annual increase of 4.2%. It has increased in every year since 1999, however the rate of increase has varied considerably. Overall there has been **a significant increase in the smoothed index since 1999.**

From all years for which data are included (1990-2018), counts from 375 sites contribute to the trend analysis in England (sites surveyed in two or more years with Natterer's bat recorded in at least one year).

Figure 32. England index of Natterer's bat population from the Hibernation Surveys

Roost Count



The smoothed index is currently 2.9% below the 2002 base year value, equivalent to an annual decrease of 0.2%. It has been relatively stable over the period monitored and overall the smoothed index is **not significantly different from the 2002 base year value.**

Data from 72 sites contribute to the trend analysis in England (sites surveyed in two or more years).

Figure 33. England index of Natterer's bat population from the Roost Count

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Natterer's bat trend | Scotland

Hibernation Survey

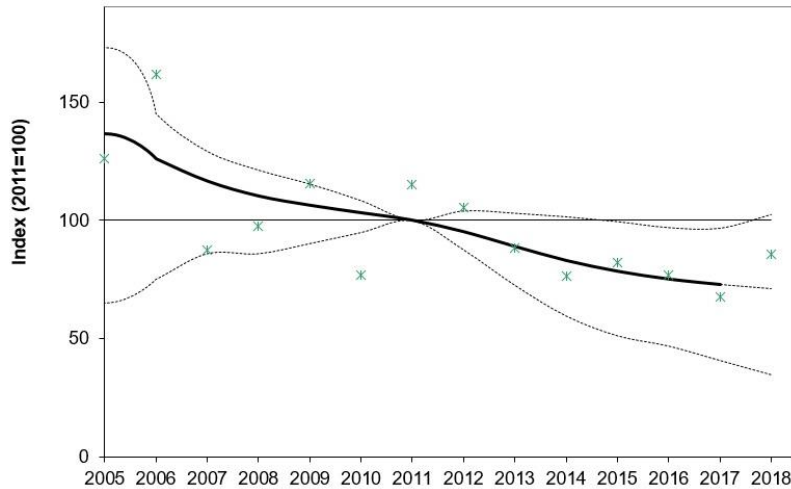


Figure 34. Scotland index of Natterer's bat population from the Hibernation Survey

The smoothed index is currently 28.8% below the 2011 base year value, equivalent to an annual decrease of 4.7%. It has declined every year since the baseline year, although the rate of decline has slowed in recent years. Between 2015 and 2017 it was significantly lower than the baseline year, however in 2018 the precision of the trend has reduced and it no longer differs significantly from the baseline. Overall the index **does not differ significantly from the 2011 base year value**.

From all years for which data are available (2005-2018), counts from 22 sites contribute to the trend analysis in Scotland (sites surveyed in two or more years with Natterer's bat recorded in at least one year). **This is fewer sample sites than would be ideal to produce trends and as such the results may be unreliable.**



Natterer's bat trend | Wales

Hibernation Survey

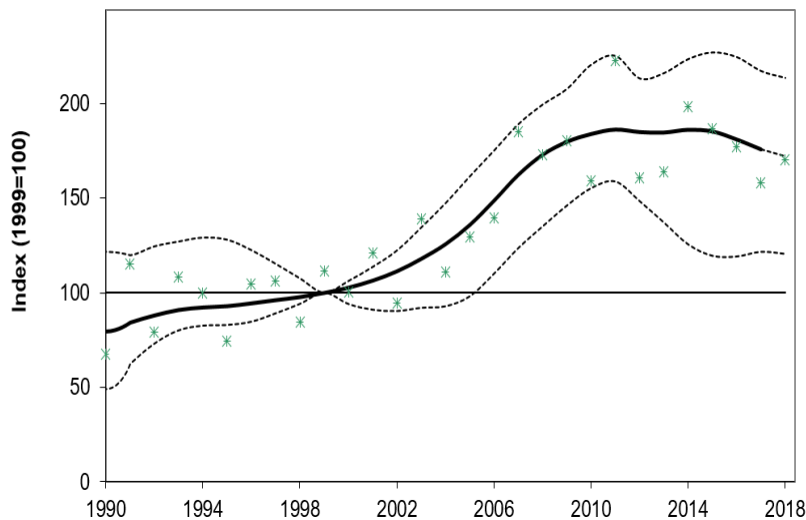


Figure 35. Wales index of Natterer's bat population from the Hibernation Survey

The smoothed index is currently 72.0% above the 1999 base year value, equivalent to an annual increase of 2.9%. It increased between 1999 and 2011, becoming significantly higher than the baseline year in 2006. Since 2011 the smoothed index has fallen in every year apart from 2014, however it remains significantly higher than the baseline year. Overall there has been a **significant increase in the smoothed index since 1999**.

From all years for which data are available (1998-2018), counts from 136 sites contribute to the trend analysis in Wales (sites surveyed in two or more years with Natterer's bat recorded in at least one year).

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Common pipistrelle trends | Great Britain

Pipistrellus pipistrellus

Summary of survey results for Great Britain

The trend from the Field Survey shows a significant increase in the smoothed index since the baseline year, while the trend from the Roost Count shows a significant decline. However, the Roost Count trend is not considered a reliable measure of population change for common pipistrelle, therefore **the population of common pipistrelle in Great Britain is considered to have increased since 1999.**

Population trends are also produced for common pipistrelle at a country-level for England and Scotland. There are currently insufficient data to produce population trends for this species in Wales.

Field Survey

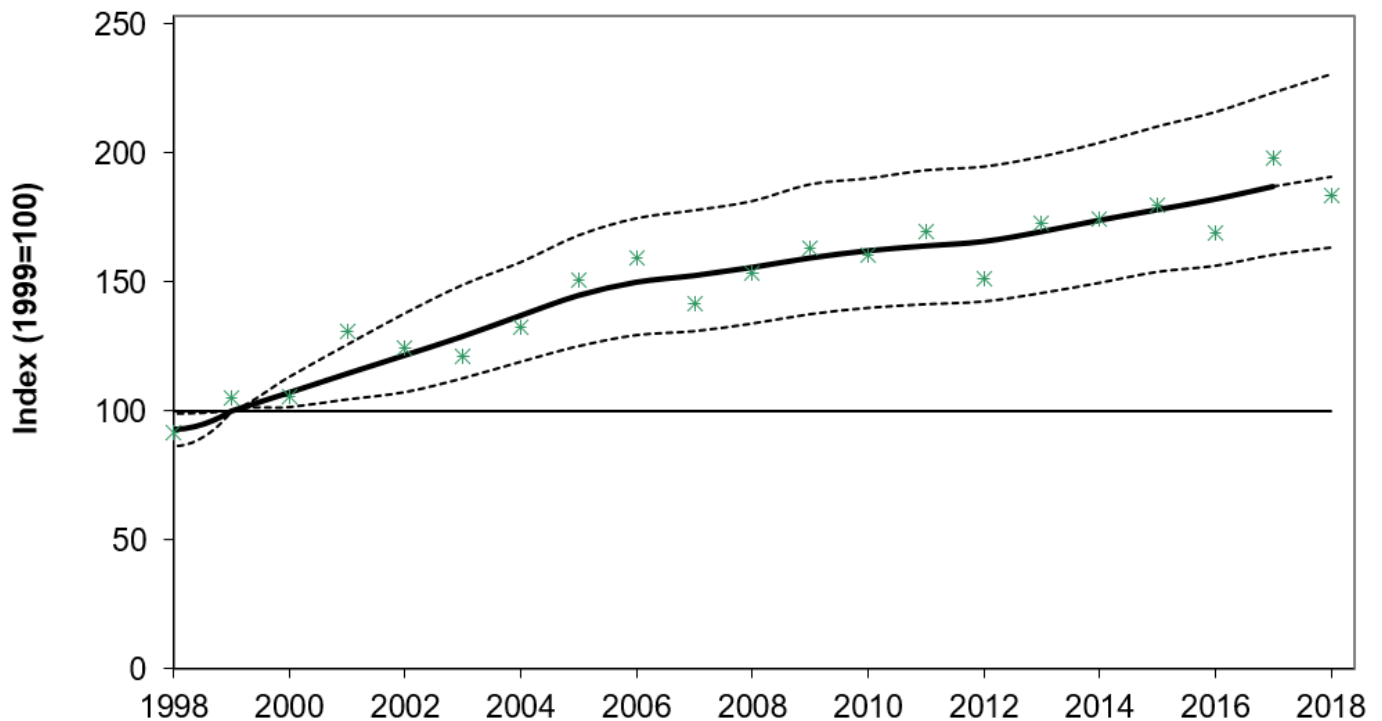


Figure 36. GB index of common pipistrelle population from the Field Survey showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 90.9% above the 1999 base year value, equivalent to an annual increase of 3.5%. The trend has increased consistently since monitoring began. There has been a **significant increase in the smoothed index** since 1999.

Data from 626 sites surveyed between 1998 and 2018 contribute to the overall trend.

Roost Count

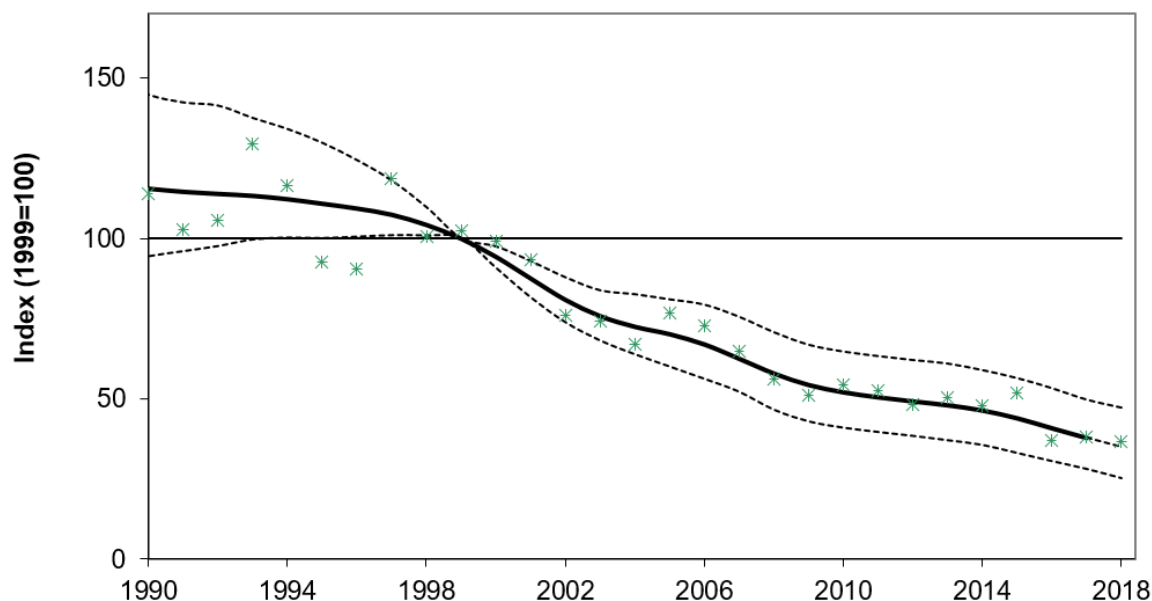


Figure 37. GB index of common pipistrelle population from the Roost Count showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 65.0% below the 1999 base year value, equivalent to an annual decrease of 5.4%. There has been a **significant decline in the smoothed index since 1999. However, it is likely that this species' frequent roost switching results in a negative bias in the Roost Count trend (see Robustness of Monitoring, page 8) and this trend is not therefore considered a reliable measure of population change for this species.** We are currently investigating the causes of this negative bias in more detail and exploring ways to correct it (see Developments and Future Directions, page 67).

Data from 510 sites surveyed between 1997 and 2018 contribute to the trend (sites surveyed in two or more years).



