

Bat News



Climate change – how is it threatening bats?

The Goldilocks approach: Bat boxes in a changing climate and landscape

Return of the night rider

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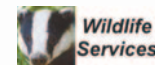
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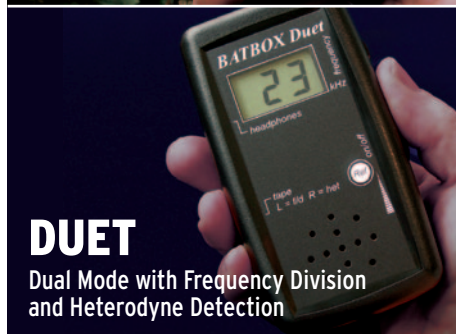
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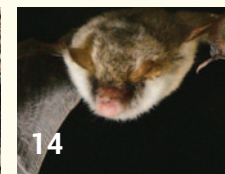
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Contents

Spring 2021

- | | |
|---|--|
| 4 Welcome from Kit Stoner | 18 Feature: The decline of the northern bat |
| 6 Spotlight on Bat Groups | 20 Research: The Goldilocks Approach – bat boxes in a changing climate and landscape |
| 10 Feature: Climate – a menace to bats | 22 International Conservation: Bat responses to increased aridity |
| 12 Feature: Insights on climate impacts | 24 BCT Feature: Return of the true night rider |
| 16 Feature: Migration shifts could help bats as the climate heats | 26 Bats and you: Jenny Clark |
| | 30 Bat Chat: Updates from across the batty world |



Bat News issue 123 correction:
BCT would like to apologise as the photo on page 18 of the last issue of *Bat News* should have been credited to Derek Smith, not Baptiste Chadeyron.

Cover – Spectacled flying foxes (*Pteropus conspicillatus*) – male, female and her young © Justin Welbergen. After the 2018 extreme heatwaves in Australia that led to the death of almost one-third of the nation's spectacled flying-foxes, IUCN upgraded the species from 'vulnerable' to 'endangered'.

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Welcome

From Kit Stoner, Chief Executive



This issue of *Bat News* focuses on climate change. Our Government has committed to targets to combat climate change and just as we were going to print, they announced that they are preparing to put legally binding targets to stop nature's decline into the Environment Bill. Although we are waiting to see the detail, it has the potential to make England the first country EVER to put a deadline for nature's recovery in law. Over the last few years many of you have been supporting our efforts on this front and we can't thank you enough. Our voices are being heard.

In our most recent campaign, we joined with other organisations to call for a State of Nature target to be incorporated into the Environment Bill. Over 160,000 people signed this petition which has undoubtedly played a part in letting government know that people care. While we wait for the detail of the government legislation, there is still time to add your name to the petition and ask your friends and family to do the same. www.tiny.cc/BCTEnvironmentBill

Nature and climate change are integrally linked. As outlined on page 12, our impacts on the natural environment through land use change, habitat loss and fragmentation, pollution and over-exploitation of natural resources have resulted in extensive wildlife losses and climate change. These two major challenges interact, threatening our food security and survival.

Last year was the hottest on record, and most years in the past decade have been too. Climate change has already had an impact on bats globally. Heatwaves in recent years have resulted in mass mortality events of flying foxes in Australia and insectivorous bats in Cambodia. Even in the UK, last summer 63 baby bats struggling in the heatwave had to be rescued (see page 5).

In this issue, we explore the potential impacts of climate change on bats. The increase in temperature extremes causing heatwaves, droughts, floods and wildfires, pose an immediate threat to many species, including bats. You can read more about the research that is taking place to help understand the ecological and evolutionary responses of bats to climate change (see pages 10-15).

Some bat species have already expanded their geographical range in response to increasing temperatures linked to climate change. Highly mobile species such as migratory bats could potentially shift their summer and wintering habitats to higher or lower latitudes according to regional climate changes (see page 16).

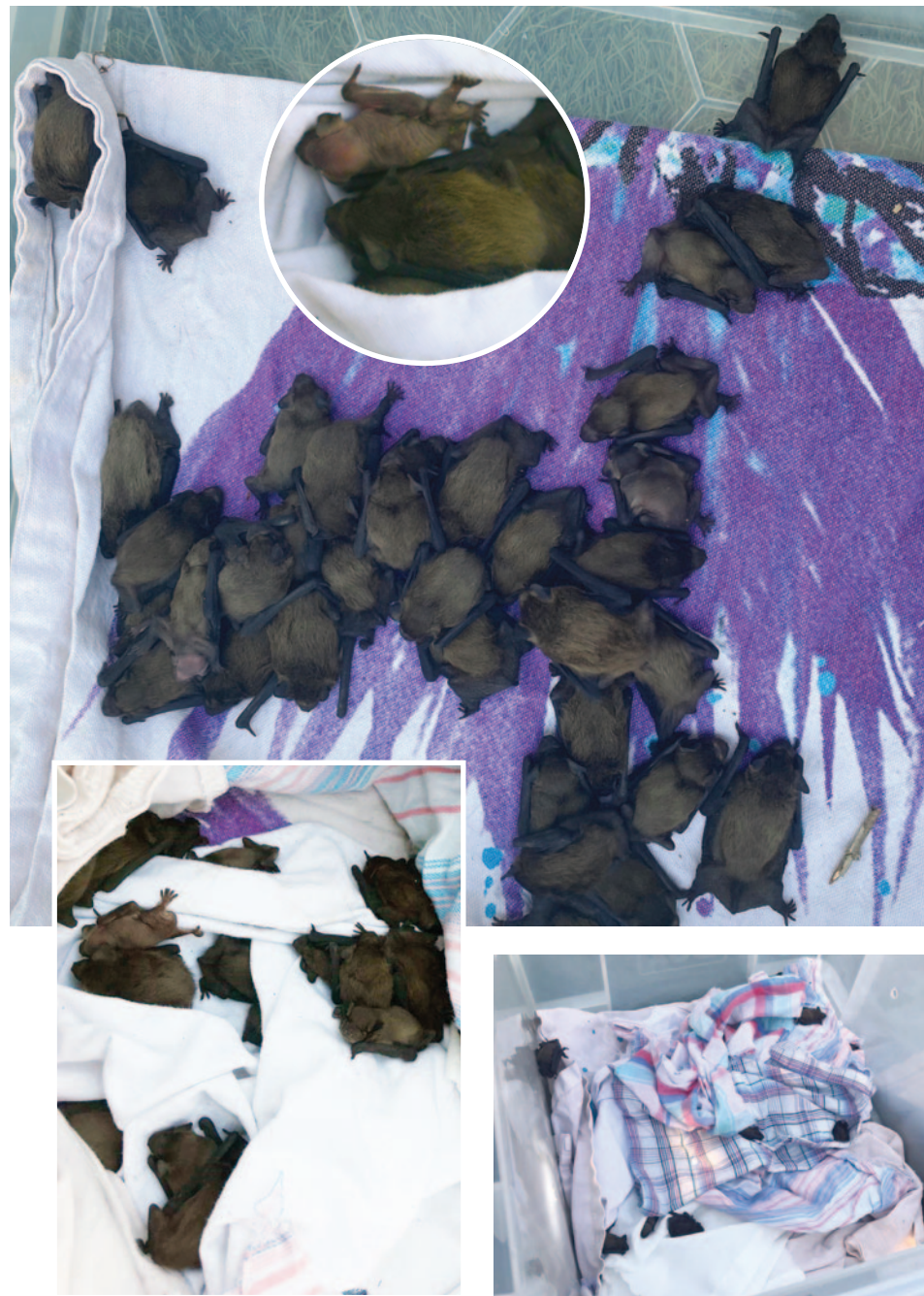
Elsewhere in this issue you can read about whether the decline of the northern bat is linked to climate change (page 18), bat responses to aridity (page 22) and some of the ways in which we can help mitigate some of the impacts of climate change on bats (pages 21 and 24).

