



Definition of Favourable Conservation Status for Leisler's Bat

Defining Favourable Conservation Status Project

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Executive summary

This document sets out Natural England's view on Favourable Conservation Status for Leisler's Bat in England.

Favourable Conservation Status is the minimum threshold at which we can be confident that the species is thriving in England and is expected to continue to thrive sustainably in the future.

This definition has been produced following the Natural England approach to defining Favourable Conservation Status described in the guidance document [Defining Favourable Conservation Status in England](#).

Section 1 of this document describes the species covered by this definition and its ecosystem context.

Section 2 specifies the units used to describe the three Favourable Conservation Status parameters. These are:

- Natural range and distribution (where the species occurs).
- Population (how many there are of the species).
- The extent and quality of habitat supporting the species population.

Section 3 outlines the evidence considered when developing the definition. This definition is based on the best available evidence on the ecology of Leisler's Bat. The evidence covers the current situation, historical changes and possible future changes.

Section 4 sets out the conclusions on the favourable values, which is the value for each of the three parameters when the species has achieved Favourable Conservation Status.

This document does not include any action planning, or describe actions, to achieve or maintain Favourable Conservation Status. These will be presented separately, for example within strategy documents.

Summary definition of Favourable Conservation Status

Leisler's Bat (*Nyctalus leisleri*) is a relatively uncommon species, widely distributed through central and southern England, but rarer in the north and south-west. It is assessed as IUCN Near Threatened in England and Great Britain, but as IUCN Least Concern globally and in continental Europe and the European Union.

Leisler's Bats feed on insects taken on the wing at heights of up to 150 m. They forage over pasture, open water and riparian habitats and, less often, in woodland, along woodland edges and tree-lined roads. They are highly dependent on tree roosts in mainland Europe but will commonly use buildings in England. A colony will change roosts frequently, splitting temporarily into several sub-groups and so require a close network of suitable roosts.

The widespread use of broadband bat detectors has significantly increased the number of records and extended the known distribution of this species. However, there is considerable overlap in the call parameters with other Nyctaloid bats making accurate identification difficult. The estimated range, based on the availability of suitable habitat for Leisler's Bats, is 68,353 km² across England although we have poor confidence in the estimate due to the level of potential misidentification.

We do not know whether the current range or the extent of suitable habitat is favourable. Whilst we believe that the species has similar ecological requirements to the Noctule, and it may be thought reasonable to expect them to share a similar range, we know little if anything about how these species interact, whether they might compete or, indeed, whether their requirements in England are as similar as we suppose.

A provisional favourable population of Leisler's Bats in England is considered to be 89,000 individuals: the current population size is not at a favourable level.

Data for this species in England is very limited and consequently there is a high level of uncertainty in defining Favourable Conservation Status. Provisional favourable levels have been suggested here but further work on the population status of the species is urgently required and new information should be used to review favourable values as soon as it becomes available.

Table 1 Confidence levels for the favourable values. © Natural England 2025; This table is published under the [Non-Commercial Government Licence v2.0](#) for public sector information.

| Favourable Conservation Status parameter | Favourable value | Confidence in the favourable value |
|---|---|---|
| Range and distribution | Maintenance of the current range at 68,353 km ² | Low |
| Population | An increase in the population from the last available estimate (9,750) to 89,000 individuals. | Low |
| Supporting habitat | Maintain the current extent of supporting habitat at 68,353 km ² but increase the extent of connected good quality habitat for Leisler's Bats. | Low |

As of August 2025, based on a comparison of the favourable values with the current values, Leisler's Bats are not in Favourable Conservation Status. Note, this conclusion is based solely on the information within this document and not on a formal assessment of status nor on focussed and/or comprehensive monitoring of status.

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About the Defining Favourable Conservation Status project

Natural England's Defining Favourable Conservation Status (DFCS) project is defining the minimum threshold at which habitats and species in England can be considered to be thriving. Our Favourable Conservation Status (FCS) definitions are based on ecological evidence and the expertise of specialists.

Through setting our ambition and aspiration for species and habitats, our definitions will inform decision making and actions to achieve and sustain thriving wildlife.

Our Definitions will be embedded into delivery of the UK government's Environmental Improvement Plan, through the Nature Recovery Network, biodiversity net gain and environmental land management schemes.

