

# National Bat Conference

16th - 18th September 2011, University of Warwick



## Conference abstracts 2011

### Session one: Bat surveying and development

#### **A comparison of the precision of four common methods currently used to count bats emerging from summer maternity colony roosts in the UK**

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Counting the number of bats emerging from a roost gives a good indication of how many individuals are using the structure at the time of survey. These emergence counts are a valuable survey technique and are used by ecological consultants to aid in the design and post-monitoring of mitigation. Therefore the survey methods used must be accurate if correct conservation measures are to be applied.

This study compared four common methods used by surveyors to determine how effective advanced technologies are for providing precise counts of roost numbers, in comparison to traditional visual observational surveys. Recommendations are made as to which survey type should be applied under various conditions.

Methods used were:

- a. A visual count using the naked eye
- b. A visual count using the naked eye aided by a heterodyne bat detector
- c. A visual count using a night vision scope connected to a video recorder
- d. A remote recording bat detector

All four methods were carried out together for six of the UK bat species at six different roost locations. The species were Brandt's bat *Myotis brandtii*, brown long-eared bat *Plecotus auritus*, Daubenton's bat *Myotis daubentonii*, Leisler's bat *Nyctalus leisleri*, lesser horseshoe bat *Rhinolophus hipposideros* and soprano pipistrelle bat *Pipistrellus pygmaeus*.

When comparing emergence counts recorded using the night vision scope to the other three methods there was a significant difference for the brown long-eared and Daubenton's bat roosts. These two later emerging species are harder to count visually due to lower light levels. There were also differences between methods for the Brandt's, Leisler's, lesser horseshoes or soprano pipistrelles, although these differences were not statistically significant.

Factors influencing which methods should be used during surveys include

- a. The roost entrance/exit
- b. The species of bat
- c. Activity around the roost

Careful judgement should be used when deliberating which combination of methods and survey effort are required as this study has found that the total number of bats can easily be either under- or over-estimated. In the most extreme examples, the naked eye method only counted 34% of the bats emerging whilst at a different roost the visual count overestimated by 23%.

## **The Bechstein's Bat Project**

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In this paper we discuss the results of the Bechstein's Bat Project, a four year project launched by the Bat Conservation Trust (BCT) to better understand the distribution of the Bechstein's bats and make recommendations regarding the use of these results to inform future conservation policy and woodland management.

Bechstein's bat (*Myotis bechsteinii*) is one of the UK's rarest mammal species and is predominantly associated with ancient broadleaf woodlands. In the UK Bechstein's bat is restricted to parts of southern England and south Wales, which comprise the northwestern edge of its European range. The great difficulty involved in detecting and surveying for Bechstein's bat using traditional methods resulted in a lack of basic knowledge of the species' distribution and population size. There was, therefore, very little information on the habitat requirements of Bechstein's bat, its conservation status or the threats it faced. This situation began to change following the development of an ultrasound synthesizer (the Sussex Autobat) that acts as an acoustic lure, that greatly enhances our ability to catch the species.

The aim of the Bechstein's Bat Project was to produce a more comprehensive distribution map based on systematically collected survey data, and to gather information to inform future conservation policy and woodland management. The survey method comprised an initial phase of site selection within the species' known range in which target woods were selected that most closely match habitats where breeding colonies of the species have been recorded. The selected woodlands were then surveyed using the Sussex Autobat to produce simulated social calls of Bechstein's bats. These calls attract the bats into harp traps in which they are caught. A key feature of the project was the special training and deployment of volunteers from the local bat group network, which allowed us to survey woodlands over a large area.

## **Mitigating the effect of development on wildlife: impact and effectiveness of legislation for bats in England**

Dr Emma Stone, Professor Stephen Harris and Professor Gareth Jones, University of Bristol