Population estimate

Country	GB	England	Wales	Scotland	N. Ireland
Number (Plausible intervals in brackets)	3,040,000 (991,000–7,510,000)	1,870,000 (609,000 – 4,620,000)	297,000 (96,600 – 732,000)	875,000 (285,000 – 2,160,000)	1,150,000
	Reliability score = 2.				
Source	Mathews <i>et al.</i> 2018				Russ 1999

Distribution of common pipistrelle in the UK
(Map taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)



Common pipistrelle trends | England

Field Survey

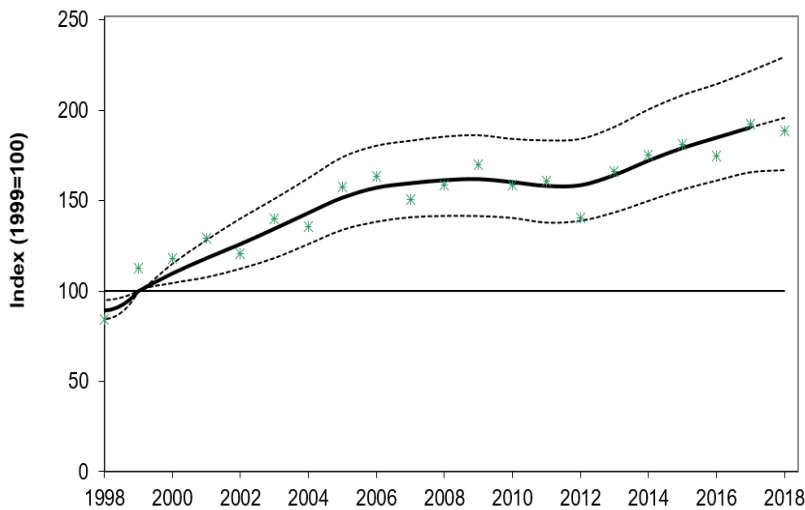


Figure 38. England index of common pipistrelle population from the Field Survey

The smoothed index is currently 95.7% above the 1999 base year value, equivalent to an annual increase of 3.6%. It increased steadily between 1999-2006, was relatively stable between 2006-2012, and since 2012 has been increasing again. Overall there has been a **significant increase in the smoothed index since 1999**.

Data from 512 sites contribute to the trend analysis in England.

Roost Count

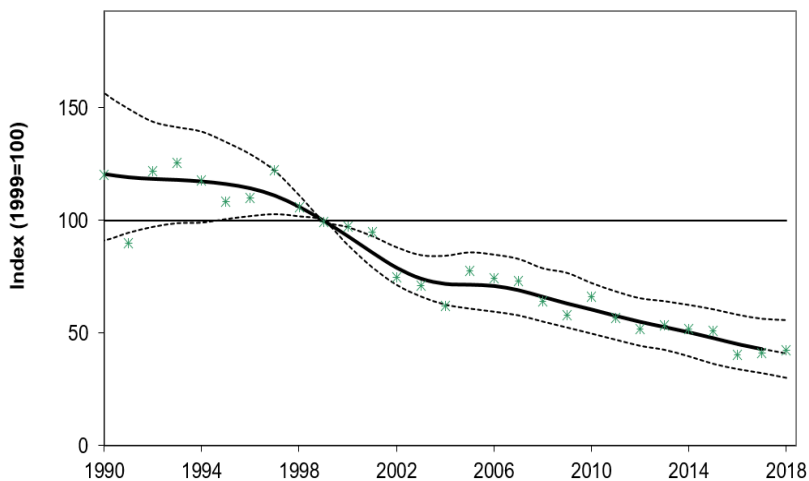


Figure 39. England index of common pipistrelle population from the Roost Count

The smoothed index is currently 58.9% below the 1999 base year value, equivalent to an annual decrease of 4.6%. The value of the smoothed index has fallen steadily since the baseline year and overall there has been a **significant decline in the smoothed index since 1999**. However, it is likely that this species' frequent roost switching results in a negative bias in the Roost Count trend (see Robustness of Monitoring, page 8) and this trend is not therefore considered a reliable measure of population change for common pipistrelle. We are currently investigating the causes of this negative bias and ways to correct it (see Developments and Future Directions, page 67).

Data from 404 sites contribute to the trend analysis in England (sites surveyed in two or more years).

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Common pipistrelle trends | Scotland

Field Survey

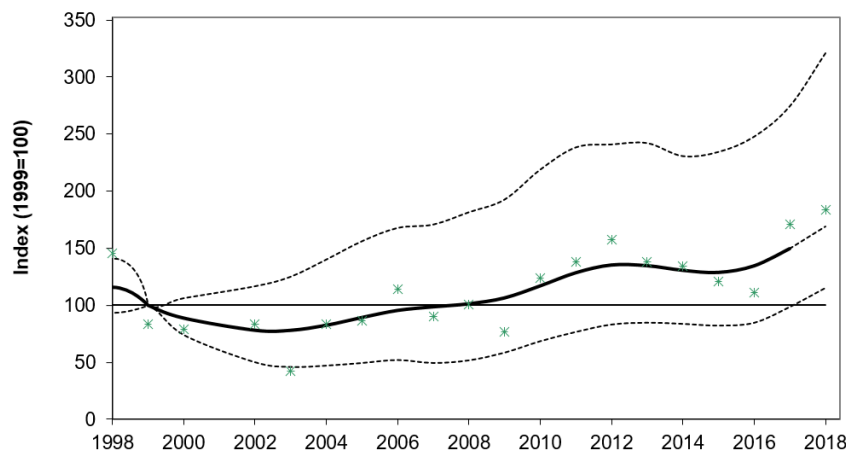


Figure 40. Scotland index of common pipistrelle population from the Field Survey

The smoothed index is currently 69.3% above the 1999 base year value, equivalent to an annual increase of 2.8%. It has increased in most years since 2003, but it is only in the last year of monitoring that it has differed significantly from the baseline year. Overall there has been a **significant increase in the smoothed index since 1999**, however the value of the smoothed index in 2018 is provisional and may be revised with the addition of future year's monitoring data.

Data from 67 sites contribute to the trend analysis in Scotland.

Roost Count

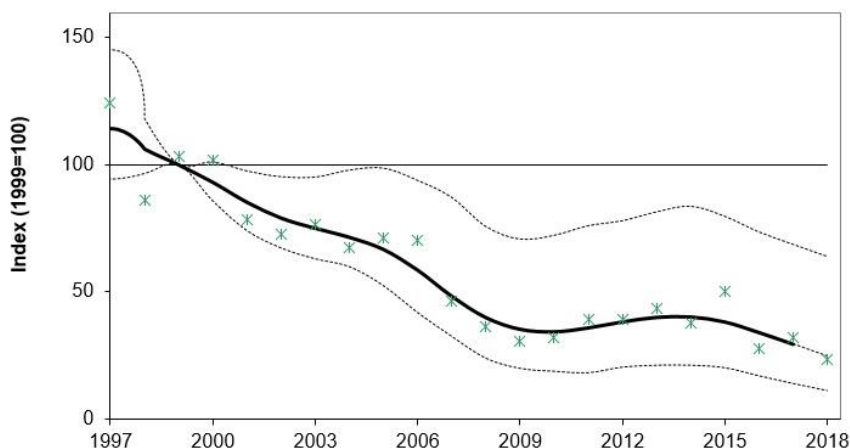


Figure 41. Scotland index of common pipistrelle population from the Roost Count

The smoothed index is currently 74.9% below the 1999 base year value, equivalent to an annual decrease of 7.0%. The value of the smoothed index fell steadily between 1999 and 2009. Between 2009 and 2014 it increased slightly, before falling again in recent years. Overall there has been a **significant decline in the smoothed index since 1999**. However, it is likely that this species' frequent roost switching results in a negative bias in the Roost Count trend (see Robustness of Monitoring, page 8) and this trend is not therefore considered a reliable measure of population change for common pipistrelle. We are currently investigating the causes of this negative bias and ways to correct it (see Developments and Future Directions, page 67).

Data from 67 sites contribute to the trend analysis in Scotland (sites surveyed in two or more years).

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Soprano pipistrelle trends | Great Britain

Pipistrellus pygmaeus

Summary of survey results for Great Britain

The trend from the Field Survey shows no significant increase in the smoothed index since the baseline year, while the trend from the Roost Count shows a significant decline. However, the Roost Count trend is not considered a reliable measure of population change for soprano pipistrelle, therefore **the population of soprano pipistrelle in Great Britain is considered to have been stable since 1999.**

Population trends are also produced for soprano pipistrelle at country-level for England, Scotland and Wales.

Field Survey

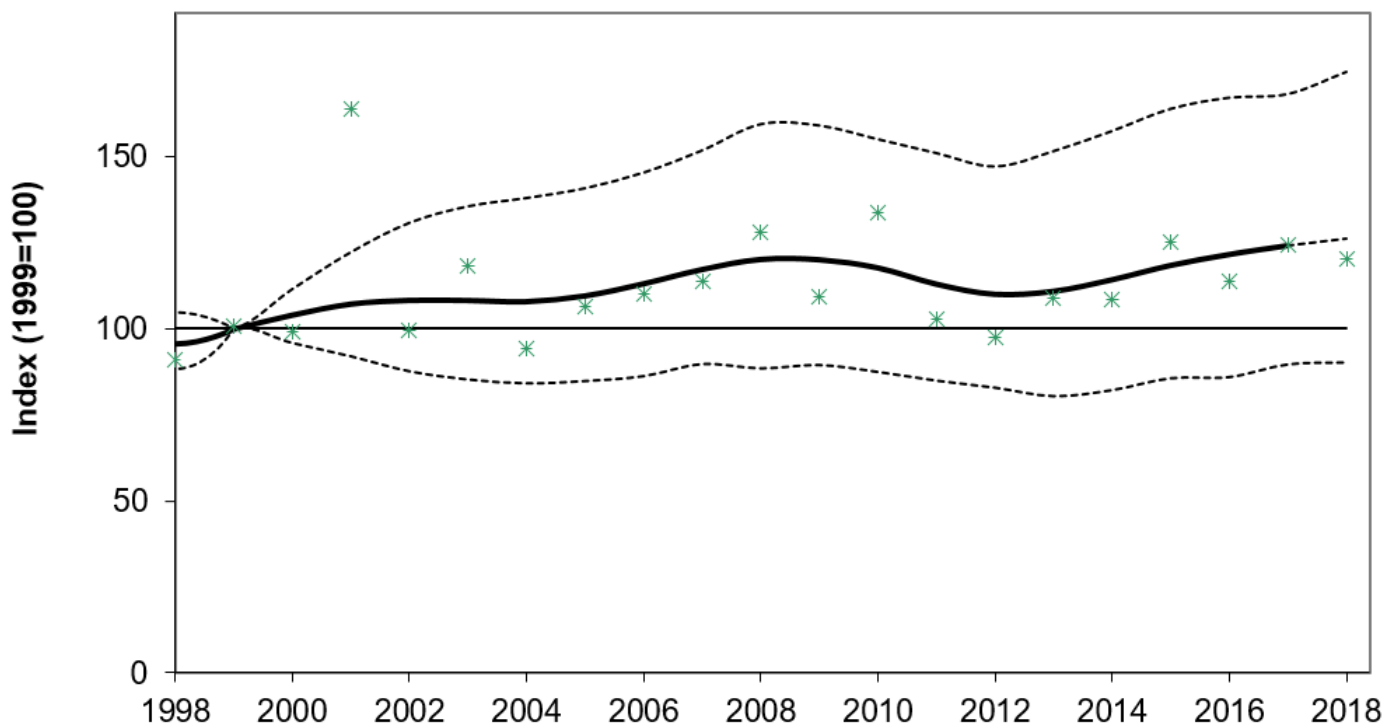


Figure 42. GB index of soprano pipistrelle population from the Field Survey showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 26.3% above the 1999 base year value, equivalent to an annual increase of 1.2%. It is **not significantly different from the 1999 base year value.**

Data from 624 sites surveyed between 1998 and 2018 contribute to the trend.

