ENGLISH NATURE

Report Number
658

Woodland management advice for Bechstein's bat and barbastelle bat

English Nature Research Reports

working today
for nature tomorrow

English Nature Research Reports

Number 658

Woodland management advice for Bechstein's bat and barbastelle bat

Frank Greenaway
David Hill
July 2004

Barbastelle bat, *Barbastella barbastellus*.

Bechstein's bat, *Myotis bechsteinii*

ISSN 0967-876X

Acknowledgements

The compilation of this report has taken eight years of field work. During this period many people have contributed, notably, Dan Whitby, Patrick Fitzsimmons, Jon Flanders, Stephanie Murphy, Steve Bailey and Bill Landell. Our thanks go to all of them.

Thanks are also due to all the landowners who have been involved over the years but especially to Sussex Wildlife Trust on whose reserve at Ebernoe Common most of the work has been conducted.

Organisations that have supported or been involved in this work include English Nature, The University of Sussex, The National Trust, Forest Enterprise, Sussex Wildlife trust, Dorset Wildlife Trust, Surrey Wildlife Trust, Bat Conservation Trust, The Mammals Trust UK and The Peoples Trust for Endangered Species.

Contents

Acknowledgements

1. Introduction 9

2. Bechstein's bat 9

2.1 The size and structural requirement of woodlands with Bechstein's bat nursery colonies 9
2.2 Where roosts are located within the colony forage area of Bechstein's bat 10
2.3 Bechstein's bat roost movements and the nursery roosts used in a single summer season 11
2.4 Nursery roost site requirements of Bechstein's bat. 11
2.5 Bechstein's bats and woodpeckers 12
2.6 The useful life of Bechstein's bat tree roost holes 12
2.7 Female Bechstein's bat roost site requirements in winter 12
2.8 Male Bechstein's bat roost site requirements 13
2.9 Foraging habitat requirements of adult and juvenile Bechstein's bats 13
2.10 Woodland management requirements for the roosting and foraging of Bechstein's bat 13
2.11 Artificial roost sites for Bechstein's bats 14

3. Barbastelle bat 14

3.1 The size and structural requirement of woodlands around barbastelle bats nursery roosts 14
3.2 Nursery roost site requirements of barbastelle bat 15
3.3 Barbastelle bat roost site requirements at other times of year 15
3.4 Foraging habitat requirements of juvenile barbastelle bats 16
3.5 Ensuring a continuing supply of roost sites for barbastelle bat colonies into the future 16
3.6 Artificial roost sites for barbastelle bats 17

4. Combined woodland management for barbastelle and Bechstein's bats 17

Illustrations 19

1. Introduction

Barbastelle and Bechstein's bats are at the northern edge of their range in Britain with the barbastelle reaching a bit further north than Bechstein's bat. Both species are considered rare in Britain although the Bechstein's bat has at least the potential to have high local populations in large areas of dense deciduous woodland. The barbastelle on the other hand has small populations spread over very large areas at all its known colonies. Both animals are extremely hard to locate and observe and viable populations can remain unnoticed even in well-studied woodlands.

As with several other bat species, the distribution of nursery colonies of both of these animals seems to be in the prime older woodland habitat locations. Frequently a scatter of lone male animals is recorded from across the wide areas of intervening space between these nursery colonies. These male bats, living in sub-optimal habitats and occasionally using underground roosts in winter, form the bulk of the species records as the tree roosting females in their old undisturbed woodlands very rarely come into contact with people. In consequence the mapped range of both species may considerably misrepresent the range and in particular the colony locations of the species.

Both Bechstein's bat and barbastelle bat will share roosting woodlands as there is some overlap in the structural requirement of the woodlands, albeit for different reasons. Any similarity stops there however as both the types of roost trees they require and the summer foraging habitat requirement are completely different. For the female Bechstein's bat the woodland is both a provider of roosts and the source of forage. For the female Barbastelle, the roost woodland is the communal roost site but the major summer forage habitats can be many miles distant.

Bechstein's bat is a warm temperate deciduous woodland species. It should respond well to the predicted warmer summers and wetter winters global warming will bring to England. Barbastelle bat, also on the northern edge of its range, is arguably already more suited to the maritime climate and has a rather wider distribution reaching further north than Bechstein's bat. Provided suitable habitat exists, global warming should allow the barbastelle to spread further north. Because of its large territorial and multiple foraging habitat requirements barbastelle colonies currently remaining in southern England may come under further pressure from human land use.

2. Bechstein's bat

2.1 The size and structural requirement of woodlands with Bechstein's bat nursery colonies

The ideal Bechstein's bat woodland is an unevenly aged, deciduous woodland with a high number of oaks in the species mix. The woodland would be of a minimum of 40 to 50 hectares in extent and be semi-natural or ancient woodland with a dense mixed species understorey. Very large continuous areas of high forest seem to produce lower numbers and more widely spaced nursery colonies than slightly fragmented structurally diverse forests. Some blocks of continuous high forest may have populations of Bechstein's bats that are almost exclusively males. Similar all male or non-breeding populations can be found in woodlands that are too small to support nursery colonies. The reasons for this resource

partitioning between male and female animals are a little obscure. The local abundance of insect life in more structurally diverse woodlands on the northern edge of the animals range and/or the availability of old woodpecker nest holes as roost sites for breeding colonies may well play a part in the selection. This pattern may not hold true in more southern parts of Europe.