Conservation bodies will use them to inform their work, including management planning for the land they own. Businesses will have a clear understanding of how their work impacts nature recovery and how they can help contribute to achieving thriving nature.

By considering the evidence for FCS, decisions will be more confident and strategic, with an understanding of their contribution to, or impact on, the national ambition.

1. Species definition and ecosystem context

1.1 Species definition

Leisler's Bat *Nyctalus leisleri*, Kuhl (1818). Also known as the Lesser Noctule Bat in mainland Europe.

1.2 Species status

Red list status

An assessment of the risk of extinction.

Global: Least Concern (Juste and Paunović 2016).

European: Least Concern (Hutson and others 2007).

GB: Near Threatened (Mathews and Harrower 2020).

England: Near Threatened (Mathews and Harrower 2020).

Conservation status

- Species of Principal Importance under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.
- Listed as a Species of Community Interest in need of strict protection under Annex IV of the Habitats Directive.

1.3 Life cycle

From early May onwards, adult females start to congregate in maternity roosts to give birth to their pups. Maternity roosts typically comprise 20-50 females in mainland Europe (Dietz and Keifer 2016), but data are lacking on the size of maternity roosts in England. Females display a level of natal philopatry, with some females returning to natal roosts to have their young. Colonies often split, with the subgroups using a network of roosts. Therefore, any maternity roost is likely to represent only a fraction of the local population (Forsyth 2011; Boston and others 2012).

One maternity roost studied in Northern Ireland (Forsyth 2011), became established following rapid build-up in early May, with the number of emerging bats remaining between 95-120 throughout the season. The adults/sub-adults in this roost were each tagged with a Passive Identification Transponder (PIT), which showed that the roost composition was

relatively stable until mid-June. Thereafter, there was a progressive reduction in the number of PIT-tagged bats matched by an equivalent increase in the number of unmarked bats (presumably juveniles of the year). The increase in juvenile numbers as adult numbers declined suggested that females abandon their pups in the roost, and the pups continue to use the roost for some time after their mothers have gone. By mid-July 75-80% of the bats using the roost were unmarked.

Young bats are generally weaned and able to fly within 3-5 weeks (Kozurina 1995; Abelencev and others 1956) and are fully grown after about 2 months (Kurskov 1981). The most important factor affecting growth appears to be roost temperature, with German maternity roosts located on south-exposed slopes above the levels reached by cold fog (Ohlendorf 1983).

Leisler's Bats have also been shown to use hedgerow trees and bat boxes as advertising posts during mating (O'Neill 2001; Russ and others In Prep). Males call to attract females forming harems, comprised typically of a single male and up to ten females (Waters and others 1999; O'Neill 2000). It is possible these trees or boxes are along dispersal routes for the species, supporting a promiscuous mating system resulting in a low level of kinship within colonies (Boston and others 2012). Such dispersal routes could relate to seasonal migration. Leisler's Bat is considered migratory in mainland Europe but thought to undergo only local dispersal within the UK (Shiel and others 1999).

Individuals or groups in small colonies hibernate, typically from October to March (Roer 1989; Kuhner-Ryser 1990), though it may continue until the first week of May (Blackmore 1964). Temperature-sensitive radio transmitters have revealed that bats enter torpor when the ambient temperature dropped below 6 °C (Hopkirk and Russ 2004).

1.4 Supporting habitat

The habitat required to maintain populations of Leisler's Bats in England is a combination of the habitat required for roosting, including maternity roosts, temporary roosts and hibernation sites, and that required for foraging and dispersal.

Roost requirements

Leisler's Bats are considered to be highly dependent on tree roosts in mainland Europe (Marnell and Presetnik 2010), but will commonly use buildings in England and Ireland, particularly when forming maternity colonies (Allen and others 2000; BCT 2010; Dietz and Keifer 2016; O'Sullivan 1994). They will use a wide range of roosts and a colony will change roosts frequently, splitting temporarily into several sub-groups, thus requiring a close network of suitable roosting opportunities within an area.

Tree roosts are rarely recorded in England, but this is likely to be due to the difficulty of detecting tree roosts as opposed to trees not being used by Leisler's Bats for roosting.

