# NIEA, Natural Environment Division - Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland

## 1. Introduction

There are 8 regularly occurring species of bat found in Northern Ireland and all are strictly protected under the Conservation (Natural Habitats etc.) Regulations (Northern Ireland) 1995 (as amended) (known as the Habitats Regulations). They are known as a European protected species and are protected from deliberate capture, injury, killing and disturbance. Their breeding and resting places (roosts) are also protected at all times. Northern Ireland planning policy provides additional protection to bats and other legally protected species and they are material considerations in the determination of a planning application. Therefore, the likely harm to bats from a development proposal must be properly assessed, and all necessary survey information submitted, before any planning approval is granted.

NIEA, Natural Environment Division (NED) is the statutory nature conservation body for Northern Ireland and is a statutory consultee in the Northern Ireland planning system. NED provides expert advice to Northern Ireland planning authorities on the protection and conservation of bats with regard to development proposals, including wind turbines. NED also publishes survey guidelines to help standardise ecological surveys submitted alongside planning applications and to set minimum acceptable standards. NED assesses all bat surveys submitted with planning applications for wind turbine developments to ensure they comply with published guidance and enable a full assessment of the likely impact of the proposal on bats to be completed before a planning application is determined. NED will advise the planning authority on the likely harm from a development proposal to bats and on any mitigation measures which are necessary to minimise the impact of a proposal to bats, to prevent harm, and to prevent an offence from being committed under the legislation.

Wind turbine developments have the potential to cause harm to bats in several ways:

- Direct mortality through collisions with turbine blades, barotrauma and other injuries;
- Loss of, damage to, or fragmentation of commuting and foraging habitat through installation of wind turbines and associated infrastructure, such as access roads;
- Loss of, damage or disturbance to roosts;
- Displacement from foraging and commuting habitats.

There is extensive evidence from the UK and around the world of significant bat casualties from operational wind turbines and mortality from wind turbines has the potential to impact on the conservation status of bats (see Eurobats Publication No. 6, 2014 and Matthews et al, 2016).

In order to comply with legislation and planning policy and properly assess the risk to bats from wind turbine developments, appropriate surveys, including specialist bat activity surveys and, where appropriate, carcass searches, are required to be carried out at a proposed wind turbine site and submitted with any planning application for assessment.

## 2. Background/Purpose

There are several existing UK and European guidance documents regarding bat surveys for wind turbine developments available (see below) and this NED guidance is not intended as a replacement for that existing guidance but aims to provide additional clarifications and outline the minimum standards which NED expects for professional bat surveys carried out for onshore wind turbine development proposals in Northern Ireland. Where this guidance is silent on a particular topic the existing published guidance should be used.

This NED guidance applies to both proposed single wind turbine developments and wind farms. However, the survey methodologies and minimum recommended survey effort for each type of proposal differs and is outlined below.

All bat surveys for wind turbine developments should follow this guidance and all existing relevant guidance. Where submitted bat surveys do not follow the recommendations and minimum standards set out by this guidance and other relevant guidance then further information, including additional surveys, may be required before a planning application can be determined and this could cause significant delays to the project.

Where there is any doubt regarding the design of surveys for wind turbine projects the commissioned ecologist should contact NED for further advice before commencing the surveys.

## 3. Existing Relevant Guidance

*Bats and onshore wind turbines – survey, assessment and mitigation* was published in January 2019 by the three British statutory nature conservation bodies (Scottish Natural Heritage, Natural England and Natural Resources Wales) in collaboration with partners, such as the Bat Conservation Trust (BCT) and the University of Exeter (hereafter referred to as the 2019 SNH guidance). This guidance updated previous bat survey guidance on wind turbines from the BCT in 2012 (see below). However, it is intended for wind farms and does not explicitly apply to single wind turbines, although many of the recommendations are relevant. It also contains guidance on the assessment of results and species vulnerability as well as mitigation and post construction monitoring. https://www.nature.scot/bats-and-onshore-wind-turbines-survey-assessment-and-mitigation

Chapter 10 of the Bat Conservation Trust's: *Bat Surveys - Good Practice Guidelines*, 2nd Edition (2012), contains guidance on bat surveys for both wind farms and single turbines. It has largely been replaced by the 2019 guidance above, however, it still contains some relevant guidance and recommendations regarding site assessment and survey design.

The third edition of the Bat Conservation Trust's good practice guidelines: *Bat Surveys for Professional Ecologists - Good Practice Guidelines* (2016) contains guidance on all aspects of bat surveys for development purposes but doesn't contain any specific guidance or recommendations for surveys for wind turbines. However, its guidance for carrying out bat roost surveys should be followed when there are potential roosts near a proposed wind turbine site. https://www.bats.org.uk/resources/guidance-for-professionals/bat-surveys-for-professional-ecologists-good-practice-guidelines-3rd-edition

Other relevant guidance is available from Europe in Eurobats Publication No. 6: *Guidelines for consideration of bats in wind farm projects,* revised in 2014.
http://www.eurobats.org/publications/eurobats_publication_series

## 4. Repowering/Amendment Applications

Applications to replace a currently approved or operational wind turbine with a different turbine model, usually with increased height, blade length and/or power output, and/or to extend the lifespan of a project beyond the original planning consent period, should be assessed as if it were a new planning application in line with current legislation, planning policy, knowledge and guidance. It cannot be assumed that changes to an existing wind turbine site will not present any additional risk to bats. Research has shown that the risk to bats increases with increasing size of turbines and a longer period of operation will also present a greater risk of mortality.

It is also important to note that natural heritage interests around a site may have changed since the original planning approval was granted and any previous surveys carried out may not reflect the current conditions of the site or comply with current guidance.

Therefore, each planning application for a repowering or amendment of an existing wind turbine or wind farm should be accompanied with an up to date assessment of the likely impact of the proposal on bats.

However, if previous bat surveys have been carried out at a repowering site then these may still be relevant, particularly if there have been no significant habitat changes since the original surveys were carried out and the surveys are no more than two years old. If no previous surveys have been carried out on the site, or these are more than two years old, then a new assessment of bat activity should be carried out, based on current guidance, before planning approval is granted for the repowering or amendment application.

NED recommends that all repowering and/or amendment proposals for existing wind turbines are subject to appropriate bat surveys comprising both bat activity surveys and bat carcass searches in accordance with this guidance and the other relevant guidance listed above.