Small streams with at least some water in summer are usually a feature of nursery roost woodlands. It is also normally the case in central southern England that smaller nursery roost woodlands are well connected by hedgerows. Occasionally these links are well enough developed and short enough to allow several smaller woodlands to act as one colony territory for a single large colony.

Many colonies in southern England are in derelict hazel coppice where the oak standards have closed canopy over the old hazel. The widespread practice of re-coppicing and in particular the thinning of oak standards, without a prior bat survey, could well pose a threat to the future success of the species.

Oak and mixed hardwood forestry plantation woodlands can support colonies of Bechstein's bat but success of the colonies depends on local roost availability and the age, pattern and size of the plantation. When compared with colonies in semi natural woodlands these plantation animals have smaller colonies, larger forage areas and will commute further to reach them. The temporal stability of the colonies in such situations will be closely tied to the forestry practice in the woodlands. Current data suggests that young plantations or plantations with a high percentage of conifer seem of limited use as forage areas. Two colonies located in such areas have less than twenty breeding females and may be failing. The major removal of canopy at tree felling can potentially remove the whole of a colony's summer forage area. Even selected felling seems likely to swing the balance of forage availability in favour of other gleaning bat species such as brown long-eared bat *Plecotus auritus*. Clear fell operations on oak plantations in summer is likely to cause the demise of any such small local Bechstein's bat colonies.

By contrast three colonies, each occupying much older plantation woodlands, have been identified. In each case the woodland is made up of small blocks of various conifer species and larger areas of older hardwoods. In all these plantations the hardwoods are around the 80 to180 year class and have thick understoreys making the woodland rather like an even aged semi-natural woodland. These three woodlands have thriving Bechstein's bat colonies and indeed long bat species lists. Interpretation of this is difficult as it may simply be an effect of the age of the bat colony matching the age of the oaks. The small areas of conifer certainly seem to have no negative effect and may even be beneficial under some circumstances.

2.2 Where roosts are located within the colony forage area of Bechstein's bat

Bechstein's bats move between nursery roost sites with some frequency. The current data suggests a slow movement of a colony's roost site around the whole of the colony's territory. The pattern and timing of roost use seems roughly similar each year. Clusters of roosts do appear but this may well represent the tree selection by woodpeckers rather than the areas chosen by the bats. There appears to be no distinct preference for any particular location in relation to the territory boundaries.

2.3 Bechstein's bat roost movements and the nursery roosts used in a single summer season

Bechstein's bat chooses deep cavities in trees as roosts for its nursery colonies. This selection keeps the breeding females and their young well insulated from the swings of temperature and humidity that naturally occur in woodland and which increase with the openness of the area surrounding the roost. Such roosts have characteristics quite the opposite of the roosts used by barbastelle bats, where the animals are very exposed and must use dense surrounding vegetation as an environmental buffer. For Bechstein's bats the protection inside the tree allows a considerable degree of variation in the exposure of the selected roost trees. In consequence the use of hedgerow trees is not unusual but it does expose the bats to predation at dawn and dusk as they move to and from the roost tree. Understorey and cover around roosts will give emerging bats some degree of protection from predation. Whilst these deep tree cavities provide a high degree of protection from changes in the weather they also provide a static retreat for many ectoparasites and prevent the escape of bat droppings and urine. A further problem is the intense degree of competition for such sites from other bat species and birds. This competition is not restricted to the spring as many bird species roost in such holes throughout year. The result of the accumulated problems is that the bats need to move roost occasionally, perhaps once a week on average through the summer season. It is quite unusual for enough large roost holes to be available in a colony territory woodland for the required number of roost moves of the entire colony. In consequence the colony does divide and recombine with some frequency into smaller holes. These divisions have been shown to be bats sharing a common reproductive condition and looking for similar roost conditions. An excellent Bechstein's bat colony woodland would provide in excess of a dozen large available roosts within the forage woodland with many other smaller holes suitable for smaller bat groupings. In woodlands of lesser roosting quality roosts are fewer, survival seems lower, groupings smaller and eventually the colony needs to roost well outside its forage territory. In one colony the actual roost site in a hedgerow tree was 3.5 kilometres from the main plantation forage area. The use of hedgerow trees for roosting is not uncommon in colonies that forage in plantations as hedgerow trees are frequently the only available trees with old woodpecker cavities. Colonies observed under this sort of pressure often also suffer from rather restricted forage availability and have low numbers of breeding females.

2.4 Nursery roost site requirements of Bechstein's bat

Natural roost sites selected by Bechstein's bats are almost invariably in old woodpecker holes in trees. These holes can be old nest chambers but are often also simply enlarged natural cavities or old branch scars. Both greater spotted woodpecker holes and green woodpecker holes are used, but there is some preference for the cavities originally formed by the latter species as they are a little larger and usually sited in slightly decayed trees with rotten trunk centres. Large live oak trees are preferred to smaller trees, dead trees or other species. Roost holes are usually situated at heights of about 4 to 8 metres on the main trunk. Occasionally, and often in very hot weather, the selected holes are much higher. The presence of a lot of woodpeckers does not necessarily mean that many adequate roosts are immediately available. It can take many years for a large cavity to form upwards from a woodpecker hole and before this the cavity will be much cooler than the optimum requirement of the bat cluster as the air warmed by the bats will rise out of the entry hole.

