

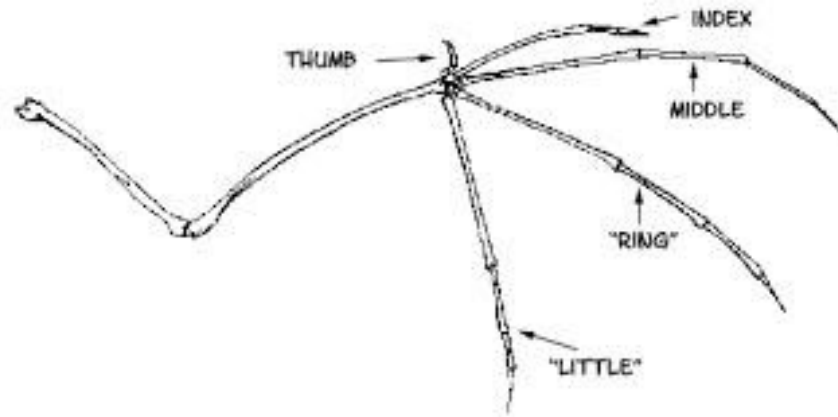
Bats of Britain

- What are bats?
- A year in the life of a (UK) bat
- Bats in the UK



What are bats?

- ▶ Mammals
- ▶ Order Chiroptera 'hand-wing'
- ▶ Three things set them apart from other mammal groups
- ▶ Torpor/ hibernation
- ▶ Echolocation
- ▶ Flight



Evolution of bats

- ▶ Fossil bat from Messel shale Germany
- ▶ Ca. 30 million years old, other fossil bats as old as 50 million years
- ▶ Already had echolocation
- ▶ Fed on flying insects
- ▶ Fully capable of powered flight
- ▶ Must have evolved much earlier
- ▶ Molecular studies place divergence at ca. 90 MYA
- ▶ Flapping primate or gliding insectivore?
- ▶ Early evidence suggested macrobats evolved from early primate
- ▶ Current thought is that all bats have a common ancestor
- ▶ Although horseshoe bats and their relatives are more closely related to macrobats than to the other microbats!
- ▶ Implications for evolution of echolocation



- Is this what the ancestor of modern bats looked like?



Flight

- ▶ Only mammals to have evolved flight
- ▶ Flying squirrel, sugar gliders etc. do not truly fly
- ▶ Very efficient way of travelling



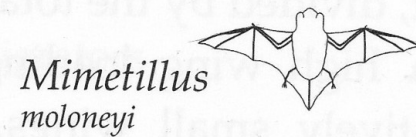
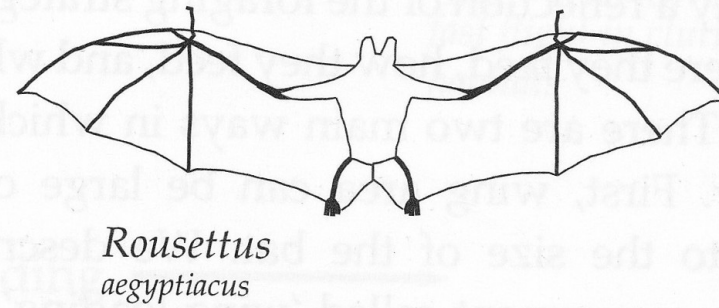
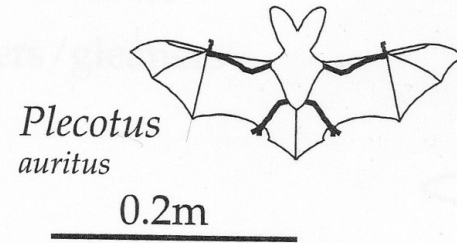
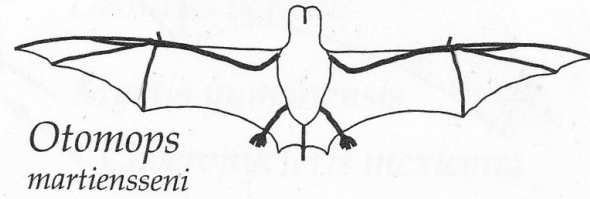
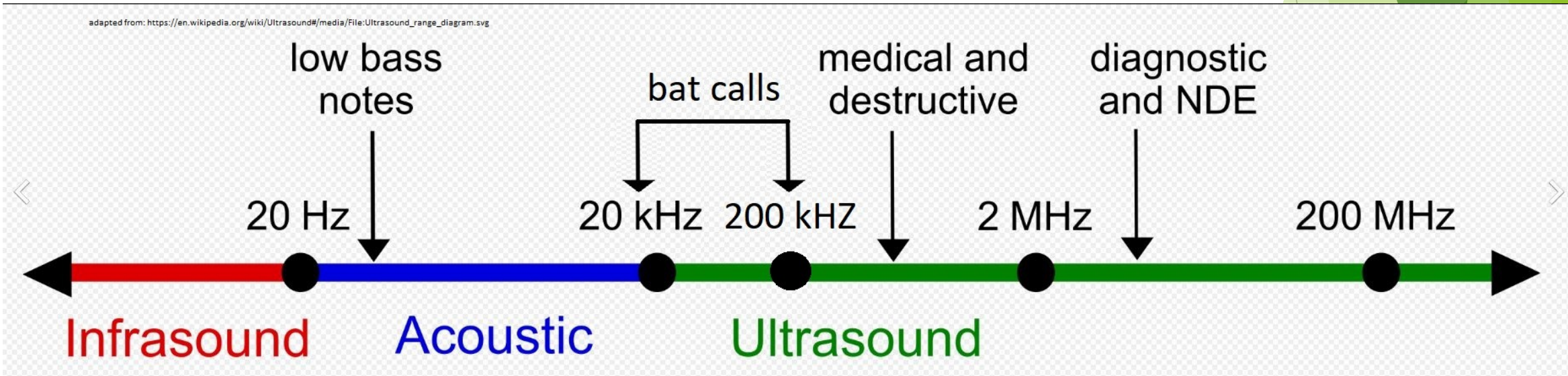


Figure 2.16 Variation in the wing shapes of bats.