Under the EU Habitats Directive, all member states are obliged to establish a system for strict protection of species listed in Annex IV(a) of the Directive, including all bat species. In England the legislation for bats allows for derogation under licence, provided activities are conducted to mitigate negative impacts. Despite the increasing number of licenses issued each year, the impact of development and mitigation activities on bats has not been assessed. We analysed data from 389 bat derogation licences issued in England between 2003 and 2005 to determine the nature and extent of development and mitigation activities and their impacts on bats. Licenses covered 1776 roosts and 15 species. Overall impacts on roosts were negative; the majority of roosts affected were destroyed (68%). There were species-specific differences in the probability of roost destruction. Some species were positively associated with specific development and structure types, in accordance with difference in species roosting ecology. Bats were recorded at 53% of sites post-development and bat numbers were significantly reduced (mean -44%). Information provided in licence applications was inadequate and inconsistent. The majority of applicants (67%) failed to submit post-development reports and post-development monitoring was conducted at 19% of sites. Despite an estimated spend of £4.1 million on mitigation between 2003 and 2005, it is unclear whether the current licensing process meets the EU obligations, highlighting the need to overhaul the licensing process and establish a comprehensive standardised post-development monitoring system.

## Session two: Bats and Health

### White-nose Syndrome in North America: Status and Next Steps

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White-nose Syndrome (WNS) has devastated bat populations across the eastern United States since it was first discovered in a single cave in New York in 2006. The disease has likely killed millions of bats, leading biologists to say it is causing “the most precipitous wildlife decline in the past century in North America.” Nine bat species in 19 U.S. states and four Canadian provinces have been documented with either WNS or the fungus, *Geomyces destructans*, that is the likely cause of this devastating disease.

The emergence and spread of WNS as a pathogenic fungus that infects hibernating bats has the potential to undermine the basic survival strategy of more than half the bat species in the US and all species of bats that occur in the higher latitudes of North America. In a 2010 issue of *Science* magazine, a study predicted that WNS could lead to regional extinction of the little brown myotis (*Myotis lucifugus*), previously one of the most common bat species in North America. Now the fungus has made leaps that apparently open western states and perhaps Mexico to this disease.

As this relentless disease keeps spreading into new areas, BCI is working with agencies, organizations and individuals to understand and stop WNS and begin restoring these decimated bat populations.

### Hunting of flying foxes and emerging infectious diseases in Indonesian Borneo

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Widespread flying fox hunting across South-east Asia has generated concern regarding population declines and the spread of emerging infectious diseases. To investigate the potential impacts of this trade, we conducted questionnaires in 45 settlements across 11 population centres within Central Kalimantan, Indonesia, a region identified previously as a hunting hotspot. By combining results from 63 hunter and 88 vendor interviews, we identify two population centres (Palangka Raya and Buntok/Tamiang Layang) with higher hunting rates than other areas, which likely act as flying fox trading hubs. Province-wide population declines in flying foxes were evident: declines in captures and sales were reported by 81% of hunters and 60% of market vendors, who also reported availability as the key factor underlying temporal variations in trade. The risk of zoonotic disease transmission between bats, hunters and traders was high: the vast majority of respondents were unaware that flying foxes carry potentially fatal viruses, and so few people protected themselves from physical contact. Moreover, both hunters and vendors were frequently bitten and the majority of bites drew blood. Most hunters (58%) also reported unintentional by-catches that included keystone bird species and slow lorises. The scale of hunting over Central Kalimantan represents a serious threat to the long-term viability of flying fox populations (and potentially those of other species), and could have serious public health implications. Reducing or eliminating hunting and trade would mitigate the risk of disease transmission, while maintaining the economic and ecosystem benefits that flying foxes provide, in terms of pollination and seed dispersal.

## Wytham woods – A study of the ecology, parasites and pathogens of bats

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Wytham woods has been the home to wildlife research for over 60 years but scientists have not previously studied the ecology of the resident bats. We present results from 5 years of data, gathered from the three most abundant species: *Myotis daubentonii*, *M. nattereri* and *Plecotus auritus*.

At Wytham, bats commonly roost in woodcrete bird boxes distributed throughout the wood. To date over 1800 individual bats have been ringed and some have been recaptured up to 10 times. Over the past two years ectoparasites have been counted on most bats captured (a total of 11,334 individual mites) and faecal samples have been taken for identification of enteric viruses.

The data reveal the effects of sociality and seasonality on levels of mite infestation including a pronounced increase in infestation during the maternity season. Molecular methods show that Coronaviruses and Astroviruses are present in faecal samples from *M. daubentonii*, and *M. nattereri*. Both viruses are related to emerging diseases.

The ringing data were used to model the social structure of each species. There is strong social segregation within species and in some cases we observe up to 3 spatially segregated social groups within 1.5km<sup>2</sup> of woodland. The implications of the observed population structures for parasite and disease transmission, and bat conservation will be discussed.