## 5. General Considerations for Wind Turbine Bat Surveys

### 5.1 Qualifications/Experience of Surveyors

The applicant must ensure that the commissioned surveyor(s) has the necessary experience and qualifications to carry out bat survey work. Surveyors must have a demonstrable track record of experience in surveying bats and preferably be a member of an appropriate professional body such as the Chartered Institute of Ecology and Environmental Management (CIEEM)[1]. For example, an acceptable minimal standard would be an ecologist with experience of similar types of bat surveys in the UK or Ireland in a variety of habitats and locations, who is competent in the use of bat detectors and in the identification of Irish bat species.

In the event that the planning application goes to an appeal or public inquiry, the person(s) contracted to do the survey and assessment should be prepared to appear at or give evidence to the hearing and defend their work based on scientific evidence. This should include defending the extent of survey work undertaken, the methodology, interpretation of results and mitigation proposed.

[1] https://cieem.net/

## 5.2 Equipment

The appointed ecologist must have access to all the necessary equipment for conducting the appropriate bat survey types for the project and be experienced in their use. Further information on relevant equipment is contained within Appendix 1 of the Bat Conservation Trust's *Bat Surveys for Professional Ecologists - Good Practice Guidelines, 3rd edition.*

Automated bat detectors (statics) are required for all wind turbine proposals. These normally come in two different types which record bat calls in different formats: Full Spectrum (FS) and Zero Crossing (ZC).

FS detectors are more sensitive than ZC detectors as they record the full spectral information within a sound file whereas ZC analysis renders the spectral information down into a series of time vs. frequency dots. FS detectors will tend to pick up more bat registrations and are better at filtering out background noise. The recordings are also better for distinguishing between different species at the sound analysis stage and for distinguishing social calls from echolocation. However, the disadvantages of FS is that the equipment is more expensive and the file size of recordings are significantly larger which can cause problems with batteries dying and memory cards filling up during deployments. The recordings also take a significantly longer time to process because of the large file size. The 2019 SNH guidance recommends that automated bat detectors (statics) deployed during surveys should be of the full spectrum type.

However, while NED recognises the advantages of full spectrum over zero crossing, the use of zero crossing detectors for wind turbine bat surveys may not be as much of an issue in Northern Ireland as in other parts of the UK. Northern Ireland has significantly fewer bat species than Britain (8 compared to 18) and it is much easier to distinguish between these species using the zero crossing format. In particular, the four main bat species in Northern Ireland at most risk of collision with wind turbines (Leisler's bat, Nathusius pipistrelle, Soprano pipistrelle and Common pipistrelle) are all fairly easy to distinguish on zero crossing recordings by an experienced surveyor. The biggest issue may come when trying to distinguish between social calls and echolocation. However, for impact assessments for wind turbines the most important factor in determining the risk to bats is the level of bat activity, which is usually defined as the number of passes, and this is usually calculated based on echolocation signals. Differentiating between social calls and echolocation is usually more important when assessing potential bat roosts.

Therefore, NED will currently continue to accept bat surveys carried out using zero crossing detectors for all single wind turbine proposals. However, for wind farms we recommend that at least one full spectrum detector is deployed on a site and that this is used to compare with bat registrations picked up by other zero crossing detectors deployed on the site and both results presented in survey reports. Depending on these comparisons and the publication of any further UK guidance or research NED may revise its position on the use of zero crossing detectors.

All survey reports must provide full details of equipment used during the surveys, including the models of bat detectors, microphones and recording format. All equipment should be used according to the manufacturer's instructions and it should be regularly serviced and checked for any faults or deterioration, especially in microphones. Any adjustments to the sensitivity of microphones should be detailed in the report. Details of the software package used for sound analysis must also be presented in the report.

## 5.3 Reporting

Survey reports should follow the guidance and templates in the Bat Conservation Trust's *Bat Surveys for Professional Ecologists - Good Practice Guidelines, 3rd edition* and/or CIEEM's *Guidelines for Ecological Impact Assessment in the UK and Ireland*[2] depending on the nature of the project. The qualifications and experience of all surveyors must be included in the survey report.

Survey reports should be submitted to the planning authority within one year of the survey being carried out. Surveys which are more than two years old are likely to be considered as out of date by NED.

Recorded bat activity at each turbine should be presented in appropriate results tables which include:

- Number of passes per night for each species and for total number of bats;
- Maximum number of passes per night for each deployment period for each species and for total number of bats;
- Average (mean or median) passes per night for each deployment period for each species and for total number of bats.

All reports must include appropriately scaled maps showing the areas surveyed and the location of static detectors. If additional surveys, such as roost surveys or manual walked transects, have been carried out then any additional information gathered on roost locations and bat foraging or commuting routes should also be shown on maps.

The report should include recommendations regarding appropriate mitigation measures to protect bats (see below). The report must contain sufficient detail of any recommended mitigation measures to allow a full assessment of the proposal prior to determination.

## 5.4 Site Risk Level and Survey Effort

All proposed wind turbine sites should be assessed for their suitability to support bats through a desktop assessment and a preliminary survey visit prior to any activity surveys commencing in order to assign a risk level to the site and design future survey work. The appropriate level of survey effort for a site depends on the quality of habitat present and the scale and likely impact of the development. Consideration should be given to the presence of suitable commuting and foraging habitat and the likely presence of bat roosts near proposed turbines (usually within 200m plus rotor diameter). A data search for records of bats should be carried out using information from the appropriate environmental record bodies (e.g. CEDaR[3]). Further guidance on site suitability assessments is contained within existing survey guidance from the Bat Conservation Trust: *Bat Surveys for Professional Ecologists - Good Practice Guidelines*, 3rd Edition (2016), Chapter 4; and *Bat Surveys - Good Practice Guidelines*, 2nd Edition (2012), Chapter 10.

[2] https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/

[3] CEDaR - Centre for Environmental Data and Recording. https://www.nmni.com/CEDaR/CEDaR-Centre-for-Environmental-Data-and-Recording.aspx

Sites should be assigned to either low, medium or high risk categories and the appropriate survey work planned. However, it is important to highlight that preliminary results from activity surveys should be used to review the risk level of a site and decide whether any additional survey effort is required. Very rarely wind turbine sites could be assessed as negligible risk to bats but this is likely to only be the case for sites in extreme environments or outside the known geographical range of bats.

