Bat Detectors – A Beginner's Guide for Orthopterists

A Recording Revolution

The use of bat detectors to record orthoptera by picking up their ultrasound emissions, particularly from bush-crickets, has been both a revolution and a revelation. The process of recording has been speeded up. In just three months use of a bat detector in 2003, records on the ERCCIS database for the Speckled Bush-cricket have increased by 80%, and for the Dark Bush-cricket by almost 25%. The Speckled Bush-cricket, formerly considered local, has been found to be plentiful. The detector is also a quick means to obtain evidence of absence for a species. Such negative evidence is important for confirming any future distribution increase of species like the Long-winged Cone-head.

It is not just an aid for those whose hearing may have deteriorated, as it will greatly increase the range at which even an easily heard species like the Dark Bush-cricket can be detected. This means you will hear them before they hear you and dive into the foliage.

What is ultrasound?

A young child can hear sounds across a typical frequency range from 20Hz to 20kHz. Those at higher frequencies are known as ultrasounds. The stridulation of each orthopteran species will cover a range of frequencies, with that of grasshoppers being mostly within normal hearing. The output of bush-crickets extends well into the ultrasound. For the Speckled Bush-cricket the greatest part is in the ultrasound, and even those with perfect hearing may find its stridulation inaudible. Your ability to hear higher frequencies diminishes with age (more quickly in men than women), so a middle-aged adult may only hear frequencies up to 14kHz. That is why even our loudest bush-crickets may become totally inaudible as you get older.

What does it cost?

Bat detectors can be found from just under £50, to well over £2,000. Fortunately, the cheapest set, the Magenta Bat Mark 2, is a more than adequate machine for orthoptera recording (if you have a flair for electronics, you can even save a further £14 by buying it as a self-assembly kit). It is of simple design with just an on/off/gain (volume) control, and a frequency control (from about 20kHz to 130kHz – guide indications only). There is a loudspeaker, as well as a socket for an earpiece or headset. The easily available 9 volt PP3 battery will last for a couple of months of normal usage.

How is it used?

There are few references on orthoptera recording with bat detectors, but they quote a specific frequency for each species. For a beginner, this seemed to pose practical problems in their use. If it was set to one frequency, would you miss all the others? Would you have to keep twiddling up and down the frequency scale to ensure that all the species were detected, and how slowly did you have to move the dial? And what if the insect just happened not to be calling when you were passing through its frequency?

Magenta Bat Mark 2 in use

Fear not, dear reader, because it is nowhere near as critical as that. Just set the frequency control knob to a middle setting around 35-40kHz, with the volume control at about half, and then slowly pan the detector around. If there is anything about, you will hear it. Once heard, if you wish, you can rotate the frequency dial until you find the maximum level. Whilst this frequency may be critical for determining the identity of bat species, it is not essential for orthoptera. In most cases, the sound itself is suitably distinctive for species confirmation. Unlike bats, orthoptera are relatively sedentary whilst calling, and you can always home in on the sound (the detector is quite directional) to see the stridulating insect, or a female attracted to the call. This will obtain that conclusive identification.

Background ultrasounds

When using the detector, there is a surprising amount of background ultrasound, especially that caused by your own movements. The loudest comes from walking on grass or leaves, particularly the dry foliage found in late summer or autumn fields. This can swamp out the fainter orthopteran sounds. For this reason, it is best to stand still whilst scanning your surroundings. The effective range of a detector is about 15 metres, so a suitable quick recording method is to stop every 10 paces and scan. In quiet country lanes, continuous recording may be possible by walking on the edge of the tarmac (beware traffic!) rather than the grass verge. Treading on a pebble can produce a sound similar to a Speckled Bush-cricket, so ignore single, unrepeated, clicks. If that elusive sound on the detector is keeping pace with you, and stops when you do, it is probably coming from keys or coins moving in your pockets.

There are other ultrasounds which may lead to some confusion. An odd 'stridulation' on the Camel Trail, near Wadebridge, turned out to be made by cycle wheels as they sped past. When you are near overhead power cables, they can give rise to buzzing sounds vaguely reminiscent of a species of bush-cricket.