## Session 3: Bat Acoustics

### The detectability of bats: a question of biology or technology

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Although bat detectors are used as an essential survey tool by many people and there are now several models available, there has been very little systematic testing of the relative performance of different models of bat detectors, either under laboratory or field conditions. For studies where estimation of inter-specific comparisons of activity levels or occupancy across space or time is important, the unknown probability of detecting different species of bats acoustically leads to a bias towards species of bats which are more likely to be detected.

We addressed the issue of the reliability and comparability of acoustic bat survey data by directionally calibrating six commercially available bat detectors (Anabat SD1 and SD2, Song Meter SM2BAT, Batbox Duet, Batbox Griffin, Ecoobs Batcorder) using digitised playbacks of calls from eight species of UK bats (noctule, Leisler's bat, Natterer's bat, brown long-eared bat, soprano pipistrelle, lesser horseshoe, greater horseshoe and barbastelle) in an acoustic chamber. It was then possible to calculate a three-dimensional survey volume for each call type relative to the following factors within a given survey scenario: species/call type; bat detector model and environmental conditions. The next step was to derive correctional factors for survey scenarios to enable the calculation of activity levels corrected for both temporal (unit of time) and spatial (survey volume) factors.

The results of this study demonstrate that there is substantial variation in the overall detectability of different UK bat species due to variation in the frequency and amplitude of their calls. There is also variation in the sensitivity of different bat detectors to different bat calls and this variation is particularly dependent on the microphone design, which affects the detection directionality. This work provides a novel analysis technique to correct a substantial bias inherent to the results of survey work which is reliant on bat detectors. It also emphasises the need for greater awareness of the limitations of bat detectors and provides an objective method for comparing their relative performance.

## **Open source echolocation call analysis software and its application to field studies**

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Bat detectors are an invaluable tool in the study of bat ecology and in conservation work. However, two main factors have limited the breadth and scale of acoustic monitoring in field studies: the high labour costs involved in analysing large amounts of data and the difficulty in identifying calls reliably to species. To help address these issues we have developed an Open Source (source code publicly available) software application for the automated extraction and classification of echolocation calls from time expanded and direct sampling recordings (i.e. those collected by the latest generation of loggers, such as the Pettersson D500X and the Song Meter SM2). Written in C++ for speed of execution, echolocation calls are quickly extracted from recordings using an adapted algorithm originally designed for music analysis, with adjustable settings to influence the sensitivity of the call finding. By using libsvm, an efficient library implementing support vector classification, we are able to identify even *Myotis* species with classification rates of >95%. I will summarise the development of the software before detailing some of the discoveries we've already made from its application, both to summer and swarming activity field studies, such as the surprising abundance of whiskered/Brandt's in the Lake District. By releasing the software as open source we hope the wider research community will help extend the project in the future, to keep pace with the latest advances in bioacoustics and echolocation analysis.

## **The bat in the CAT: micro-imaging of the bat's ear, nose and throat**

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The bat's echolocation system is capable of some extraordinary feats which are of great interest to engineers who wish to replicate them. The output system of the bat's larynx can produce very loud signals over a very wide frequency range, while the auditory system is extremely sensitive and highly directional. Both these characteristics are potentially useful in a range of ultrasound applications. The key to understanding both the vocal tract and the auditory system is the 'transfer function', how energy is transferred from the bat to the outside world and vice versa. This depends on the detailed structure of the bat's vocal tract and external ears. In order to study both in situ, we have used a micro computer aided tomography (CAT) scanner at the University of Manchester, a machine more usually used to detect faults in engineering components. Bats which had died from natural causes are placed in the machine and a series of x-rays taken as the bat is rotated by a degree at a time. The x-ray images are then used to construct a 3-D image of both the outside and inside of the bat's head and throat as well as the external ears. This model can then be used to either simulate the interaction of outgoing or incoming sounds with the bat using acoustic simulation software or even to produce a scaled-up model of the bat's head through rapid prototyping which can be used in real acoustic studies. We describe the results so far, derived from a range of bat species, and the potential applications of the findings.

