

NPWS

**Conservation objectives supporting document –
Lesser Horseshoe Bat (*Rhinolophus hipposideros*)**

Version 2

June 2024

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Please note that this document should be read in conjunction with the Site-specific Conservation Objectives documents published by National Parks and Wildlife Service for Special Areas of Conservation for which Lesser Horseshoe Bat (*Rhinolophus hipposideros*) is a Qualifying Interest.

Citation: NPWS (2024) Conservation objectives supporting document – Lesser Horseshoe Bat (*Rhinolophus hipposideros*) Version 2. Conservation Objectives Supporting Document Series. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Dublin, Ireland.

1. Introduction

1.1 Lesser Horseshoe Bat (*Rhinolophus hipposideros*)

Lesser Horseshoe Bat (*Rhinolophus hipposideros* Bechstein) (EU Habitats Directive species code 1303) is protected by European legislation through its listing on Annex II and Annex IV of the EU Habitats Directive (Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora). In Ireland, the species is also protected under the Wildlife (Amendment) Act, 2000.

Lesser Horseshoe Bat is widely distributed through western, central and southern Europe and as far east as Kashmir and through northern Africa to Arabia, Ethiopia and Sudan (Mitchell-Jones *et al.*, 1999). Ireland represents the most northerly and westerly limits of the species' distribution (Roche, 2001) and here it is confined to six west coast counties: Mayo, Galway, Clare, Limerick, Cork and Kerry (McAney, 1994). A single animal has also been recorded in Co. Roscommon in 2004 (B. Keeley, *pers. comm.*).

Although Lesser Horseshoe Bat has declined in many European countries, Ireland is considered a stronghold for the species (Marnell *et al.*, 2019). Of the nine species of bat known to be established in Ireland, the Lesser Horseshoe Bat is the only member of the Rhinolophidae; the eight other species belong to the Vespertilionidae family. Lesser Horseshoe Bats differ from the Vespertilionidae bats in that they have a number of folds of skin in the shape of a horseshoe around their nostrils called a noseleaf, with which it projects its echolocation call. Lesser Horseshoe Bats hang freely by their feet and wrap their wings around their bodies when at rest. They feed close to the ground, gleaning their prey from branches and stones. They often carry their prey to a perch to consume, leaving the remains beneath (Marnell *et al.*, 2022).

Summer roosting sites are often in the attics of old or derelict buildings. The bats are faithful to a roost site and will return to the same site each year. Hibernation sites are typically caves, souterrains, cellars and icehouses (O'Sullivan, 1994; Kelleher, 2004). In Ireland, the EU Habitats Directive Annex I habitat 'Caves not open to the public' (EU habitat code 8310) is an important habitat for the species, predominantly in winter (see Section 1.2).

Lesser Horseshoe Bats forage on flying insects predominantly in deciduous woodland and riparian vegetation normally within a couple of kilometres of their roosts (Bontadina *et al.*, 2002; Motte and Libois, 2002). The bats rely on linear landscape features (*e.g.* treelines, stonewalls and hedgerows) to navigate and commute from roosts to feeding sites and they are reluctant to fly out in the open (Schofield, 2008).

Lesser Horseshoe Bats are sensitive to disturbance and normally do not occupy the same buildings as humans. Loss of roosting sites due to deterioration or renovation of old buildings, loss of commuting routes linking roosts to foraging sites and unsympathetic management of foraging sites are the major threats to this species (McAney, 1994; McGuire, 1998; Roche, 2001).

In Ireland, the Overall Conservation Status of Lesser Horseshoe Bat is assessed as Unfavourable - Inadequate. The population overall is doing well; monitoring has demonstrated significant increases in numbers in the core areas. Over much of its distribution, both range and area of suitable habitat have remained stable. In Limerick and North Kerry, however, worrying declines in habitat, and

consequently in range, have been observed. These are considered likely to continue without significant intervention. For these reasons, Habitat, Range and their associated Future prospects, which were all considered to be Favourable in the last Article 17 report, are now considered Inadequate, and the Overall Status of this species is assessed as Inadequate and declining (NPWS, 2019a).