Effects of weather

Orthopterans are much more likely to be calling on a sunny day. Even on a hot day, a sharp summer shower may stop them calling altogether, and they may not resume for some considerable time. On a showery day, it may be best not to rely on a detector for confirmation of a species' absence at a particular site.

Species accounts

It is not easy to give an adequate written description of an audible sound, it will always remain subjective. In order to illustrate the ultrasound call further, song diagrams (plotting the change in sound over time) are given for most of the species. These diagrams are all from actual field recordings made during 2003.

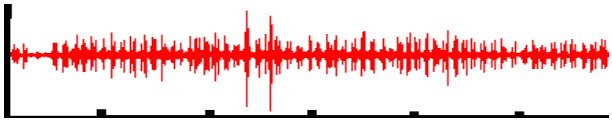
In Cornwall we have only a small number of species, and it will be relatively easy to learn the different sounds made. A reference CD of these sounds is available (see below for details).

Bush-crickets

Great Green Bush-cricket: This is our loudest species, so a detector may not be necessary. However, it will often increase range for older orthopterists whose high frequency hearing is naturally diminishing.

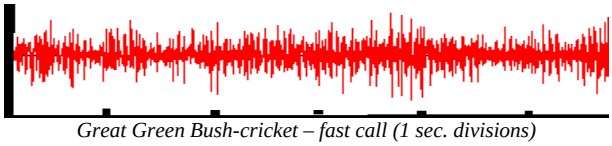
The call may be ventriloquial, as on my local cliffs there were occasions at night when the stridulation was audible, but the detector registered nothing when pointed in the direction of the calling. This may need further investigation.

The stridulation heard on the detector can be likened to an old electronic typewriter. The sound comes from rubbing the wings together about 10 times a second.



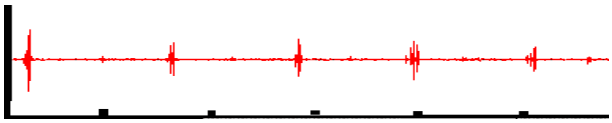
Great Green Bush-cricket – typical call (1 sec. divisions)

In hot weather, it can be much faster, rubbing the wings together almost 20 times a second, when it sounds similar to that of a cone-head.



Great Green Bush-cricket – fast call (1 sec. divisions)

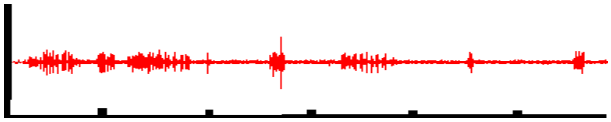
Dark Bush-cricket: The familiar 'chip' call of this species is clearly audible without a detector, but with one the range is greatly increased to 15 or more metres.



Dark Bush-cricket - typical call (1 sec. divisions)

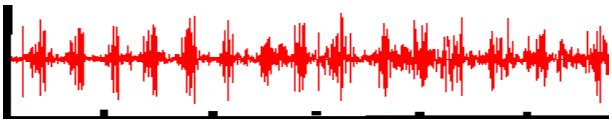
The normal sound heard on the detector is similar to a short croak, as it briefly rubs its wings together for about 1/10th second, repeated at 1-2 second intervals.

There is an aggression call when two males meet and challenge each other, which is an extended 'growl', lasting a second or two.



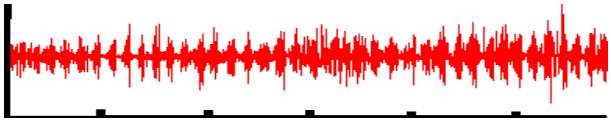
Dark Bush-cricket - challenging call (1 sec. divisions)

Grey Bush-cricket: Without a detector the call is virtually inaudible above background sounds, even at very close range of just a few metres. With a detector, it is clearly audible to 15 metres or more. The sound is a slow 'chuffing' like a steam train, as it rubs its wings together around three times a second.