Roost Count

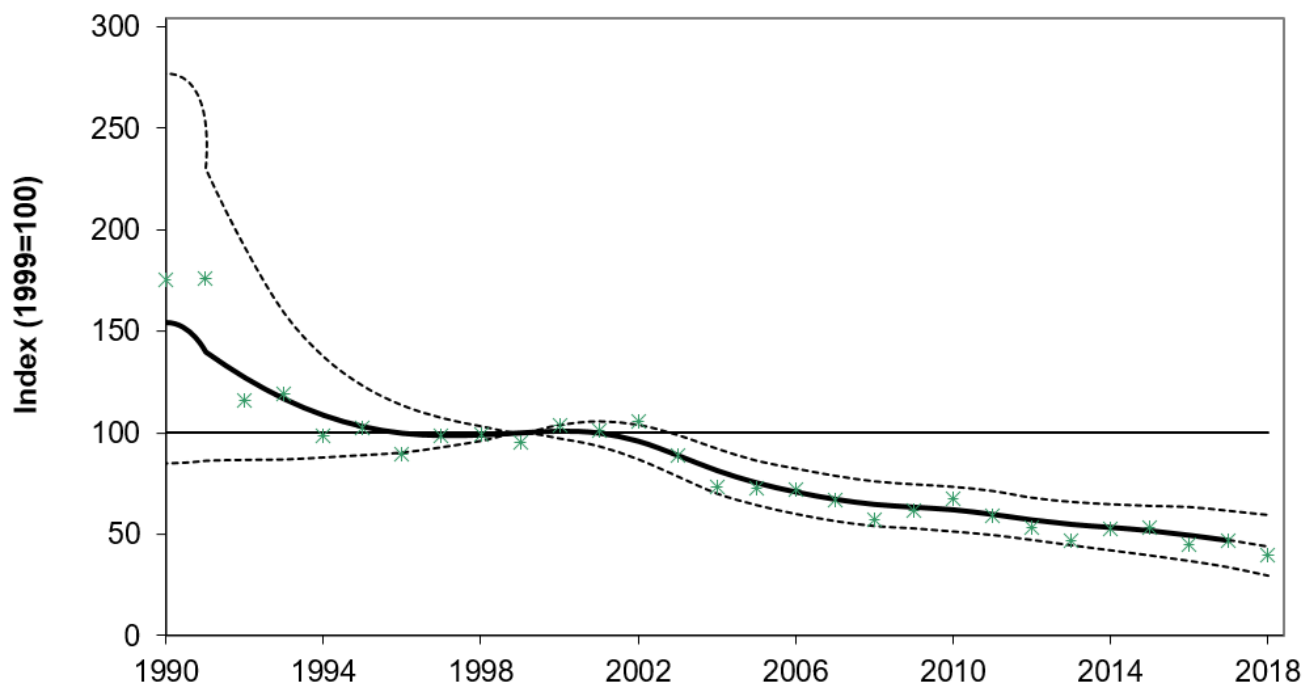
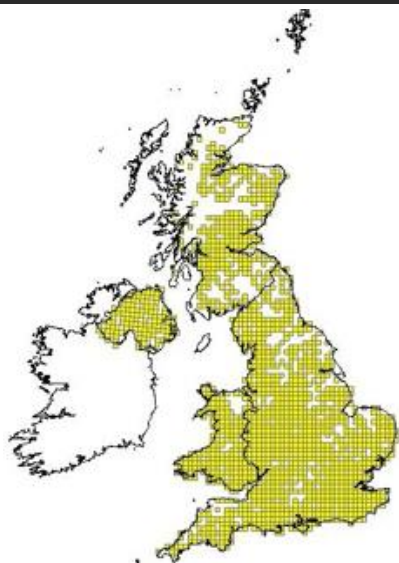


Figure 43. GB index of soprano pipistrelle population from the Roost Count showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 55.9% below the 1999 value, equivalent to an annual decrease of 4.2%. **The value of the smoothed index has fallen steadily since the baseline year, and overall there has been a significant decline in the index since 1999. However, it is likely that this species' frequent roost switching results in a negative bias in the Roost Count trend (see Robustness of Monitoring, page 8) and this trend is not therefore considered a reliable measure of population change for soprano pipistrelle. We are currently investigating the causes of this negative bias and ways to correct it (see Developments and Future Directions, page 67).**

Data from 401 sites surveyed between 1997 and 2018 contribute to the trend analysis (sites surveyed in two or more years).



Population estimate

Country	GB	England	Wales	Scotland	N.Ireland
Number (Plausible intervals in brackets)	4,670,000 (1,970,000–8,400,000)	2,980,000 (1,260,000 – 5,360,000)	478,000 (202,000 – 862,000)	1,210,000 (512,000 – 2,180,000)	580,000
Source	Mathews <i>et al.</i> 2018				Russ 1999

Distribution of soprano pipistrelle in the UK
(Map taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)



Soprano pipistrelle trends | England

Field Survey

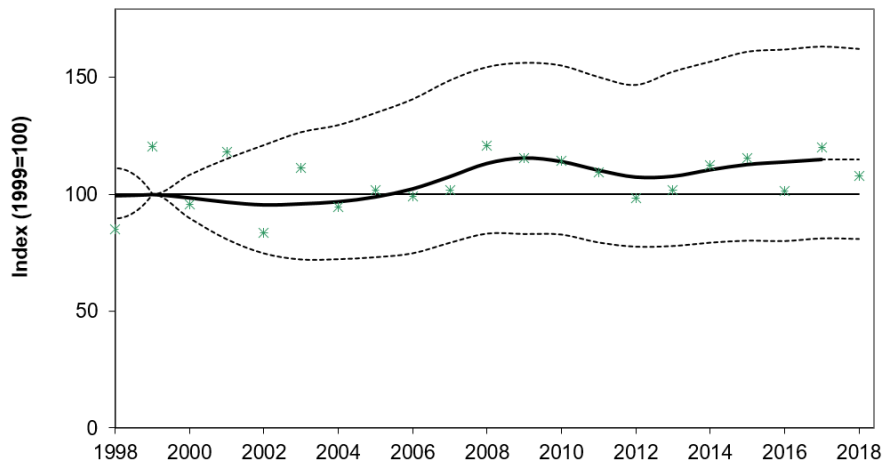


Figure 44. England index of soprano pipistrelle population from the Field Survey

The smoothed index is currently 14.7% above the 1999 base year value, equivalent to an annual increase of 0.7%. The smoothed index is **not significantly different from the 1999 base year value**.

Data from 511 sites contribute to the trend analysis in England.

Roost Count

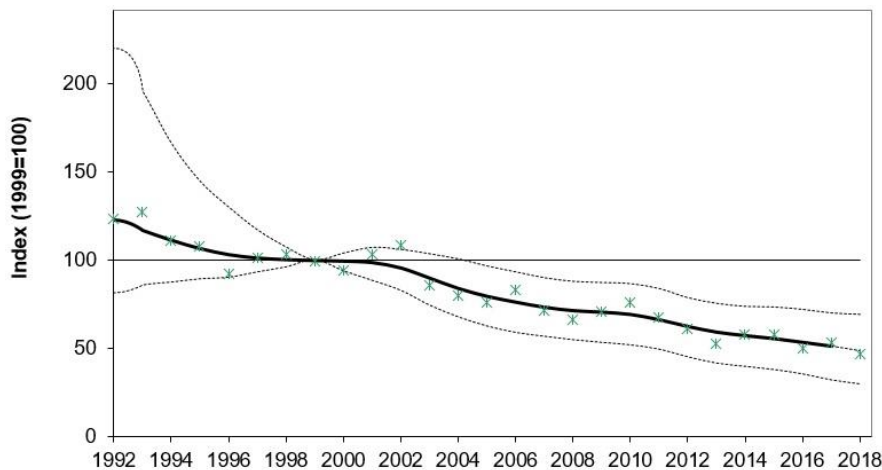


Figure 45. England index of soprano pipistrelle population from the Roost Count

The smoothed index is currently 51.2% below the 1999 base year value, equivalent to an annual decrease of 3.7%. The value of the smoothed index has fallen steadily since the baseline year, and overall there has been a **significant decline in the smoothed index since 1999**. However, it is likely that this species' frequent roost switching results in a negative bias in the Roost Count trend (see Robustness of Monitoring, page 8) and this trend is not therefore considered a reliable measure of population change for soprano pipistrelle. We are currently investigating the causes of this negative bias and ways to correct it (see Developments and Future Directions, page 67).

Data from 262 sites contribute to the trend analysis in England (sites surveyed in two or more years).

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Soprano pipistrelle trends | Scotland

Field Survey

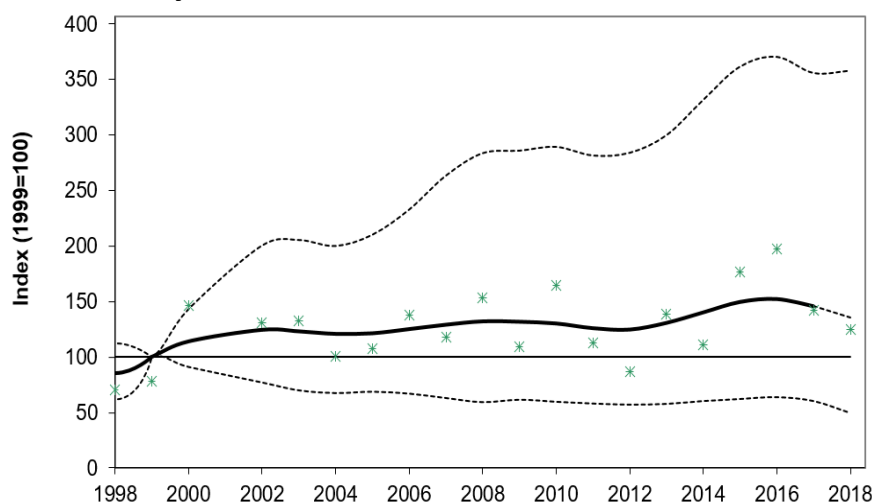


Figure 46. Scotland index of soprano pipistrelle population from the Field Survey

The smoothed index is currently 35.4% above the 1999 base year value, equivalent to an annual increase of 1.6%. It was relatively stable between 2000 and 2012. Since 2012 it has fluctuated slightly, but overall the smoothed index is **not significantly different from the 1999 base year value**.

Data from 67 sites contribute to the trend analysis in Scotland.

Roost Count

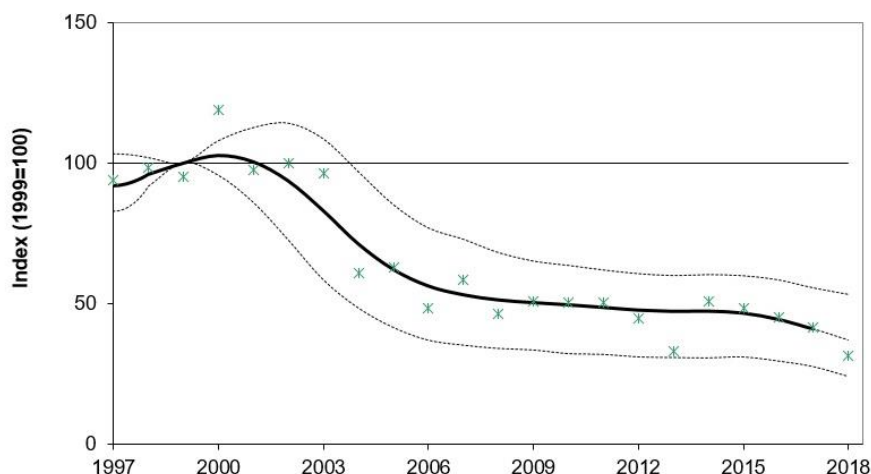


Figure 47. Scotland index of soprano pipistrelle population from the Roost Count

The smoothed index is currently 63.0% below the 1999 base year value, equivalent to an annual decrease of 5.1%. After a slight increase initially, the value of the smoothed index fell steadily between 2000 and 2006. Between 2006 and 2015 it was relatively stable before falling again in recent years.

Overall there has been a **significant decline in the smoothed index since 1999**. However, it is likely that this species' frequent roost switching results in a negative bias in the Roost Count trend (see Robustness of Monitoring, page 8) and this

trend is not therefore considered a reliable measure of population change for soprano pipistrelle. We are currently investigating the causes of this negative bias and ways to correct it (see Developments and Future Directions, page 67).

Data from 87 sites contribute to the trend analysis in Scotland (sites surveyed in two or more years).

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Soprano pipistrelle trend | Wales

Roost Count

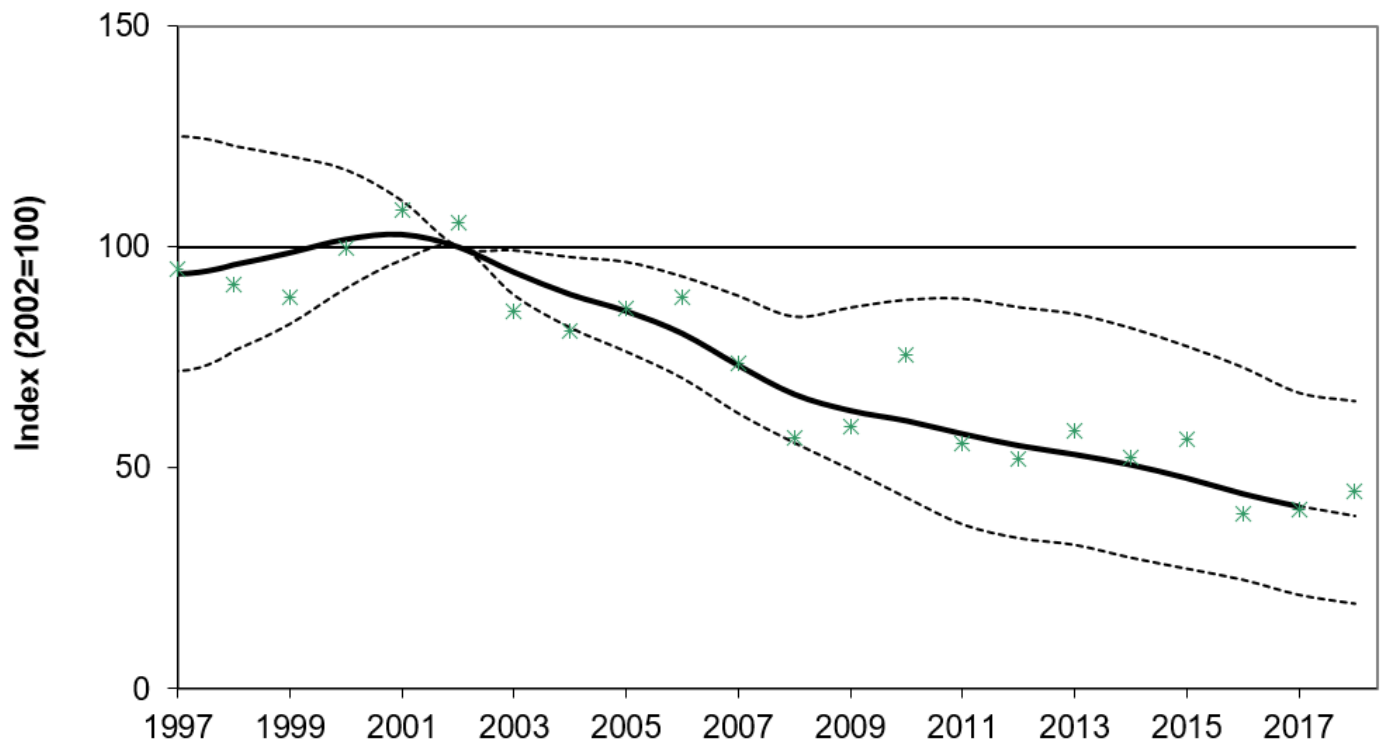


Figure 48. Wales index of soprano pipistrelle population from the Roost Count, showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 61% below the 2002 base year value, equivalent to an annual decrease of 5.7%. The value of the smoothed index has fallen steadily since the baseline year, and overall there has been a **significant decline in the smoothed index since 2002**. However, it is likely that this species' frequent roost switching results in a negative bias in the Roost Count trend (see Robustness of Monitoring, page 8) and this trend is not therefore considered a reliable measure of population change for soprano pipistrelle. We are currently investigating the causes of this negative bias and ways to correct it (see Developments and Future Directions, page 67).