Echolocation



- ▶ Not unique to bats
- ▶ Is made by 'shouting'
- ▶ At a frequency of ~12-110kHz in UK
- ▶ Human hearing range ~20Hz-20kHz
- ▶ Using bat detectors and practice, it is possible to identify species by call
- ▶ Calls are so loud, bats would deafen themselves if not for special adaptations



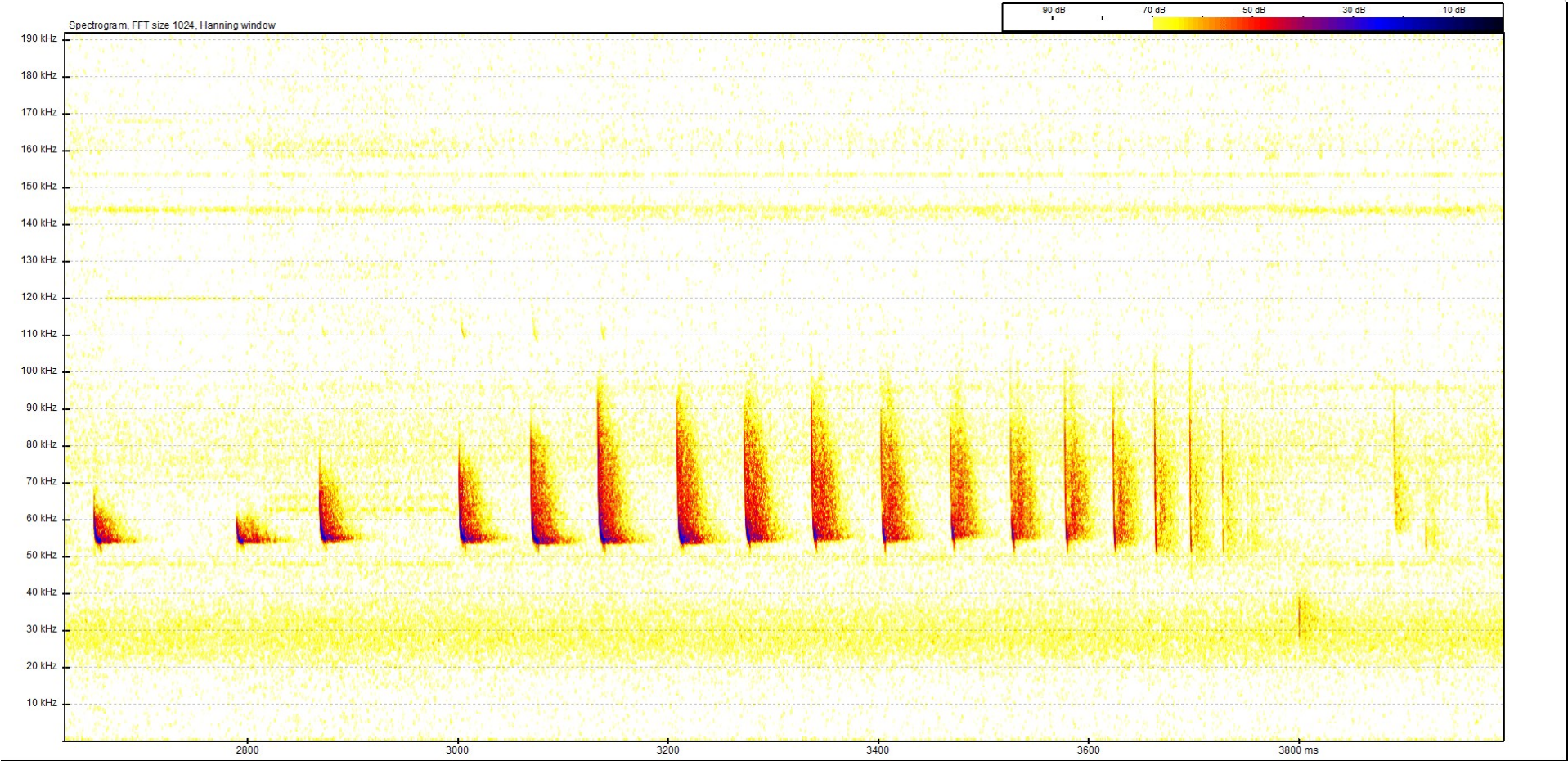
Why echolocation?

- ▶ When mammals evolved there were already lots of diurnal creatures about
- ▶ Presumably being nocturnal was an adaptation to avoid competition with reptiles and birds
- ▶ Allows navigation and prey finding in low light and complete darkness