Tree roosts in Ireland are used throughout the year, but particularly for hibernation: roosts in deciduous trees are used almost exclusively after November. Russ and others (In Prep)

found Leisler's Bats in Northern Ireland favoured roosts in Oak *Quercus* spp., followed by Beech *Fagus sylvaticus*, with the most common roosting feature being splits within tree branches. Fifty percent of the roosts identified were on forest edges and paths, all identified roosts were within 200 m of a woodland edge.

In a study of tree roosts in Białowieża forest, eastern Poland, Leisler's Bats showed a preference for cavities at 19 m or higher from the ground, in open surroundings, with small entrances (less than diameter of a Stone or Pine Marten's head) and natural cavities with more than one entrance as opposed to Woodpecker holes, indicating roost choice is heavily influenced by protection from predators (Ruczyński and Bogdanowicz 2005). Oak and Ash were selected over Hornbeam and Alder with Oak preferentially used when average ambient temperatures were lower and during pregnancy and lactation (Ruczyński and Bogdanowicz 2008). Dying trees were selected over healthy trees indicating the importance of mixed age woodland for this species.

In buildings, these bats have been found around the gable ends in lofts, between tiles and underfelt, under ridge tiles, above large soffit boards, behind hanging tiles, under loft floor insulation, behind window shutters, within cracks and in disused chimneys and have shown preferences for buildings with roofing felt and stone walls and an avoidance of brick buildings (BCT 2010; Dietz and Keifer 2016; Lundy and others 2011; Russ and others In Prep).

In Ireland, Leisler's Bats have the most specific roosting habitat requirements of all Irish bat species, selecting areas of woodland and freshwater for roosting whilst avoiding areas of mixed agriculture, arable land and conifer woodland (Lundy and others 2011).

Leisler's Bats have also occasionally been found in caves, tunnels and buildings during the hibernation period (BCT 2010; McAney 2006) and will also use bat boxes, particularly outside the maternity period and where tree roosting resources may be limited, such as within coniferous forests (Aughney 2008; Collin 1995; Russ and others In Prep). A Northern Ireland radiotelemetry study (Hopkirk and Russ 2004) recorded most Leisler's Bat hibernacula in mature deciduous trees (notably in splits in Oak and Beech, although rot holes and exfoliating bark were also used). Both tree and building roosts were used from August to early November, but thereafter roosts were exclusively in trees.

Leisler's Bats are able to respond to negative changes in their environment by using roosts previously considered less suitable. For example, there is a significant difference in the selection of roosting habitat between managed and pristine areas of Białowieża Forest (Ruczyński and others 2010). Within the pristine forest, there was a strong preference for roost trees located within old deciduous stands (greater than 100 years), whereas in the managed part of the forest old, wet woodland was preferred while all medium and young forest stands were avoided. However, the level of flexibility these bats can exhibit is unknown.

Foraging habitat requirements

Leisler's Bats feed on the wing on small and medium sized insects including Diptera (flies) – particularly Chironimids (midges) and Scathophagidae (dung flies) – Lepidoptera (moths), and Coleoptera (beetles) (Shiel and others 1998; Waters and others 1999).

Habitat associations of foraging bats are difficult to define, but radio-tracking studies have found that foraging activity is mostly focussed over open areas, particularly pasture, open water and riparian habitats, but it may also extend into woodland, along woodland margins and tree-lined roads (Shiel and Fairley 1999; Shiel and others 1999; Waters and others 1999). Improved grassland does not appear to be favoured in Northern Ireland (Russ and Montgomery 2002), but it is used during the pre-hibernal period (Russ and others In Prep). Lundy and others (2011) found Leisler's Bats in Ireland were associated largely with broadleaved woodland, mixed woodland and riparian habitats and small amounts of urbanisation. Areas of peatland and heavily urbanised areas were avoided. No seasonal variation in habitat use was found by Russ and others (2003). Shiel and Fairley (1998) found no overall habitat preference for Leisler's Bats in Ireland except for streetlights. Mathews and others (2015) also found Leisler's Bats to favour lit areas of roadside, presumably to take advantage of prey species around mercury vapour and high-pressure sodium streetlights.