Surveys should be carried out over one bat activity season as a minimum, however, for higher risk sites, or where the data gathered over one season is inconclusive, additional years survey work may be required.

Recommended survey effort and methodology for wind farms and single wind turbines is further detailed below.

### 5.5 Survey Period

All bat surveys for wind turbine developments should take place between April and October with survey effort spread over the activity season. Note that for some sites, such as exposed upland sites, weather conditions usually restrict the survey season and surveys in April or October may not yield adequate data.

Survey effort should take place during the spring (April-May), summer (June to August) and autumn (September to October) periods. Bat activity can change significantly on a site throughout the year and it is important to collect a representative sample of activity during each season.

For upland sites, where weather conditions often limit bat activity, the spring period should be considered to be between mid-April and mid-June, the summer period between mid-June and mid-August, and the autumn period between mid-August and mid-October.

### 5.6 Ground Level Static Surveys

Automated surveys using static bat detectors is the main way in which bat activity at wind turbine sites is recorded and assessed. Detectors should be located at proposed turbine locations (i.e. within 15m or the minimum detection range of the microphone) and ideally mounted at a height of approximately 2m on a wooden pole, tripod, fence post or similar. Detectors may also be mounted on existing wind turbine hubs or met masts but care should be taken so that there is no significant interference to the microphone from background noise. Where livestock are present care should be taken to protect detectors from damage or disturbance as this can lead to lost survey nights.

The 2019 SNH guidance provides recommendations on the number of detectors to deploy on wind farm sites: *Detectors should be placed at all known turbine locations at wind farms containing less than ten proposed turbines. Where developments have more than ten turbines, detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites up to a maximum of 40 detectors for the largest developments. Thus, a development with 22 proposed turbines would require 14 static detectors*.

## 5.7 Paired Static Detectors

The deployment of paired static detectors can provide a useful comparison between bat activity at a proposed wind turbine site and nearby habitat features. However, their use would only be necessary where there is a significant habitat feature (e.g. mature hedgerow or treeline, woodland, river, lake) in close proximity to the turbine (i.e. within 100m plus rotor diameter). This may be likely in a lot of cases, however, a short, well managed or gappy hedgerow, or a post and wire fence, would not normally be considered a significant habitat feature unless it has been noted as a potential commuting route from a roost.

Paired detectors are important for wind farm sites proposed to be "key-holed" into commercial forestry to provide a comparison between bat activity at forestry edges and in cleared areas (see Section 7 below).

The need for paired detectors should be assessed on a site by site basis by the commissioned ecologist.

## 5.8 Monitoring at Height

Bat activity can vary from ground level up to the height of the rotor swept area of turbine blades where collisions occur and therefore bat activity recorded by surveys can vary depending upon what height it is measured at. Some species, like Leisler's bats, will conduct a significant proportion of their flying time at height and this activity may be missed by detectors placed at ground level due to limitations with the recording range of detector microphones. Results from research in the UK (Matthews et al, 2016) has highlighted that monitoring at ground level only may underestimate the activity of medium and high flying bat species at wind turbine sites and is not able to accurately predict bat activity within the full rotor swept area of turbines for all species. As bat casualties could occur within the entire rotor swept area of a wind turbine it is important to try and monitor as much bat activity at height as possible.

NED recommends that any opportunity to survey at height, in addition to ground level monitoring, should be taken. This is particularly important for wind farm sites proposed to be "key-holed" into commercial forestry plantation as a significant amount of activity can take place above the tree canopy height.

However, NED recognises the practical difficulties surrounding monitoring at height and recommends that this is considered on a site by site basis taking into account the likely abundance of high flying bat species and the availability of suitable infrastructure, such as existing turbines or meteorological masts to mount the equipment.

Where monitoring at height is not feasible other survey methods, such as thermal imaging, should be considered to provide additional data on bat activity and behaviour at height. Further guidance on thermal imaging surveys is provided by the BCT[4].

For post construction monitoring of bat activity at operational wind turbine sites monitoring at height is even more important and detectors should be placed at nacelle height to accurately record bat activity within the rotor swept area of turbines. This should be in addition to detectors placed at ground level to replicate the pre-construction survey effort. Where detectors are

[4] https://www.bats.org.uk/resources/guidance-for-professionals/thermal-imaging-bat-survey-guidelines

placed at height and at ground level the same detector systems should be used to produce comparable data.

Monitoring at height should only be necessary on turbines with a hub height of greater than 40m when ground level detectors are unlikely to pick up activity within the upper rotor swept area of the turbine. In such circumstances detectors should be placed at least 40m above ground level.

### 5.9 Manual Walked Transects and Vantage Point Surveys

Manual walked transects using hand held bat detectors provide useful additional information on bat behaviour at a site and should be used to complement automated surveys. However, they are not necessary at every site and should not be used to determine bat activity levels in the final assessment. The need for manual surveys should be assessed on a site by site basis by the commissioned ecologist depending on the habitat features present near the turbine and the presence of any bat roosts. They are likely to be more useful in lowland areas with habitat features such as trees, hedgerows and woodland and less useful in upland sites with large expanses of open habitat, such as bogs with few trees.

NED recommends that manual walked transects are carried out when a significant habitat feature is located within 100m plus rotor radius, or a significant roost within 200m plus rotor radius, of the turbine location and additional information on bat behaviour would add context to the survey results.

Where manual surveys are deemed necessary the level of survey effort can be left to professional judgement but it should be proportionate to the habitat features present and the risk level of the site and sufficient to adequately characterise bat behaviour on a site.

Vantage point surveys at early dusk can provide useful additional information, particularly for early commuting and foraging species such as Leisler's bats. Their use should be considered on a case by case basis and they should precede manual walked transects.

### 5.10 Roost Surveys

Key features (e.g. caves, structures and trees) which may support roosting bats or significant hibernation/swarming sites within 200m plus rotor radius of the proposed turbine(s) should be investigated. This should initially comprise a daytime inspection of features following the guidelines for a "Preliminary Roost Assessment" in the BCT Guidelines, 3rd Edition. Any potential roosts of species at medium or high vulnerability to wind turbines or significant roosts of other species should be subject to further roost surveys in accordance with the BCT Guidelines. Any potentially significant hibernation/swarming sites should also be subject to further surveys in accordance with the BCT Guidelines. All results from preliminary roost assessments (e.g. descriptions, maps, photos) must be included in the final survey report, even when no evidence of roosting bats has been found.