Grey Bush-cricket (1 sec. divisions)

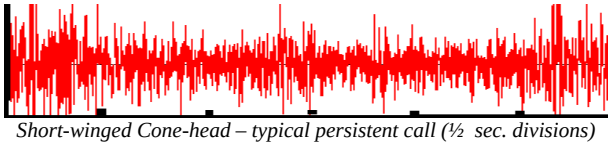
Bog Bush-cricket: Whilst the stridulation is discernable by ear, it is much more easily heard with a detector, and from over 15 metres. It has a distinct 'chuffing' sound, rather like a steam train under load. It is around twice as fast as the Grey, as it rubs its wings together some six times a second.



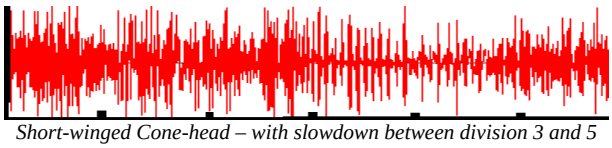
Bog Bush-cricket (1 sec. divisions)

Long-winged Cone-head and Short-winged Cone-head: Both species have a faint call to the human ear, but it is loud with a detector. The calls of these two cone-heads are distinctive from those of other bush-crickets (except perhaps a fast Great Green Bush-cricket on a hot day), but they can be sufficiently similar that confirmation of which cone-head species is present should be made by visual inspection.

Both have a very long call, often continuing for several minutes or more. The Short-winged call is almost invariably interspersed with a brief section as if slowing down for a second or two before speeding right back up again. The Long-winged call generally does not have a slowing down section. However, Long-winged calls have occasionally been heard which include the slowing down part, and Short-winged calls have been heard which persist for 2 or 3 minutes without it. Chris Haes observed a Long-winged male whilst he had a bat detector trained on it, and noted that the slowing down section corresponded with the insect changing its orientation. This may also be the case for the Short-winged Cone-head.

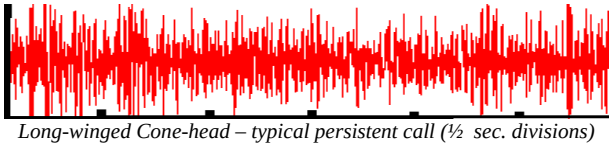


Short-winged Cone-head – typical persistent call (½ sec. divisions)

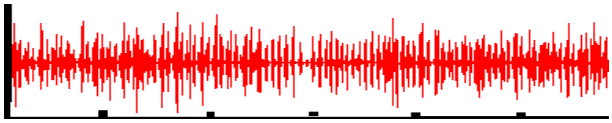


Short-winged Cone-head – with slowdown between division 3 and 5 before speeding up again (½ sec. divisions)

For both the Long-winged and the Short-winged Cone-head, the wing is rubbed together about 20-25 times a second during the slowed down section. In the typical call, the wings are rubbed together 2 or 3 times this speed, possibly up to 60-70 times a second.

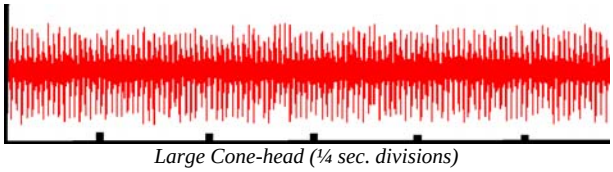


Long-winged Cone-head – typical persistent call (½ sec. divisions)



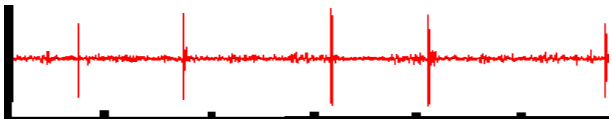
Long-winged Cone-head – with slowdown between division 2 and 4 before speeding up again (½ sec. divisions)

Large Cone-head: I am grateful to Paul Stancliffe for supplying a copy of the recording he made of the first natural UK occurrence of this species. The call is a constant electrical buzz, similar to a mains hum, as the wings are rubbed together just over 80 times a second.