The apparent diversity of habitats exploited by foraging Leisler's Bats may relate to their need to search out suitable insect prey at heights of up to 150 m. Here, patterns of insect distribution may be as much influenced by such factors as air movements and temperature fluctuations as by gross habitat type at ground level (Russ and others 2003). Thus, although habitat associations may give an indication of the foraging requirements of Leisler's Bats, especially in uniform habitats covering a large area (such as cattle pasture), it is likely that other factors play a more important role in influencing insect movements and determining gross habitat selection (Russ and Montgomery 2002).

Despite the fact that Leisler's Bats will forage high above the ground, when light levels are high on emergence from roosts, they tend to follow linear landscape features such as hedgerows (Russ and others 2003), indicating the importance of these features within the landscape. It is likely that roosts that are located close to these linear elements will be selected.

1.5 Ecosystem context

The range of Leisler's Bats extends from western Europe to central and southern Asia. They are distributed throughout Europe except in Iceland, northern Scandinavia and northern Russia. They are considered migratory in Europe (Dondini and others 2013) but thought to undergo only local dispersal within their summer range to mate and hibernate in Ireland (Russ and others In Prep; Shiel and others 1999).

Molecular evidence indicates that the British and Irish populations are a separate lineage from that found in the rest of Europe and that there is only limited contemporary gene flow between Britain, Ireland and continental Europe (Boston and others 2015).

Leisler's Bats are widely distributed through central and southern England, but rarer in the north and south-west. They are rare throughout Wales, though with a concentration of records in the south-east. Populations are confined to the south-west in Scotland (JNCC 2013). They are common and widespread in Ireland, which appears to present a stronghold for the species (Lundy and others 2011).

Leisler's Bats occupy a similar ecological niche to Noctule Bats (*N. noctula*), sharing comparable flight styles, activity patterns and habitat preferences and similarities in behaviour and echolocation patterns means the two species are often confused. The relative abundance of Leisler's Bats in Ireland may be a reflection of the absence of Noctule Bats as a potential competitor, although there is a lack of evidence to support this. Ruczyński and others (2016) found no evidence of temporal segregation between Noctule and Leisler's Bats in Białowieża forest, eastern Poland, but did not investigate spatial segregation.

2. Units

2.1 Natural range and distribution

Square kilometres (km²).

2.2 Population

The number of adult individuals.

2.3 Habitat for the species

Square kilometres (km²). This metric has been used in Article 17 reporting and for range estimations.

3. Evidence

Our confidence in the available evidence is codified as either High, Moderate or Low, based on the quality of the evidence, its applicability and the degree of consensus around it.

The matrix in Figure 1 is used to assess the confidence level assigned to blocks of evidence. White = High confidence; Light blue = Moderate confidence and Dark blue = Low confidence.

| | | |
|--------------------------------------|-------------------------------------|-------------------------------------|
| Limited evidence Strong agreement | Medium evidence Strong agreement | Robust evidence Strong agreement |
| Limited evidence Medium agreement | Medium evidence Medium agreement | Robust evidence Medium agreement |
| Limited evidence Weak agreement | Medium evidence Weak agreement | Robust evidence Weak agreement |

Figure 1 Matrix used to assign confidence to blocks of evidence © Mastrandrea and others 2010.

Quality of evidence is defined as follows:

- Robust evidence is that which has been reported in peer-reviewed literature, or other reputable literature, from well-designed experiments, surveys or inventories that shows signs of being applicable generally.
- Medium evidence is that reported from well-designed experiments, surveys or inventories but from only one or a small number of sites, with uncertainty over its more general applicability, or is correlational or circumstantial evidence.
- Limited evidence includes ‘expert opinion’, based on knowledge of ecological factors that plausibly suggest an effect, but there is no circumstantial or direct evidence available.

Agreement is defined as follows:

- Strong agreement is consensus across the literature and amongst those with expertise on the habitat or species.
- Medium agreement is common consensus across the literature and amongst experts but there are some differing papers or reports and/or some differences of opinion.

- Weak agreement is little consensus across the literature and amongst experts and, possibly, many different findings and/or opinions.

3.1 Current situation

Natural range and distribution

Leisler's Bats are widely distributed through central and southern England, but rarer in the north and south-west.