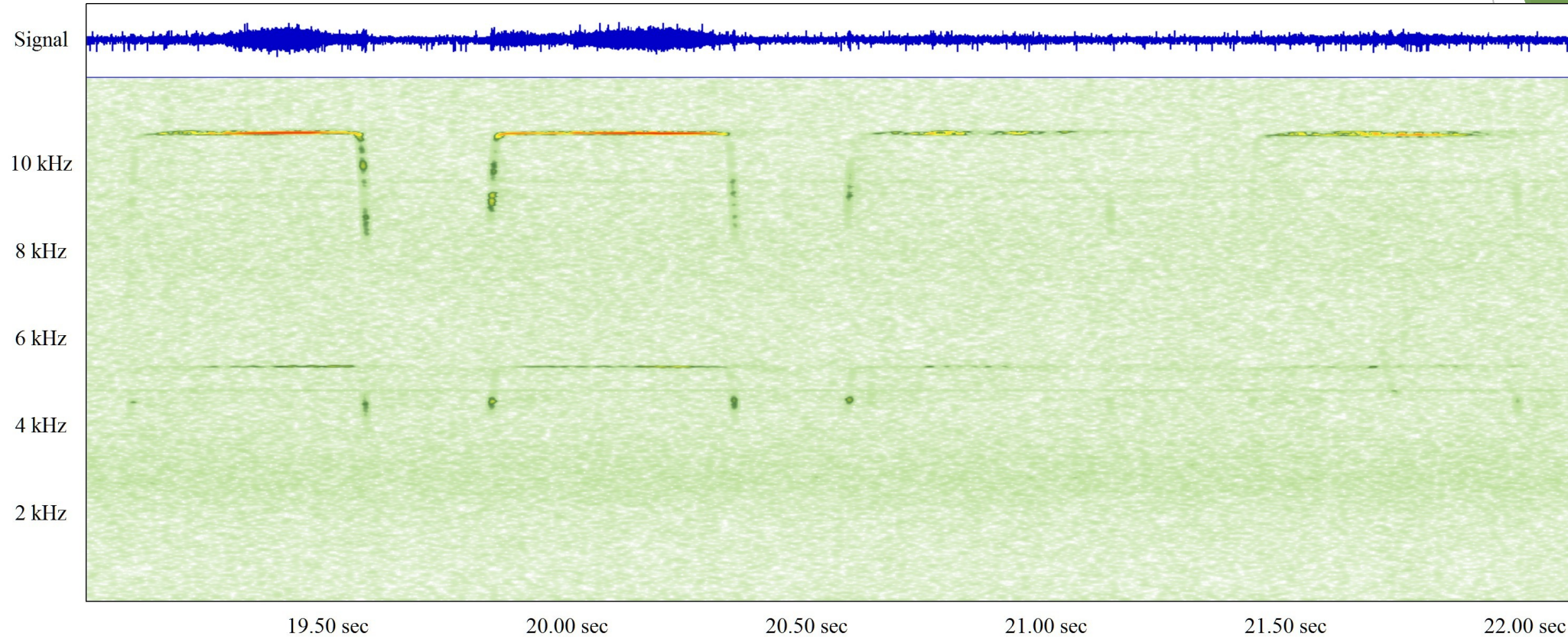


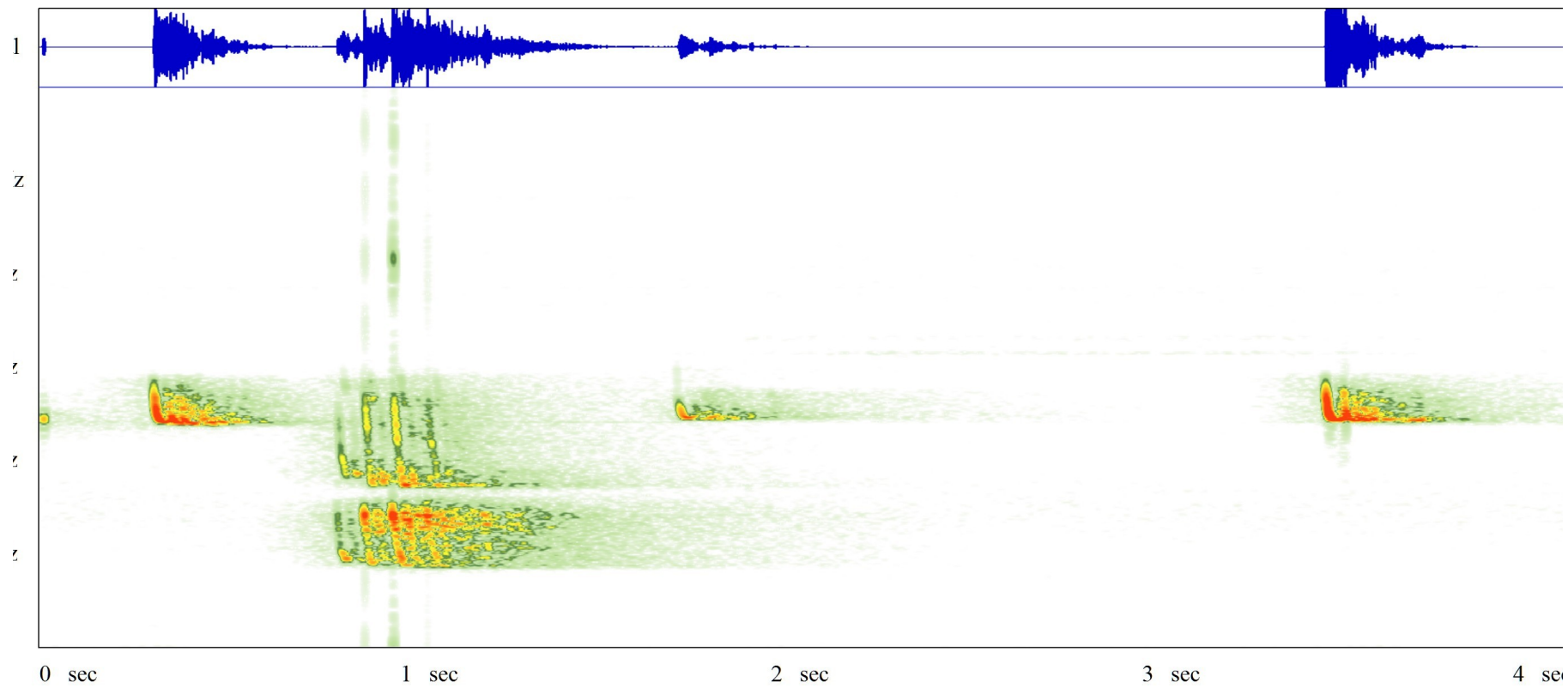
Frequency modulated calls

e.g. common pipistrelle



- Constant frequency calls
- e.g. lesser horseshoe bat





Social calls

Wide range of functions, this one is probably a mate-attracting call

Still a very poorly-understood field



Blind as a bat?