The internal shape and size of the cavity is also of some importance as an un-enlarged nest chamber is not normally large enough to accommodate an entire Bechstein's colony of perhaps as many as seventy or eighty adult bats and their young. Selected cavities are usually ascending into the rotted out core of the tree trunk, sometimes metres long.

2.5 Bechstein's bats and woodpeckers

During the period before a new woodpecker hollow becomes useable by Bechstein's bats as a nursery roost, woodlands can change greatly in structure and character. In consequence the habitat selected by the woodpeckers is not necessarily the same as that selected as colony territory by the bats. Several very good Bechstein's bat sites have a medium term history of being more open than their current state. These more open conditions do seem to be the required habitat of Green woodpeckers and the current roosts may well be a legacy from those times.

On a long-term basis it would be worth monitoring the woodpecker population as well as the bats at nursery colony sites. Should woodpeckers become absent for any sustained period action will be required to maintain roosts. Green woodpeckers have a requirement for open areas in which to hunt for ants and both the larger woodpecker species have a requirement for over mature timber in which to hunt beetle larvae. All woodpecker species should be considered and encouraged in management plans for Bechstein's bats.

2.6 The useful life of Bechstein's bat tree roost holes

Once formed a roost hole has every prospect of lasting a very long time, often as long as the tree. With oaks this could be as much as fifty years or more. Such time periods will frequently last over the lives of several generations of bats. Cavity size appears to be selected in response to the changing size of the colony grouping and the metabolic and spatial needs of pregnant bats and their young. So one hole can continue to be used for short periods each year, with a slowly changing role across the years as the cavity changes character. Eventually natural rot processes will make many holes too large and allow the possible entry of larger predators at which point it will cease to be used.

2.7 Female Bechstein's bat roost site requirements in winter

To date only one adult female Bechstein's bat has been radio tagged and followed to its early winter hibernation area. The roosts discovered were all situated in a close group of trees in very deep woodpecker holes. All the trees were oaks located close to the centre of the colony's territory and appeared to have decay in the tree core. Some of the same trees have also been used in the summer months as nursery roosts.

Records show that a very few individuals have been found hibernating underground but from the very low numbers involved this must be exceptional behaviour. Some other woodland bats such as noctules *Nyctalus noctula* hibernate in large clusters within large thick walled and usually still living, hollow trees. It seems very probable that like the individual radio tagged bat tracked so far, this is the hibernation strategy followed by the vast majority of female Bechstein's bats.

2.8 Male Bechstein's bat roost site requirements

It should be emphasised that this is an area where more data is still required. The roost and roost site selection by male Bechstein's bats in summer is fairly well documented but hibernation roost sites are much less well known.

Male Bechstein's bats normally roost alone in small tree cavities through the summer and can be found in small woodlands remote from nursery colonies. Occasional males do turn up roosting within the area of female colony territories but this seems a little unusual until late summer when mating starts and the male population becomes more mobile. In winter male Bechstein's bats will go underground to hibernate, but these records represent only a tiny fraction of the male population and the overwhelming majority must winter in trees.

2.9 Foraging habitat requirements of adult and juvenile Bechstein's bats

The standard pattern of foraging within a Bechstein's bat colony is for the suitable canopy areas within about 1.5 km of the roost to be divided up into many small areas each occupied by a single bat. While most breeding females in a colony follow this pattern it seems that a low number of individuals have rather different foraging strategies following quite long circular or linear paths.

The ideal forage woodland is actually exactly the same as roost woodlands (see above) as the two are synonymous. About 50 hectares of mature oak with a good understorey and small streams seems to be ideal. In all probability quite a range of other deciduous woodland will be capable of supporting colonies but colony size and success seems to be greatest with oak as the dominant species, available at the one site in a wide range of age classes.

The very limited data available on foraging by juvenile Bechstein's bats suggests that the juveniles follow their mothers into their individual forage areas and, after they are weaned, range rather erratically around the colony territory. Male juveniles seem to leave the colony territory in August and juvenile females stay in the colony. Good woodland or hedgerow connections to more distant woods will aid this dispersal of males. Adult females disperse into a slightly wider area in late August in order to mate and it is thought, return to the colony woodlands to hibernate.

2.10 Woodland management requirements for the roosting and foraging of Bechstein's bat

In semi-natural or ancient woodlands over 50 hectares little needs be done other than monitor to ensure the natural regeneration of stands of oak trees. Provided the total woodland is in excess of 50 hectares and has a diverse structure with the complete range of tree age classes, natural roosts will be available. Less diverse woodlands will require a larger area of trees in order to provide a continuing roost supply. In practice it is not easy to obtain a continual succession on what is actually a small woodland area. While the colony may only occupy 50 hectares at any one time it is more likely to thrive if it has scope to drift around over time within a rather larger area of slowly changing woodland.

In dedicated plantation woodlands Bechstein's bat colonies may exist for periods but they are neither stable nor sustainable in the longer term with current commercial woodland practice. Colonies rely heavily on semi-mature or mature canopy to forage in and a continuous supply

of suitable roost trees into the distant future. This requires linked canopy cover with understorey over an area of about 50 hectares with further areas going into canopy decline and others not yet in canopy closure or in sapling stage. The current trend in forestry practice towards a wider remit of wildlife and recreation as well as timber production gives some scope for management practice to improve matters. A forestry timber extraction policy that follows the slow removal of prime individual trees on a continuous basis, rather than clear fell, will avoid sudden crashes in colony population sizes by maintaining adequate canopy cover for foraging.