Our knowledge of the species' English range is based on bat detector data and known records and has been calculated as 68,353 km², based on 20 km kernels around all known records obtained since 1995 (Mathews and others 2018). Changes from heterodyne to broadband acoustic bat detectors have increased the frequency of records in recent years, but an unknown number may relate to misidentified Nyctaloid bats as considerable overlap in the call parameters with Noctule and Serotine (*Cnephaeus serotinus*) makes accurate identification difficult. Many acoustic records are not supported by regional records of bats identified in the hand or by molecular analysis of droppings, raising doubts about their validity (Mathews and others 2018) and raising considerable uncertainty in our range estimate.

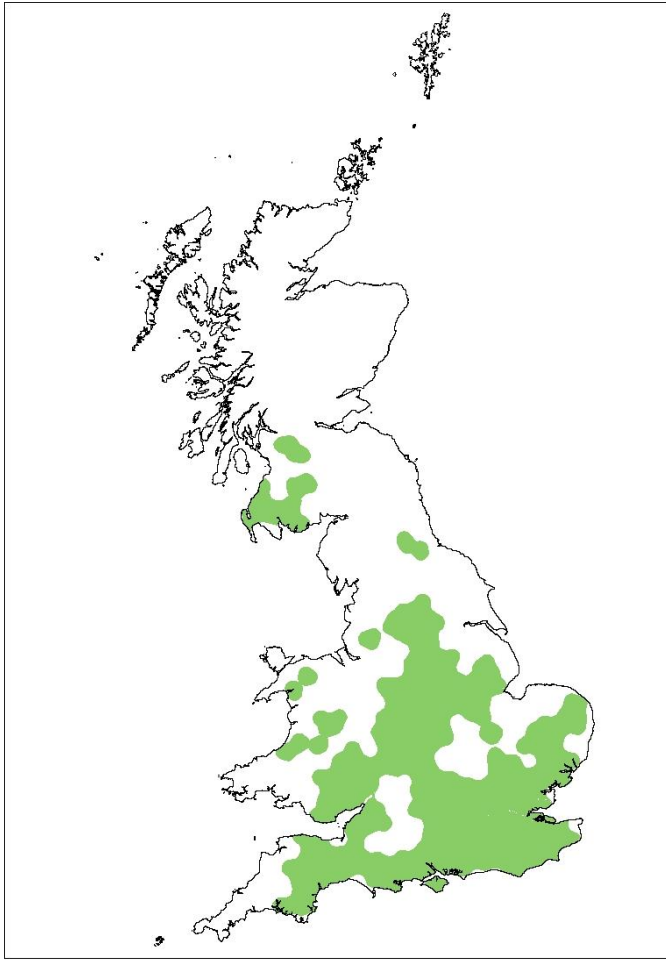


Figure 2 Species distribution map for Leisler's Bat, based on presence data 1995-2016, Mathews and others (2018). © Fiona Mathews 2025.

Confidence: Low.

Population

The current population of Leisler's Bats in England is unknown (Mathews and others 2018). Our only available estimate of 9,750 individuals, made by Harris and others (1995) using expert opinion and taking into account the ratio of Leisler's roosts to Pipistrelle roosts or the ratio of Leisler's Bats to Serotine, has very poor reliability.

There is currently insufficient data collected for the National Bat Monitoring Program to allow calculation of UK population trends, with the exception of Northern Ireland, where there has been a statistically significant increase in the population since 2010 based on Bat Conservation Ireland's Leisler's Bat Car Survey data (Bat Conservation Ireland 2025).

Other sources: Boston and others 2012.

Confidence: Low.

Habitat for the species

An estimated 68,353 km² of suitable habitat exists in England (Mathews and others 2018; JNCC 2019). The estimate is derived by including all of the area within the species range with the exception of montane habitat, considered unlikely to support maternity roosts. It is considered very unlikely that all of this estimated area is good quality habitat for Leisler's Bats.

Confidence: Low.

3.2 Historical variation in the above parameters

The numbers of Leisler's Bats in England may have declined as roost availability has declined, agricultural management has intensified, and woodland management has changed over the years.

Roost availability in buildings has declined as a result of renovation and exclusion of bats by humans (Stebbing 1995; Mitchell-Jones 2010) and mortality from the use of remedial timber treatments (Mitchell-Jones and others 1989).