- Most bats see relatively well and have low-light vision similar to humans
- Some are known to have colour vision and can even see into the ultraviolet
- The larger the eyes, the less important echolocation is
- BLE have relatively large eyes compared to our other bats



- Regulation of body temperature and metabolic rate
- Torpor is often an involuntary reaction to external conditions
- Hibernation is a 'conscious decision' to save energy
- All UK bats do this
- Even tropical bats are known to enter torpid states to conserve energy
- This is real regulation as the bats maintain temperature within a certain degree of ambient temperature
- Only other UK animals to hibernate are hedgehogs and dormice



Macro/microbats



Lesser short-nosed fruit bat



Serotine

- ▶ Around 1,400 bat species known worldwide 20% of all mammal species
- ▶ 200 of these are macrobats
- ▶ Contain the largest bat in the world- wingspan of around 6 ft; weigh 1-1.5 kg
- ▶ Large eyes
- ▶ Most do not echolocate, some click their tongue to similar effect

- ▶ Microbats have the smallest; around 2 g
- ▶ About the same weight as world's largest bee



- ▶ Echolocation to find prey and orientate themselves
- ▶ Generally small eyes

Where do bats live?

- ▶ Almost anywhere large (not too large though) enough to shelter them
- ▶ Important to know the life cycle to understand why bats roost where
- ▶ Caves are ideal hibernation roosts; in northern Europe they are too cold to act as summer roosts but are readily used in the south
- ▶ Tree holes, cracks and crevices
- ▶ Anything man-made that mimics the above- roof voids, tiled roofs, timber-clad walls etc. etc.



A year in the life of a bat

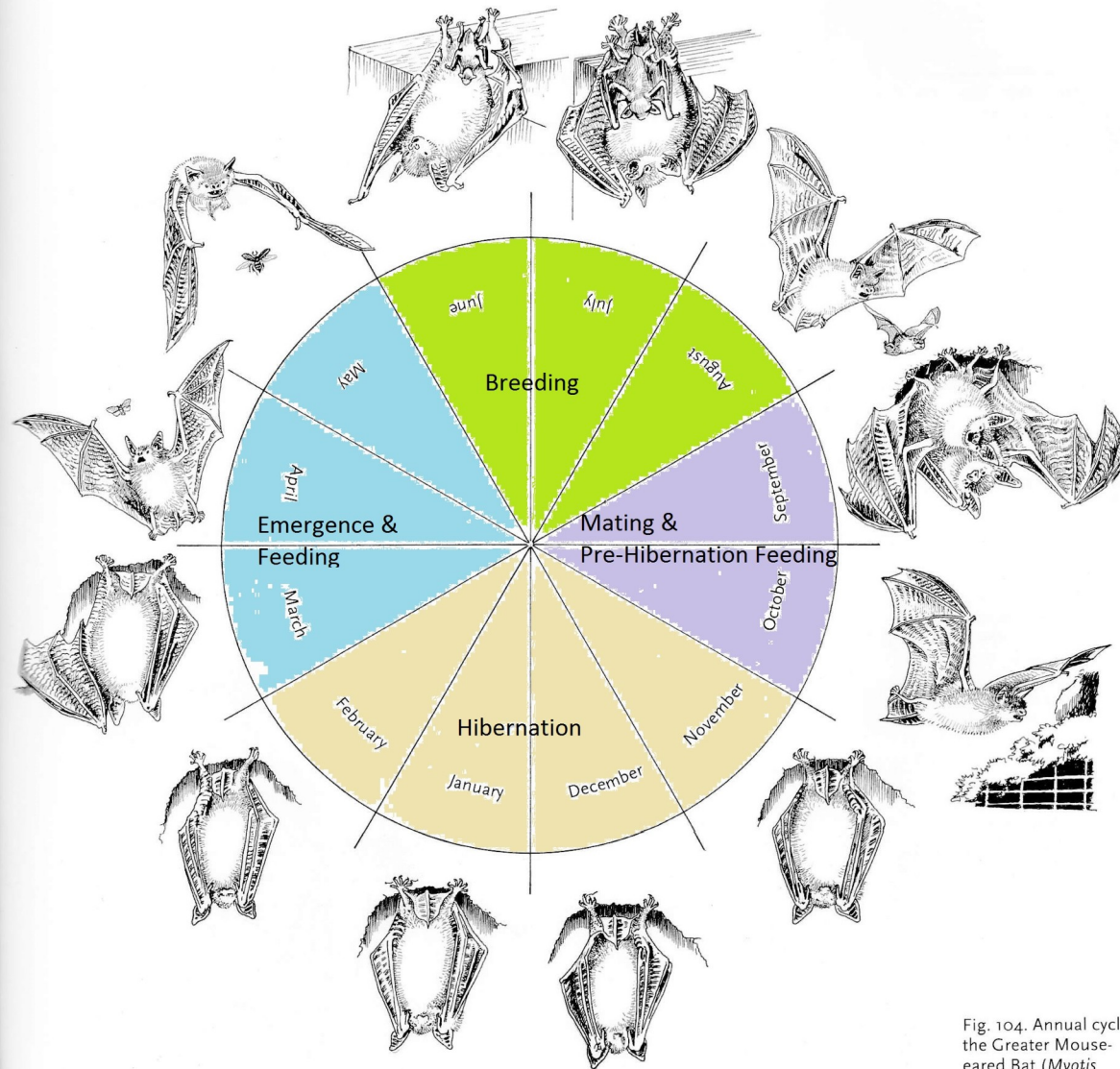


Fig. 104. Annual cycle of the Greater Mouse-eared Bat (*Myotis myotis*). Diagram: F. Weick from gen. lit. 17.