## **Benefits of automating bat call identification and the use of Anascheme**

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Acoustic detection is an integral component of any comprehensive bat diversity survey. It is now possible to deploy some detectors remotely and collect bat call data at large temporal scales. Despite the financial, conservation and research benefits of using this method of detection, the problem of accurate species identification remains. I will discuss the use of AnaScheme, a bat call identification program developed by Matt Gibson. AnaScheme can be used to extract many frequency, time and shape variables from calls recorded with the Anabat system, which can be analysed and used to construct identification keys. AnaScheme then provides identification output for call sequences, using a chosen key. I will present the results of a study conducted in eastern NSW, where 18-19 species or species groups were included in identification keys constructed for three different regions. By incorporating an 'unknown' category into the identification process, 56-75% of independent call sequences in a region were correctly identified to species, while misidentification of sequences was 5% or less. I will discuss the potential benefits of using automated call identification systems such as AnaScheme, as well as some of the problems needing to be dealt with.

## Session 4: Bat ecology in a changing environment

### Climate change linked range expansion of *Nathusius' pipistrelle* bat

Emma Boston<sup>2</sup>, Mathieu Lundy<sup>1,2\*</sup>, Ian Montgomery<sup>1</sup>, Jon Russ<sup>3</sup>; <sup>1</sup>School of Biological Sciences, <sup>2</sup>Centre for Irish Bat Research, <sup>3</sup>Ridgeway Ecology; [e.boston@qub.ac.uk](mailto:e.boston@qub.ac.uk)

We modelled habitat and climatic associations of *P. nathusii* in the UK and applied this model to the species' historical range in continental Europe. A binomial logistic regression model was constructed relating the occurrence of *P. nathusii* to climate and habitat characteristics using historical species occurrence records (1940–2006) and CORINE land cover data. This model was applied to historical and projected climate data to examine changes in suitable range (1940–2080) of this species. We tested the predictive ability of the model with known records in the UK after 2006 and applied the model to the known species' range in Europe. The distribution of *P. nathusii* was related positively to the area of water bodies, woodland and small areas of urbanization, and negatively related to the area of peat/heathland. Species records were associated with higher minimum temperatures, low seasonal variation in temperature and intermediate rainfall. We found that suitable areas have existed in the UK since the 1940s and that these have expanded. The model had high predictive power when applied to new records after 2006, with a correct classification rate of 70%, estimated by receiver operating characteristic analysis. Based on climate projections, our model suggests a potential twofold increase in the area suitable for *P. nathusii* in the UK by 2050. The single most influential climate variable contributing to range increase was the projected increase in minimum temperature. When applied to Europe, the model predictions had best predictive capability of known records in western areas of the species' range where *P. nathusii* is present during the winter. We show that a mobile, migratory species has adapted its range in response to recent climate change on a continental scale. We believe this may be the first study to demonstrate a case of range change linked to contemporary climate change in a mammal species in Europe.

### Do agri-environment schemes benefit bats and their insect prey?

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Many bat species in Europe have undergone large population declines during the last century. One of the driving causes is believed to be the loss of roosting and foraging habitat through agricultural expansion and intensification. Agri-environment schemes (AES) aim to counteract the negative effects of modern agriculture on biodiversity by providing financial incentives for farmers to adopt environmentally-sensitive agricultural practices. Whilst such schemes are potentially beneficial to bat populations, to date no study has quantified the response of either bats, or their prey species, to the implementation of AES prescriptions.

In 2008, we surveyed 18 pairs of AES and conventionally-managed farms in central Scotland to evaluate the effects of specific AES management prescriptions (field margins, hedgerows, species-rich grasslands and water margins) on foraging bats and nocturnal insects. In addition, we assessed the importance of habitat in the wider landscape at several spatial scales on foraging bats and their insect prey to determine at which scale management was most important for their conservation. Moth abundance and species richness were higher on farms participating in AES than on non-participating farms. In contrast, non-Lepidoptera insects (mainly Diptera and Trichoptera) were more abundant on conventionally-managed farms. Bat activity levels (mainly *Pipistrellus* spp.) were also higher on conventionally-managed farms. The surrounding landscape influenced bat activity; fragmentation metrics related to woodland configuration were the most important landscape characteristics influencing bat activity levels. In summary, the implementation of AES management prescriptions applied to relatively small areas benefits moth populations; this could potentially benefit some bat species (e.g. moth-eating bats such as *Plecotus auritus* and *Barbastella barbastellus*). However, our data suggests that the implementation of AES management prescriptions assessed in this study does not benefit bats foraging on Diptera. Such species may respond more positively to a landscape-scale management approach focused mainly on the creation and management of woodland.