1.2 Caves not open to the public (habitat code 8310)

The EU Habitats Directive habitat 'Caves not open to the public' (habitat code 8310) is defined in the Interpretation Manual of EU Habitats (European Commission, 2013) as "Caves not open to the public, including their water bodies and streams, hosting specialised or high endemic species, or that are of paramount importance for the conservation of Annex II species (*e.g.* bats, amphibians)". There is little evidence that Irish caves support much in the way of specialised troglobite fauna, or highly endemic cave species. However, Lesser Horseshoe Bat occurs in caves in Ireland. Consequently, in practice, this EU habitat is confined in Ireland to caves not open to the public that host important numbers of Lesser Horseshoe Bat (NPWS, 2019b).

Maternity (summer) roosts do not occur in caves in Ireland; however, individual Lesser Horseshoe Bats may turn up in caves at any time of year. From September to November, bats leave summer roosts and go to hibernation roost sites for the winter. These hibernation sites are structures that maintain a constant low temperature throughout the winter, typically caves, but also souterrains, cellars and icehouses (O'Sullivan, 1994).

Lesser Horseshoe Bats require cool, stable temperatures and minimal disturbance for winter hibernation and suitable 'caves not open to the public' (habitat code 8310) were selected where available. Sixteen of the most important caves are protected within nine Special Areas of Conservation (SACs), (see Section 1.3).

Overall, the future prospects for this habitat are considered to be good. Although the overall conservation assessment for the Lesser Horseshoe Bat in Ireland is now Inadequate due to a small contraction in range, these concerns do not relate to areas with bats in caves. The Overall Status of Caves not open to the public (habitat code 8310) is Favourable and stable, as it has been over the last two reporting periods. Many vulnerable bat caves are already protected from disturbance through grilling. Regular monitoring is underway, and if further vulnerable cave sites are identified, these will also be grilled. (NPWS, 2019b).

1.3 SACs for Lesser Horseshoe Bat and caves not open to the public

A total of 42 SACs have been designated for the Annex II species Lesser Horseshoe Bat (1303), of which nine have also been selected for the Annex I habitat 'Caves not open to the public' (8310). The list of SACs is presented in Table 1. The distribution of SACs selected for Lesser Horseshoe Bat in Ireland and the distribution of the nine SACs selected for caves not open to the public, based on the centroids of the SACs, is presented in Figure 1.

Table 1 Special Areas of Conservation (SACs) selected for Lesser Horseshoe Bat (*Rhinolophus hipposideros*) (EU species code 1303) and for 'Caves not open to the public' (EU habitats code 8310)

| Site Code | Site Name | 3130 | 8310 |
|-----------|---|------|------|
| 000030 | Danes Hole, Poulnalecka SAC | 3130 | 8310 |
| 000032 | Dromore Woods and Loughs SAC | 3130 | |
| 000037 | Pouladatig Cave SAC | 3130 | 8310 |
| 000054 | Moneen Mountain SAC | 3130 | |
| 000057 | Moyree River System SAC | 3130 | 8310 |
| 000064 | Poulnagordon Cave (Quin) SAC | 3130 | 8310 |
| 000090 | Glengarriff Harbour and Woodland SAC | 3130 | |
| 000174 | Curraghchase Woods SAC | 3130 | |
| 000238 | Caheglassaun Turlough SAC | 3130 | |
| 000252 | Coole-Garryland Complex SAC | 3130 | |
| 000286 | Kiltartan Cave (Coole) SAC | 3130 | 8310 |
| 000297 | Lough Corrib SAC | 3130 | |
| 000299 | Lough Cutra SAC | 3130 | |
| 000353 | Old Domestic Building, Dromore Wood SAC | 3130 | |
| 000364 | Kilgarvan Ice House SAC | 3130 | |
| 000365 | Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC | 3130 | |
| 000474 | Ballymaglancy Cave, Cong SAC | 3130 | 8310 |
| 000527 | Moore Hall (Lough Carra) SAC | 3130 | |
| 000606 | Lough Fingall Complex SAC | 3130 | |
| 001312 | Ross Lake and Woods SAC | 3130 | |
| 001342 | Cloonee and Inchiquin Loughs, Uragh Wood SAC | 3130 | |
| 001774 | Lough Carra/Mask Complex SAC | 3130 | |
| 001926 | East Burren Complex SAC | 3130 | 8310 |
| 002010 | Old Domestic Building (Keevagh) SAC | 3130 | |
| 002041 | Old Domestic Building, Curraglass Wood SAC | 3130 | |
| 002081 | Ballinafad SAC | 3130 | |
| 002091 | Newhall and Edenvale Complex SAC | 3130 | 8310 |
| 002098 | Old Domestic Building, Askive Wood SAC | 3130 | |
| 002157 | Newgrove House SAC | 3130 | |
| 002158 | Kenmare River SAC | 3130 | |
| 002173 | Blackwater River (Kerry) SAC | 3130 | |
| 002179 | Towerhill House SAC | 3130 | |
| 002245 | Old Farm Buildings, Ballymacrogan SAC | 3130 | |
| 002246 | Ballycullinan, Old Domestic Building SAC | 3130 | |
| 002247 | Toonagh Estate SAC | 3130 | |
| 002314 | Old Domestic Buildings, Rylane SAC | 3130 | |
| 002315 | Glanlough Woods SAC | 3130 | |
| 002316 | Ratty River Cave SAC | 3130 | 8310 |
| 002317 | Cregg House Stables, Crusheen SAC | 3130 | |
| 002318 | Knockanira House SAC | 3130 | |
| 002319 | Kilkishen House SAC | 3130 | |
| 002320 | Kildun Souterrain SAC | 3130 | |