Thank you once again for adding your voice to ours in calling for positive change. We hope the government takes this once in a generation opportunity to influence the laws that will help protect all our wildlife for today and future generations.



Kit Stoner Chief Executive

In July 2020, the National Bat Helpline and members of South Lancashire Bat Group rescued 63 baby bats that were found in daylight and struggling in the heat wave. It is thought the dramatic rise in temperature probably became too much for the mothers, so they flew off somewhere cooler during the day and left their pups behind. Mums and pups were later successfully reunited.



Photos © Steve Parker

SPOTLIGHT on Bat Groups

Bat groups, made up of many dedicated volunteers, are the mainstay of bat conservation in the UK, undertaking vital front-line conservation work.

When you can't go out to survey the bats, get the bats to come to you!

Jessica Dangerfield, of Cardiff Bat Group, tells us about the adventure of finding an elusive bat!

The 2019 season was an action packed one for us, with multiple new projects running in our Bat Group including the Welsh Nathusius' Project. We surveyed three sites catching 11 male Nathusius' pipistrelles (the females eluded us). Sadly, the project was then suspended due to the coronavirus pandemic.

In 2020, we undertook what limited work we could, visiting and deploying AudioMoths at potential new sites and with sadness accepted that we would not be seeing any Nathusius' pipistrelles this year. However, we didn't dwell for too long as the 2020 season kept us extraordinarily busy with bat care (following all the new safety procedures, of course).

In October, we received a call from a teacher whose students had found a bat inside their classroom. The school itself was situated at the top of a lake we would have been surveying this year! On arrival, I peered into the box and saw a Nathusius' pipistrelle staring back! I excitedly explained to the teacher about our research on this species (who politely humoured me), before taking it home, and on closer inspection... it was a female! A first for us, having caught only males last year! Luckily, she had no injuries but was slightly underweight. She was fed up and fitted with a ring before being released back at the lake.

We are now even more excited to recommence surveying for the Nathusius' Project (when it's safe to do so) and all the more keen to survey this site in particular! Hopefully, we might encounter this girl again. This story goes to show the additional value bat care work has in generating species records, so to all the Bat Carers out there – keep up the good work!



Here she is all snuggled up and looking very inquisitive



The female Nathusius' pipistrelle in care after being found in a classroom

Photos © Jessica Dangerfield/Cardiff Bat Group

The Lothians' lockdown bat survey

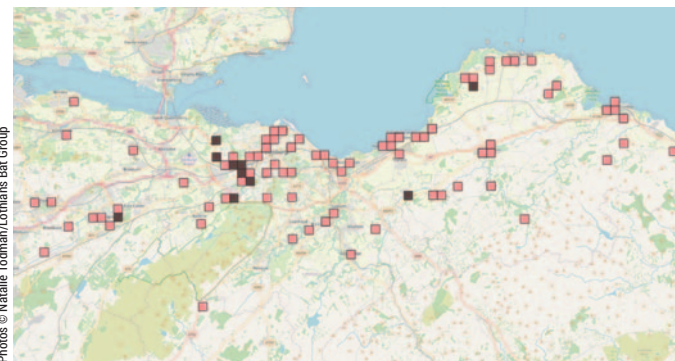
Natalie Todman describes some of the inventive ways Lothians Bat Group has kept engagement up during the lockdown.

Like most other bat groups, when the country went into lockdown at the end of March, we saw all our batty plans for spring and summer surveys and engagement disappear into the mist of COVID-19. So, we had a little think and wondered... if we couldn't do survey work, could we find out something more about our local species over our whole Bat Group area – and so the 'Lothians' Lockdown Bat Survey' came into being!

We chose a Tuesday evening in early May and advertised the survey to our members through our email list, and more widely to other individuals and groups via Facebook and Twitter. The idea of the survey was simple - people were asked to watch from their garden or window for an hour from sunset and submit their postcode and whether they saw any bats.

Although the general idea was adapted from the ethos of the NBMP Sunset/Sunrise survey, we wanted something that required no equipment or specialist knowledge, or even participants to leave the comfort of their living room!

The response we got was far greater than we had ever hoped! On the evening of the survey we had people commenting on our Facebook page, posting pictures and videos of the bats they were seeing in their gardens, tweets, emails and messages. So many people who participated had no previous interest in, or experience of bats, but had seen the survey advertised and thought it would be something a bit different for a lockdown evening! Overall, we received 115 records, 82% of which included bat sightings; many of these were from areas where we had no previous records which was great. However, to be honest, the big outcome from this wasn't about generating records, but rather to encourage people to engage with bats, not just as something that you have to travel somewhere specific to see, but as part of the wildlife in your own local environment.



The results from the Lothians' Lockdown Survey; pink squares show where bats were recorded and brown where there were no recorded bats



The survey was a great way to spend a lockdown summer's evening and gave the volunteers an opportunity to enjoy the outdoors



Bat detector at the ready!

Photos © Natalie Todman/Lothians Bat Group

Bats in Churches and Derbyshire Bat Group team up!

Rose Riddell writes how the Derbyshire Bat Group has put up bat boxes in a churchyard for the Bats in Churches project to provide extra homes for the church bats at St Peter's, Netherseal.

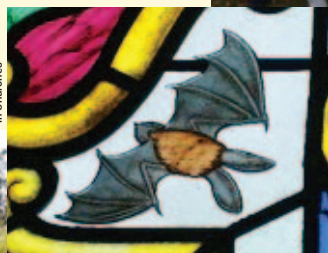
Several hardy members of Derbyshire Bat Group (DBG) braved a brief but torrential downpour on 9 October 2020 to install five Eco Kent bat boxes (The Nestbox Company) in the churchyard of St Peter's church in the Derbyshire village of Netherseal.

The medieval church is involved with the Bats in Churches (BiC) project as it shelters a maternity colony of brown long-eared bats, as well as being visited by pipistrelles and Natterer's bats. The bats fly inside the church leaving droppings and urine staining throughout. With funding from the BiC project, bat surveys are being carried out this year by an ecologist to find out exactly how the bats are using the church and to come up with solutions to minimise their impacts on the



The sun came out eventually. Bill Cove, Aiden Leheup (DBG) and Rose Riddell (BiC) with St Peter's in the background

© Jill Leheup/Derbyshire Bat



Living bats are not the only ones that can be found in St Peter's. One of the windows sports a very fine stained-glass brown long-eared bat

historic interior, without causing them any harm. DBG also installed seven boxes in the grounds of adjacent Newlands Leonard Cheshire residential home. One standard bat box had been donated to the church (left in the

porch by an unknown bat enthusiast!) and this was also put up in the grounds of Newlands. The boxes will provide additional alternative accommodation for the church bats. DBG are planning a bat walk at the church later in the year when it is safe to do so.

The Bats in Churches project is supported by the National Lottery Heritage Fund. BCT is one of the project's partners along with the Church of England, Natural England, the Churches Conservation Trust and Historic England. More information at www.batsinchurches.org.



Bill Cove from Derbyshire Bat Group attaching the Kent box to one of the pines in the churchyard

© Rose Riddell/Bats in Churches

© Diana Spencer/Bats in Churches

South Lancashire BATlas project

Brian Robinson, of South Lancashire Bat Group, describes how the BATlas project has encouraged members to get involved with hands-on bat conservation!