### 5.11 Weather Conditions

Weather data, including wind speed, temperature and rainfall, are important for the interpretation of bat activity data and should be recorded nightly for all types of bat survey and detailed in the final report.

Bat surveys should generally not be carried out in periods of low temperatures, high wind speeds or heavy rain as bat activity is usually significantly reduced. However, deployment of static detectors for long periods is invariably going to coincide with poor weather conditions for bats. Therefore, in order to gather sufficient data during favourable weather conditions it is likely to be necessary to leave out detectors for longer than the minimum periods recommended below.

For lowland sites (<200m), survey nights when temperatures are below 10°C and wind speeds above 5m/s for most of the survey period would not be acceptable. For upland sites this can be relaxed and a minimum temperature of 8°C and maximum wind speed of 7.5m/s should be used.

For all proposed wind farms an automated weather station should be deployed in a central area of the site to gather appropriate weather data, including temperature, wind speed and rainfall. Data should also be used from existing wind turbines or met masts where available.

For single wind turbine developments a weather station is not required. However, sufficient weather data should be recorded for each night of survey or static detector deployment. If the development is a repowering proposal then temperature and wind speed data should be gathered from any existing turbine. If this is not available then a record of weather conditions on each survey night will have to be obtained from the nearest Met Office weather monitoring station.

For wind speed data it must be clearly stated where it was measured from (e.g. ground level or turbine nacelle height).

## 6. Carcass Searches

While bat activity surveys provide a good indication of the level of bat activity at a particular site at the time of survey concerns have been raised that they are not a good predictor of the actual risk to bats from wind turbines at that location (see Lintott et al, 2016) and bat casualties have been found at operational wind farms which were previously assessed as being low risk. Additionally, research has shown that bats can become attracted to operational wind turbines and therefore pre-construction surveys may not accurately reflect what bat activity levels will be like post construction.

Therefore, carcass searches, i.e. searching for dead bats under operational turbines, provide the most reliable way of determining the actual risk of wind turbines to the local bat population.

Carcass searches are normally carried out as part of post construction monitoring of bat activity at a wind turbine site in order to check that pre-construction surveys have been accurate in determining the risk level to bats and that any mitigation implemented has been successful in minimising bat casualties. However, where a proposal is for the replacement or repowering of an existing wind turbine or wind farm then carcass searches should also be carried out as part of the assessment prior to planning approval being granted.

Existing guidance for carrying out carcass searches for bats under operational wind turbines is available in the 2019 SNH guidance and in Eurobats Publication No. 6. However, NED provides the following clarifications and recommendations regarding the appropriate methodology and survey effort to follow for both single wind turbines and wind farms.

### 6.1 Recommended Methodology

Carcass searches should be carried out concurrently with bat activity monitoring using static detectors to provide a comparison between bat activity levels, weather conditions and actual mortality.

For wind farms carcass searches should be carried out at each turbine where activity monitoring is taking place.

Carcass searches should be split into blocks of survey effort within which regular searches take place. Searches should take place every 2-4 days within each survey block with one search every two days the recommended frequency for most sites. However, sites with high levels of carcass removal through predation or scavenging may require daily searches. There should be no more than 4 days between each search.

Survey blocks should be between 5 and 10 days with the minimum number of searches within each block being 3.

For example, in a 10 day survey block:

- a search every 2 days = total of 5 searches (day 1, day 3, day 5, day 7, day 9)
- a search every 3 days = total of 4 searches (day 1, day 4, day 7, day 10)
- a search every 4 days = total of 3 searches (day 1, day 5, day 10)

Survey blocks should cover at least two seasons (including summer) on low risk single turbine sites but should cover every season on wind farms and higher risk single turbine sites, with higher coverage during the summer or other high risk period.

Further details on recommended minimum survey effort for wind farms and single wind turbines is provided in Tables 1 and 2 below.

All searches should be carried out within a search area a minimum 50m radius from the base of each turbine, i.e. a 100m x 100m grid centred on each turbine. Searches should be carried out along transects a maximum 5m wide, however, in vegetation which is hard to search (e.g. tall heather) this width should be reduced accordingly.

All surveyors should have experience in searching for dead bats under wind turbines or have been trained by a suitably experienced surveyor.

Carcass searches should be timed to only occur on mornings after a night when there has been favourable weather conditions for bat activity and the wind turbine has been operational.

Bat carcass searches can only provide an estimate of the true number of bats killed at a wind turbine and there are a number of factors which can influence the accuracy of these estimates. Eurobats Publication No.6 (2014) states:

> *"It is important to be aware that the number of carcasses found does not equate to the real number of bats that are killed. This is because the count process is biased due to several factors, such as: removal of casualties by scavengers or predators; searcher efficiency (which depends, among other factors, on the type and height of ground cover underneath the turbines – i.e. detectability); and effort invested in the survey (monitoring schedule, time interval and size of the searched area). Additionally, some bats fly away and die later on due to internal injuries."*

Therefore, in order to correct for these survey biases an estimate of carcass removal rates and searcher efficiency should be carried out at each wind turbine site. This will require at least two trained personnel to be involved – the seeker and the tester. Carcass removal trials and searcher efficiency trials can be combined in an integrated trial as they are both time sensitive. Using this method the same test carcasses should be used for both trials and left in place for the duration of the survey period. Further guidance on carcass removal trials, searcher efficiency trials and on the estimation of mortality rates is contained within the 2019 SNH guidance and Eurobats No.6.

The vegetation type and height within each search area should also be assessed at least once before searches begin and classified according to search difficulty (see Eurobats No.6 for further information). Where significant changes to the vegetation occur during the survey period - e.g. mowing, cutting, heavy grazing or significant grass growth - the vegetation classes should be re-assessed and the carcass removal trials and searcher efficiency trials repeated.

NED recommends a search methodology is developed based on the risk level of the site and as such we have suggested three different levels of search methodology and intensity: basic level; standard level; higher level.

For proposed single wind turbines on low risk sites with easy to search vegetation, such as moderately or intensively grazed grassland, NED will dispense with the requirement to carry out

carcass removal and searcher efficiency trials and a basic level search can be carried out. However, should at least 1 bat carcass be found during searches the methodology should be elevated to the standard level and include these trials.