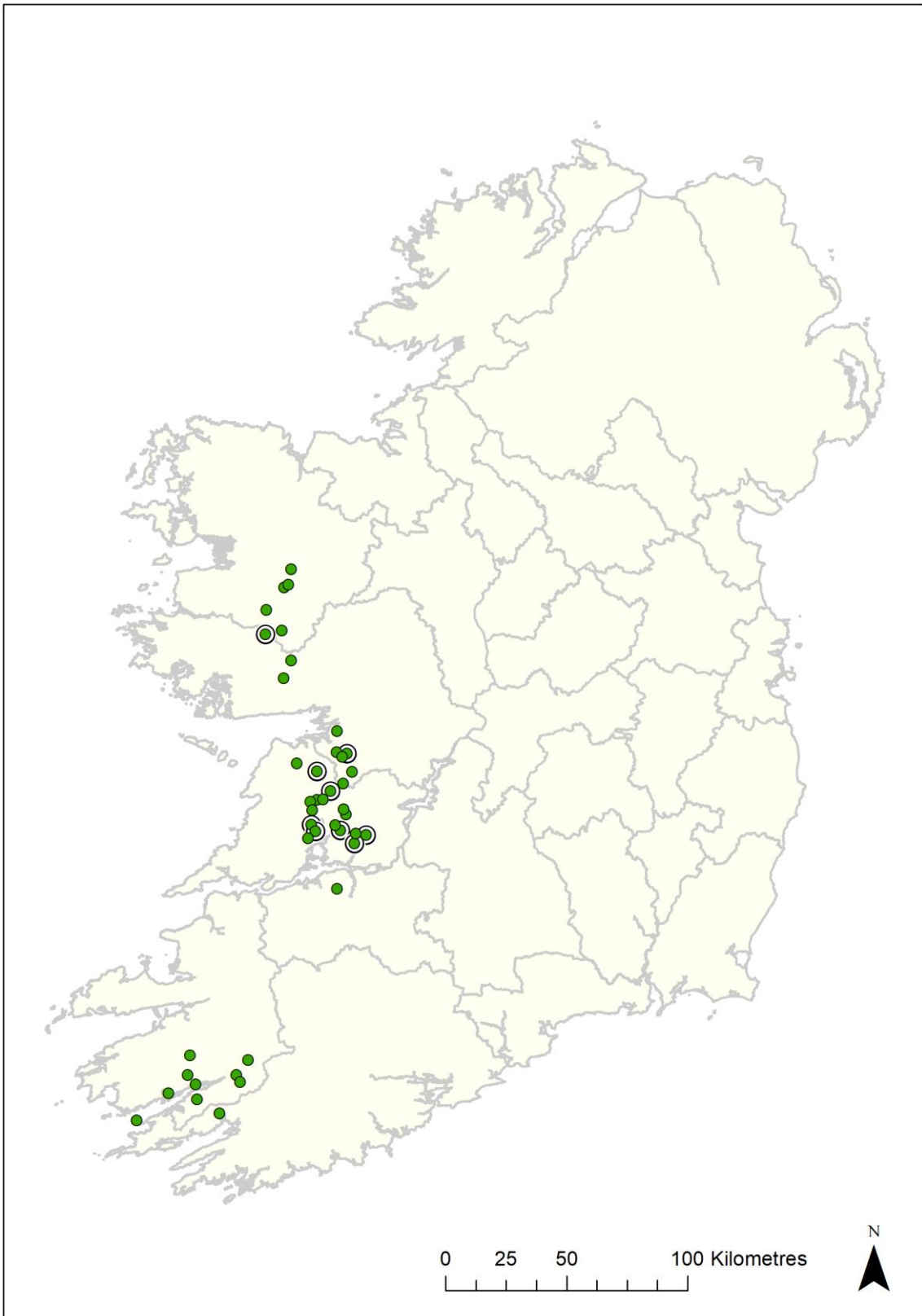


Figure 1 The distribution of the 42 Special Areas of Conservation (SACs) selected for Lesser Horseshoe Bat (*Rhinolophus hipposideros*) (EU species code 1303) and the nine SACs selected for caves not open to the public (EU habitat code 8130) in Ireland. Based on the centroids of the SACs designated for Lesser Horseshoe Bat (green dots) and caves not open to the public (white circles).

2. Conservation objectives

Achieving Favourable Conservation Status (FCS) is the overall objective to be reached for all Annex I habitat types and Annex II species of European Community interest listed in the Habitats Directive 92/43/EEC (European Commission, 2013). It is defined in positive terms such that a habitat type or species must be prospering and have good prospects of continuing to do so.

A site-specific conservation objective aims to define the Favourable conservation condition of a habitat or species at site level. The maintenance of habitats and species within sites at Favourable condition will contribute to the maintenance of Favourable Conservation Status of those habitats and species at a national level.

Conservation objectives for species are defined using attributes and targets that are based on parameters as set out in the Habitats Directive for defining Favourable Status, namely population, range, and habitat for the species. This conservation objectives supporting document explains and provides context for the attributes and targets set for Lesser Horseshoe Bat.

Conservation objectives for habitats are defined using attributes and targets that are based on parameters as set out in the Habitats Directive for defining Favourable Status, namely area, range, and structure and functions.

As the habitat 'Caves not open to the public' (habitat code 8310) is integrally linked to Lesser Horseshoe Bat as part of the habitat for the species, separate conservation objectives have not been set for the habitat. However, further research is required to determine the aspects of cave structure and functions (*e.g.* size, air flows, light, humidity, temperature regimes and hydrology) which are critical for bat utilisation (NPWS, 2019b).

Note that the attributes and targets for Lesser Horseshoe Bat outlined below may change/become more refined as further information becomes available.

3. Population

3.1 Population per roost

The measure used for this attribute is: Number of individual bats.

Each particular SAC was selected for Lesser Horseshoe Bat because of the presence of one or more "Qualifying roosts". The minimum qualifying standard (MQS) for an SAC roost was set as 100 bats for a summer roost and 50 bats for a winter roost. This initial figure was considered, on the basis of expert opinion, to reflect roosts of international importance. Some roosts with slightly lower numbers were also considered to be internationally important (with consequent SAC designation) because of their strategic location at the edge of the Lesser Horseshoe Bat's national range.