Hibernation

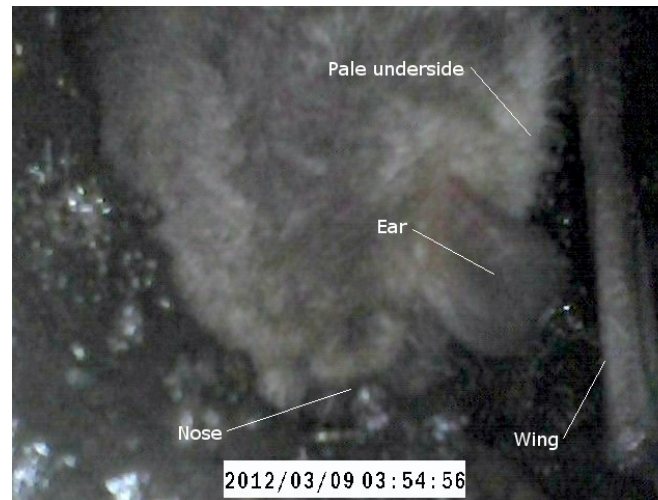
- ▶ All UK bats feed on invertebrates, so must hibernate when these are scarce
- ▶ Seek out places with fairly constant, cool temperature, such as caves, but trees are also used
- ▶ High moisture content, not uncommon to find bats covered in condensation
- ▶ Even in deep hibernation, bats probably awake on average once every 2 weeks, possibly to drink or move to more suitable conditions



Caves and old quarries are ideal



Trees are also used



Even bat boxes...



- Emergence in spring dependent on weather conditions, typically February/ March in UK
- Move to breeding grounds, which in the UK are not typically far away
- Continental species do migrate
- Fatten up in time for breeding season

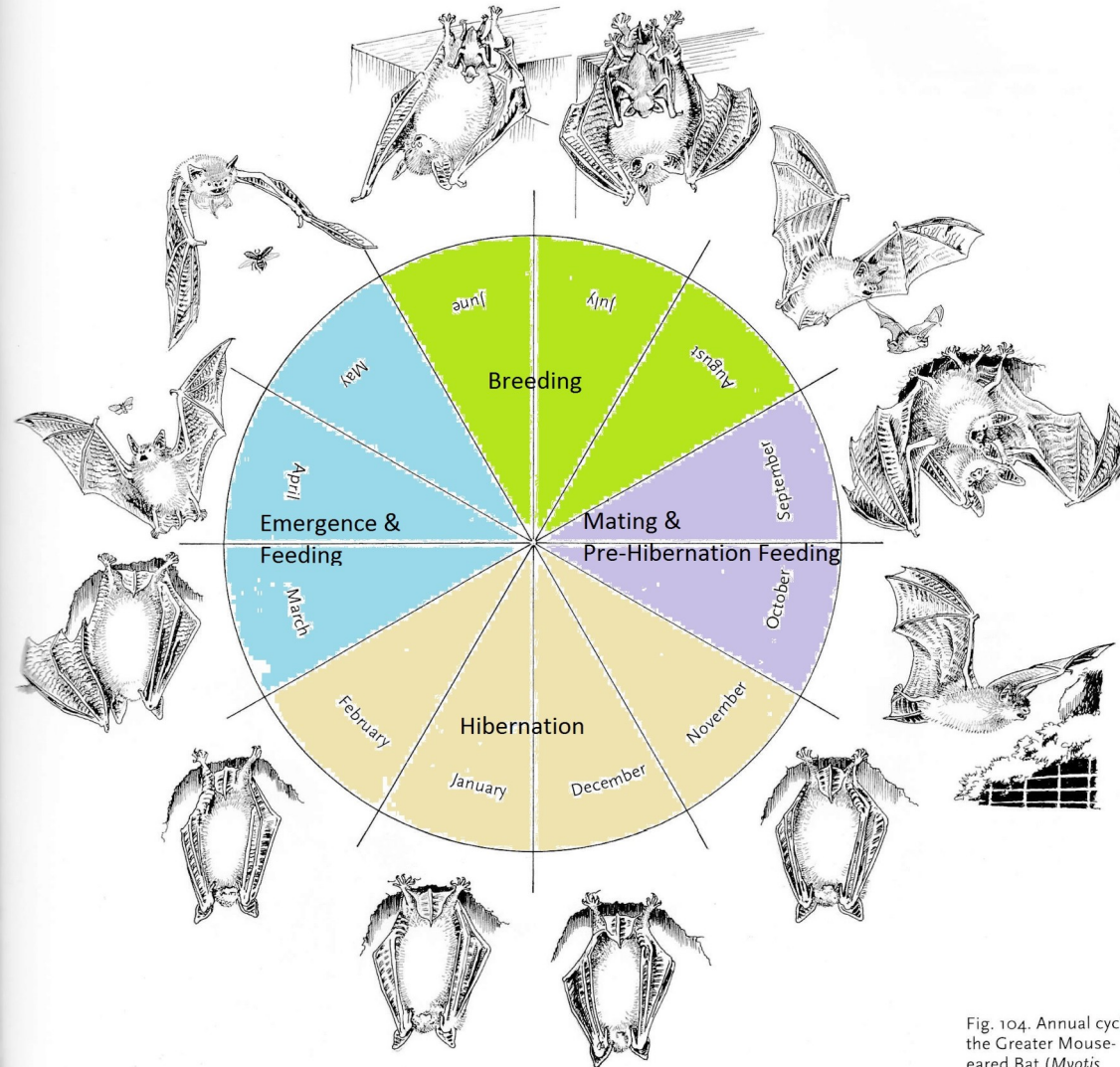


Fig. 104. Annual cycle of the Greater Mouse-eared Bat (*Myotis myotis*). Diagram: F. Weick from gen. lit. 17.