Basic Level Carcass Searches: This applies to single wind turbines on low risk sites only. It simply requires searches for bat carcasses by suitably experienced or trained surveyors to be carried out on within the search area grid in appropriate survey blocks. There is no requirement to calculate carcass removal rates or carry out searcher efficiency trials but the vegetation type and height within the search area should be assessed and classified according to its search difficulty. Where at least 1 bat carcass is found during these searches the methodology should be elevated to the standard level and include carcass removal and searcher efficiency trials.

Standard Level Carcass Searches: Searches should be carried out by suitably experienced or trained surveyors within the search area grid in appropriate survey blocks with the frequency and minimum number of surveys depending on the risk level of the site (see Tables 1 and 2 below). Carcass removal and searcher efficiency trials should be carried out at least once per survey.

Higher Level Carcass Searches: In some circumstances for high risk sites on hard to search vegetation, such as tall heather, it may be necessary to use trained dog search teams as these are significantly more efficient and faster at finding carcasses than human surveyors. The use of dog search teams should be considered on a site by site basis but particularly when bat carcasses have already been found and there are concerns that some carcasses may have been missed. This is more likely to be required for post construction monitoring on sites where turbine curtailment has been implemented and more robust data is necessary to determine the effectiveness of these measures.

Where any bat carcasses are found during searches the following information should be recorded and included in the report: time, date, location (turbine number and grid reference using GPS), species and sex (if possible), distance from turbine hub, vegetation type, notes on any injuries, weather conditions from previous night, any other relevant notes. Photographs of each specimen should be taken and included in the report. Bats may be collected, stored and frozen for further analysis, such as DNA testing or post mortem.

### 6.2 Wildlife Licensing

As bats are a European protected species an appropriate wildlife licence is required to be issued by NIEA for handling or retaining dead bats found during surveys. For further information see the DAERA website at https://www.daera-ni.gov.uk/articles/wildlife-licensing or contact the NIEA Wildlife Team - Tel: 028 905 69557, email: elmswildlife@daera-ni.gov.uk.

### 6.3 Legal Considerations

Case law has clarified that bat fatalities due to interactions with wind turbines can be considered incidental killing under the Habitats Directive and Habitats Regulations. However, above a certain level the killing of bats could cease to become incidental as it could have a significant effect on the species as a whole, usually with regard to the local conservation status of bats and continuation of such an operation could lead to the killing becoming intentional or deliberate under the Habitats Regulations.

Under the Habitats Regulations the Department is required to monitor the incidental killing of European protected species, such as bats, and take any necessary conservation measures to ensure that is does not have a significant negative impact on the species.

Therefore, NED considers that the discovery of more than 1 bat carcass per turbine per year during carcass searches should be considered significant and must trigger additional mitigation measures to prevent any significant effects on the local bat population (see Section 10 below).

## 7. Wind Farm Survey Effort

All wind farm bat surveys should follow the 2019 SNH guidance while taking into account the guidance and recommendations detailed above. Survey effort should vary according to the risk level of the site with longer static detector deployments being required at higher risk sites. Surveys should cover all seasons (spring, summer and autumn) but there should be greater coverage during the summer months or other high risk periods on higher risk sites.

For low risk sites there should be a minimum of 30 nights of automated surveys at ground level at each turbine per year, with at least 10 consecutive nights in each season. For example: three deployment periods, of at least 10 consecutive nights each, covering spring, summer and autumn, with at least one week between each deployment period.

For medium risk sites there should be a minimum of 40 nights of automated surveys at ground level at each turbine per year, with at least 10 consecutive nights in each season and an additional 10 nights in summer or other high risk period[5].

For high risk sites there should be a minimum of 50 nights of automated surveys at ground level at each turbine per year, with at least 10 consecutive nights in each season and an additional 20 nights in summer or other high risk period.

When considering the length of deployment periods attention should be paid to weather conditions (see 5.11) as a minimum deployment period of 10 nights when a significant proportion of the survey period has been unfavourable for bat activity would not be acceptable. Therefore, NED would encourage detectors to be left in place for as long as possible to ensure an adequate number of nights with favourable weather conditions have been surveyed.

Monitoring at height should be considered on a case by case basis (see section 5.8 above).

Manual walked transects and the use of paired static detectors should be considered on a case by case basis depending on the habitat features present near the turbine locations (see 5.7 and 5.9 above).

Carcass searches are required for all proposals involving the replacement or repowering of an existing wind farm, prior to planning approval being granted.

Table 1 below provides a summary of the minimum survey effort expected at low, medium and high risk wind farm sites.

Key-holing

For sites proposed to be “key-holed” into existing forestry it is important that any opportunity is taken to survey at height. Additionally, as the habitat available to bats will change post felling, it is important to try and represent what bat activity will be like on site post construction. Therefore, paired static detectors should be used at forestry edges and in more open habitats, such as forestry rides or clearings, to try and mimic what conditions will be like post construction.

[5] For medium and high risk sites the additional survey effort required can consist of one deployment period of 20 to 30 consecutive nights or multiple deployments of at least 10 nights.