The number of bats varies greatly from roost to roost depending on numerous factors such as roost suitability, habitat availability in the area, landscape connectivity, etc. Numbers may also vary from year to year at a roost due to disturbance, weather and other factors. NPWS conducts annual counts at each qualifying roost. Counts are carried out in winter sites from January 1st to February 28th and in

summer sites from May 23rd to July 7th. The target number of individual bats for a roost is set as the mean over the five most recent years of available count data, but with the highest count and the lowest count removed. Just one count is taken for any given season, *i.e.* the highest available within the monitoring date range (± 1 week). This qualified mean is therefore considered a roost-specific reflection of bat numbers. A total combined count is used for any roosts that are considered paired or linked (*i.e.* the same bats move between them between years).

The target for population per roost is the qualified mean number of bats, except in certain instances:

- In some cases, the MQS target has not been achieved during recent counts, *i.e.* the qualified mean is less than the MQS, in which case the target for the particular SAC is set to 50 bats for a winter roost site and 100 bats for a summer roost site.
- In other cases, the target may be set to a number other than the qualified mean or the MQS because of factors that pertain to that particular SAC.

4. Habitat for the species

4.1 Winter roosts

The measure used for this attribute is: Condition

Condition in this instance refers to the suitability of a winter roost site to host Lesser Horseshoe Bats in numbers at or exceeding the MQS. It comprises a number of elements, any of which may interact, and which include locational context, landscape connectivity, structural integrity, microclimate, levels of artificial light at night (ALAN), level of disturbance by humans or predators and risk of catastrophic events, such as flooding (Ransome, 1990; Altringham, 1996; Schofield, 2008; Stone *et al.*, 2012; McAney *et al.*, 2013; Reiter *et al.*, 2013; Stone, 2013; Roche *et al.*, 2015).

Suitable sites in winter generally witness low levels of disturbance and have high humidity and stable temperatures. These conditions are typically met in underground structures such as souterrains, cellars, tunnels, ice houses and natural caves (including those selected as habitat 8130 'Caves not open to the public'). Hibernacula may be abandoned or numbers of bats using the site may decline in circumstances when there is a decline in condition. Examples of decline in condition may include, but are not limited to:

- increased use of an underground site by humans (*i.e.* increased disturbance)
- cave or tunnel closure
- loss of structural integrity (*e.g.* roof collapse in a souterrain)
- flooding in a cave system causing entrapment and/or drowning of bats

The target is that there is no decline in the condition of winter roosts.

4.2 Summer roosts

The measure used for this attribute is: Condition

Condition in this instance refers to the suitability of a summer roost site to host Lesser Horseshoe Bats in numbers at or exceeding the MQS. It comprises a number of elements, any of which may interact, and which include landscape connectivity, structural integrity, microclimate, levels of ALAN, level of disturbance by humans or predators and risk of catastrophic events, such as storm damage (Ransome, 1990; Altringham, 1996; Schofield, 2008; Stone *et al.*, 2012; McAney *et al.*, 2013; Reiter *et al.*, 2013; Stone, 2013; Roche *et al.*, 2015).

Suitable sites in summer generally witness low levels of disturbance, have appropriate access points for Lesser Horseshoe Bats and achieve the microclimatic conditions required for raising young. These conditions are typically met in buildings, for example stables, abandoned cottages and farm buildings, attics of large houses, large chimneys of ruined buildings, modern boiler houses, sheds and garages. Summer roosts may be abandoned or numbers using the site may decline in circumstances when there is a decline in condition. Examples of decline in condition may include, but are not limited to:

- increased use of a site by humans (*i.e.* increased disturbance)
- loss of structural integrity (*e.g.* roof deterioration)
- closure of the Lesser Horseshoe Bat access point(s)
- predator disturbance (*e.g.* domestic cat, pine marten)
- reroofing or redevelopment of the site

The target is that there is no decline in the condition of summer roosts.

4.3 Auxiliary roosts

The measure used for this attribute is: Number and condition

Lesser Horseshoe Bat populations will use a variety of roosts during the year besides the main roosts listed above. Lesser Horseshoe Bats rely on a network of sites that may include satellite, transitional and night roosts along with summer and winter roost sites, to fulfil their lifecycle requirements within a locality. Transitional roosts may be used after hibernation but prior to occupation of the maternity roost. Alternative day roosts used by a colony are known as satellite roosts; these are typically used by individuals or small clusters (Schofield, 2008). Night roosts are often situated in home core range areas and are used by the bats to minimise commuting distances between foraging bouts. Availability of night roosts within and close to key foraging areas ensures that these remain suitable for Lesser Horseshoe Bats (Knight and Jones, 2009). In addition, males may set up mating roosts in autumn and attract females to their territory (Schofield, 2008). While the largest number of individuals may be found in the summer roost and winter roost sites, a full complement of varied roosting structures is required to maintain populations and facilitate successful reproduction.