I think it's fair to say that when we asked for volunteers to take part in the BATlas project at the start of 2020 we had no idea what was about to happen. However, the project (where volunteers go out and record bats by themselves) has fitted fantastically around the restrictions faced during this lockdown year.

The 'BATlas' project at its heart uses QGIS to show us where we don't have bat records in our area, and then asks volunteers to survey there. Simple. The project isn't new or novel to SLBG and other groups have provided us with advice on how best to set it up.

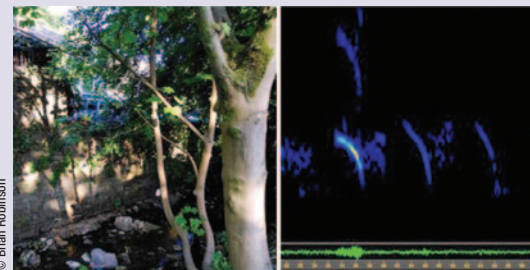
I would recommend any other group who has the ability to start their own to do so. For us, it's been a great way of reinforcing to our members that the data they gather for fun is valuable, and that the data can be used to make better assessments of bat species distribution in our area. It's encouraged members to go out and look for bats and demonstrated that you don't have to rely on the bat group to organise events for you – you can take on the role of organising and participating for yourself, and the data will contribute to something greater.

In the end we hope to create an atlas of bat species distribution for our area, but in the meantime, this has been a great way to drive participation in the group through what has been a difficult year, and to get new, newish, and long-standing members all out listening for and enjoying bats. And what could be better than that?



Steve and Polly on the hunt for bats

© Fiona Parker



© Brian Robinson

This picture shows the calls from a Myotis species (right) and where the recording was taken (left)



Can you spot the bat detector?

© Baptiste Chadeyron

To find details of a bat group near you please check the BCT website: <https://www.bats.org.uk/support-bats/bat-groups> or contact **Abby Packham**, Bat Groups Officer at: batgroups@bats.org.uk / 020 7820 7193

How climate change is threatening bats

By Yann Gager

Climate change is shifting natural habitats faster than ever - from global rises in temperatures to increases in the frequency of extreme climate events. This has resulted in landscape changes that not all species can adapt to, with bats being no exception.

A study published in the journal *Annals of the New York Academy of Sciences*, highlights climate change as one of the major menaces to the survival of many bat species. It adds other major threats including logging and harvesting plants, agriculture, hunting, energy production and mining (Fig. 1). The list of threats was determined by analysing 180 bat species which have all been recognised by the IUCN Red List as Critically Endangered, Endangered, or Vulnerable.

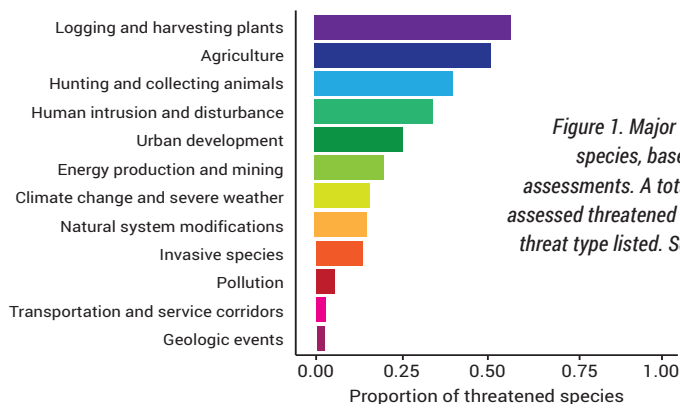


Figure 1. Major threats to threatened bat species, based on 2018 IUCN Red List assessments. A total of 170 species (94% of assessed threatened species) had at least one threat type listed. Source: Frick et al. (2019).

Since the beginning of the industrial revolution, heat-trapping gases released by human activity have directly increased the frequency, duration and intensity of temperature extremes, storms and droughts. Extreme temperature events have already threatened multiple bat species. For instance, temperatures above 42° Celsius (107.6°F) in Australia led to mass die-offs of flying foxes due to physiological stress.

In just one day in the summer of 2014, more than 45,500 bats belonging to three species, the black flying fox, grey headed flying fox and little red flying fox, all died from such an event. Higher mortality was observed in adult females and dependent pups, resulting in long-term negative impacts on species persistence due to reduced breeding in the population.

In response to increasing temperatures linked to climate change, some bat species have also expanded their geographical range. A well-known example is Kuhl's pipistrelle, which has increased its species distribution range by 394% in the last four decades.

According to consensus projections, tropical cyclones will decrease in number but increase in their maximum intensity and rainfall. Different species of flying foxes will be negatively impacted by cyclonic storms, with significant declines previously observed in various archipelagic systems, such as Guam, the Marianas, Rodrigues, Samoa, the Solomon Islands, and Tonga.



© Andrew Mercer



© Elizabeth Curran

Figure 2. Grey-headed flying fox in Brisbane, Australia (left). This species is extremely vulnerable to heatwaves, resulting in mass die-offs (right)

Individuals are not only killed by storms but also starved in their wake, due to the resulting reduction in food resources. This leads to bats foraging in sub-optimal spaces near villages or closer to the ground, making it possible for humans and pets to kill them. Crashes in flying fox populations are catastrophic for the forest ecosystems on islands because bats cease to function as seed dispersers long before they become rare.

An indirect threat from climate change to bats comes from the need for renewable energy sources leading to the expansion of industrialised wind farms. Wind turbines can have a significant negative impact on both bird and bat populations if they are built at the wrong site, disproportionately and negatively impacting migratory species that are attracted to the turbines. This situation is a green dilemma, where conflict between the needs of renewable energy to reduce carbon emissions are at odds with biodiversity conservation.

Turning off wind turbines during periods of low wind speeds as well as during migration season are examples of proven mitigation strategies to reduce casualties. Furthermore, recent research in Texas shows that ultrasonic acoustic deterrents can reduce bat fatalities for some species. Understanding the numerous causes and consequences of bat fatalities at wind farms is critical to minimising the impact of wind energy on bat populations.

The increase in temperature extremes, storms, and droughts predicted by current climate models will increase additional pressures on species already threatened, as well as species not yet threatened. Furthermore, there are at least 227 bat species where science does not yet have enough data to fully understand the impacts or conservation status, according to the 2018 IUCN Red List – that is roughly 16% of all bat species. Such species often slip through the cracks when determining conservation priorities. These species should be the focus of research to get a more accurate and detailed picture of the threats faced by all bats from climate change. It is abundantly clear that climate change has already made an impact on bats, and consequently whole ecosystems dependent on bats, such as island forests, are being affected as well.

Fighting climate change by decarbonising human activities is an endeavour that bat researchers and enthusiasts alike can contribute to, in order to ensure bat species and natural spaces thrive into the future.

Acknowledgments

This text was initially a guest post hosted on the blog of the Global Union of Bat Diversity Networks. I am grateful to Susan Tsang for her great help.

Climate change and bats

Last year was the hottest year on record. The question now is: 'How will climate change impact on bats?' **Dr Orly Razgour**, at the University of Exeter, has been looking for answers...

Last year was the hottest on record, and most years in the past decade have been too. Globally, average temperatures are now more than one degree Celsius warmer than during pre-industrial times. What does this mean for the biodiversity upon which we depend?

Our impacts on the natural environment through land use change, habitat deterioration and fragmentation, pollution and over-exploitation of natural resources have resulted in extensive wildlife losses and climate change. These two major challenges interact, threatening our food security and survival.

We are already seeing evidence of species shifting their range, moving to higher latitudes and altitudes in pursuit of suitable climatic conditions. We are also seeing changes in the growing season and timing of life history events. Up to 35% of species may go extinct by the year 2100 due to climate change, according to modelling studies. We have recently witnessed the first mammal species extinction caused by climate change – the Bramble Cay, an Australian rodent.