Data from 52 sites contribute to the trend analysis in Wales (sites surveyed in two or more years).



Serotine trends | Great Britain

Eptesicus serotinus

Summary of survey results for Great Britain

Trends from both the Field Survey and Roost Count show no significant change in the smoothed index from the baseline year. **The population of serotine in Great Britain is considered to have been stable since 1999.** However, this finding should be treated with caution as serotine is encountered relatively infrequently during surveys. Therefore, the level of uncertainty associated with these trends is large, making trends for this species are more difficult to detect.

Population trends are also produced for serotine in England. Serotine is only rarely recorded in Wales, therefore there are insufficient data to calculate a population trend for that country. This species does not occur in Scotland.

Field Survey

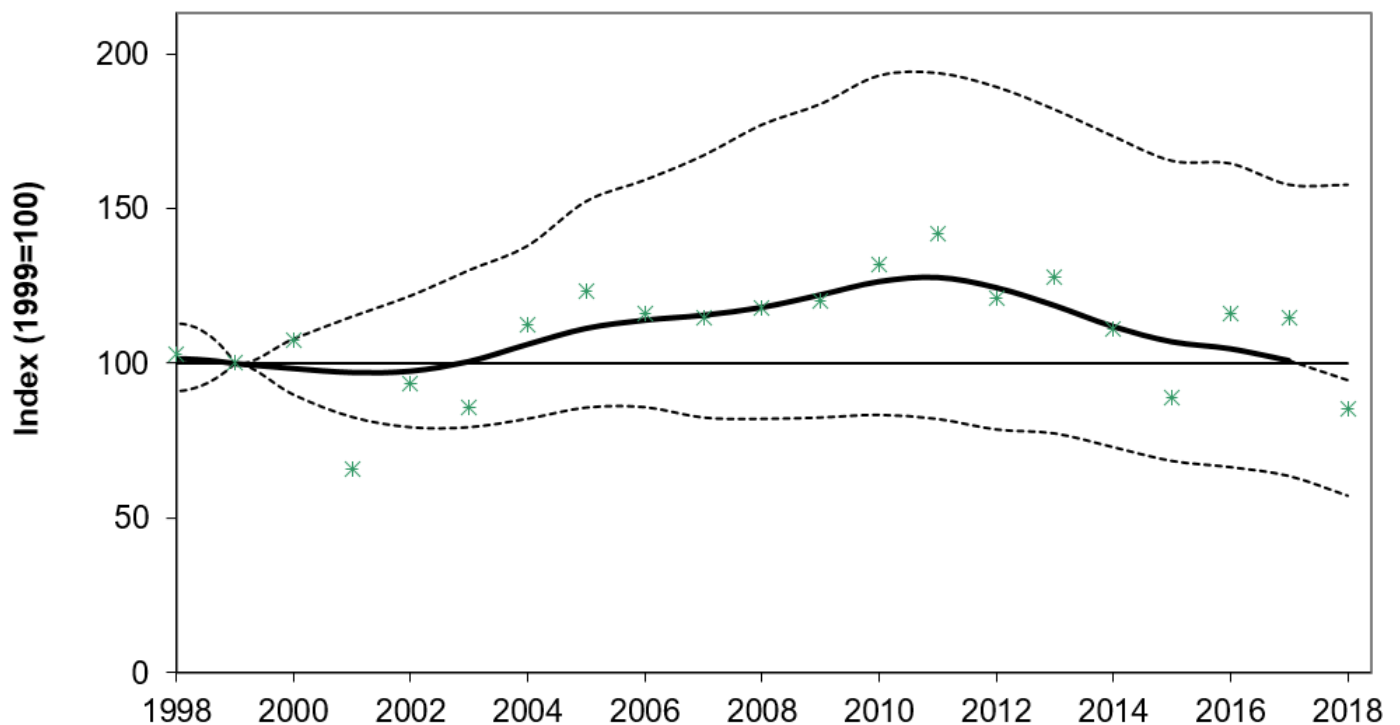


Figure 49. GB index of serotine population from the Field Survey showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 5.6% below the 1999 base year value, equivalent to an annual decrease of 0.3%. It is **not significantly different from the 1999 base year value.**

Data from 426 sites surveyed between 1998 and 2018 contribute to the overall trend analysis.

Note: As serotine is restricted to southern parts of GB no geographic weighting has been applied to this analysis.

Roost Count

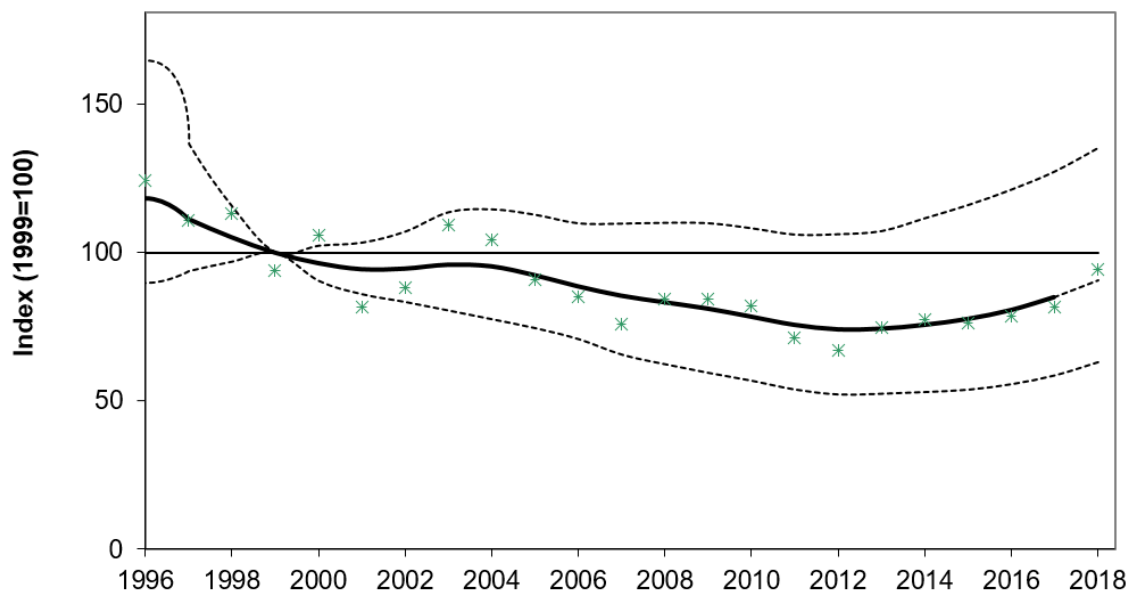
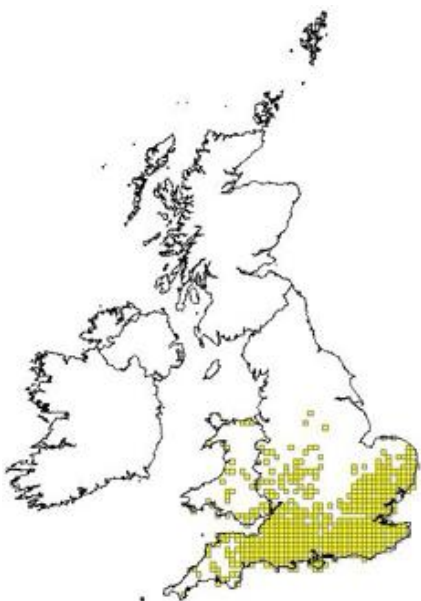


Figure 50. GB index of serotine population from the Roost Count showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 9.3% below the 1999 value, equivalent to an annual decrease of 0.5%. Between 1999 and 2004 it was relatively stable, before falling steadily between 2004 and 2012. Since 2012 the smoothed index has been increasing, however it has not differed significantly from the baseline year in any year, and overall there has been **no significant change in the smoothed index since 1999**.

Data from 97 sites contribute to the trend analysis from 1997-2018 (sites surveyed in two or more years).



Population estimate

Country	GB	N.Ireland
Number	136,000 (PIs = 7,300–413,000). Reliability score = 3.	does not occur
Source	Mathew <i>et al.</i> 2018	

Distribution of serotine in the UK
(Map taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)



Serotine trends | England

Field Survey

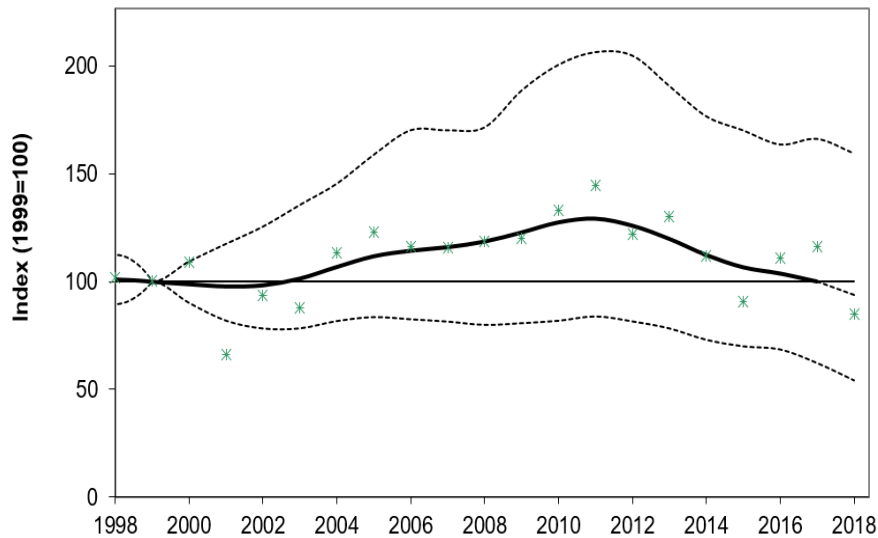


Figure 51. England index of serotine population from the Field Survey

The smoothed index is currently 6.1% below the 1999 base year value, equivalent to an annual decrease of 0.3%. It is **not significantly different from the 1999 base year value**.

Data from 390 sites contribute to the trend analysis in England.

Roost Count

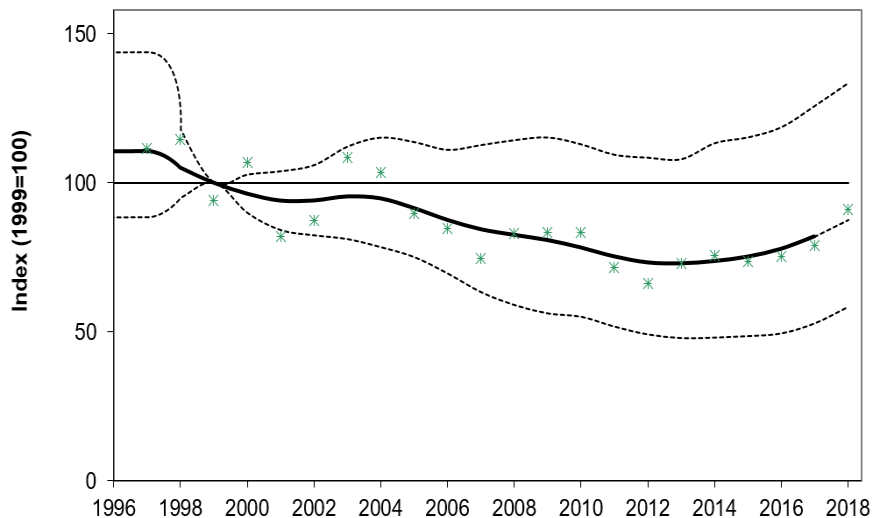


Figure 52. England index of serotine population from the Roost Count

The smoothed index is currently 12.4% below the 1999 base year value, equivalent to an annual decrease of 0.7%. Between 1999 and 2004 the smoothed index was relatively stable, before falling steadily between 2004 and 2012. Since 2012 it has been increasing, however it has not differed significantly from the baseline in any year, and overall the smoothed index is **not significantly different from the 1999 base year value**.