Improvements in plantation management should include:

1. Creating non-intervention strips along all watercourses within the woodlands. This should include all the small floodplains and steep banks along the woodland streams.
2. Harvesting hardwood trees in plantations only when unavoidable and then by selected felling only, done on a slow continuing basis cutting only the best sound mature timber at appropriate times of the year.
3. Monitoring stands of trees used as nest sites by woodpeckers and leaving these stands as non-intervention until their natural decay.
4. Creating a series of suitable areas within which Green Woodpeckers can forage for ants. These areas should be over and above the woodland area required by the bats to forage in.
5. Ensuring, by new planting if necessary, that all hardwood blocks in nursery colony areas have deciduous woodland connections.
6. Leaving not only hollow trees but the immediate stand of trees around them together with the understorey during any felling operations.

2.11 Artificial roost sites for Bechstein's bats

Nursery colonies of Bechstein's bats will readily colonise suitable bat boxes within their colony territory. The preferred boxes are Schwegler 2fn specials but several other types have been used successfully as well. All these boxes are susceptible to having the entrances blocked by birds nesting material and need constant inspection and cleaning to remain of use. The boxes are also attractive to most other deep cavity roosting bat species, raising the issue that the balance of bat species within a woodland will be disturbed by this use and thus have a potential negative impact on the Bechstein's bats. Whilst bat boxes certainly have a function in the short term to counter a failing habitat they should not be seen as a permanent solution to shortcomings in the availability of suitable trees.

3. Barbastelle bat

3.1 The size and structural requirement of woodlands around barbastelle bats nursery roosts

Barbastelle bat nursery colonies have a strong tendency to be sited towards the north or northwestern side of the brows of quite low wooded hills. The woodland itself is usually semi-natural in character, often ancient in origin and frequently of high natural humidity. High numbers of oaks killed by crown competition or storm damage are often present. A

dense understorey that will aid humidity retention around roost trees and lower wind speeds is frequently present, particularly when the colony is located in areas with naturally low summer humidity. The classic location for a nursery colony is within woodlands on the headwaters of small rivers with the river giving access to the floodplain for summer foraging. Woodlands do not individually need to be particularly large but the connected woodland total needs to be a fair percentage of the landscape. Approximately thirty percent woodland seems to be average within the majority of colonies. A few colonies are known from more open areas with lower woodland cover percentages but such colonies have not been studied on a landscape scale and it is not known how they behave, particularly with respect to individual forage areas or for foraging in the winter months. Such open country colonies are considerably more scattered than those in the preferred heavily wooded country.

Roosts are usually located within a restricted area of the selected nursery woodland block, a 'loyalty area'. The bats move roost around this area over the summer utilising subtle differences in the woodland structure to maximise the benefits of buffering large swings in ambient temperature and humidity.

3.2 Nursery roost site requirements of barbastelle bat

The tree nursery roosts of barbastelle bats are located behind loose plates of bark on dead trees and in narrow cracks and fissures of tall broken tree stumps. Storm damage cracks in the major limbs and stems of large living trees are also used. In western areas loose ivy also seems important. The selected sites are usually very narrow but the bats themselves may be quite close to the surface, frequently visible from the ground with a torch. Protection from the prevailing weather conditions is minimal and colonies move roost with great frequency, often daily when sufficient roost sites are available. The entire nursery colony only comes together into one roost occasionally and is normally in several subgroups scattered across the roosting area of woodland.

When woodland containing suitable trees is no longer available, or when conditions become exceedingly dry, barbastelle bats will switch to other high humidity roost alternatives. An example of this use of alternative sites is the use of a massively timbered stone barn with a thatched roof and deep narrow recesses in the structure used by one colony in East Anglia. All the evidence to date suggests that loyalty to a nursery colony is absolute, female barbastelle bats do not change colonies.

Commercial forestry woodlands are rarely of much use to barbastelles as nursery woodlands. Damaged or dead trees are removed too quickly and the understorey is rarely allowed to develop sufficiently to retain woodland humidity. It is probable that when management for barbastelles nursery roosts in plantation forestry is required it should be tailored to each particular situation as it arises.

3.3 Barbastelle bat roost site requirements at other times of year

Barbastelle bats become less social outside the nursery colony season (May to Sept). When the requirement for very high levels of energy input falls after the young are weaned, the bats reduce the long commuting flights and forage within a few kilometres of the current roost. By October individual bats roosts are much more scattered although it is not unusual for almost exclusively juvenile collective roosts to remain in the nursery woodlands until quite late in the autumn. A number of adults from a colony certainly remain in the same nursery roost area

that has been occupied all summer but do so in a solitary fashion. Many females also disperse outwards towards their individual summer forage areas, especially so if this was a woodland habitat.