Breeding season

- ▶ Females come together in 'maternity roosts'
- ▶ In roosts that need to be warm, safe and damp but not wet
- ▶ Bats in UK typically give birth in June
- ▶ A single young/ pup
- ▶ Young is born well-developed, ca. 30% of mother's body mass the equivalent of a six-year old child!
- ▶ Young are independent within 3 months
- ▶ Males are not involved but may be present in the roost







- ▶ Species found in houses include brown long-eared bat, serotines, horseshoe bat and all three pipistrelle species

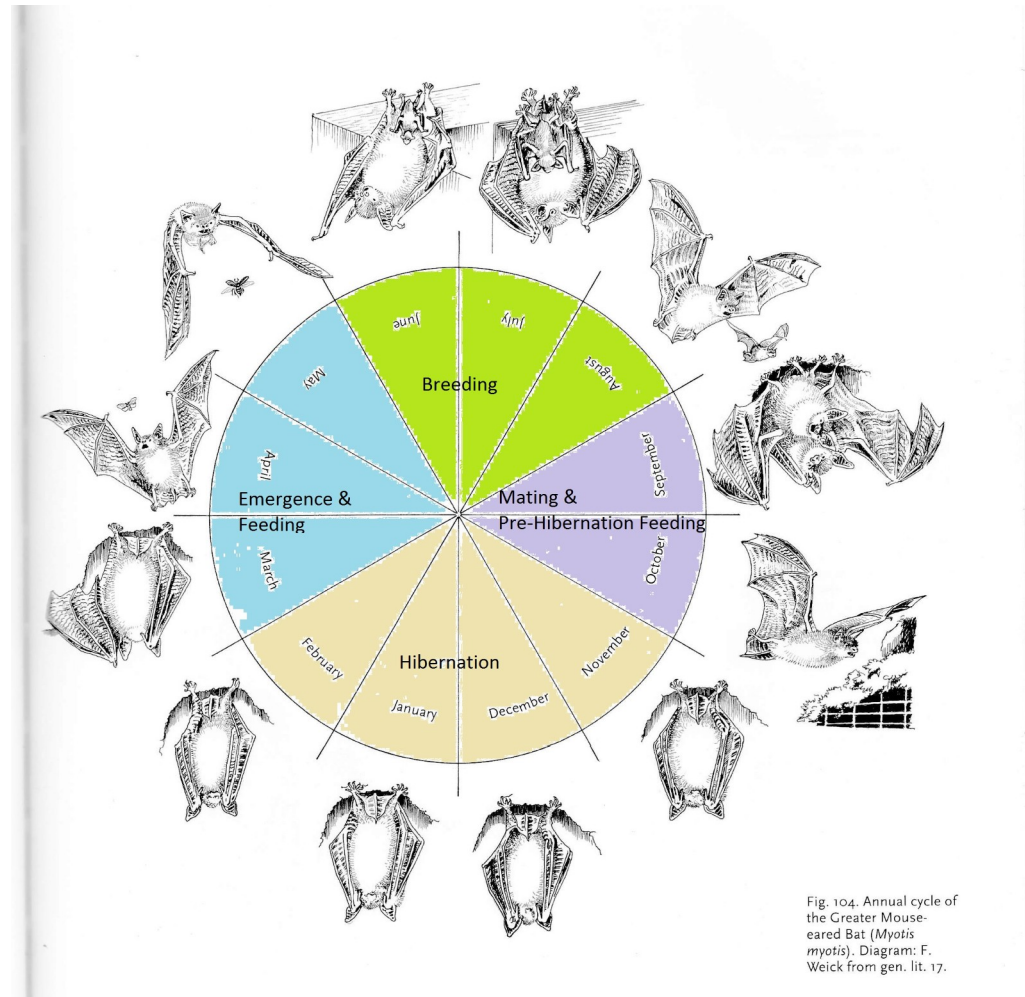


- ▶ Tree-dwelling species include brown long-eared bat, Natterer's bat, noctule, barbastelle and Bechstein's bat