Data from 95 sites contribute to the trend analysis in England (sites surveyed in two or more years).

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Noctule trend | Great Britain

Nyctalus noctula

Summary of survey results for Great Britain

The trend from the Field Survey shows no significant change in the smoothed index since 1999. **The population of noctule in Great Britain is considered to have been stable over the period 1999-2018.**

Population trends are also produced for noctule at a country-level for England. There are insufficient data to calculate population trends for this species in Scotland and Wales.

Field Survey

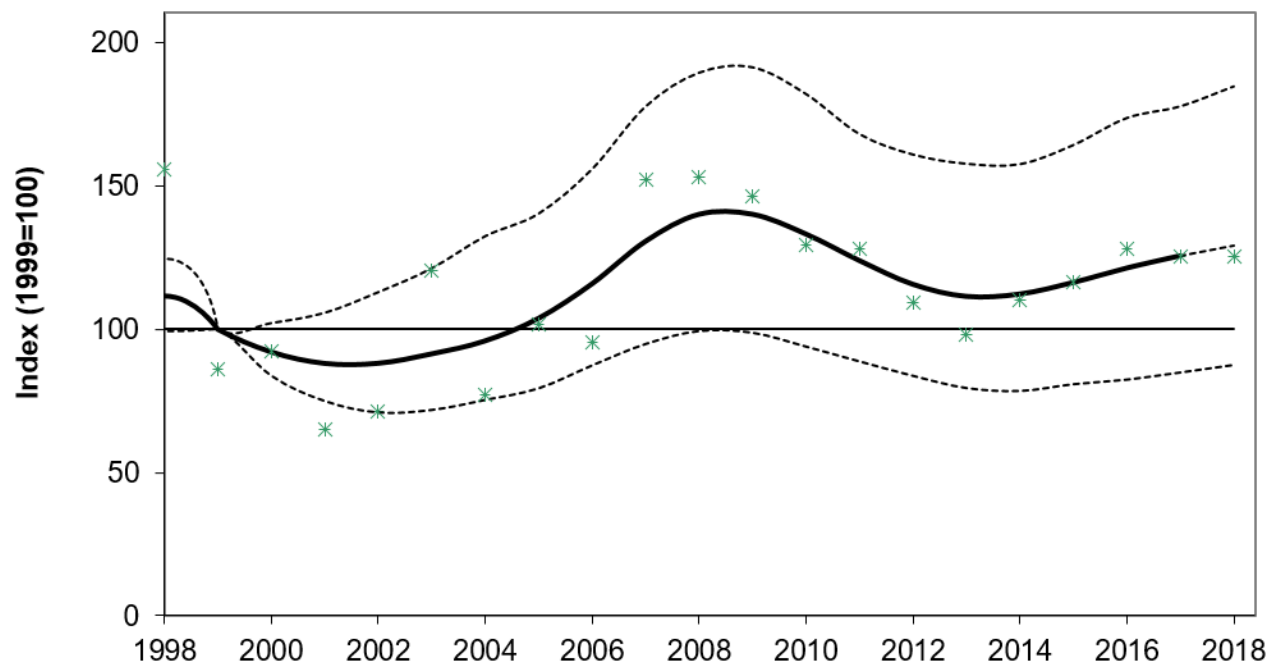


Figure 53. GB index of noctule population from the Field Survey showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 29.3% above the 1999 base year value, equivalent to an annual increase of 1.4%. The trend has fluctuated considerably since the start of monitoring. It has fluctuated over the period monitored. It increased from 2001 to a peak in 2009, then fell between 2009 and 2013, before increasing once again in recent years. However, it has not differed significantly from the baseline in any year, and overall the smoothed index is **not significantly different from the 1999 base year value.**

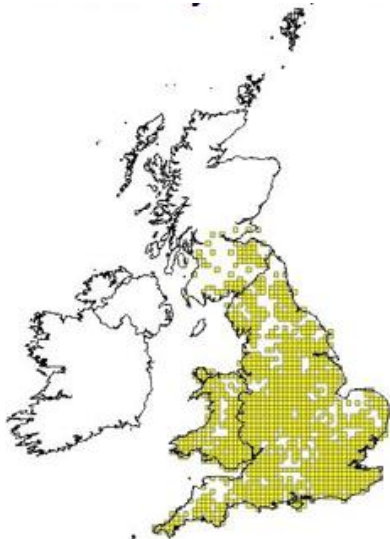
Data from 623 sites surveyed between 1998 and 2018 contribute to the overall trend analysis.

Distribution and abundance

Noctule is relatively common and widespread in England, Wales, and southern Scotland. It is absent from Northern Ireland.

Population estimate

The population estimates are considered to be poor and should be treated with caution. Estimates are based on limited population data and rely on expert opinion only.



Country	GB	England	Wales	Scotland	N.Ireland
Number (Plausible intervals in brackets)	Not assessed	565,000 (17,700 – 1,872,000)	91,900 (2,880 – 304,000)	Not assessed	N/A
	Reliability score = 0				
Source	Mathews <i>et al.</i> 2018				

Distribution of noctule in the UK
(Map taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)



Noctule trend | England

Field Survey

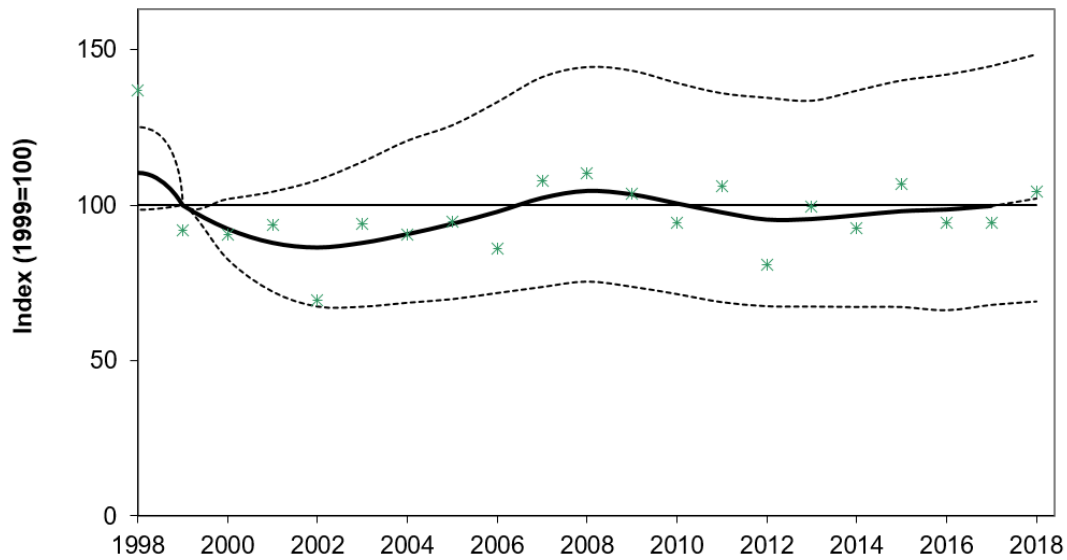


Figure 54. England index of noctule population from the Field Survey showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 2.2% above the 1999 base year value, equivalent to an annual increase of 0.1%. It is **not significantly different from the 1999 base year value.**

From all years for which data are available (1998-2018), counts from 510 sites contributed to the trend analysis in England.



Brown long-eared bat trends | Great Britain

Plecotus auritus

Summary of survey results for Great Britain

Trends from both the Roost Count and the Hibernation Survey show no significant change in the smoothed index from the base year value. Therefore, **the population of brown long-eared bat in Great Britain is considered to have been stable since 1999.**

Population trends for brown long-eared bat are also produced at country-level for England and Wales. There are insufficient data available to calculate a population trend for this species in Scotland.

Hibernation Survey

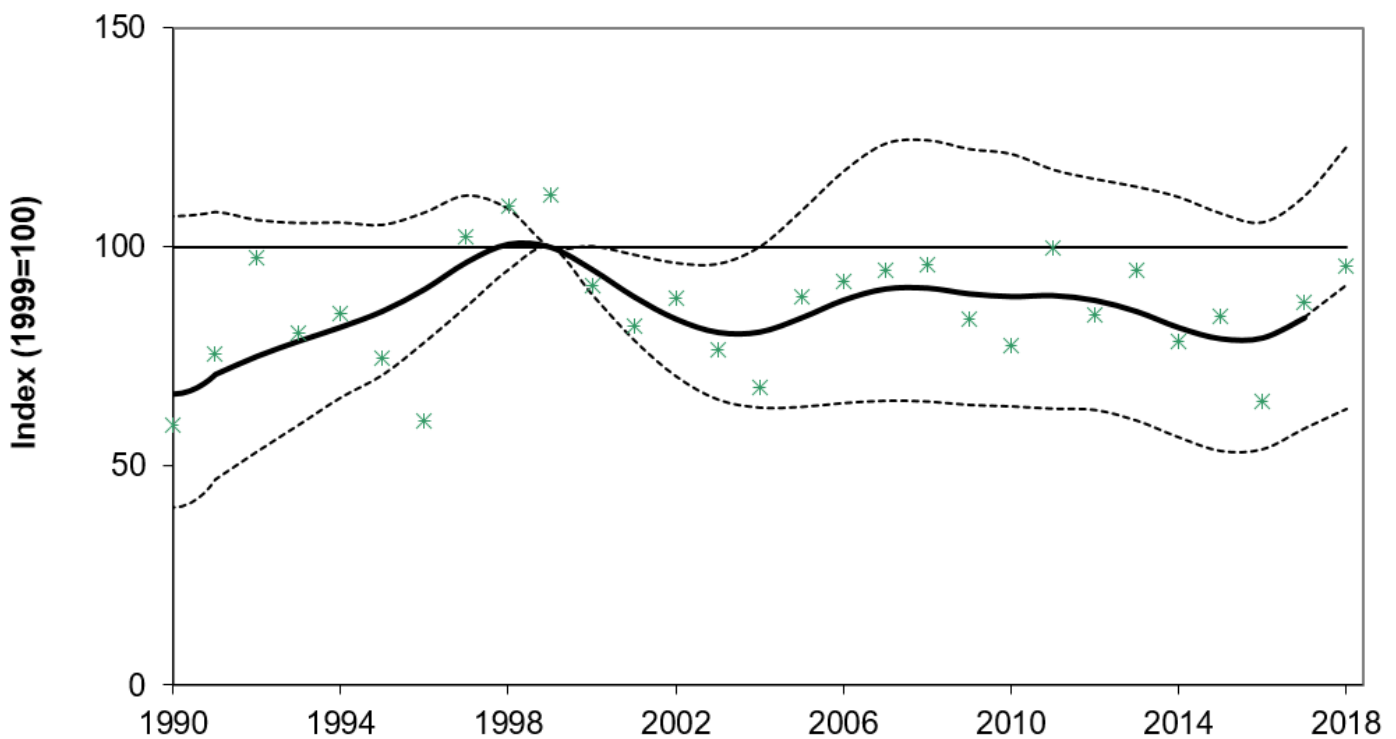


Figure 55. GB index of brown long-eared bat population from the Hibernation Survey showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 8.7% below the 1999 base year value, equivalent to an annual decrease of 0.5%. It has fluctuated but has not exceeded the value of the baseline in any year. It was significantly lower than the baseline between 2001 and 2003 but has not differed significantly from the baseline in any other year due to a combination of higher index values and lower precision. Overall the smoothed index is **not significantly different from the 1999 base year value.**

From all years for which data are available (1990-2018), counts from 461 sites contribute to the trend (sites surveyed in two or more years with brown long-eared bat recorded in at least one year).