A number of AES prescriptions to increase the amount and quality of woodland on agricultural land have been in place for the past 20 years, but little is known about how woodland character influences bat populations. Therefore, our more recent work (2009-2010) has focused on surveying woodland patches to evaluate the effect that woodland size and character (e.g. vegetation structure) have on bats and their invertebrate prey. Bat abundance was assessed using mist nets and a harp trap; the Sussex AutoBat (which simulates bat social calls) was used as an acoustic lure for bats. We will discuss these results and their management implications (e.g. woodland management recommendations to be incorporated into AES prescriptions).

### **A multi-scale approach to predicting species' distribution**

Chloe Bellamy, John Altringham; University of Leeds; [bsccb@leeds.ac.uk](mailto:bsccb@leeds.ac.uk)

To manage the landscape effectively and conserve bats, we need to understand how habitat composition and structure affect the suitability of an area for different species. However, establishing the relationships bats have with the landscape is a difficult task, given the problems finding and identifying these highly mobile and nocturnal creatures, and the difficulties in deciding on what scale to measure the surrounding habitat. We show how accurate models of species' distributions can be generated for large regions using acoustic data collected from relatively small, manageable areas. Using cutting edge Geographical Information Systems (GIS), presence-only habitat suitability modelling, and acoustic identification techniques we have produced species distribution models for the *Myotis*, *Nyctalus*, *Pipistrellus* and *Plecotus* species in the Lake District National Park. A suite of habitat variables were measured over a range of spatial scales (100 m – 6 km) before selecting the most informative scales for each species to build multiscale models.

Models revealed differences within and between genera, allowing insights into the distinctive requirements of each species. Inter-genera variations in the response to certain habitat features, such as road cover, may be explained by differences in echolocation calls, flight style and morphological characteristics. However, each individual species' distribution was best predicted using a unique set of multiscale variables. This suggests that niche differentiation mechanisms may have driven the partitioning of foraging habitats between morphologically similar species at different scales. For instance, all of the *Myotis* species were tied to inland water habitats, but *M. brandtii/mystacinus* were found to be woodland edge specialists compared to *M. nattereri* and *M. daubentonii*, which required high covers of deciduous or ancient woodland within small extents. The *Pipistrellus* species were also associated with woodland edges, but *P. pygmaeus*' preferred woodland-water boundaries surrounded by large amounts of inland water within 1.5 km. *P. pipistrellus* was more of a habitat generalist.

The final multi-scale models were found to provide accurate and useful predictions when validated with independent bat data from other regions of the Park. The resulting habitat suitability maps, which display predicted habitat suitability scores for each species, will be a useful tool for conservationists in the Park, but our approach can be applied to any landscape for which suitable data are available. The results also illustrate the importance of considering multiple landscape scales in management and policy-making decisions.

## The conservation biology of the grey long-eared bat

Orly Razgour, Gareth Jones; University of Bristol; [Orly.Razgour@bristol.ac.uk](mailto:Orly.Razgour@bristol.ac.uk)

The grey long-eared bat, *Plecotus austriacus*, is one of the rarest and least studied bat species in Britain. Lack of information on its ecology, behaviour and phylogenetic affinities has hampered the development of specific conservation management plans. Using integrated biology we studied the ecological and conservation requirement of the grey long-eared bat, focusing on patterns of distribution, habitat selection, diet and divergence from European populations.

Presence-only species distribution models (Maxent) confirmed that the distribution of the grey long-eared bat is restricted to southern England due to unsuitable climatic conditions elsewhere, including winter temperature and summer rainfall. Future climate change is predicted to favour range expansion along the west coast of England and Wales.

Radio-tracking of 20 bats from maternity colonies in Devon and on the Isle of Wight revealed that bat activity was affected by reproductive condition and temperature. Home range sizes were highly variable and foraging grounds were located up to 5 km away from the colony roost. In both colonies, grey long-eared bats preferred unimproved grasslands, riparian vegetation and broadleaf woodland, and used arable fields to the least extent.