Roosts selected are at lower levels and deeper in dense woodland but still retain the typical barbastelle characteristics of rather exposed sites behind loose bark, in tree cracks, or in cold weather conditions, deep in hollow trees. Occasionally individuals will utilise cold buildings through the mid-winter period and more extensively in periods of extreme cold. Prevailing weather conditions have a marked effect on site selection, moderate frost protection normally being given by large areas of dense vegetation around the chosen roost. In spring a slow movement commences back towards the nursery roost area finally culminating in colony roosts reforming in early to late May.

3.4 Foraging habitat requirements of juvenile barbastelle bats

Juvenile barbastelle bats become volant later in the year than most other species, often in early August. The bats are not weaned when they first start to fly and are still incapable of making the long commuting flights to follow their mothers. Radio tracking data suggests that the juveniles initially fly around the immediate area of the roosts and then slowly over a period of weeks follow their mothers further and further towards her forage grounds. During this period they become weaned and start to hunt for themselves. The availability of abundant productive forage close to the roost in this period is a major key to the success of any bat colony. As with all bat species barbastelles are particularly vulnerable to predation in the first few weeks so cover is of equal importance to suitable small insect abundance. Examples of such forage areas are small woodland floodplains and ponds or small river systems with a plentiful shrubby growth of species like willows. These forage areas need to be on the adult female bats flightlines so that she will find and feed her offspring on her return path to the roost woodlands. The critical period is actually quite short for each young bat, perhaps no more than three weeks. However, as the young of barbastelles are normally born spread out over a longer period than other bats the total period with weaning juveniles from a colony can total nearly two months. By the end of each individuals three week weaning period most juveniles are capable of following their parent the full commuting distance and start to wander in what appears from radio tracked animals to be a rather haphazard fashion around the whole of the colonies territory. In practice this apparently random behaviour may actually be a structured following of other adult bats but this is rather difficult to prove. Certainly some of the areas visited by tagged juveniles are within the areas utilised for forage by other adult females.

3.5 Ensuring a continuing supply of roost sites for barbastelle bat colonies into the future

The slowly changing natural structure of the woodland around barbastelle nursery roosts, will over time, slowly cause a drift in the bats ‘loyalty area’ to occur that takes into account the changing nature of the woodlands and their roost availability. It would be a very unusual woodland structure that could continue to produce a range of potential barbastelle roosts over several tens of years. However, unless the nursery roosting woodlands can supply such a flow of suitable trees and cover over these time periods such roost movements will eventually take the nursery roosts beyond the boundaries of reserves set up especially for the bats. Restricting this movement by ensuring a suitable succession of trees and cover should be a major focus of long term woodland management for nursery colonies of barbastelle bats. Woodland

planning and management for this eventuality will require the detailed management of much larger areas of reserve woodlands than may actually be in use as loyalty areas in any given year. The size of this larger area will depend greatly on the diversity of the surrounding woodlands but will need to be in the order of five to ten times the loyalty area in order to ensure minimal movement over a period of one hundred years. Within this wider area, woodland management will need to encourage a succession of tree age structures, over patches corresponding in size to the original loyalty area of the site. Ideally these patches would flow together in such a way that a smooth movement of the colony's loyalty area can occur as conditions alter with time.

3.6 Artificial roost sites for barbastelle bats

Barbastelles are crevice dwelling bats and do not use conventional bat boxes. Special maintenance free boxes designed to offer narrow gaps with a long access length appear much more attractive to them. Boxes like these have been used by barbastelle nursery colonies in summer and lone individuals right through the seasons at a site in West Sussex. Old carpet tiles applied to dead tree trunks like loose bark have also been used successfully in the same area. Rather more exotic but potentially interesting roost creation ideas have included the use of explosives on tree stems and deep slots made with chainsaws into standing tree trunks.

As with artificial roost sites for Bechstein's bat the provision of such structures carries the risk of altering the population structure and species balance of bats in a woodland. This alteration has the potential for unpredicted negative effects on the species that it was hoped to encourage. Winter active bats such as pipistrelles and barbastelles both forage close to their roosts, and may use similar roosts in winter. Altering the conditions within a restricted area of woodland could benefit generalist foraging species such as pipistrelles, which are then likely to out-compete the specialist species such as barbastelles, which rely on woodland foraging close to their roosts in winter. Similar problems may also occur when young barbastelles are first learning to forage for themselves. Artificial structures are by their nature temporary and should only ever be considered when an overriding reason for their use is clearly apparent.

4. Combined woodland management for barbastelle and Bechstein's bats

The two species will roost within one woodland but select physically different roost cavities so competition for roosts between the species will be almost non-existent. The preferred summer foraging habitats of adults from the two species are also well separated and foraging style between the species is sufficiently great to avoid any direct competition.

A potential exists for some prey availability reduction for juvenile barbastelles as they become volant in July or August. It is not considered that this is of any consequence as the preferred prey types are rather different and it is the time of greatest prey abundance.

Illustrations

Bat nursery colony distribution in a landscape.