**Table 1:** Minimum standards of bat survey effort for wind farms.

| | **Site Risk Level** (taking into account habitat features and records of bats in the area) | | |
|---|---|---|---|
| | **Low** | **Medium** | **High** |
| **Manual Walked Transects** | Only necessary where a significant habitat feature is located within 100m + rotor radius, or a significant roost within 200m + rotor radius, of proposed turbine locations and additional information on bat behaviour would add context to the survey results. | Only necessary where a significant habitat feature is located within 100m + rotor radius, or a significant roost within 200m + rotor radius, of proposed turbine locations and additional information on bat behaviour would add context to the survey results. | Only necessary where a significant habitat feature is located within 100m + rotor radius, or a significant roost within 200m + rotor radius, of proposed turbine locations and additional information on bat behaviour would add context to the survey results. |
| **Roost Surveys** | Daytime inspection of potential roosting sites within 200m + rotor radius of proposed turbine locations. Where potentially significant roosts may be present, emergence and re-entry surveys should be undertaken in accordance with BCT Guidelines. | Daytime inspection of potential roosting sites within 200m + rotor radius of proposed turbine locations. Where potentially significant roosts may be present, emergence and re-entry surveys should be undertaken in accordance with BCT Guidelines. | Daytime inspection of potential roosting sites within 200m + rotor radius of proposed turbine locations. Where potentially significant roosts may be present, emergence and re-entry surveys should be undertaken in accordance with BCT Guidelines. |
| **Automated Surveys at ground level** (Static Detectors) | **30 nights** of surveys at the proposed turbine locations - comprising a minimum of **3 deployment periods**[6], each consisting of at least **10 consecutive nights**, covering each season (spring, summer and autumn).<br><br>Paired detectors should be used when a significant habitat feature is present within 100m + rotor radius of any turbine. | **40 nights** of surveys at the proposed turbine locations with at least **10 consecutive nights** in each season (spring, summer and autumn) plus an additional 10 nights in summer or other high risk period.<br><br>Paired detectors should be used when a significant habitat feature is present within 100m + rotor radius of any turbine. | **50 nights** of surveys at the proposed turbine locations with at least **10 consecutive nights** in each season (spring, summer and autumn) plus an additional 20 nights in summer or other high risk period.<br><br>Paired detectors should be used when a significant habitat feature is present within 100m + rotor radius of any turbine. |
| **Automated Surveys at height** | To be considered on a site by site basis (see 5.8 above). | To be considered on a site by site basis (see 5.8 above). | To be considered on a site by site basis (see 5.8 above). |
| **Carcass Searches** (Mortality Monitoring) | Minimum of 15 carcass searches per turbine across the survey period, covering each season.<br><br>For example: 3 survey blocks of 10 days, covering each season, with a minimum of 5 evenly spaced searches taking place during each block - e.g. day 1, day 3, day 5, day 7, and day 9.<br><br>Alternatively: 5 survey blocks of 5 days with a minimum of 3 evenly spaced searches taking place during each block - e.g. day 1, day 3 and day 5.[7] | Minimum of 20 carcass searches per turbine across the survey period, covering each season.<br><br>For example: 4 survey blocks of 10 days, covering each season, with a minimum of 5 evenly spaced searches taking place during each block - e.g. day 1, day 3, day 5, day 7, and day 9.<br><br>Alternatively: 7 survey blocks of 5 days with a minimum of 3 evenly spaced searches taking place during each block - e.g. day 1, day 3 and day 5. | Minimum of 25 carcass searches per turbine across the survey period, covering each season.<br><br>For example: 5 survey blocks of 10 days, covering each season, with a minimum of 5 evenly spaced searches taking place during each block - e.g. day 1, day 3, day 5, day 7, and day 9.<br><br>Alternatively: 8 survey blocks of 5 days with a minimum of 3 evenly spaced searches taking place during each block - e.g. day 1, day 3 and day 5. |

[6] Minimum deployment periods of 10 nights should have a suitable gap of at least one week between them over adjacent seasons unless extended deployments of at least 30 nights are being used across seasons.

[7] The exact breakdown of carcass search effort can be left up to professional judgement on a site by site basis as long as the total number of searches meets the minimum effort, there is a minimum of 3 searches in each survey block (separated by no more than 4 days) and searches are carried out concurrently with automated surveys.

## 8. Single Wind Turbine Survey Effort

Single wind turbines normally pose a lesser risk to bats than wind farms due to the number of turbines and their size. However, they can still pose a significant risk of bat mortality. The methodology for bat activity surveys is the same as that for wind farms, however, a lesser survey effort is acceptable, particularly for lower risk sites.

For low risk sites there should be a minimum of 20 nights of automated surveys at ground level per year, covering at least two seasons, with at least 10 consecutive nights in spring or autumn and 10 nights in summer. Alternatively, there can be 5 consecutive nights in spring and autumn and 10 nights in summer. There should be at least one week between each deployment period.

For medium risk sites there should be a minimum of 30 nights of automated surveys at ground level per year, with at least 10 consecutive nights in each season. For example: 3 deployment periods, of at least 10 nights each, covering spring, summer and autumn. There should be at least one week between each deployment period.

For high risk sites there should be a minimum of 40 nights of automated surveys at ground level per year, with at least 10 consecutive nights in each season and an additional 10 nights in summer or other high risk period. For example: 4 deployment periods, of at least 10 nights each, covering spring, summer and autumn, with an additional deployment period in summer or other high risk period. There should be at least one week between each deployment period in adjacent seasons.

When considering the length of deployment periods attention should be paid to weather conditions (see 5.11) as a minimum deployment period when a significant proportion of the survey period has been unfavourable for bat activity would not be acceptable. Therefore, NED would encourage detectors to be left in place for as long as possible to ensure an adequate number of nights with favourable weather conditions have been surveyed.

Monitoring at height will normally not be required for proposed single wind turbine sites. An exception may be for post construction monitoring at a large turbine (>50m hub height) where a significant number of high flying species have been recorded during pre-construction surveys.

Manual walked transects and the use of paired static detectors should be considered on a case by case basis depending on the habitat features present near the turbine location.

Carcass searches are required for all proposals involving the replacement or repowering of an existing single wind turbine, prior to planning approval being granted. However, as stated above, for low risk sites with easy to search vegetation, such as moderately or intensively grazed grassland, a basic level carcass search can be carried out.

Table 2 below provides a summary of the minimum survey effort expected at low, medium and high risk single wind turbine sites.