Condition in this instance refers to the suitability of an auxiliary roost site to host Lesser Horseshoe Bats. It comprises a number of elements including locational context, structural integrity,

microclimate, levels of ALAN, level of disturbance by humans or predators and risk of catastrophic events.

The target is that there is no decline in the number and condition of auxiliary roosts.

4.4 Extent of potential foraging habitat

The measure used for this attribute is: Hectares

Lesser Horseshoe Bats tend to forage in summer in broadleaved woodland and around riparian vegetation (Bontadina *et al.*, 2002; Biggane, 2003). In 2016, the Bat Conservation Trust (BCT) carried out a review of literature pertaining to mean and maximum bat foraging distances (BCT, 2016). In their review, a Core Sustainance Zone (CSZ) refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. For the BCT review, Lesser Horseshoe Bat data was available from 83 radio-tracked individuals from four separate studies. The weighted average maximum foraging distance for Lesser Horseshoe Bats was 2.02km. The BCT noted that for Annex II species there is justification for increasing the CSZ to reflect use of the landscape by all bats in a population. Some researchers have found that Lesser Horseshoe Bats normally forage in woodlands/scrub within 2.5km of their roosts (Bontadina *et al.*, 2002); thus, for each roost, a 2.5km zone is considered an appropriate distance to foraging areas for the purpose of the current SSCO targets. The 2.5km zone around each known roost is mapped and potential foraging grounds within the zone are identified and mapped for each SAC using the Forestry Inventory and Planning System (FIPS) (2007/2012) spatial dataset.

The target is that there is no significant decline in the extent of potential foraging habitat within 2.5km of qualifying roosts.

4.5 Linear features

The measure used for this attribute is: Kilometres

This species follows commuting routes from its roost to its foraging grounds. Lesser Horseshoe Bats will rarely cross open ground and are particularly averse to doing so unless it is very dark (*e.g.* Schofield, 2008). Consequently, in order to link roosting and foraging sites, linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species, most importantly within 2.5km around each roost (Schofield, 2008). Linear features such as tree lines are also sometimes used for foraging by Lesser Horseshoe Bats (Bontadina *et al.*, 2002).

The target is that there is no significant loss of linear features within 2.5km of qualifying roosts.

4.6 Light pollution

The measure used for this attribute is: Lux

Lesser Horseshoe Bats are very sensitive to light pollution and will avoid brightly lit areas. Artificial light at night at or near roosts may impact bats in a number of ways, for example, delaying emergence time after dusk, causing abandonment of roosts when exits are lit at night and/or reducing reproductive success (*e.g.* Stone, 2013). Lesser Horseshoe Bats have been found to avoid commuting along routes lit with artificial light at levels as low as 3.7 lux emanating from energy efficient LED lights (Stone *et al.*, 2012). Other lamp types producing light at similar levels have also been found to prevent commuting (Stone *et al.*, 2009). Foraging areas that become lit at night may be abandoned, thus potentially increasing energetic costs for bats and reducing reproductive success at a population level (Schofield, 2008; Stone, 2013).

The target is that there is no significant increase in artificial light intensity adjacent to named roosts or along commuting routes within 2.5km of those roosts.