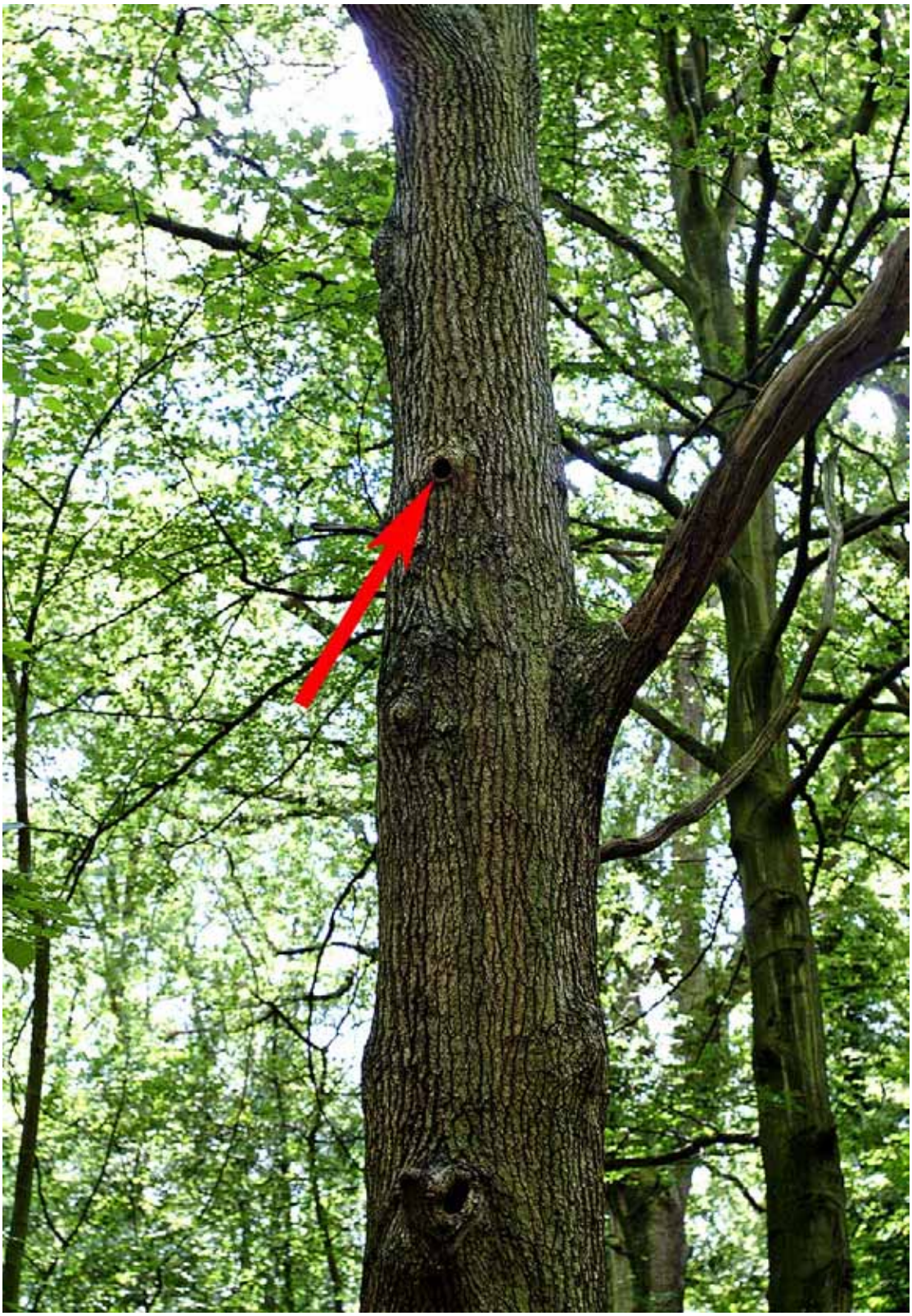
The study of bats at a landscape scale is still in its infancy and the full implications of many separate bits of information have yet to be fully understood. The outline below should be taken as a guide to how it is understood at present.

Bat densities in a landscape vary widely according to the distribution of habitat types. Naturally there are habitat preferences between species but on top of this are patterns of distribution between the sexes of each species. With woodland specialist bats major nursery colonies, or core colonies, tend to be located in the prime, semi natural forage areas with the best local roost resources etc. If enough connected semi natural woodland exists around these core colonies a few smaller satellite nursery colonies may exist. Beyond these nursery colony territories is a wider area of landscape occupied by males or occasionally non-breeding females before possible further distant nursery colonies.