**Table 2:** Minimum standards of bat survey effort for Single Wind Turbines.

| | **Site Risk Level** (taking into account habitat features and records of bats in the area) | | |
|---|---|---|---|
| | **Low** | **Medium** | **High** |
| **Manual Walked Transects** | Only necessary where a significant habitat feature is located within 100m + rotor radius, or a significant roost within 200m + rotor radius, of the turbine location and additional information on bat behaviour would add context to the survey results. | Only necessary where a significant habitat feature is located within 100m + rotor radius, or a significant roost within 200m + rotor radius, of the turbine location and additional information on bat behaviour would add context to the survey results. | Only necessary where a significant habitat feature is located within 100m + rotor radius, or a significant roost within 200m + rotor radius, of the turbine location and additional information on bat behaviour would add context to the survey results. |
| **Roost Surveys** | Daytime inspection of potential roosting sites within 200m + rotor radius of the proposed turbine. Where potentially significant roosts may be present, emergence and re-entry surveys should be undertaken in accordance with BCT Guidelines. | Daytime inspection of potential roosting sites within 200m + rotor radius of the proposed turbine. Where potentially significant roosts may be present, emergence and re-entry surveys should be undertaken in accordance with BCT Guidelines. | Daytime inspection of potential roosting sites within 200m + rotor radius of the proposed turbine. Where potentially significant roosts may be present, emergence and re-entry surveys should be undertaken in accordance with BCT Guidelines. |
| **Automated Surveys at ground level** (Static Detectors) | **20 nights** of surveys at the proposed turbine location - comprising a minimum of **2 deployment periods**[8], each consisting of at least **10 consecutive nights**, covering at least 2 seasons (spring or autumn and summer).[9]<br><br>Paired detectors should be used when a significant habitat feature is present within 100m + rotor radius of the turbine. | **30 nights** of surveys at the proposed turbine location - comprising a minimum of **3 deployment periods**, each consisting of at least **10 consecutive nights**, covering each season (spring, summer and autumn).<br><br>Paired detectors should be used when a significant habitat feature is present within 100m + rotor radius of the turbine. | **40 nights** of surveys at the proposed turbine location with at least **10 consecutive nights** in each season (spring, summer and autumn) plus an additional 10 nights in summer or other high risk period.<br><br>Paired detectors should be used when a significant habitat feature is present within 100m + rotor radius of the turbine. |
| **Carcass Searches** (Mortality Monitoring) | Minimum of **10 carcass searches** across the survey period.*<br><br>For example: 2 survey blocks of 10 days, covering at least 2 seasons (with at least 1 block in summer), with a minimum of 5 evenly spaced searches taking place during each block - e.g. day 1, day 3, day 5, day 7, and day 9.[10]<br><br>*Basic Level Carcass Search Methodology. Where bat carcasses are found the survey effort should be increased and the Standard Level Carcass Search Methodology used (see section 6). | Minimum of **15 carcass searches** across the survey period.<br><br>For example: 3 survey blocks of 10 days, covering each season, with a minimum of 5 evenly spaced searches taking place during each block - e.g. day 1, day 3, day 5, day 7, and day 9.<br><br>Alternatively: 5 survey blocks of 5 days with a minimum of 3 evenly spaced searches taking place during each block - e.g. day 1, day 3 and day 5. | Minimum of **20 carcass searches** across the survey period.<br><br>For example: 4 survey blocks of 10 days, covering each season (with 2 blocks in summer), with a minimum of 5 evenly spaced searches taking place during each block - e.g. day 1, day 3, day 5, day 7, and day 9.<br><br>Alternatively: 7 survey blocks of 5 days with a minimum of 3 evenly spaced searches taking place during each block - e.g. day 1, day 3 and day 5. |

[8] Each deployment period should be separated by an interval of at least one week.

[9] Alternatively, there can be 5 consecutive nights in spring and autumn and 10 nights in summer.

[10] The exact breakdown of search effort can be left up to professional judgement on a site by site basis as long as the total number of searches meets the minimum effort, there is a minimum of 3 searches in each block (separated by no more than 4 days) and searches are carried out concurrently with automated surveys.

## 9. Assessment

NED recommends that all assessments of the ecological impacts of wind turbines, including on bats, follow the guidance in CIEEM's *Guidelines for Ecological Impact Assessment in the UK and Ireland*[11]. The 2019 SNH guidance also provides useful advice regarding assessing the risk of wind turbine projects to bats.

The key factors to consider when assessing the risk of a project are the bat activity levels recorded during surveys, the species present, the habitat features and wider landscape surrounding the site, including how bats are using these features, and the size and design of the project itself.

It is very important that bat activity levels recorded during surveys are adequately assessed and classified. Bat activity can vary significantly at a site during the course of a survey season with substantial peaks of activity often followed by many nights of no or very low activity. Bat activity can also vary significantly at a particular location at different times during individual nights.

Bat activity is highly dependent on weather conditions and on the availability of insect prey and it is important that weather conditions are carefully considered during analysis of the results. Changes in bat activity may also be linked to the life cycle of bats and peaks in activity may occur during the formation of maternity colonies, during the breeding season and during migration to winter roosts. Therefore, it is important that temporal and spatial changes to bat activity on a site are carefully considered in the assessment.

Results from static detectors left in place for extended periods of time provide the most reliable estimate of bat activity at a proposed wind turbine site as they record bat activity over the course of a whole night and allow for a more robust assessment of temporal variations in bat activity. The use of manual surveys, such as walked transects, are subject to more surveyor bias and should not be used to classify bat activity levels. However, they can provide useful information and context as to how bats are using a particular site, and their behaviour, and should be used to complement results from static detector surveys.

Bat activity levels on a site should be classified according to an objective, standardised approach and not based solely on personal opinion or professional judgement.

NED encourages the use of the online tool Ecobat[12] which contains a comparative database of bat survey results from across the UK and can be used to quantify and classify bat activity levels (based on percentiles) and produce results tables. However, caution should be exercised when using the tool as it has a significant bias towards results from Great Britain and there is a paucity of data from Northern Ireland or Ireland where we have a significantly different species assemblage. Therefore, it is currently unlikely to produce results which accurately reflect the species composition and bat activity levels normally encountered on wind turbine sites in Northern Ireland. However, the more this tool is used by bat consultants here the more useful it will become.

Other research into bat activity levels at wind turbine sites, particularly the UK National Bats and Wind Turbines project (Matthews et all, 2016), can also be used to help produce bat activity classifications for a project.

[11] https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/

[12] http://www.ecobat.org.uk/

Whatever bat activity classification system is used the final survey report must detail how the inferred level of relative bat activity has been derived using a standardised approach and reference any external sources of information or studies which have been used.

Bat activity on a site should be divided into equal categories (percentiles), for example: low; low to moderate; moderate; moderate to high; high in order to appropriately quantify risk. This should be done at both the individual detector/turbine level and at the site level.

It is important that peaks of bat activity are taken into account in the final assessment rather than simple averages of bat activity over the survey period. Sites which have rare high peaks of bat activity on some nights but low activity over most of the survey period can still pose a significant risk to bats.

Consideration must also be given to the bat species present, their risk of collisions with wind turbines, and their vulnerability at the population level - see Table 2, 2019 SNH guidance. However, it should be noted that the relative abundance of some species in Northern Ireland is different compared to Great Britain. In particular, Leisler's bats, while fairly rare in Britain, are one of the commonest species found in Ireland. However, given their rarity in the rest of the UK, and indeed Europe, the Irish population is considered a global stronghold for the species and therefore we have an international responsibility for its protection.