Increased frequency and severity of extreme events including heatwaves, droughts, floods and wildfires pose immediate threats to many species, including bats. Heatwaves in recent years have resulted in mass mortality events of tree-dwelling old world fruit bats in Australia and cave-dwelling insectivorous bats in Cambodia. In Europe, bats roosting in bat boxes around the Mediterranean are at risk

of overheating and death from heatwaves. Even in Britain, last summer 63 baby bats struck by a heatwave had to be rescued through the BCT's Bat Helpline (see page 5).

Bats are sensitive to hyperthermia and water loss due to their large membranous wings and high body surface area to volume ratio, which means that they are likely to be vulnerable to the effects of climate change.

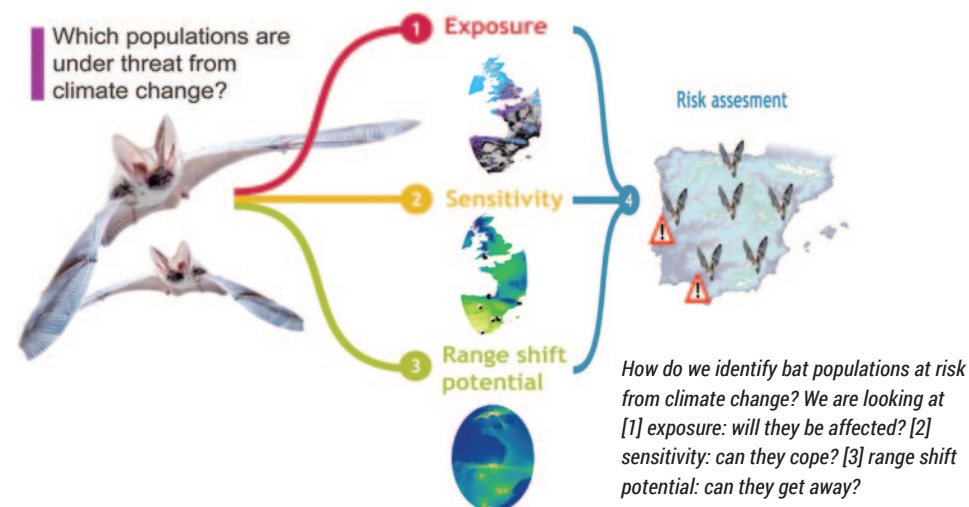
Our Global Change Genetics research group has been combining tools from different research fields to help understand the ecological and evolutionary responses of bats to climate change.

We use 'integrated' approaches. This means combining new genomic tools with ecological research, geographic data and modelling. We study the combined effects of different drivers of change and the impacts of climate change across different timescales.

KEY QUESTIONS

We began by asking how we can identify populations under threat from climate change. Much work has focused on identifying the most threatened species, but to help affected species amid climate change we need to know where to focus resources and how best to manage each population. Therefore we developed a framework that looks at whether bat populations will be affected by climate change, how well they can cope and whether they can shift their range to get away.

Wing biopsies were collected from grey long-eared bat populations in England,



Spain and Portugal, representing the northern and southern edges of the species' range.

Species distribution models were used to predict how suitable climatic conditions will change across the grey long-eared bat's range and identify populations found in areas that will lose their climatic suitability.

Bat genomic data was generated to identify populations that are adapted to cold and wet conditions, and therefore likely to be more sensitive to increasing

temperatures and reduced rainfall around the Mediterranean.

We also predicted which populations are likely to become isolated under climate change and unable to move to climatically suitable areas, based on how the landscape affects genetic connection between populations.

Finally, we combined all this information to identify populations at low, medium and high risk from climate change. Our work has highlighted the importance of landscape connectivity to enable bats to reach climatically suitable areas and for rescuing high-risk populations.

LOCAL DIFFERENCES

Current forecasts of climate vulnerability tend to treat each species as a single unit across its range, ignoring local adaptations. However, we know that local variation is likely to be important in enabling populations to respond to future changes.

We are focusing on two recently recognised Mediterranean bat species that are part of the Natterer's species complex: Escalera's bat and the Cryptic myotis (*Myotis escaleraei* / *Myotis crypticus*).



© Anton Alberdi



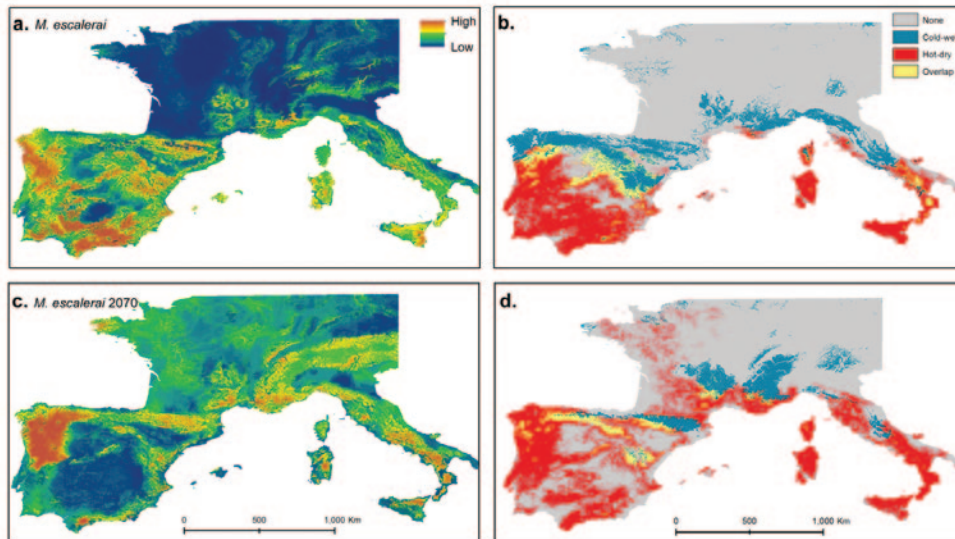
© Daniel Fernandez-Alonso

Genomic data was used to divide the bats into those adapted to hot and dry versus those adapted to cold and wet conditions. We applied this information to models predicting changes in climatic

suitability for these bats by the end of the century.

When we include these climatic adaptations, the range loss predictions are less severe. Our findings suggest that current approaches may have been over-estimating the vulnerability of certain species to climate change by exaggerating future range losses because they have not accounted for genetic variability and local differences. It is important to

identify the potential for a species to be able to adapt to climate change, and also to increase landscape connectivity between populations, to enable any adaptive genetic variation to spread.



Genetic variation within a bat species' population is an important factor when predicting potential loss or shift in its range due to climate change. These maps show predictions of present (top) and future (end of the century, bottom) climatic suitability for the Escalera's bat. The maps on the left treat the species as a single unit. Here climatic suitability ranges from unsuitable in blue to highly suitable in orange. In the maps on the right, the distribution of hot-dry (red) and cold-wet (blue) adapted bats was modelled separately. In these maps grey areas are climatically unsuitable and all other colours are predicted to be suitable for the species.