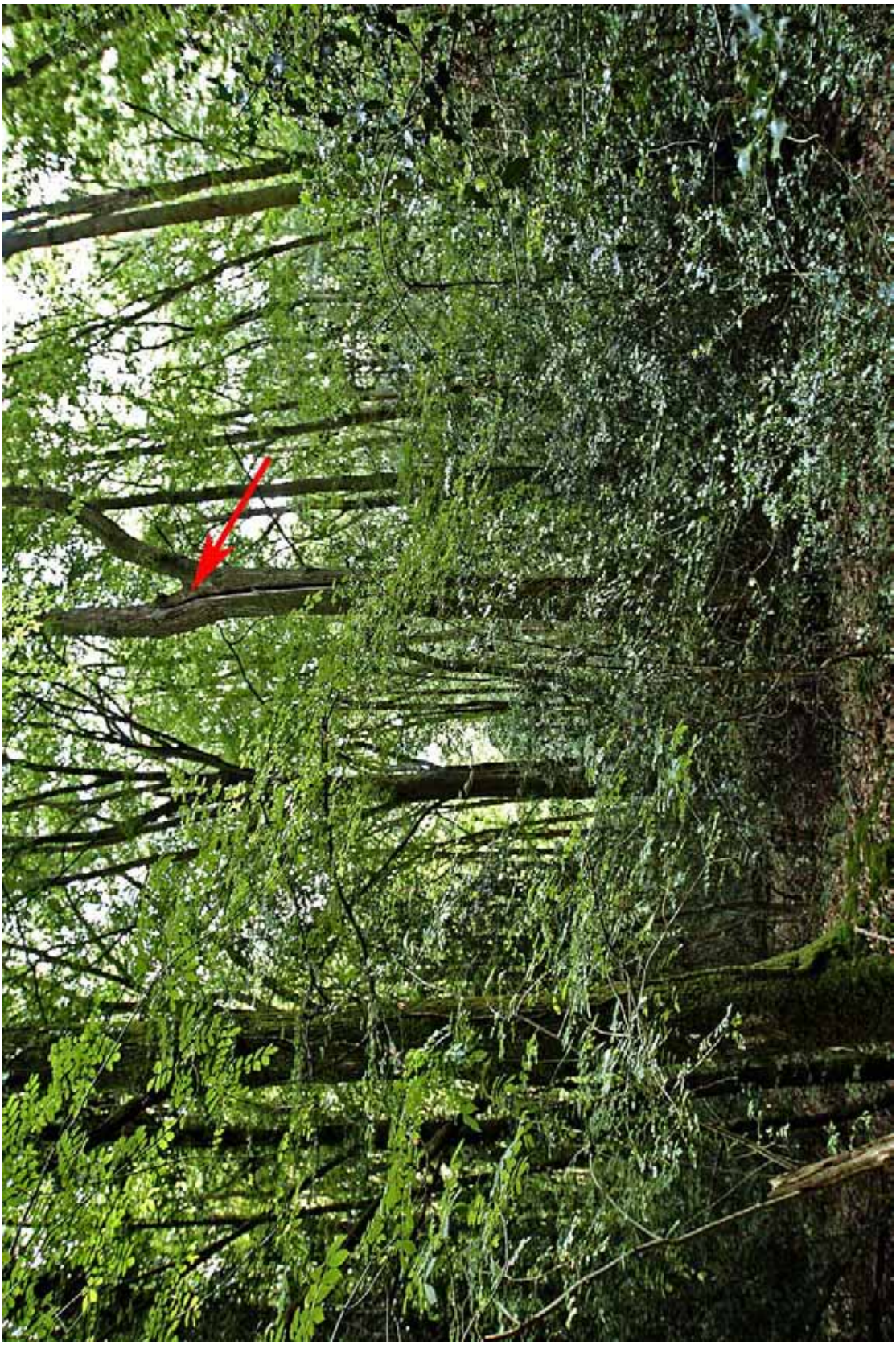
As bats are specialised in their hunting methods several species can normally co exist during summer in one rich area of habitats. This selection of similar habitats by nursery colonies can lead to very high local mixed bat species densities in mixtures of woodland and grassland habitat types. The exact mixture of woodland types, sizes, connectivity, open areas and exposure is critical to the use of a given area as a core colony location. Continuous, homogenous woodland is certainly not as advantageous as the broken woodland and pasture series illustrated above. If however the size of the woodland habitat becomes too small or forms too low a percentage of the total landscape area, the woodland specialist bat species will begin to drop out of the breeding list and the woodlands will revert to male only occupancy.

A typical Bechstein's bat forage territory with old oaks, streams and a hazel canopy. Roosts occur in several of these older trees. Bittlefield copse, West Sussex.

A Bechstein’s bat nursery roost site in an old oak. Langhurst Common, West Sussex.



A Bechstein’s bat nursery roost site in July. Bittlefield Copse, West Sussex.



A barbastelle nursery roost site and surrounding woodland vegetation in July 2004. The Mens, West Sussex.

A Barbastelle bat nursery roost site in the split bough of an oak. July 2004. The Mens, West Sussex.

A barbastelle bat nursery roost site behind loose bark, June 2004. The Mens, West Sussex.

Barbastelle cold weather roost sites

The loose bark of dead oak trees is utilised extensively by both sexes of Barbastelle bat as roosting space. During the summer months these roosts are usually quite high up but in very hot or very cold weather the bats select lower sites and will roost right down to ground level in winter. The selected dead trees are normally located in dense understorey, areas which have a naturally low air movement and high humidity. Another advantage of such sheltered locations is that the bark plates themselves are retained on the tree for much longer periods of time giving the roost a useful time span.