Combining traditional microscopic faecal analysis with novel molecular diet analysis methods we found that the diet of the grey long-eared bat in Britain is comprised primarily of the Lepidoptera family Noctuidae and the Diptera family Tipulidae. Dietary diversity and composition varies seasonally.

Finally, we are using two mitochondria genes and microsatellites to study the evolutionary history and conservation genetics of the British grey long-eared bat population.

While the broad-scale distribution of grey long-eared bats across Britain appears to be limited by climatic conditions, changes in agricultural practices within their potential range in the past century may have serious implications for the conservation and long-term persistence of the British populations.

## Latest news from BCT

Julia Hanmer, Bat Conservation Trust; [jhanmer@bats.org.uk](mailto:jhanmer@bats.org.uk)

BCT works to secure the future of bats in a changing world. In this presentation I will share with you the latest progress under our three objectives, **Discover**, **Act** and **Inspire**.

We work to **discover** more about bat's status and how they use the landscape. Here I'll give an overview of the up-to-date bat population trends from the National Bat Monitoring Programme (NBMP)'s State of the UK's Bats and our research collaboration with UEA which has published clear evidence, based on NBMP data, about how bats rely on woodland, and their landscapes management needs.

We use the latest evidence to **Act** to secure and enhance bat populations by setting standards, developing guidance and working in partnership for bat conservation. This year we have launched Roost, a database of mitigation case studies and new professional standards, tied into our Survey Guidelines, as well as updating our training to bring this in line with our new guidelines.

**Inspire** is our work to win support for bats through education, outreach and marketing. We have just launched a refreshed Big Bat Map to encourage more people to go out and look for bats, plus brand new Adopt a Bat Scheme and we have exciting plans for community fundraising this Halloween.

This year, in United Nation's Year of the Bat, we are also celebrating 20 years of BCT. We've come a long way since BCT's founding trustees joined together with great foresight, to launch BCT and there is much to celebrate. As a charity we have grown to have 35 staff and nearly 5,000 members and over 10,000 followers on Facebook and Twitter. We have partnership and network agreements with 88 Bat groups across the UK and 3,000 volunteers taking part in our monitoring, helpline and bat care work.

This support allows us to achieve so much more for bat conservation and gives me great confidence in what we can achieve going forward.

## **Session 5: People and engagement**

### **Reaching out to new audiences**

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Public outreach work by bat groups and BCT has markedly raised awareness and appreciation of UK bats, helping underpin support for their conservation. In recent years there have been increasingly innovative approaches and partnerships in spreading the bat conservation message as widely as possible. Following the Count Bat Pilot Project in 2007, the Bedfordshire Bat Group has been working with park rangers, kayakers, scouts and guides, visually impaired people, those recovering from mental illness, gardening clubs and others, as well as contact with numbers of the previously bat unaware members of the public. There have been unexpected benefits to the Bat Group.

Here we discuss why we think it is of value for bat groups to extend their outreach work, give examples of success, and outline resources, case studies and support that are available to help them in doing this.

## **Session 6: Bats and Development**

### **Bats and Lighting in the Urban Environment; some lessons learned by the Thames Landscape Strategy in London**

Ken McKenzie; The Thames Landscape Strategy; [K.Mackenzie@richmond.gov.uk](mailto:K.Mackenzie@richmond.gov.uk)

Bats and lighting in the urban environment. Some lessons learned by the Thames Landscape Strategy in London. A review of the public perception on the fear of darkness, ways forward, new lighting and preliminary results pointing to better habitats for bats. Ken MacKenzie of the Thames Landscape Strategy Hampton to Kew reviews the five year long lighting project in a key bat habitat with the twists and turns faster than a pipistrelle. You will be astounded at the progress and results.

### **Strengthening professional practices to deliver biodiversity**

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Biodiversity encompasses a range of areas and systems; BCT's Biodiversity Team reflects this broad remit and addresses the work of professionals in many different fields. The past decade has seen a shift in legislation that has resulted in an ever increasing emphasis on biodiversity and the needs of bats within the built environment, woodland management, enforcement and the planning sectors. This talk will provide an overview of the work of the Bat Conservation Trust with SNCOs, NGOs, the public sector and industry to strengthen professional practice and standards. We will focus on the challenges faced and overcome in recent years, provide an outline for future progress as well as provide the opportunity for those in the field to raise their views.