Leisler's Bats forage over open areas, but agricultural intensification (notably the widespread use of insecticides) has reduced invertebrate prey abundance and diversity. Intensification has also resulted in a decline in habitat heterogeneity which has led to the loss of hedgerows and woodland edge habitat (Robinson and Sutherland 2002; Stoate and others 2001). This is likely to have resulted in a decrease in optimal habitat for Leisler's Bats through decreased prey, connectivity in the landscape and roosting opportunities.

Given its association with woodland for both roosting and foraging, the Leisler's Bat is likely to be vulnerable to woodland loss and to poor quality woodland management. In some regions up to 30% of broadleaved woodland has been lost since 1945 due to forest clearance, conifer conversion and urbanisation (Stebbing 1988). Although in the last few decades there has been more creation, woodland covers just 13.5% of the UK but that figure falls to 10.3% for England (Woodland Trust 2025). Only 7% of native woodland is in good ecological condition, with inappropriate management a particular problem in England (Woodland Trust 2021).

Conversely, Leisler's Bats have been found to be associated with small amounts of urbanisation (Lundy and others 2011) and have been found to favour lit areas of roadside, presumably to take advantage of prey species around mercury vapour and high-pressure sodium streetlights (Mathews and others 2015). It is unclear therefore whether urbanisation may have benefited this species in some areas, or whether it is just adapting to new habitat.

Natural range and distribution

There is no evidence of a significant contraction in range in the last one hundred years. The current range has increased from the historical range, although it is accepted this probably relates to the use of modern broadband bat detectors which are able to detect more calls.

At the onset of the 20th century, limited records meant Leisler's Bats were only known in the Avon Valley, Gloucestershire, Warwickshire, Worcestershire, Cheshire and the West Riding of Yorkshire (Barrett-Hamilton and Hinton 1910-1921).

Records analysed for the Second Report by the United Kingdom under Article 17 (JNCC 2007) showed a UK range (1980-2006) of 88,618 km². The Third Article 17 report (JNCC 2013) gave a UK range (2007-2012) of 128,027.72 km², an increase of 44.5%, with increases being particularly notable in the north and west. Neither the Second nor Third report provided a range specific to England. The Fourth Article 17 report (JNCC 2019) provided both a UK (94,224 km²) and an England (68,353 km²) range (2013-2018), the latter adopting the estimate of Mathews and others (2018).

The apparent increase in range between the Second and Third reports is believed to be the result of increased bat detector survey efforts, particularly as part of the National Bat Monitoring Programme, though the possibility of actual range extension cannot be ruled out (JNCC 2013). For the 2019 report (JNCC 2019) a new, more robust method of calculating range was used, following the method outlined in Mathews and others (2018). It is based on presence data collected between 1995-2016, although areas that contain very isolated records may not have been included in the area of distribution. Although the estimated range is smaller than the 2013 figure, there is consensus that this does not represent a real reduction in range.

Range is currently considered to be stable (Mathews and others 2018; JNCC 2019).

Confidence: Low.

Population

The historical size of the population of Leisler's Bats is not known.

Habitat for the species

There is considerable potential for the historical habitat area to be greater than it is now given habitat changes through loss of woodland and agricultural intensification, particularly over the past one hundred years. However, there is no data available on the loss of suitable habitat.

3.3 The future for the species and its conservation

Whilst there is little confidence in our knowledge about which factors may limit the distribution of Leisler's Bats within England, they are likely to be vulnerable to the loss of roosting opportunities in woodland and buildings through changing woodland management, reduction in total woodland area and amount of standing deadwood, building demolition, alterations and changes in construction methods. Changes in agricultural practices may have important consequences for the bats' foraging opportunities. All of these factors are likely to have cumulative impacts on populations.

Sympathetic woodland management is needed to maintain and enhance the structural diversity of woodlands in order to provide a range of different roosting opportunities, variation in temperature and humidity and abundant insect prey. Steps are needed to build in space for roosts within buildings at the design stage, otherwise roosting resource in buildings will slowly decline (Mitchell-Jones 2010).