Bat boxes can also help



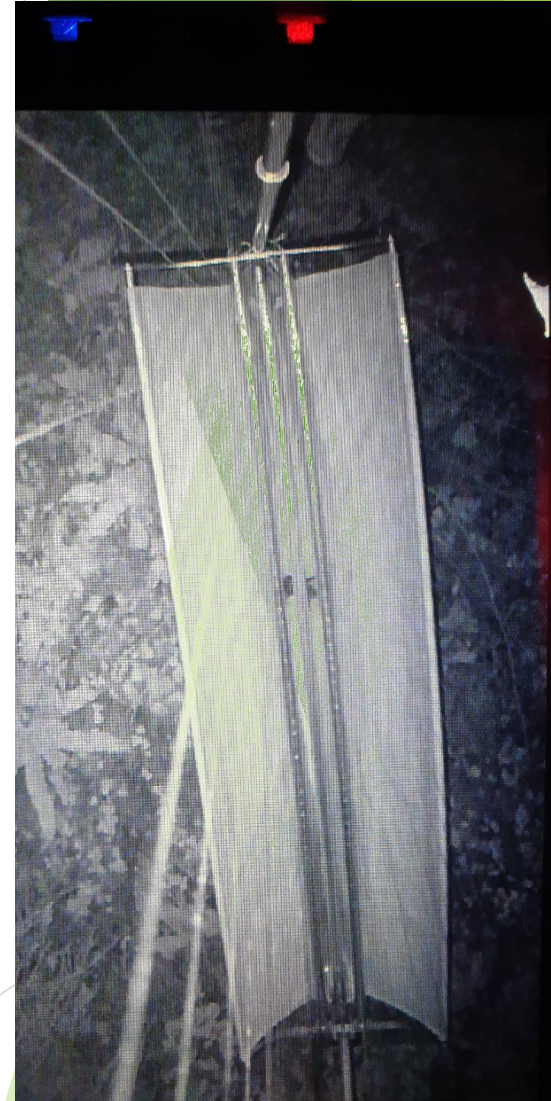
Mating in autumn



- ▶ Bats have many varied and often complex mating strategies
- ▶ In the UK, two of these are most common
- ▶ Swarming e.g. *Myotis* bats
- ▶ Resource-defence polygyny e.g. noctule, pipistrelles
- ▶ Mating is not confined to autumn though and can take place during hibernation
- ▶ The female stores the sperm and delays fertilisation; not unique to bat but very unusual
- ▶ This allows for delay in pregnancy until conditions are right and explains the high synchronicity of births within a colony



Swarming



UK bats

‘Vesper bats’



- ▶ 15/16 species in UK
- ▶ Echolocate through mouth
- ▶ Roost clinging to surface with wings by side

Horseshoe bats

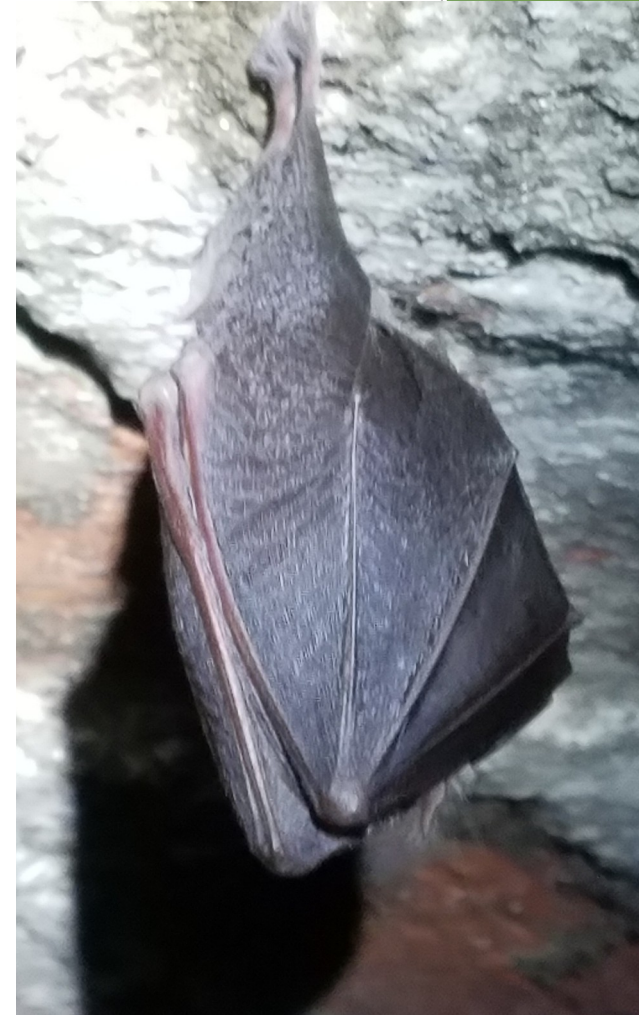


- ▶ 2 species in UK GHS and LHS
- ▶ Echolocate through nose
- ▶ Roost free-hanging with wings wrapped around

Horseshoe Bats



- ▶ Greater Horseshoe Bat
- ▶ Size of a small pear
- ▶ Back and face often visible



- ▶ Lesser Horseshoe Bat
- ▶ Size of a plum
- ▶ Back and face often hidden

18 species of bat

- ▶ 1 in 4 UK mammals is a bat
- ▶ 2 Horseshoe species
- ▶ 2 long-eared bat species; grey and brown





► Serotine



► Noctule

- Leisler's bat
- Similar to noctule, slightly smaller with shaggier fur
- On my 'to find' list

Barbastelle



► Common pipistrelle

► Soprano pipistrelle

- Only separated in 1980s when people realised that the echolocation calls were different
- There are subtle morphological differences but accurate ID remains difficult for some specimens
- Estimated bat numbers in UK 11.6 million, 7.6 million of these are these two species



► Nathusius' pipistrelle





- ▶ *Myotis* bats
- ▶ 7 species in the UK
- ▶ Bechstein's bat

► Natterer's bat



► Daubenton's bat



► Greater mouse-eared bat

- A single male known from Sussex since 2002. More recently a second was found.
- British species?

► Brandt's bat



► Whiskered bat



- These two species very similar
- Only reliably identifiable by a combination of very subtle morphological features, such as male genitalia, dentition and colouration
- As if life wasn't difficult enough...