Roost Count

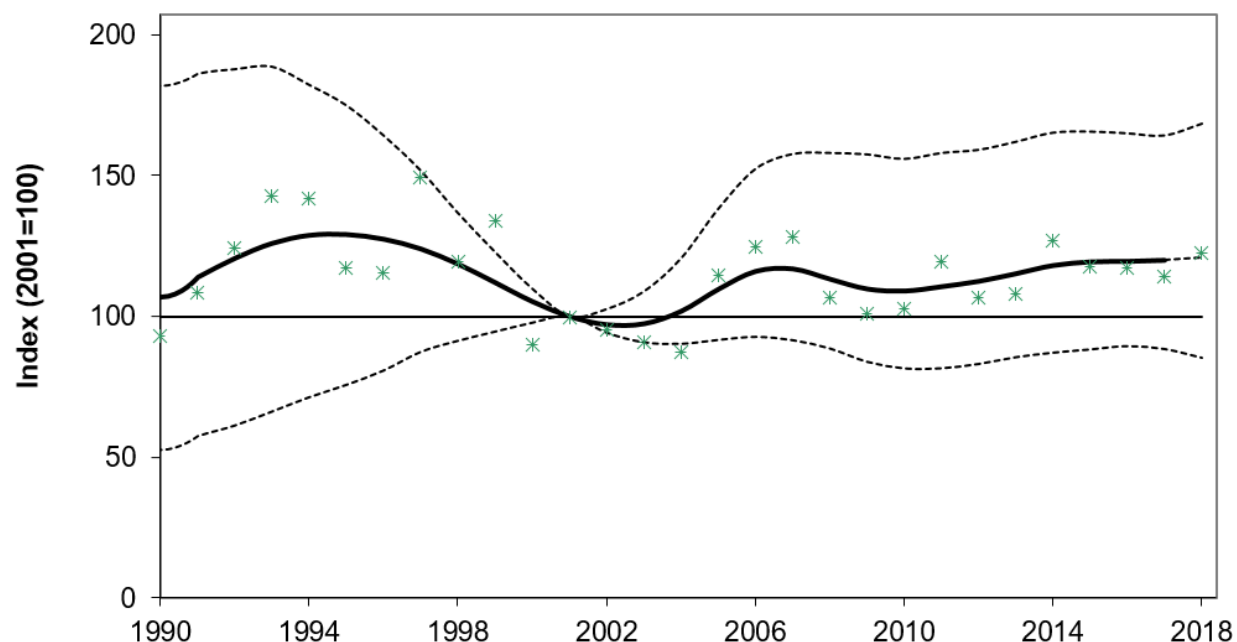
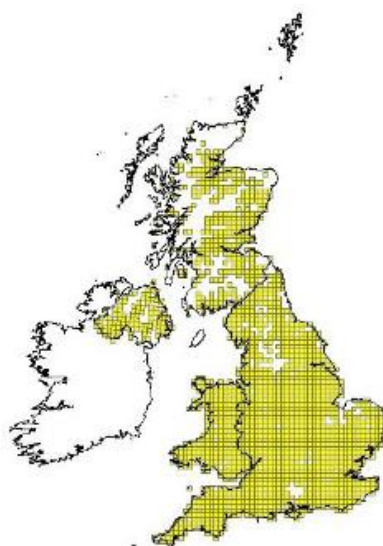


Figure 56. GB index of brown long-eared bat population from the Roost Count showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 21.1% above the base year value, equivalent to an annual increase of 1.1%. Its value has fluctuated since the start of monitoring, although over the last four years it has been relatively stable. The smoothed index has not differed significantly from the baseline in any year, and overall the smoothed index is **not significantly different from the 2001 base year value**.

Data from 159 sites surveyed between 1990 and 2018 contribute to the trend (sites surveyed in at least two years). Note: the baseline year for calculation of this trend has been set at 2001 as very few roosts were counted in earlier years.



Country	Population estimate				
	GB	England	Wales	Scotland	N.Ireland
Number (Plausible intervals in brackets)	934,000 (52,000–2,200,000)	607,000 (33,700 – 1,430,000)	96,600 (5,370 – 228,000)	230,000 (12,800 – 543,000)	45,000
	Reliability score = 2				
Source	Mathews <i>et al.</i> 2018				Russ 1999

Distribution of brown long-eared bat in the UK
(Map taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)



Brown long-eared bats trends | England

Hibernation Survey

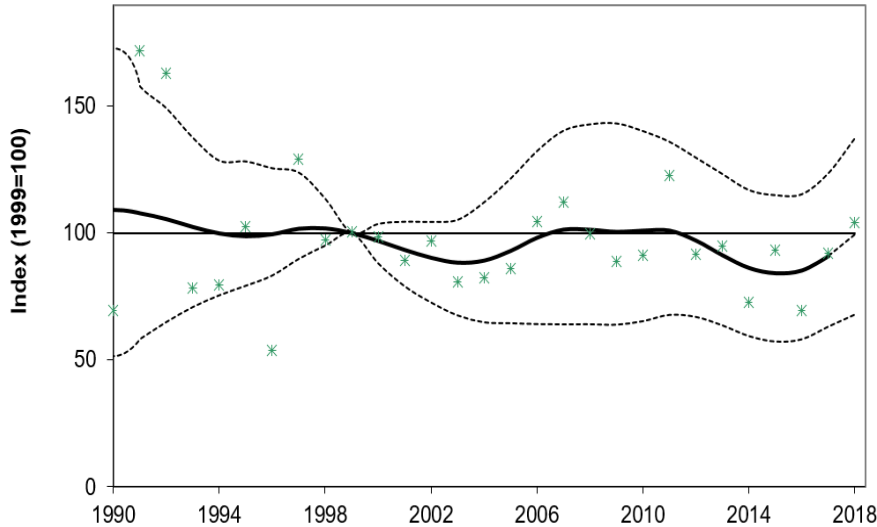


Figure 57. England index of brown long-eared bat population from the Hibernation Survey

The smoothed index is currently 0.4% below the 1999 base year value, equivalent to an annual decrease of 0.02%. It has fluctuated above and below the base year value, however it has not differed significantly from the baseline in any year. Overall the smoothed index is **not significantly different from the 1999 base year value**.

For all years for which data are available (1998-2018), counts from 350 sites contribute to the trend analysis in England (sites surveyed in two or more years with brown long-eared bat recorded in at least one year).

Roost Counts

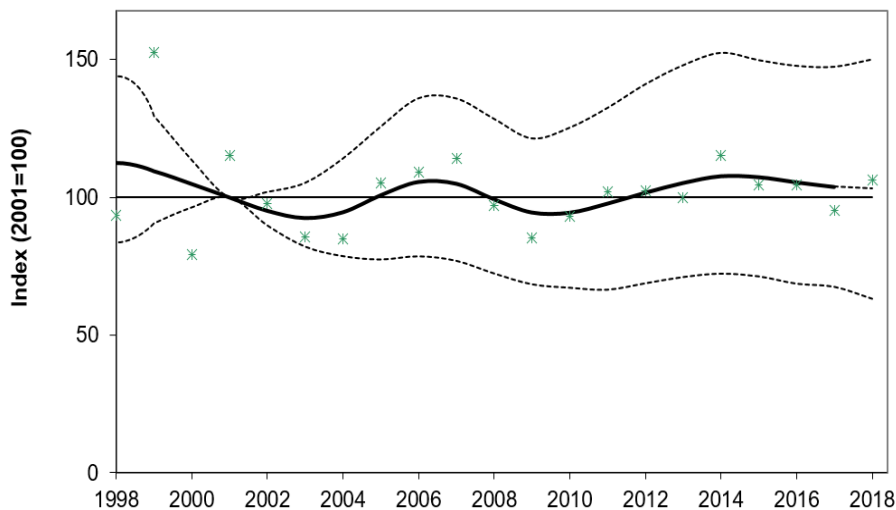


Figure 58. England index of brown long-eared bat population from the Roost Count

The smoothed index is currently 3.4% above the 2001 base year value, equivalent to an annual increase of 0.2%. Its value has fluctuated since the start of monitoring, however it has not differed significantly from the baseline in any year, and overall the smoothed index is **not significantly different from the 2001 base year value**.

Data from 114 sites contribute to the trend analysis in England (sites surveyed in at least two years).

The graphs above show the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.



Brown long-eared bat trend | Wales

Hibernation Survey

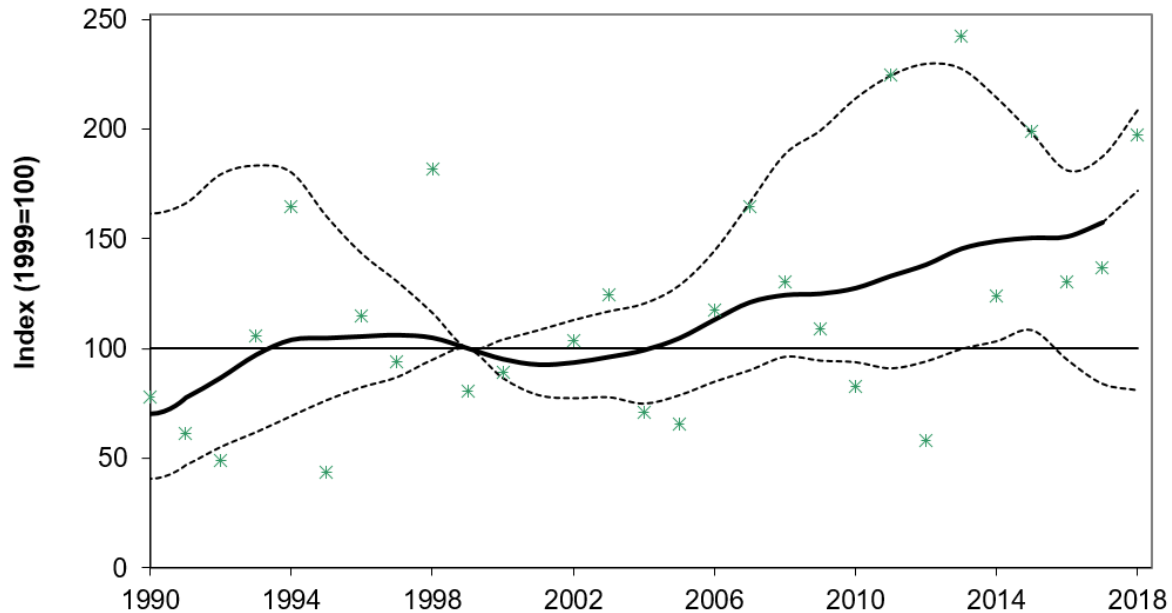


Figure 59. Wales index of brown long-eared bat population from the Hibernation Survey showing the unsmoothed index value for each year (green crosses), the smoothed trend (solid line) and 95% confidence intervals (dotted lines). The smoothed trend for 2018 is shown as a dashed line to indicate that it is provisional.

The smoothed index is currently 71.8% above the 1999 base year value, equivalent to an annual increase of 2.9%. It declined between 1999 and 2003, then has increased in every year since, although rate of increase has varied. The precision of the trend estimate increased in 2015 and as a result the smoothed index in that year was significantly higher than the baseline year. However, the precision of the trend has reduced in recent years, with the result that overall the smoothed index is **not significantly different from the 1999 base year value**.

From all years for which data are available (1998-2018), counts from 85 sites contribute to the trend analysis in Wales (sites surveyed in two or more years with brown long-eared bat recorded in at least one year).



Nathusius' pipistrelle

Pipistrellus nathusii

Nathusius' pipistrelle is a rare bat in the UK, though records have increased in recent years. Distribution data on Nathusius' pipistrelle have been collected through the NBMP by the Nathusius' Pipistrelle Survey, a bat detector survey at waterbodies which ran from 2009-2014, and since 2014 by the National Nathusius' Pipistrelle Project (NNPP). The methodology of the NNPP involves capturing bats under licence using acoustic lures and harp traps in activity hotspots. Harp traps are the safest and least stressful method for trapping bats in the field. Bats are examined to ascertain their sex, age and breeding status. If a Nathusius' pipistrelle is caught then a dropping and a fur sample may be collected for analysis, and, if an experienced bat ringer is part of the project team, the bat is ringed before being promptly released.

Key results from the National Nathusius' Pipistrelle Project include:

- Stable isotope analysis of fur samples of Nathusius' pipistrelles caught during the project, carried out by the University of Exeter, suggest that these bats have a migratory origin further northeast than the UK, and that the Nathusius' pipistrelles originated from more northerly latitudes than soprano pipistrelles.
- From 2014 to 2018, 23 bat groups have taken part in trapping surveys across 122 sites, resulting in 594 captures of Nathusius' pipistrelle
- Maternity colonies have been discovered in Kent and Northumberland.
 - Six long distant migratory records have been found:
 - one bat ringed in North Somerset was rediscovered in Holland in December 2013;
 - a bat from Latvia was recaptured in East Sussex in October 2015;
 - two bats from Lithuania were recaptured in Kent in August and October 2016;
 - two bats from Latvia turned up in Greater London in August and September 2017, and one bat from Latvia turned up in Essex in September 2017;
 - one bat ringed in East Sussex was found in Belgium in September 2018.