EXPEDITIONS

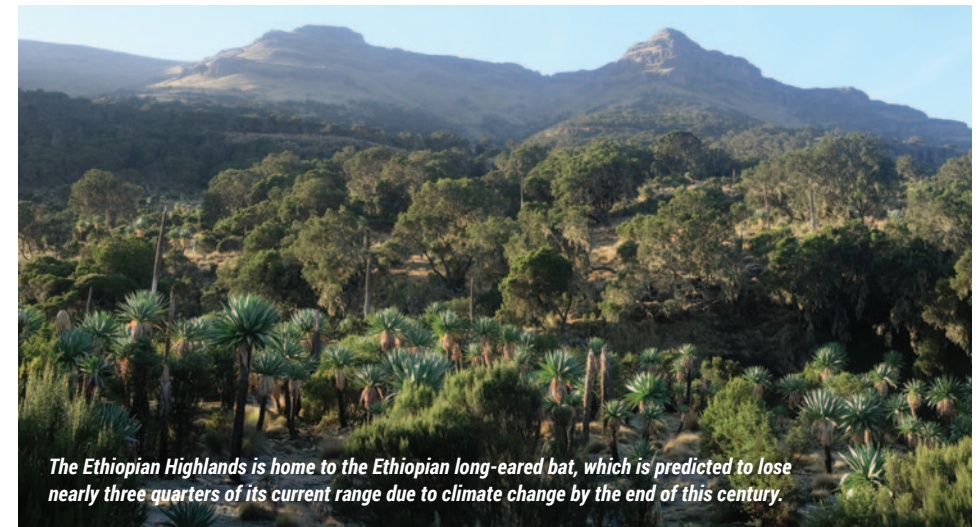
We are also looking at how climate change interacts with other drivers of change, and how that affects threatened bats. In three expeditions to the Ethiopian Highlands, we caught the endemic Ethiopian long-eared bat, (*Plecotus balensis*), which is restricted to mountain ranges above 3000 metres.

We were particularly interested in this bat because it is closely associated with high montane habitats, which are highly sensitive to the effects of climate change. Rapid population growth in Ethiopia over the last 150 years has resulted in increased pressure on the natural environment, making it an interesting case study.

expansion and extensive deforestation in the Ethiopian Highlands.

As the proportion of agricultural land cover increases, genetic diversity in these bats decreases. Put together, our work highlights current threats to biodiversity in tropical uplands from the combined effects of climate and land use changes.

Our key message on bat responses to climate change is the importance of adopting a holistic approach if we are to better understand how climate change interacts with other factors to affect bat biology, ecology and conservation. Conservation efforts for bats under climate change should also take this approach.



© Javier Juste

Our research found that climatic suitability for the Ethiopian long-eared bat has been progressively decreasing since the last glacial period (about 21,000 years ago), and that by the end of this century, these bats are predicted to lose nearly three quarters of their current range due to climate change.

We have also shown that the Ethiopian long-eared bat has experienced a severe population decline in the past 150 years, corresponding to human population

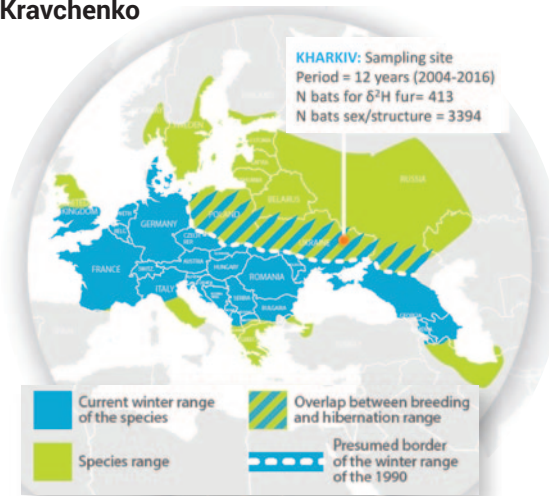
In conclusion we need increased landscape connectivity, to provide suitable habitats to sustain large populations, and we need to better understand the adaptive potential of wildlife. However, changes in bat communities and patterns of bat diversity are inevitable.

* Dr Orly Razgour's research is funded by a NERC (Natural Environment Research Council) Independent Research Fellowship.

Generational shifts help migratory bats keep pace with global warming

by Kseniia Kravchenko

The rapid pace of global warming is forcing animals to adjust their lives to ensure their survival and successful reproduction. Highly mobile species such as migratory bats could potentially shift their summer and wintering habitats to higher or lower latitudes according to regional climate changes. This flexibility could enable migratory bats to stay within optimal conditions for reproducing and rearing of young or for hibernation. For example, in recent years common noctule bats (*Nyctalus noctula*) have shifted their wintering area further north by more than 500 km (Fig.1). Yet the underlying mechanisms of climate-driven colonisation of winter grounds are poorly understood. Particularly, we would like to know which individuals regarding their sex, age and geographic origin are colonising the area first and therefore are more responsive to climate alterations. To answer this question a joint team of scientists from the Leibniz Institute for Zoo and Wildlife Research in Berlin, the Bat

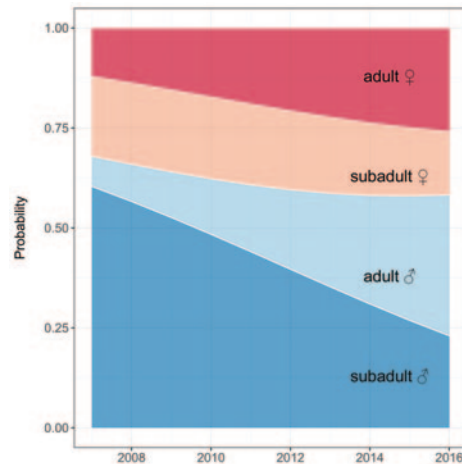


1. Change in winter range of common noctule in Europe

Rehabilitation Center of Feldman Ecopark, and the Ukrainian Independent Ecology Institute in Ukraine used a long-term study to address bat responses to climate change.

The investigation was carried out in the city of Kharkiv in northern Ukraine. Kharkiv city has a long history of bat research since the 19th century, which makes the city a unique reference site for tracking changes in bat abundance and distribution over centuries. Maternity colonies of common noctule females have long been recorded north of the Kharkiv area, with hibernating animals moving to areas well south of Kharkiv. The first individuals hibernating further north close to Kharkiv were encountered 30 years ago. Since then, we have found an increasing number of hibernating bats nearby.

Over the last 12 years, scientists collected data on age and sex of almost 3,400 individuals. The data showed that young (subadult) males were most abundant at the beginning of the colonisation of the northern



2. The proportion of different sex/age categories of individuals in hibernating communities of common noctule (*Nyctalus noctula*) for the 10-year study period



© A. Vlaschenko

winter area. Then, within the decade, the ratio of males to females and young to adult bats became more balanced (Fig.2). These results indicate that subadult male noctule bats are pioneers in establishing new winter grounds.

To reveal the geographic origin of hibernating bats, scientists analysed stable hydrogen isotopes in fur keratin. Animals incorporate the stable hydrogen isotopes from the environment in their tissues when they consume water and food. Stable hydrogen isotopes in Europe show a latitudinal gradient pattern which we can use to refer to their origin. Migratory bats change their fur (moult) once a year at their summer grounds before migration. For this reason, their fur will contain the same stable hydrogen signature until they moult again. This method is especially useful for the identification of bat's geographic origin at winter grounds.

The data of nearly 400 animals revealed that the number of long-distance migrants decreased in females and males across all age groups. This showed that in the early years of colonisation the hibernation population originated from summer quarters in the far north. More recently, the "local" population with summer quarters nearby, who previously had flown further south for hibernation, increasingly used the same area as their summer quarters for reproduction and wintering. Also, stable hydrogen analysis in fur keratin revealed that the proportion of migrants from the north decreased over time. Currently, new winter aggregations of bats at northern latitudes mainly consist of individuals of local origin. Fewer migrants

from the north indicate a decrease in the magnitude of migratory behaviour. Therefore, this study suggests that a generational shift in migratory behaviour is more prominent in young individuals, and having individual flexibility of adult bats is less relevant for the northward change in wintering range of common noctules.