The potential impacts of climate change are uncertain. Insects are highly influenced by local climatic conditions such as temperature and humidity (for example, Wagenhoff and others 2014). Any rise in temperatures could result in increased availability of aerial insects and potentially an increase in reproductive success among Leisler's Bats, although an increased occurrence of droughts could have a negative impact on those populations which have a preference for aquatic/riparian habitats for feeding and of increased rainfall/cloud cover more generally. As a result of climate change, mismatching of timings of key prey emergence and the phenology of bat species eating those prey, could be a major determining factor in the future survival of many species, under certain climate scenarios, including Leisler's Bat (Visser and Both 2005). Warmer winters could potentially affect the hibernation of Leisler's Bats as they are likely to wake more often. If insect abundance does not increase in response to warmer temperatures, it is likely to be detrimental to Leisler's Bat populations as they will be unable to replenish their reserves used from waking more frequently in the winter months.

Research is needed into the impacts of anthropogenically-induced mortality (wind turbines, vehicles etc) on populations as it is unclear if these may cause significant mortality. Leisler's Bats have a high risk of collision with wind turbines as they fly and forage in open areas and are known to be killed by wind turbines in Europe (Rodrigues and others 2014; Rydell and others 2010).

The residues of antiparasitic drugs used in cattle and sheep eliminate insects that breed in dung and may have conservation implications for Leisler's Bat, which has a major pastoral prey component in its diet (McAney 2006).

Natural range and distribution

The current range and distribution should be at least maintained in order to conserve populations of Leisler's Bat in England; that is there should be no further loss of natural populations. The current range is considered large enough to support a favourable

population and be resilient to any stochastic events within it, but insufficient data are available to conclude whether it is currently at a favourable level.

Confidence: Low.

Population

The estimate of the population of Leisler's Bats in England of 9,750 individuals is considered to be both an underestimate and likely to be too low to support the future maintenance of populations and genetic diversity. Over the estimated range of 68,353 km², the average density would be 0.14 individuals per square kilometre, which appears to be too low based upon the number of records for the species compared to its range (Howe, pers. comm).

We have identified three options for defining a favourable population, each using information on populations elsewhere within the species' range:

- 1) In the German state of Brandenburg, a density of 4.2 females per km² has been recorded (Dietz and Keifer 2016). Applying this density to the current range in England equates to approximately 287,000 females in England. Doubling this to account for males, suggests a potential population of 574,000 individuals in England (figure rounded).
- 2) Leisler's Bats have been documented flying up to 17.2 km from their roost in mainland Europe, with the maximum distance from a roost flown by adult females appearing to vary depending on whether they had bred that year or not: 17.2 km non-breeding female (six tracked nights), 7.5 km breeding female (five tracked nights), n=1 bat in both cases (Schorcht 2002). Waters and others (1999) found a mean maximum distance of 4.2 km from two maternity roosts in England (eight adult female bats tracked from two roosts, breeding status unknown). It is important to note that individual bats from a colony could commute/forage in all directions from their roost. These figures suggest approximately one to two colonies may be present within an area of 100 km².

Using data on colony size it is possible to estimate the number of bats within 100 km². Boston and others (2012) studied microsatellite markers to examine identity and attempt to estimate relatedness among females within a nursery colony in Pr cy-sous-Thil, north-eastern France over two years. They estimated approximate colony sizes of 139 and 205 individuals in 2004 and 2005 respectively with a population estimated to be between 316 and 1634 individuals in the region. In contrast, Mathews and others (2018) found a median pre-breeding roost size in Britain of 64 bats, although this is based on only two roosts.

By applying the minimum colony size figure (139) from France (the larger colonies here may be thriving or favourable) to the known range in England (68, 353 km²) we estimate a potential minimum English population of 95,000 individuals (figure rounded).

- 3) The population of Leisler's Bats in Ireland, a country generally considered to be the stronghold for the species, is estimated to be 63,000 to 113,000 individuals (NPWS 2013). The population in Ireland has been monitored since 2004, with records obtained by detecting bat calls from a moving vehicle along set transects.

The area of suitable habitat for Leisler's Bats is estimated as 48,806 km² (NPWS 2013), giving a population density of 1.3 to 2.3 individuals per kilometre square. A density of 1.3 individuals per square kilometre would give an estimated population of 89,000 in England.

The population of Leisler's Bats in the Republic of Ireland is considered to be favourable (NPWS 2013), therefore it is considered that an estimated population of 89,000 in England would be sufficient for the future maintenance of populations and diversity. It is however important to highlight the lack of knowledge surrounding this species in England as there may be subtle differences between Irish and English populations that could result in this estimate being unrealistic.