## 10. Mitigation

When designing mitigation for a project the mitigation hierarchy, as explained in CIEEM's *Guidelines for Ecological Impact Assessment in the UK and Ireland* should be applied. That is, the avoidance of negative impacts must be considered in the first place, before applying any other mitigation or, as a last resort, compensation.

NED recommends a number of options for mitigation which are consistent with the recommendations in the SNH guidance but with additional clarifications for a Northern Ireland context.

### 10.1 Avoidance

Consideration must be given to the location of the proposed project during the early design stage with regard to its potential impact on bats. On sites with significant bat activity consideration must be given to relocating turbines or reducing the number of turbines proposed. In some cases where bat activity is very high and mitigation will be difficult to achieve, implement, or there is uncertainty over its effectiveness, NED may recommend to the planning authority that planning permission is refused.

### 10.2 Buffers

A minimum 50m buffer to all habitat features used by bats (e.g. hedgerows, tree lines) should be applied to the siting of all wind turbines. This buffer is measured between the blade tip of the turbine and the nearest point of the habitat feature rather than between the hub and the habitat feature.

For higher quality habitat features, such as semi-natural woodlands and significant watercourses or waterbodies, a greater buffer distance of up to 200m may be required, in accordance with the Eurobats No.6 guidance.

For wind farms proposed to be key-holed into commercial forestry plantation NED recommends a minimum buffer of 100m between the turbines and the edge of the forestry. This buffer should take into account the growth rate of the surrounding trees over the lifetime of the project.

However, it is important to highlight that the application of buffers on their own are unlikely to mitigate for impacts to some species of bats which do not closely follow habitat features such as trees, hedgerows or woodland. In particular, Leisler's bats are at high risk of collision with wind turbines due to their high flying behaviour over open areas and the application of a buffer is unlikely to be effective in significantly reducing the risk for this species.

### 10.3 Feathering of Turbine Blades

In addition to any buffers applied to habitat features NED recommends that all wind turbines are subject to 'feathering' of turbine blades when wind speeds are below the cut-in speed of the proposed turbine. In practice this means that the turbine blades are pitched at 90 degrees or parallel to the wind to reduce their rotation speed while idling to below two revolutions per minute. This measure has been shown to significantly reduce bat fatalities (by up to 50%) in some studies. It can be applied to all turbines without reducing their economic output as electricity is not generated below the cut-in speed of wind turbines. An appropriate planning condition should be placed on all wind turbine approvals to apply this mitigation.

### 10.4 Curtailment

Curtailment involves raising the cut-in speed of wind turbines and feathering the blades to reduce their operation during periods of high bat activity. As bat activity is highly dependent on environmental factors, such as temperature and wind speed, 'shutting down' a wind turbine during periods of favourable conditions for bats is likely to significantly reduce any casualties.

Curtailment can be applied as a blanket approach during certain times of the year when bats are most active (usually April to October) or it can be linked to real time data, e.g. temperature and wind speed, gathered on site and programmed using the SCADA operating system of wind turbines. However, this approach requires sufficient pre-construction survey data to have been gathered on the site to accurately model bat activity against environmental data, such as wind speed, temperature, precipitation and time of year, which affects bat activity.

Curtailment should be considered for all projects where at least a moderate risk to bats has been identified.

Where curtailment has been recommended as mitigation for a project full details of the proposed operating parameters of the turbine(s) will need to be provided for agreement. NED will assess the survey data to ensure that sufficient data has been gathered to provide confidence that the proposed mitigation will significantly reduce the risk to bats. However, in all circumstances where curtailment is proposed post construction monitoring will also be required to check the effectiveness of the mitigation. An appropriate planning condition will be required to be placed on any planning approval to secure the implementation of the agreed curtailment regime and on any monitoring.

Any proposed curtailment mitigation strategy should aim to ensure that a wind turbine is 'shut down' during conditions where at least 90% of bat activity was recorded.

### 10.5 Post Construction Monitoring

As highlighted in section 6 above, pre-construction bat activity surveys may not always be a good predictor of the actual risk of a proposed wind turbine project to bats. Further, bat behaviour at wind turbine sites may change post construction. Therefore, a programme of post construction monitoring of bat activity and searches for bat carcasses at an operational wind turbine site is often necessary to check that pre-construction predictions of risk are accurate and that any mitigation implemented has been effective. Additionally, should concerns arise during post construction monitoring it provides an opportunity for mitigation measures to be adjusted and/or for additional mitigation to be applied.

Post construction monitoring should be carried out on all sites where a curtailment regime has been implemented. The requirement for post construction monitoring on other sites should be assessed on a case by case basis depending on the nature of the site and the bat survey data submitted.

Where post construction monitoring is recommended it should be detailed in a Bat Monitoring and Mitigation Plan (BMMP) which should be submitted for assessment and agreed before any planning approval is granted. The implementation of the BMMP should be secured via an appropriate planning condition. The BMMP should include details of bat activity monitoring and carcass searches at wind turbines. It should also include provisions for the implementation of any additional mitigation necessary, such as adjustment of the curtailment regime. Post construction monitoring should last for a period of 3 to 5 years depending on the risk level of the site but should also be subject to review. Reports of the results of the monitoring should be submitted to the planning authority and NED for review on an annual basis and prior to the next season of monitoring so that any changes to the plan can be agreed in advance.

### 10.6 Bat Deterrent Systems

There are emerging technologies which use ultrasound devices to deter bats from operational wind turbines. These systems have been tested in the USA and Europe but have not been approved for use in Northern Ireland. NED does not currently recommend their use and awaits further evidence of their effectiveness and potential harms. The use of such devices is likely to require a wildlife licence to be issued by NIEA to prevent an offence of disturbance under the Habitats Regulations from being committed.

## 11. Application of this Guidance

This guidance should be considered and applied to any wind turbine bat surveys which commence after its publication date. Surveys which have already commenced before publication can continue to follow existing guidance, unless advised otherwise by NED. For all wind turbine bat surveys carried out in 2021 NED will apply a degree of discretion in its assessment with regard to the survey effort and methodology used. This guidance will be reviewed in 2022, taking account of any issues encountered, feedback received, and in light of any new UK research or guidance published, and any updates will be published before the next bat survey season.

## References

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