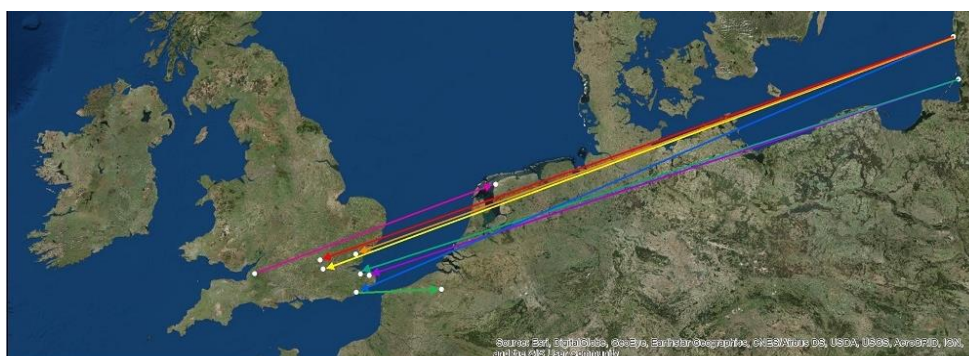


Figure 60. Movements of ringed Nathusius' pipistrelles from the National Nathusius' Pipistrelle Project

Distribution and abundance

Nathusius' pipistrelle is rare but widespread throughout Great Britain. It is more abundant in Northern Ireland.

Population estimate

Country	GB	N. Ireland
Number	Unknown	Unknown



Barbastelle

Barbastella barbastellus

Special Areas of Conservation designated for barbastelle are monitored through the Woodland Survey. Data on barbastelle are also collected from a small number of Hibernation Survey sites but currently there is insufficient data to produce a robust population trend.

Woodland Survey Results

The NBMP Woodland Survey was piloted by BCT in 2004 and rolled out in 2005 as a new method to assess the presence and relative abundance of barbastelle (*Barbastella barbastellus*). The survey and analysis methods were revised in 2006 and surveys have been completed using this revised methodology since then.

The surveys are completed in three periods:

- Period 1: 25th July to 8th August
- Period 2: 9th to 23rd August
- Period 3: 24th August to 7th September

Currently Natural England provide funding to monitor the presence of barbastelles using this survey methodology at five woodland Special Areas of Conservation (SACs) in England where the presence of barbastelle is a primary reason or qualifying feature for designation. An additional site is surveyed in Wales. The results across all survey years are summarised in the table below.

Table 10. Summary of Woodland Survey results 2005-2018 (P = barbastelles present; N/S = not surveyed)

Year	SAC Site / barbastelle recorded						
	Briddlesford Copses	Ebernoe Common	Eversden & Wimpole Woodlands	Exmoor & Quantock Oakwoods	The Mens	Mottisfont	North Pembrokeshire Woodlands/ Coedydd Gogledd Sir Benfro
2005	N/S	N/S	P	N/S	N/S	P	P
2006	N/S	N/S	P	N/S	N/S	P	N/S
2007	N/S	N/S	P	N/S	N/S	P	N/S
2008	N/S	N/S	P	N/S	N/S	P	N/S
2009	P	P	P	P	N/S	P	P
2010	P	P	P	P	P	P	P
2011	N/S	P	P	P	P	P	P
2012	N/S	P	P	P	P	P	N/S
2013	N/S	P	P	P	P	P	P
2014	N/S	P	P	P	P	P	P
2015	N/S	P	P	P	P	P	P
2016	N/S	P	P	P	P	P	P
2017	N/S	P	P	P	P	P	P
2018	N/S	P	P	P	P	P	P

Since 2005 a total of 49 transects have been surveyed. This includes transects in seven Special Areas of Conservation (SACs). From 2011 surveys have been primarily focused on the SAC sites.

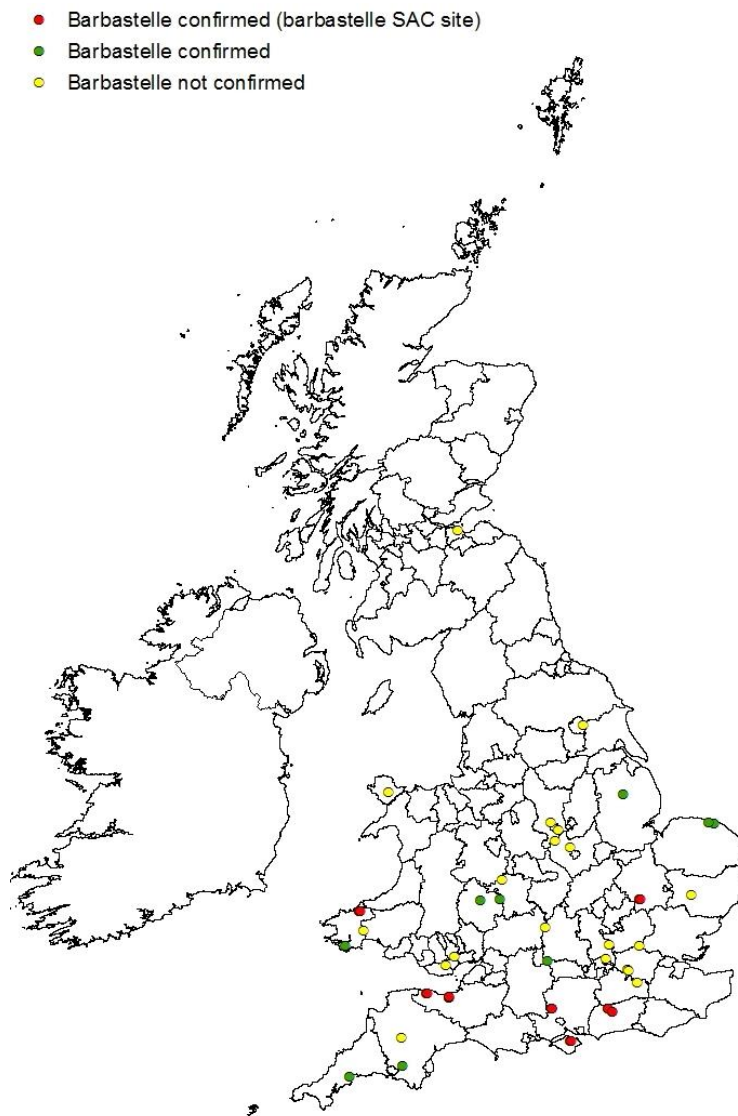


Figure 61. Distribution of Woodland Survey sites 2005-2018

Distribution and abundance

Barbastelle is a rare species, found in southern England and Wales. It is absent from Scotland and Northern Ireland. Barbastelle is classed as Near Threatened on the IUCN Red List.

Population estimate

Country	GB	N. Ireland
Number	Unknown	N/A



Grey long-eared bat

Plecotus austriacus

Roost counts

Five grey long-eared bat roosts are included in the NBMP, although two of these are not currently monitored. A roost in Devon has been monitored annually since 2013. The fifth roost was added late in 2018 for monitoring from 2019.

As part of the “Back From the Brink” suite of projects (<https://naturebftb.co.uk/>) BCT is leading on a project focused on grey long-eared bat which involves working with landowners to discover how to retain and enhance the precious habitats that the bats need. An aim of this project is to have eight maternity roosts monitored for the NBMP.

NBMP Grey long-eared bat Project 2012

In summer 2012 the National Bat Monitoring Programme undertook an exciting project, the aim of which was to try to identify grey long-eared bat roosts and so expand our knowledge of the distribution of this rare species. We enlisted the help of long-eared bat roost owners within the species' known range and asked them to collect and return droppings from their roosts. Many roost owners and other volunteers kindly participated and the bat droppings they returned were sent off for DNA analysis to confirm if they came from a brown long-eared bat or were in fact from the similar, but rare, grey long-eared bat. Grey long-eared bat was identified at one of these roost sites. The full report is available at <http://jncc.defra.gov.uk/page-6316>.



Population estimate

Country	England	Wales	Scotland	N.Ireland
Number	1,000 (Pls 400–3,000). Reliability score = 1.	0	0	N/A
Source	Mathews <i>et al.</i> 2018			

Distribution of grey long-eared bat in the UK
(Map taken from 3rd Report under Article 17 on implementation of the Habitats Directive in the UK, JNCC 2013)

Sunset/Sunrise Survey

The Sunset/Sunrise Survey has been running since 2002 as an engagement survey designed to enable new volunteers to take part in a simple bat survey. More experienced volunteers have also taken part as it is an effective technique for locating bat roosts. From 2002 to 2018, 1,274 volunteers have taken part in the survey.

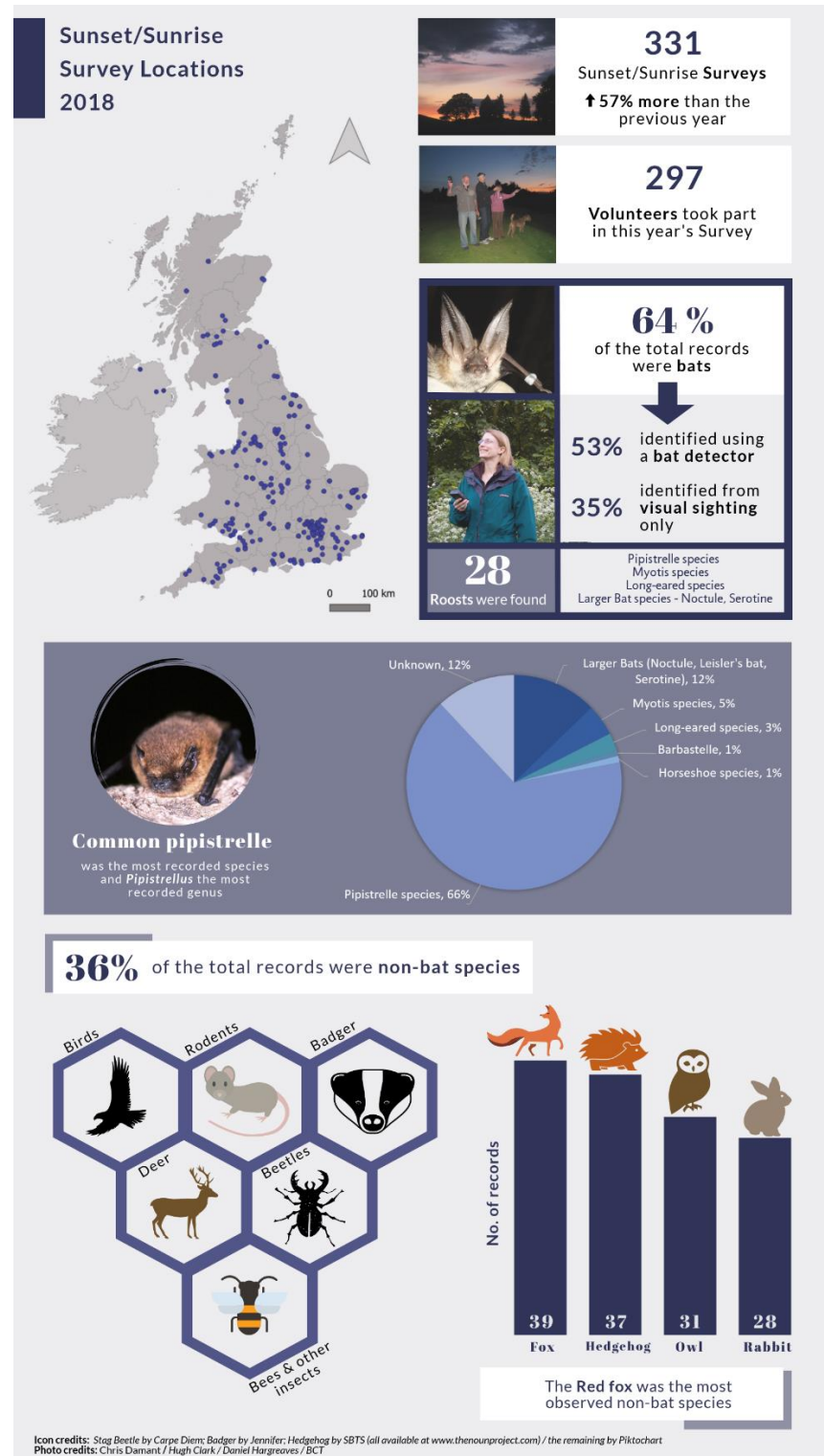
Volunteers are asked to spend the hour after sunset and/or the hour before sunrise in their garden or local open space and look for any bats or other nocturnal animals they can spot. A visual guide is provided to help beginners identify a few of the more common bat species. Results are inputted via a dedicated online recording page developed and hosted by iRecord.

The survey can be carried out anytime from April to September. Between June and August is the best time to see bats swarming as they return to the roost.