This third option is the preferred option for obtaining a favourable population estimate for England because it uses structured monitoring data drawn from across a whole country rather than from a local study. The rounded estimate of a favourable population for England is thus 89,000 bats.

Confidence: Low.

Habitat for the species

The most recent Article 17 report (JNCC 2019) specifies that there is thought to be a sufficient amount of habitat in the UK to support a viable population of the species. However, given the proposed favourable population is a tenfold increase on the current population estimate it is likely there will need to be an increase in suitable habitat, including foraging and roosting resources, in order to achieve the proposed favourable population level. However, there is no clear indication of the level of habitat increase required. Similarly, it is also likely that there will need to be an increase in favourable habitat management, along with a better understanding of niche differentiation with other bat species.

Climate change will potentially result in changes in the vegetation communities and insect populations and Leisler's Bats will need sufficient, connected favourable habitat in order to respond and adapt favourably to these changes.

Confidence: Low.

3.4 Constraints to expansion or restoration

To maintain or increase the current populations in England there would need to be a reversal in the decline and fragmentation of important foraging and roosting habitats, continued favourable improvements in habitat management and continued legislative protection to protect roosts.

Increasing the quality of foraging habitat and availability of roosting opportunities will help consolidate existing range and it is possible that we may see the range of Leisler's Bat increase and extend further north (Rebelo and others 2010).

Emphasis should be placed on protecting and increasing areas of semi-natural deciduous woodland with suitable edge enhancement, enhancing pasture foraging areas through sympathetic land management to increase insect prey and enhancing and creating hedgerows to increase foraging resources and improve and strengthen commuting routes between roost sites and foraging areas. Riparian habitat and open water should also feature in the habitat mosaic where possible, given the importance of this habitat for foraging. Habitat improvements would need to be carried out at the landscape scale in order to create connected ecological networks within or along which animals can move in response to environmental factors such as climate change.

The amount of particular habitat types within the surrounding landscape seems to be more important for bats (Fuentes-Montemayor and others 2011, Treitler and others 2016) rather than the way it is managed as such (Froidevaux 2017), although it is clear certain management regimes will have negative effects for bats. Therefore, focus should be placed on the conservation and creation of essential landscape elements at a landscape scale in order to benefit whole populations.

Breaking up large areas of homogenous habitat into a landscape mosaic should be beneficial to all bats as it increases the available edge habitats which provide food, dispersal routes and shelter. A decrease in the linear landscape features connecting roosting and foraging areas may isolate populations, or limit access to suitable foraging habitats. The maintenance of a mosaic of natural habitats with good connectivity at the landscape scale will also be beneficial to many other species in England.

There is no clear evidence for competition between Noctule and Leisler's Bats (Ruczyński and others 2016), but given the similarity in niches it is possible that an increase in the population of Leisler's Bats may impact upon Noctule or even other bat species populations. Given that the proposal to increase Leisler's Bat populations is through the creation and improvement of habitat, it is considered likely that Noctule and other bat species would also benefit from this, thus reducing any potential impacts through competition.

Confidence: Low.

4. Conclusions

4.1 Favourable range and distribution

It is unknown whether the current range (68,353 km²) represents the favourable range of the Leisler's Bat. The distribution of Leisler's Bat is thought to be widespread across England, which could indicate sufficient availability of roosts and adaptability to foraging in a range of habitats. However, the confidence in the occupied current range is poor given the uncertainties surrounding the accuracy of data. There is no evidence to suggest that this figure is not favourable across England and therefore it should be maintained at a minimum, however further work is urgently needed to improve accuracy of the data. Further review of the favourable range will be required as further data become available.

4.2 Favourable population

Based on information on population densities in Ireland, a favourable population of Leisler's in England is considered to be 89,000 pending further study.

The existing population estimate of Leisler's Bat in England of 9,750 is considered to be too low to represent a favourable population but is also considered to be an underestimate.

Further information is required on the density and size of roosts and variability in occupancy across geographical or habitat gradients within the range.

4.3 Favourable supporting habitat

The area of supporting habitat for the Leisler's Bat should be no less than 68,353 km² to ensure sufficient habitat remains available to the species. Measures should be taken to protect and enhance essential landscape elements within this area to achieve favourable population status. It is recommended further study is undertaken to investigate the required area for supporting habitat more comprehensively.

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