The longevity, reproductive rate and dispersal capacity of mammals define how fast a mammal species can adjust to global warming by moving its geographical distribution. Since common noctules have a short life span, a relatively high reproduction rate, and can disperse over long distances, they may be able to adjust relatively quickly to global warming, even if the wintering area only successively changes from generation to generation. As we see in the case of common noctule bats, a significant change in species' wintering range has occurred over a relatively short period, starting several decades ago. However, mammal species with higher life expectancies, lower reproductive rate, and lower dispersal capacity may have a much harder time keeping up with the pace of global warming. If species' ranges only shift between generations, the pace may be too slow to keep up with the high rate of climate change, increasing the chance of species extinction. Further research will be necessary to understand these mechanisms of spatial adjustment to climate change in other mammalian species.



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The decline of the northern bat

by Jens Rydell

Ongoing climate change is affecting bats. Many researchers are currently trying to predict what will happen to them in the long run. In temperate regions we can expect that with longer and warmer summers and shorter, milder winters, many bat populations will increase in abundance and spread northwards. At the same time, species that live further north will face increased competition and new diseases from the south, which will likely result in declining populations and a shrinking range, with the centre of distribution moving northwards. How does this scenario compare with what actually happens?

Winter counts of bats have been carried out since the late 80s in hundreds of caves and mines all over Europe. These counts were recently summarised, and the result is clear. Nearly all species that hibernate underground, and thus were included in the study, like the mouse-eared bat, showed historical increases in numbers, from Italy and Spain to Scandinavia. As shown in other studies, bat species that tend to hibernate in trees or houses, such as pipistrelles, also increased in numbers and in some cases extended their range rapidly northwards.

However, a look at the northern bat *Eptesicus nilssonii*, the world's northernmost bat by far, in Scandinavia indicates that this species has declined dramatically. The decline was estimated to as much as 60% over the past 30 years. This figure was reached by means of



© Jens Rydell



© Jens Rydell

repeated counts of flying bats using a bat detector from a car along a 27km transect in Sweden. The count was repeated once per week over two years in 1988-89 and then, again, in 2016-17.

The increase and spread of the continental bat species and the decline of the northern bat seems to be in agreement with climate change predictions. Should we then conclude these results are caused by climate change? This would indeed be tempting, because it would indicate that we understand the effects of global warming reasonably well. However, we must first exclude alternative explanations, of which there are several. The northern bat often feeds on insects attracted to streetlamps and it seems likely that this extra food resource has boosted the population of northern bats over several decades, as long as streetlamps have been in use. However, the strongly insect-attracting mercury-vapour lights were replaced by less insect-attracting high pressure sodium lights in the period between the two surveys. The shift provided a "natural" experiment.

The transect was partly lit and partly unlit, and when these two areas were analysed separately, an interesting and somewhat unexpected pattern emerged. The decline of the northern bat activity was obvious in lit as well as unlit parts of the transect, but it was more dramatic in the former. There was an 85% decline in bat passes in lit areas compared to a 59% decline in unlit areas. This means that the decline of the northern bat was real and caused by the change of the lights from white (mercury-vapour) to orange (high pressure sodium). If the apparent decline had been an artefact of bats moving away from the streetlights following the change to high-pressure sodium lights, we would not have seen a decline in the dark section, only in the lit section.

Unfortunately we did not have sufficient information on species' distribution and abundance in the north and therefore we were unable to evaluate the climate change theory. However, if the decline of the northern bat had been an effect of climate change it would have been the same in lit and unlit areas.

In the end, our study did not seem to agree with the predictions from climate change theory, but suggested that the decline by more than half, of the northern bat, was primarily an effect of changed use of lighting technology. Things may not always be how they first appear.

The Goldilocks Approach – bat boxes in a changing climate and landscape

By **Cori Lausen**, Kaslo, British Columbia, Canada – Wildlife Conservation Society Canada

Bats are dropping dead from bridges during unusual cold in Texas, from trees in Australia during heat waves, and from bat boxes in Spain, Canada and elsewhere during exceptionally hot summers. Our climate is changing and it is no surprise that this is having a dramatic impact on bats – small mammals that walk an energy tightrope. A couple of degrees can mean the difference between thriving and perishing. Our efforts to help bats need to ensure they meet bats' very particular needs. What do we need to know to ensure we help and not hinder bats?

Bats have a unique struggle. Flight is energetically expensive, and limits the amount of food that can be eaten and fat that can be stored. So bats simply can't just maintain a 'normal mammalian' body temperature like humans. Luckily, a physiological adaptation – torpor – lets them use the temperature of their surroundings to great advantage.

Torpor is an energy-saving strategy whereby bats cool their bodies. In a cold roost they'd burn far too much fat keeping their bodies warm, so instead they slow their cellular metabolism, becoming almost lifeless in appearance. But while a cold body is good for saving energy, it is bad for a female trying to reproduce. Developing a fetus and producing milk requires cellular metabolism and thus a warm body. Quite the energy conundrum. The solution? – find a



Yuma myotis

© Cori Lausen

roost where the mother bat can use the heat of her surroundings to warm her body, instead of burning her own fat. Your attic or roof, heated by the sun, is likely to fit the bill, if they can gain access. Building roosts also offer enough nooks and crannies that bats can move around to find a 'just right' spot to roost

every day – not too hot, not too cold.

In a natural roosting environment female bats switch between trees or rock crevices, sometimes daily, to find that 'just right' roost. Studies of bats using natural roosts, as conducted by myself and others, have found that bats making up a single colony can use >70 roosts in one summer. In our ever-changing landscape, choice of natural roosts is shrinking. Some bat species have adapted to using buildings where a female can crawl around inside to find the microclimates she needs to develop a fetus, produce milk and ensure her pup is surrounded by warmth, day and night, for



Twin bays bulging bats in bat box

© Cori Lausen



© J Seremba

Bat house colony farm with white sheet awning

fast growth. My earlier research shows that females of some species thrive in buildings.

Here in Canada we are witnessing more evictions of bats from houses. Where do bats go when they are excluded from a roost that they may have been using for decades? That likely depends on how much has changed over that time – tree removal, demolishing of old buildings and construction of new sealed houses all reduce the likelihood of suitable alternative roosts in the neighbourhood. Good intentioned people are following recommendations to provide a bat house (or bat box, as I prefer to call it – it really is just a box!) to the colony that has been evicted. Following their winter hibernation, these creatures of habit return to find that their building-roost which had offered a myriad of microclimates, has been replaced with a small wooden box – akin to a single tree roost. And yet, a single tree would never provide all of the microclimates a female bat needs to raise a pup, so how can we expect a single bat box to?

Could this be the crux of our

overheating bat box problem? We know that natural crevice roosts will overheat also, but bats are not in them when they do. So why are bats remaining in overheating bat boxes? We are trying to answer this question in our ongoing research in western Canada; our main hypothesis is that they really don't have any choice. For example, in British Columbia, Canada, we witnessed an overheating colony of female *Yuma myotis* fleeing during the day from the only bat box erected near the building from which they were evicted. Luckily they didn't have any pups yet to have to carry. Another colony in Metro-Vancouver was not as lucky, and dozens of adults and pups dropped dead from an overheated bat box, situated near the house in which they used to roost.

We may not have all of the answers yet, but a precautionary approach seems warranted – one bat box is not enough. Dubbed the *Goldilocks Approach*, the goal is to erect multiple nearby boxes in a variety of sunny and shady spots to support an evicted maternity colony of bats – for female bats to find that 'just right' roost every day. A 'bat-friendly' neighbourhood will need multiple landowners to erect boxes, and they might consider erecting a large-scale bat house (Bat Condo) to offer greater microclimate options than a bat box. Indeed, it might 'take a village to raise the next generation' of urban bats.