5. References

- Altringham, J.D. (1996) *Bats: Biology and Behaviour*. Oxford University Press, Oxford, UK.
- BCT (2016) *Core Sustainance Zones Explained*. The Bat Conservation Trust, UK.
- Biggane, S. (2003) *The lesser horseshoe bat Rhinolophus hipposideros (Bechstein 1800) at Dromore, Co. Clare: diet, foraging activity, habitat selection and nocturnal behaviour*. Ph.D. Thesis, National University of Ireland, Galway, Ireland.
- Bontadina, F., Schofield, H. and Naef-Daenzer, B. (2002) Radio-tracking reveals that lesser horseshoe bats (*Rhinolophus hipposideros*) forage in woodland. *Journal of Zoology* **258**: 281–290.
- European Commission (2013) *Interpretation Manual of European Union Habitats - EUR 28*. DG Environment - Nature and Biodiversity, Brussels, Belgium.
- Kelleher, C. (2004) Thirty years, six counties, one species - an update on the lesser horseshoe bat *Rhinolophus hipposideros* (Bechstein) in Ireland. *Irish Naturalists' Journal* **27**: 387-392.
- Knight, T. and Jones, G. (2009) Importance of night roosts for bat conservation: roosting behaviour of the lesser horseshoe bat *Rhinolophus hipposideros*. *Endangered Species Research* **8**: 79–86.
- Marnell, F., Kelleher, C. and Mullen, E. (2022) Bat mitigation guidelines for Ireland v2. *Irish Wildlife Manuals*, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.
- Marnell, F., Looney, D. and Lawton, C. (2019) *Ireland Red List No. 12: Terrestrial Mammals*. National Parks and Wildlife Service, Department of the Culture, Heritage and the Gaeltacht, Dublin, Ireland.
- McAney, C.M. (1994) The lesser horseshoe bat in Ireland - past, present and future. *Folia Zoologica* **43(4)**: 387–392.
- McAney, K., O'Mahony, C., Kelleher, C., Taylor, A. and Biggane, S. (2013) *The Lesser Horseshoe Bat in Ireland: Surveys by The Vincent Wildlife Trust*. Irish Naturalists' Journal, Belfast, Northern Ireland.
- McGuire, C. (1998) Survey of lesser horseshoe bats *Rhinolophus hipposideros* (Bechstein) and other bat species in north Co. Clare. *Irish Naturalists' Journal* **26**: 43–50.
- Mitchell-Jones, A.J., Amori, G., Bogdanowicz, W., Krystufek, B., Reijnders, P.J.H., Spitzenberger, F., Stubbe, M., Thissen, J.B.M., Vohralik, V. and Zima, J. (1999) *The Atlas of European Mammals*. Poyser Natural History.
- Motte, G. and Libois, R. (2002) Conservation of the lesser horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study of feeding habitat requirements. *Belgian Journal of Zoology* **132(10)**: 49-54.
- NPWS (2019a) *The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments*. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill.

- NPWS (2019b) *The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments*. Unpublished NPWS Report. Edited by: Deirdre Lynn and Fionnuala O'Neill.
- O'Sullivan, P.J. (1994) *Bats in Ireland*. Irish Naturalists' Journal Special Zoological Supplement. Irish Naturalists' Journal, Belfast, Northern Ireland.
- Ransome, R.D. (1990) *The Natural History of Hibernating Bats*. Christopher Helm, Kent, UK.
- Reiter, G., Pölzer, E., Mixanig, H., Bontadina, F. and Hüttmeir, U. (2013) Impact of landscape fragmentation on a specialised woodland bat, *Rhinolophus hipposideros*. *Mammalian Biology - Z. Für Säugetierkd.* **78**: 283–289.
- Roche, N. (2001) The status of lesser horseshoe bats *Rhinolophus hipposideros* Bechstein in Co. Limerick. *Irish Naturalists' Journal* **26**: 437–484.
- Roche, N., Aughney, T. and Langton, S. (2015) Lesser Horseshoe Bat: population trends and status of its roosting resource. *Irish Wildlife Manual No. 85*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Schofield, H. (2008) *The Lesser Horseshoe Bat Conservation Handbook*. The Vincent Wildlife Trust, Herefordshire, England.
- Stone, E.L. (2013) *Bats and lighting: Overview of current evidence and mitigation guidance*. University of Bristol, UK.
- Stone, E.L., Jones, G. and Harris, S. (2009) Street lighting disturbs commuting bats. *Current Biology* **19**: 1123–1127.
- Stone, E.L., Jones, G. and Harris, S. (2012) Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats. *Global Change Biology* **18**: 2458–2465.