- ▶ In 2001 a new species of 'small *Myotis*' was described from Greece
- ▶ Named Alcathe bat
- ▶ Almost identical to Brandt's bat and similar to whiskered
- ▶ Some specimens can only reliably be identified using DNA
- ▶ In 2009 it was confirmed from the UK
- ▶ Now known from Yorkshire and Surrey/ Sussex/ Hampshire & Wiltshire
- ▶ Seems unlikely that there are none in between or elsewhere, although a project in 2013/14 has found no additional roosts
- ▶ The new 'holy grail' of UK bat workers

Threats to bats

- ▶ Pesticides; timber treatment
- ▶ Use of avermectins to treat livestock
- ▶ Habitat loss and especially loss of roost sites
- ▶ Habitat fragmentation
- ▶ Predation

Is this important?

- ▶ Moral imperative to prevent other species suffering at our expense- not on our watch!
- ▶ Guano gathering
- ▶ Pollination, including food crops
- ▶ A pipistrelle eats 3,000 midges a night?
- ▶ Conservatively, that translates into 400 billion midges a year!
- ▶ Estimates in the US put a net value of \$8 on each bat
- ▶ Anti-coagulant clot busters from vampire bats
- ▶ Other medicinal research- Ebola, Marburg, SARS etc.
- ▶ Anecdotal evidence bats do not get cancer

So what to do?

- ▶ Change to less toxic pesticides
- ▶ Organic farming
- ▶ Retaining habitat connectivity
- ▶ Manage existing habitat appropriately
- ▶ Mitigation schemes
- ▶ Bat boxes can help

Dorset bat group

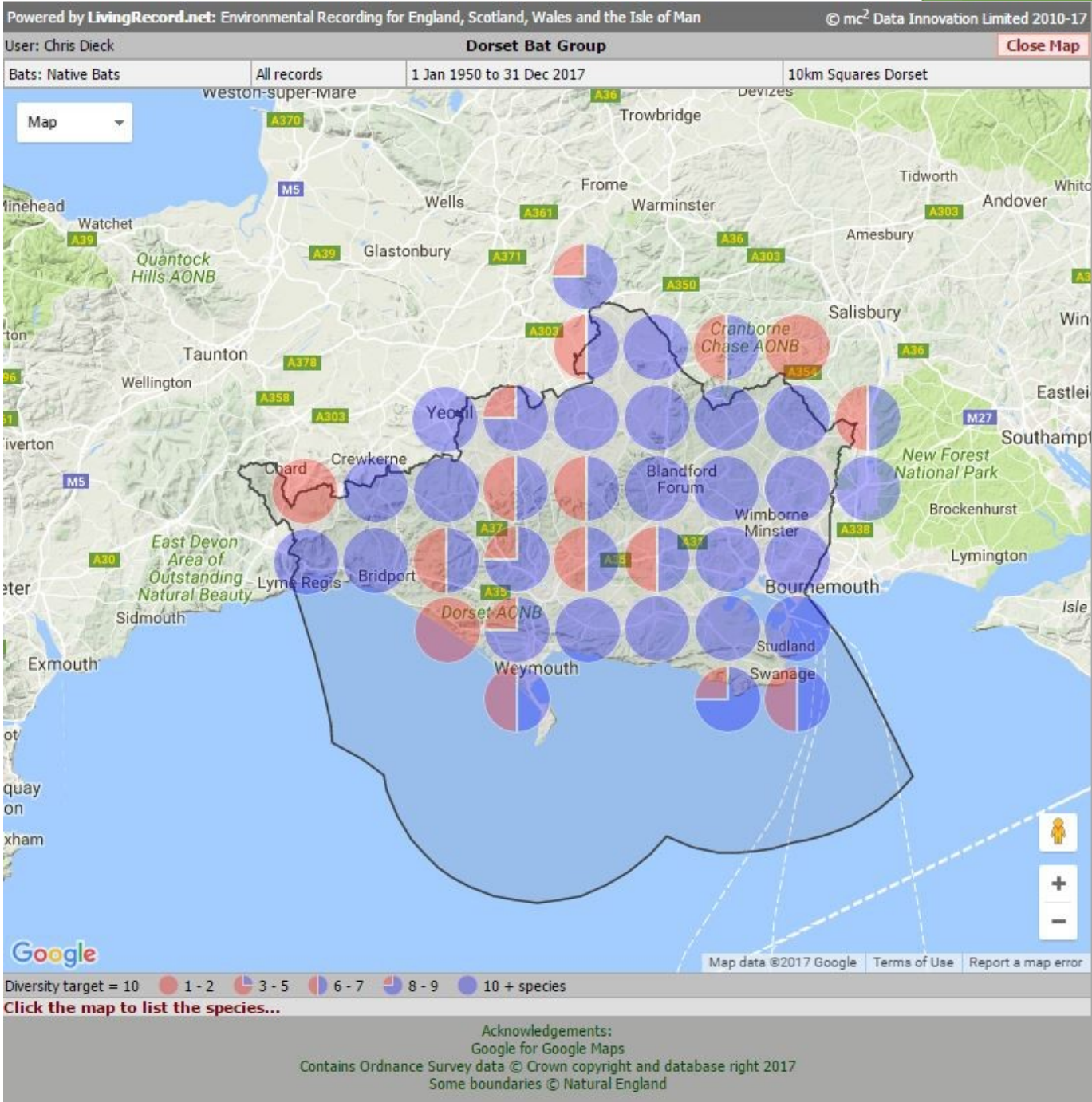


What do we do?

- ▶ 'We are volunteers with a shared passion - we all love bats! Our role is one of helping record and protect the bats of Dorset. We do this by carrying out surveys, roost visits, engaging with the public - anything that will help raise awareness of the bats around us and the need for their protection.'



Bats in Dorset





Thanks for listening