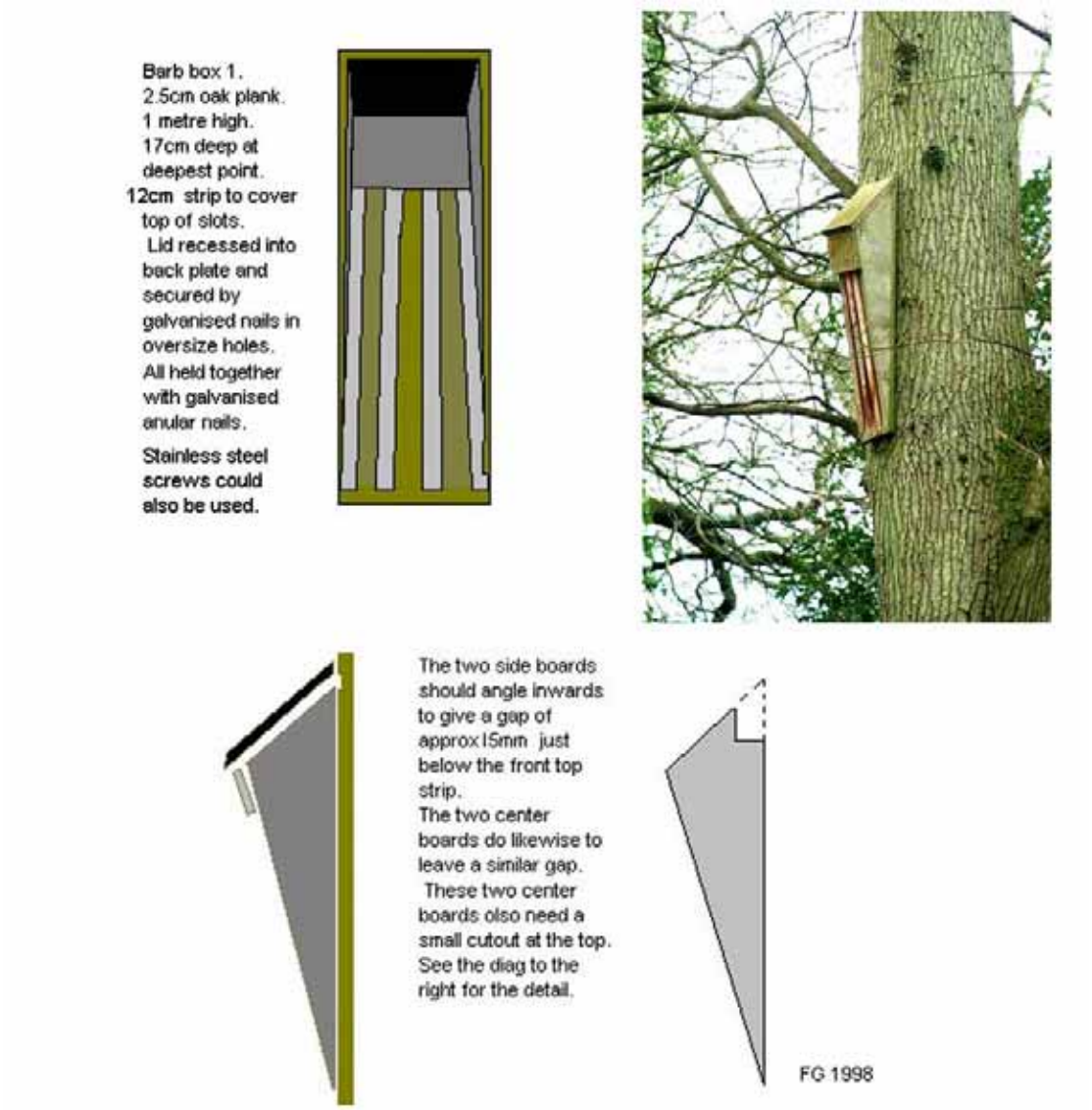
Tall dead oak trees can provide a succession of roosts over a number of years as the bark is slowly shed from the stem. This process normally starts high in the crown and slowly moves down the tree producing roosts with different microclimates as it moves lower. It is only oak trees that produce this roost resource. The thick bark, which readily separates from the dead sapwood, provides a better insulation layer than other native species.

Barbastelle bats winter hibernation sites

Barbastelle bats are winter active and only enter extended periods of topor when the ambient temperature remains close to freezing for extended periods. When this occurs bats select roost sites that are rather more protected from frost than can be obtained within the classic loose bark roosts. Typically winter hibernation roosts offer a range of protection of increasing effectiveness so that if the weather becomes colder all that is required is a slow movement away from the roost entrance.

The two roosts illustrated offer such retreats. The church porch has timber supports close against the main brick structure that allow a little of the residual warmth from the building to keep frost at bay. If sustained frost makes further movement necessary small holes allow an entry to the brickwork.

The massive beech tree illustrated has an ascending tight hollow that reaches many metres up the trunk. The DBH of the tree is 120 cms. Whilst such trees must form winter retreats for many bat species in the British Isles the level of protection given would be totally ineffective in a continental climate and European individuals would need the much greater protection of underground sites.



A green oak bat box suitable for use by barbastelle bat nursery colonies

Bat boxes for barbastelle bats should only be considered when natural roost sites are limited or an attempt is being made to retain a colony in its traditional 'loyalty area' that is under pressure from changing conditions.

This style of box will last many years if made and fitted correctly and will need no maintenance or cleaning.

When erecting any bat boxes a potential problem exists with changing the number of available roost sites. Larger numbers of different species may be able to exist under the new changed conditions. Increased numbers of another species may actually be in competition with the species the boxes are trying to encourage.

Bechstein's bat, *Myotis bechsteinii.*

ENGLISH NATURE

English Nature is the Government agency that champions the conservation of wildlife and geology throughout England.

This is one of a range of publications published by:
External Relations Team
English Nature
Northminster House
Peterborough PE1 1UA

www.english-nature.org.uk

Cover printed on Character Express, post consumer waste paper, ECF.

ISSN 0967-876X

Cover designed and printed by Status Design & Advertising, 2M, 5M, 5M.

6

888

Awarded for excellence