Websites: www.bcbats.ca
www.albertabats.ca www.wcsbats.ca

Today's Bat Box Microclimate Report:



© Goldilocks cartoon by Hiro Sheridan

BAT RESPONSES TO INCREASING ARIDITY

by **Ricardo Rocha** and **Irene Conenna**

A bat's size, mobility and echolocation style influence how well it can respond to climate change. Understanding how these traits will play out under mixed climate predictions offers a crystal ball view of the future. In a new study, scientists have found that when areas become more arid, bats with long narrow wings, larger bodies and lower echolocation frequencies are faring better.

Arid and semi-arid regions cover around one third of the planet's land surface and are home to numerous bat species, including a wide diversity of desert and semi-desert specialists. A study led by Irene Conenna, a PhD candidate at the University of Helsinki, Finland, and now published in *Global Ecology and Biogeography*, mapped the assemblage-level averages of bat traits describing wing morphology, echolocation, and body size, for 915 bat species across the world, and modelled them against aridity values for the regions they inhabit. The observed trait variation in bats along global aridity gradients suggest that greater mobility and larger body size are advantageous features in arid environments.

Bats display wide variation in morphology, echolocation and habitat use, making them an excellent indicator group for assessing how species respond to changes in their habitats. "The responses exhibited by bats offer important insights into the responses of other taxonomic groups" explains Conenna, "our findings show that greater mobility favours bats' ability to track patchy and temporary resources, while the reduced surface-to-volume ratio



Close-up of a yellow-winged bat (*Lavia frons*)

© Adria López-Barcelis



African sheath-tailed bat (*Coleura afra*) in a semi-desert in Kenya

© Irene Conenna

associated with a larger body size is likely to reduce water stress by limiting cutaneous evaporative water loss. This allows us to better understand how increased aridity affects bats foraging efficiency, leading us one step forward to understanding limits in aridity tolerance and impacts of climate change", adds Conenna.

"Bats are some of the most successful desert mammals. Powered flight allows them to efficiently track scarce resources and their nocturnal lifestyle buffers them from the baking sun. Nonetheless, aridity poses a multitude of challenges to bat species and most species struggle to find enough resources in extremely arid ecosystems. Describing variation in functional traits along the aridity gradient, as presented in this study, can help us identify these changes and suggest how different groups of species might respond to the expected expansion in arid lands", says Ricardo Rocha, one of the co-authors of the paper.

The results of this global analysis largely align with a previous study also led by Conenna, in which miniature satellite-based tags were used to reveal that during drier periods desert bats must fly further and longer to fulfil their nightly needs, signalling their struggle as their habitat becomes harsher. Conenna equipped yellow-winged bats with 1g GPS devices to reconstruct the movements of 29 animals, 15 in the rainy season and 14 in the dry and, for one week she recorded their nightly whereabouts along the shores of Lake Turkana, the world's largest desert lake in Sibiloi National Park, Northern Kenya. This allowed Conenna to observe that during dry periods, bats used larger home ranges and had extended activity periods, potentially to compensate for a shortage in food. This suggests the fundamental role that mobility has in responding to increasing aridity.

Many ecosystems around the world are getting warmer and are predicted to become drier, and as they warm, bats and other animals need to cope with even harsher conditions. "Gathering information that helps us understand how bats will respond to these changes is fundamental to understand how local communities will be impacted and how we can implement better management to reduce these impacts", adds Conenna.

Return of the True Night Rider

by **Craig Dunton**, Grey Long-eared Bat Project Officer for Back from the Brink

Introduction

Since 2017, Bat Conservation Trust (BCT) has been working alongside the rest of the Rethink Nature partnership and Natural England on Back from the Brink. Funded by the National Lottery Heritage Fund, Back from the Brink is an ambitious species recovery programme, aiming to save 20 species from extinction and benefit over 200 more. The delivery for this has been through 19 projects running the length and breadth of England, from the tip of Cornwall to Northumberland National Park. Some of these projects have been focused on single species and some have been combined efforts focused on habitats and landscapes. Bat Conservation Trust has been involved with several of these projects and is leading on the species recovery project for the grey long-eared bat.

As the Back from the Brink programme draws to a close in August 2021 it is greatly satisfying that BCT, in partnership with East Devon Area of Outstanding Natural Beauty, is working on a new grey long-eared bat project. Focused on parishes in East Devon and West Dorset, this work aims to bolster and expand on the work of Back from the Brink by engaging with landowners to enhance the floral value of grasslands. Species-rich grasslands support a wide diversity and abundance of invertebrates, making them the favourite foraging habitat of the grey long-eared bat.

Habitat mosaics

Whilst wildflower meadows and the invertebrates they support are vital to grey long-eared bats, it's

important not to forget the wide range of biodiversity in the landscape that is threatened. Over 1600 species that occur in Devon are considered to be threatened with extinction in the British Isles, or are nationally scarce. Following the commitments outlined in the National Association of Areas of Outstanding Natural Beauty's (AONB) 'Colchester Declaration', this extensive list has been narrowed down to eight – to receive particular attention from East Devon AONB in the form of species action plans. This 'Elusive 8' contains three bat species (the others being Bechstein's bat and greater horseshoe bat) as well as other plants and invertebrates. This not only highlights the importance of wildflower meadows, it's also important for the landscape to be a diverse habitat mosaic, capable of supporting and connecting a wide range of species.

Why grey long-eared bats?

Why not, they're so beautiful! On a more pragmatic note, they are one of England's rarest mammals and certainly likely to be



affected by the changing climate. Distributed throughout Europe, their stronghold is in the Iberian Peninsula in Spain and Portugal and the English population is at the very edge of its northerly range. (See map).

As the climate changes, the conditions in the bat's stronghold are likely to become more harsh and unsuitable – driving populations further north (where that is possible). This means that populations at the northern-most edge of the range, including England, are likely to increase. However, there is one caveat that is absolutely critical to a species' ability to adjust its range in a heating climate, and that's the availability of suitable habitat. In this case, species-rich grassland.

England, and more broadly, the UK is likely to see an increase in the number of bat species supported, not only increases in populations. However, this may not all be good news for bats. Evidence suggests that species that are more adaptable – habitat generalists – are faster at expanding their ranges than more specialised species. For bats, this could ultimately mean that the more common species will benefit, whilst some rare species are disadvantaged. This is why increasing habitat quality, quantity,

diversity and connectedness is so important for bats, and all biodiversity.

Genetic resilience

Whilst Back from the Brink was focused on grey long-eared bats in Devon, the new project has ventured across the border into Dorset (see project areas shown in red). Bats don't recognise lines on the map, so it is vital that conservation organisations work together when restoring habitats. The aim is to focus on habitats around roosts and along the most likely route of travel for grey long-eared bats to move between populations. This will encourage and ensure genetic diversity, promoting a strong and healthy population that will be able to effectively adapt to the changing climate, now and in the future.

The grey long-eared bat project 'Return of the True Night Rider', will be running until February 2022. It is being funded through the government's Green Recovery Challenge Fund administered through the National Lottery Heritage Fund.

For more information about grey long-eared bats check out the latest edition of *British Island Bats (Volume 2)* or contact cdunton@bats.org.uk.



JENNY CLARK

Jenny Clark MBE is the founder of the Sussex Bat Hospital and long term supporter of the Bat Conservation Trust. Although she has now retired from bat care, she continues to raise awareness to the serious plight of bats across the UK and to change perceptions on bats. She has been involved with education from nursery to university level as well as large bat conservation events across the UK.