In 2018, 331 Sunset/Sunrise Surveys were completed by at least 297 volunteers. Twenty-eight bat roosts were located through spotting down swarming.

The infographic on this page was produced after the 2018 survey season in order to give feedback to volunteers who took part in the survey.

Volunteers can print off the survey form/instructions and access the online recording form at www.bats.org.uk/our-work/national-bat-monitoring-programme/surveys/sunset-sunrise-survey.



Research and Conservation

The National Bat Monitoring Programme contributes data and expertise to a wide variety of research and conservation work. This is a summary of some recent work supported by the NBMP.

Assessing the status of biodiversity

Data from the NBMP is used to calculate two UK biodiversity indicators: C8 Mammals of the Wider Countryside (bats) and C4 Status of UK Priority Species (Defra, 2018).

NBMP data contributes to the latest State of Nature assessment led by the RSPB, which is due to be published later this year. The previous report, published in 2016, gathered data and expertise from more than 50 nature conservation and research organisations to give an overview of the state of nature in the UK. It showed that between 1970 and 2013 56% of species declined, with 40% showing strong or moderate declines; 44% of species increased, with 29% showing strong or moderate increases (Burns *et al.* 2018; Hayhow *et al.*, 2016).

Drivers of population change

Bats are considered valuable bioindicator species, yet knowledge of the drivers of historic and recent bat population trends is poor. We are co-supervisors of a PhD hosted at UCL which is using data from the NBMP together with novel Bayesian statistical models to consider how spatial and temporal changes in climate and land cover are impacting UK bat population trends.

As part of this study the existing evidence for drivers of population change was reviewed, including human disturbance, agricultural practices, changes to woodland, climate change, urbanisation and pollution. Decreasing human disturbance was identified as the most important driver of recent population change in UK bats, which is likely due to the legal protection all UK bats receive, prohibiting deliberate harm and/or disturbance at roosts. Intensive agricultural practices had the next greatest impact on UK bat populations (Browning *et al.*, *in review*).

Agriculture

We worked with the Welsh Government and the RSPB to examine the response of six bat species to Tir Gofal, a Welsh agri-environment scheme that operated from 1999 to 2011. This study found that participation in Tir Gofal did not have a beneficial effect on farm bat activity. However farming in the study area mainly employed traditional extensive land management; Tir Gofal prescriptions may have greater impact in a more intensively farmed landscapes (Angell *et al.*, 2019).

We co-supervised a PhD hosted at the University of Bristol, which investigated the effect of hedgerow management, a common agri-environment scheme prescription, on bats and their insect prey. Hedgerows that had been untrimmed for longer periods were taller, had greater insect family richness and higher dipteran abundance. Bat activity increased as the time since last trimming increased, and delayed trimming substantially benefitted greater horseshoe bat, lesser horseshoe bat and long-eared bat species. This study recommends encouraging farmers to keep hedgerows untrimmed for longer periods (>3 up to 10 years) to benefit bat populations in agricultural landscapes (Froidevaux *et al.*, 2019).

Woodland use and management

Members of the NBMP team are collaborating with Forest Research to model the ecological and human factors impacting woodland bat species' distributions at local, regional and landscape scales, using data from the NBMP and

other sources. This study has compared a range of methods for incorporating environmental predictors at different scales into habitat suitability models, using the lesser horseshoe bat as a case study. It found that hierarchical multi-scale models demonstrate improved model accuracy and improved inference over traditional modelling approaches (Bellamy *et al. in review*). This project will go on to compare different approaches to monitoring bats in woodland.

Bats in churches

At the start of 2019 the Bats in Churches Partnership moved into the delivery phase. The five year project is funded by The National Lottery Heritage Fund and is a collaboration between Natural England, the Church of England, Bat Conservation Trust, Historic England and the Churches Conservation Trust. Part of the project focuses on a citizen science element across England, to better understand the factors affecting the use of churches by bats and to understand the perspectives of the church representatives living with bats. Work is being carried out to get ready for the start of two Bats in Churches surveys, named the National Bats in Churches Study (NBiCS) and Church Bat Detectives. These surveys will sit within the NBMP and registration for NBiCS will open from June 2019. NBiCS looks at a stratified random sample of 1000 churches. We aim to survey at least 70 churches this survey season (June-July) and 210 churches between 2020 and 2022. Church Bat Detectives is a slightly simpler survey and can be conducted in any CofE church across England (with the agreement of the parish). While these are one-off surveys, the hope is that many volunteers will join up to the NBMP Roost Count, to provide long-term data on the bats using churches.

White Nose Syndrome

The NBMP previously contributed to research at the University of California (Santa Cruz) investigating the prevalence in Europe and elsewhere of *Pseudogymnoascus destructans*, the fungus which in North American bats can lead to white nose syndrome. NBMP volunteers took environmental samples and swabs from bats at hibernacula. Analysis of these samples is now complete and the results will be published shortly. This year further samples from NBMP hibernation sites were collected and submitted to the United States Geological Survey as part of a wider international study comparing the substrate biomes of hibernacula in North America with those in Europe where *P. destructans* is endemic.

Developments and future directions

The strategic aim of the NBMP is to deliver a world-leading, cost-effective citizen science programme supported by motivated volunteers, providing high quality data able to inform evidence needs, policy-relevant questions and metrics of bat population status, change and distribution. Here is a summary of the some recent work to further this aim, and work planned for the future.

The British Bat Survey

Development of the British Bat Survey (BBatS) continued this year. This is a new citizen science survey employing passive full-spectrum acoustic detectors and automated call identification software in an innovative end-to-end open-source system for the acoustic monitoring of bat populations at national scales. It will enable us to calculate population trends for more bat species than is currently possible and engage a wider range of volunteers than ever before. In 2017 we received funding from the National Environment Research Council to develop BBatS in collaboration with UCL, University of Oxford and the BTO. Key achievements of this collaboration include extensive consultation with volunteers, end-users and experts; testing and reconfiguring the sensing technology for ultrasonic surveys; piloting the end-to-end system in Scotland over summer 2018; establishing options for the final survey protocol and developing an interactive results website (Fairbarss *et al.* 2018). Our NERC-funded collaboration came to

a formal end in December however the project group continue to input into survey development. Also feeding into the development of the British Bat Survey is a PhD hosted at UCL and co-supervised by NBMP staff. This study is comparing the performance of different acoustic sensors for passive acoustic monitoring, and seeking to improve the accuracy of automated signal detection and classification algorithms for bat calls. A small-scale roll out of BBatS is planned for summer 2019.

Impacts of bias on detecting bat population change

For some species, the population trends estimated from Roost Count data differ substantially to trends estimated from data collected using other survey methods. We are co-supervising a PhD, hosted at the Centre of Ecology and Hydrology, which seeks to understand and, if necessary, statistically correct these differences. This research has assessed potential biases in roost counts using a simulation approach. A virtual bat population was modelled to provide a simulated 'true' population trend, then several data collection scenarios with different levels of biased site selection and observer motivation were applied to provide an 'observed' population trend. The differences between true and observed trends were evaluated and it was found that, while the true trend was stable, the observed trends were declining. As such the simulation demonstrates that biased site selection and lack of volunteer motivation to continue surveying in the absence of bats can produce a negative trend. However the strength of the decline in the observed trends differed between scenarios; observer motivation influenced these declines more than biased site selection. The next step is to explore options for correcting these biases to ensure population trends derived from Roost Count data are robust.

Training the next generation of biodiversity recorders

There are widespread concerns that there is a decline in university graduates with species identification skills which are critical to helping ensure we have a future generation of wildlife recorders, carrying out the vital monitoring of the UK's wildlife. In response to this we have developed the Training the Next Generation Project which trains students in the skills needed to identify bats in the field based on the bats' echolocation calls and visual clues. It covers two key methods for identifying bats: from their ultrasonic calls in the wild using tuneable (heterodyne) bat detectors; and on a computer through analysing calls recorded from a broadband bat detector that uses software that is free to download.

The training courses are split across two days and are offered to colleges and universities across the UK. In total we aim to train between 225 - 300 students over the next few years. The course is free to students; a similar course run by a commercial organisation would cost several hundred pound. This project also includes the provision of bat detecting equipment to each educational establishment and a newly developed bat ID field guide for each student to keep.

The students gain valuable new skills and the widespread improvement in these skills will benefit their careers and bat conservation.

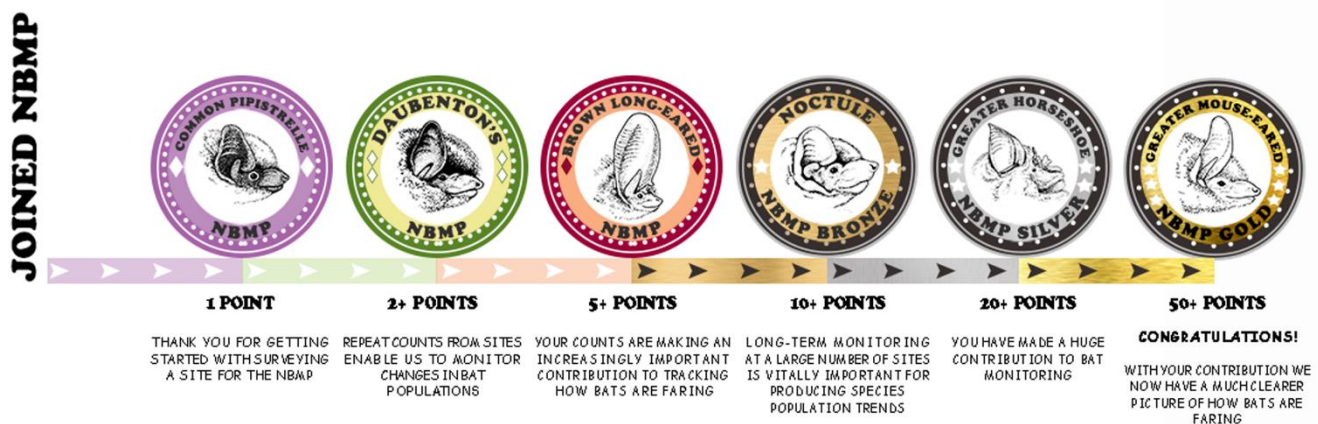
Thanks to funding from several funders, we have been able to develop the resources for this project, including a species identification booklet, buy equipment to give to the universities, and run the two courses at Brunel University and Reading University in autumn 2018. Further courses are being run at the University of Gloucestershire in spring 2019 with a further course (venue TBC) in autumn 2019. We are seeking funding to enable further courses to be run from 2020 onwards.

Volunteer engagement

New resources have been produced in order to improve our engagement of new and existing volunteers.

A set of three NBMP postcards has been produced each with an excellent bat photo and the programme name and URL on the front, and basic information about surveys on the back. This replaces the NBMP sign-up leaflet which had more detail about each survey but was more liable to go out of date; also its use has declined dramatically now that most people sign up online rather than returning a printed form in the post. The postcards give people a link to find out the most up-to-date information about surveys and it is likely that some people will pin them up rather than discard them, which may mean that even if they do not sign up to the NBMP right away they will be reminded to do so in future.

A new NBMP “badge” system has been set up, awarding volunteers different badges based on points calculated from the number of sites and years they have contributed data for in each survey. Volunteers are periodically sent an email showing the badges they are currently awarded for each survey. This scheme aims to acknowledge volunteers’ contribution to the NBMP, make them feel valued regardless of how new they are to the programme, and encourage them to continue submitting data and progress to being awarded higher level badges. The range of badges is shown below.



Acknowledgements

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A huge thank you must go out to all of our hard-working NBMP volunteers who have collected bat data that have contributed to this report. The NBMP relies on the ongoing efforts of hundreds of volunteers whose dedication allows us to produce population trends for UK bats. Without our volunteers the NBMP would not exist.

Many of our volunteers have received training from our volunteer Regional Bat Detector Workshop Leaders (RBDWLs) and we would like to thank them for their continuing dedication to helping us to train up volunteers to maintain the high standards of NBMP surveys. RBDWLs include Mike Castle, Diana Clark, Rebecca Collins, Ian Cornforth, Richard Crompton, Richard Dodd, Colin Edwards, Elisabeth Ferrell, Andrea Hudspeth, Claire Lacey, Bill Landells, Steve Lucas, Helen Lundie, John Martin, Aidan Matthews, Steve Parker, Beverley Plummer, Liz Probert, Clare Rawcliffe, Adam Samson, Annette Smith, Natalie Todman, Nick Tomlinson, Denbeigh Vaughan, Edward Wells, Lisa Worledge and Anne Youngman. Many BCT staff have contributed to the NBMP and special thanks go to our interns and office volunteers who contributed to the programme in 2018: Alfred Bennett, Elizabeth Clark-Lim, Megan Davey, Joana Fernandes and Charlotte Smith.

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