1. Bat Conservation Trust is celebrating its 30th anniversary this year. When did you first get involved in bat conservation and why?

My first introduction to a bat was a very long time ago. I've always been an animal person along with my husband who was an animal photographer. One day a friend phoned and said, do you want to photograph a bat my cat has caught? I hadn't a clue what to do with it. I looked after it until it started flitting round and then got it released. We were both captivated by the charm of this little creature which we knew nothing about, so we contacted the local bat group and talked to them. From then on it was a very steep learning curve, every bat was an opportunity to learn about it, to observe it and to watch it carefully to see its reactions. I felt that these wonderful little creatures were fascinating and beautiful, and all so different.

2. What has been the biggest change in bat conservation over the last 30 years?

They are immense. When I started trying to help bats there was a negativity and misunderstanding about them. I realised almost straight away that this was so unfair and so I started taking my bats to schools. Nowadays it is totally different, and this is due to all the bat groups throughout the country. Everybody working to explain to people what wonderful creatures they are has made a difference. Bat Conservation Trust

(BCT) has done immense work to educate the public about bats. I haven't got enough words to say how marvellous BCT are and how wonderful the work you've done. We are still learning about bats and trying to understand them. The only way we can truly help bats in this country and throughout the world is to understand the species.

3. Can you share a rewarding or magical moment of your bat conservation work?

I realised there was a need to show people how wonderful these little amazing creatures are and started going to schools with my small team of education bats who could not be released. In my first primary school, as I opened the door all the children's faces looked a bit frightened and then when I started showing the bats they lit up. Their eyes popping out and jaws dropping down with sheer amazement. You could hear a pin drop and they loved these bats.

Children are the grown ups of tomorrow, they will take that moment throughout their lives and when they grow up and have children, they will teach their children.

4. What advice would you give to someone considering getting involved in bat conservation?

I would welcome anyone that wants to get involved with open arms, but I would say examine your life and ask how much time

you are able to give. It does not matter if it's only a tiny bit. Join your local bat group, join the Bat Conservation Trust and if you have children join The Young Batworker. It's a wonderful magazine which inspires children. The best thing is if you can get the whole family involved. You can turn your garden into a wildlife haven. All you need is a little bit of time, just go to the BCT website and read all the literature. Learn about bats so it can help to spread the word.

5. What are the biggest challenges for bat conservation today?

I think it's terribly difficult for bats not only in this country but throughout the world. The challenge is to keep on learning, we need to fully understand all our bats. The more we understand about all the different species the better we can help them. That is why I have put so much of my energy in the last 40 years into children and education. You must inspire people to want

to do it and the way to do that is through the children. Let them see the sheer wonder of it and let them understand the problem. You also must get out there on television. Through television you meet an audience of five million or more. A village hall might be 20 or 30 people, do you see? It has to be the right message, not doom and gloom. Inspiration and wonder. Bats are incredibly diverse, and they all play an important role to keep the planet healthy.

6. Not a fair question, but do you have a favourite bat species?

I love all bats equally; they are all special in their own way. They are all endearing, and all have wonderful personalities. When I am handling one bat, I'm thinking you are the best bat in the world. I put it down, pick up another one and think, 'Oh you are so special'. So, all the bats are so endearing so special, clever and intriguing. I love them all equally.



BatWeekend at the Natural History Museum BatFest

Photo taken in 2014 © Natural History Museum BatFest



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The National Bat Conference 2021

29 – 31 October 2021

Thank you to everyone who responded to our survey regarding the National Bat Conference this year. As a result of this feedback, we are going to hold the National Bat Conference online again this year and we are moving it later in the bat season. It will be held on Friday 29 – Sunday 31 October 2021. Please save the dates! You can also stay up-to-date with all the latest plans by registering your interest in the event here: <https://forms.gle/VMFqYopXsPy57qVc7>



Our plans are still shaping up, but if you have any suggestions of elements from other online events that worked well, please send them through to our Training and Conferences Manager Naomi – nwebster@bats.org.uk

The Bat Conservation Trust AGM will be held on Saturday 9 October 2021

Get ready for the Sunset Surveys



Keen to get involved in bat monitoring?

You don't need any previous experience and you can start monitoring bats with 4 simple steps:



1. Download the survey form – scan the QR code or see the link below
2. Head out to your garden or local green space at dusk or dawn (or both!)
3. Spend 1hr looking out for bats (and other nocturnal wildlife you can see or hear)
4. Submit your exciting findings! Scan the QR code or see the link below



<http://bit.do/SunsetSurvey>

Rare bats feature on new stamp collectibles

Two of Britain's rarest bats, Kuhl's pipistrelle which may now be breeding here and the greater mouse-eared bat which may now be extinct in the UK, feature in a new series of commemorative stamp First Day Covers released in January 2021, to celebrate the 70th anniversary of Britain's first National Parks being established. Sales of the stamps generate a donation to BCT <https://www.buckinghamcovers.com/bct>



Out of Hours Helpline Crowdfunding

Thank you to everyone who donated and/or shared the Helpline Out of Hours Service crowdfunding; we raised just over half of the funds needed. Although we did not meet our full target BCT are committed to the work we do helping the public when they find bats in need of rescue and we will continue to fundraise for this service. If you weren't able to donate you can still do so here:

<https://www.justgiving.com/campaign/OutOfHoursBatHelpline>. The Out of Hours Helpline will start on 17 May 2021 and alongside it we are seeking volunteers to help us with bat care calls during in-office-hours. Together, these volunteers will make up our Volunteer Bat Care Helpline. While our funding goal has yet to be met, we will run the Volunteer Bat Care Helpline on a donate-what-you-can basis this summer. You can learn more here:

<https://www.bats.org.uk/support-bats/volunteer/helpline>



© Peter Crome

Bat Conservation Trust is celebrating its 30th Anniversary

BCT is celebrating its 30th anniversary this year. In the next issue of Bat News we want to celebrate some achievements in bat conservation over the last 30 years. We would also like to hear from you! From your most memorable experience through to what you think has been the greatest achievement, get in touch by emailing comms@bats.org.uk or writing to FREEPOST BAT CONSERVATION.

Company handed largest ever fine in relation to a wildlife crime

On Tuesday, 8 December Bellway Homes were fined for destroying a soprano pipistrelle roost at a construction site in London in 2017. Bellway Homes was ordered to pay a fine of £600,000 by Woolwich Crown Court with further costs on top. The company also made a voluntary £20,000 donation to the Bat Conservation Trust which will be used to continue fighting wildlife crime.

We need nature's recovery in law – PLEASE HELP

Great news for nature and bats! The Government has listened to the 160,000+ people who signed the State of Nature petition and it has promised to make England the first country EVER to put a deadline for nature's recovery in law.

A huge thanks to you and to everyone who have supported this campaign. We're winning for wildlife!

We need a legal guarantee that the Government will live up to its promise and protect nature so we want to ask you to please continue sharing this petition with your friends and family too: www.tiny.cc/BCTEnvironmentBill. Thank you for supporting stronger protections for nature!



Threats to bats

We do not currently have the resources to investigate or provide specific advice on individual planning or development cases. We rely on concerned members of the public to help us protect bats by bringing matters to the attention of the relevant authorities when there is a danger to bats and/or the law is being broken. We have information available via our website to help with any campaigns. We do occasionally publish position statements where a case threatens a bat population of national importance OR has the potential of setting a precedent that could undermine the legislation that protects bats and other wildlife. Two such position statements have recently been updated on HS2 and the Proposed Norwich Distributor Road Western Link <https://www.bats.org.uk/our-work/biodiversity-policy-advocacy/position-statements-1/hs2-position-statement>