Large Cone-head (¼ sec. divisions)

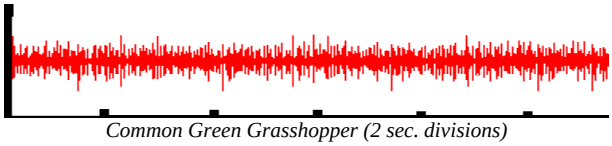
Speckled bush-cricket: This call can only be heard with a bat detector. Each insect makes a distinctive tick, repeated every few seconds, as it simply flicks its wings together for about 1/70th second. However, as it is frequent, and the call is heard at up to 15 metres or more, you are likely to hear a series of many clicks from all the insects within range.



Speckled Bush-cricket (1 sec. divisions)

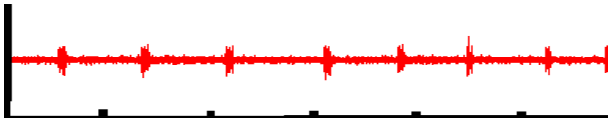
Grasshoppers

Common Green Grasshopper: This can be picked up on a detector, although, as our loudest grasshopper, it is very readily heard by ear. The sound is a persistent stridulation of around 15-20 seconds in duration.



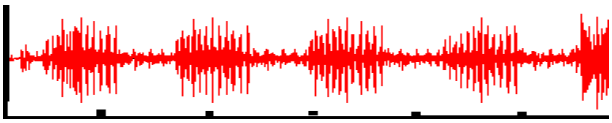
Common Green Grasshopper (2 sec. divisions)

Field Grasshopper: The call of this species has almost no ultrasound. A faint sound was picked up on the detector at around 2 metres distance, when almost standing on the insect. The ears and the eyes are still superior for locating this grasshopper. The call is a brief 'zip' repeated about once a second.



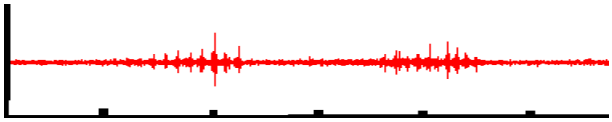
Field Grasshopper (2 sec. divisions)

Meadow Grasshopper: The detector is useful for this species, as it doubles the normal range. The typical call is an intermittent series of 'chuckles' repeated every 1-2 seconds.



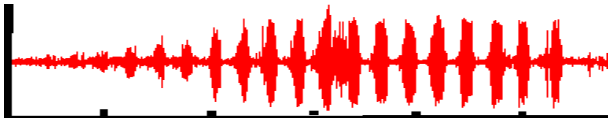
Meadow Grasshopper - typical call (2 sec. divisions)

A chilled specimen may stridulate slowly at about half the normal speed, until it is warmed up. Such a call can be reminiscent of a bush-cricket.



Meadow Grasshopper - slow call (2 sec. divisions)

Mottled Grasshopper: This can be easily heard by ear, but a detector does extend the range. The call is a series of around 15-20 short buzzes, rising in volume, before stopping.



Mottled Grasshopper (2 sec. divisions)

Woodland Grasshopper: It was not possible to get to a colony of this species in 2003, but Chris Haes advised that a detector was no help when he visited colonies on the Lizard peninsula.

CD of Orthoptera Ultrasounds

With the exception of the Woodland Grasshopper, the various ultrasounds of all the above species were digitally recorded in 2003. If you would like a CD of all these calls for reference, please send a cheque (made payable to Malcolm Lee) for £2 to:-

Gullrock
Port Gaverne
Port Isaac
Cornwall
PL29 3SQ
e-mail: gullrock@ukonline.co.uk

Further Information on Bat Detectors

For those with access to the internet, there is some useful information on the different types of bat detectors. The two most helpful were the Bat Conservation Trust website at http://www.bats.org.uk/nbmp/whichdet.htm and Dr. Dean A. Waters Leeds University website at

http://www.biology.leeds.ac.uk/staff/dawa/bats/Detector.htm Information on the Magenta Mark 2 Bat Detector is at http://www.magenta2000.co.uk/kits/861.htm.

At the end of July 2004, the price of the fully assembled unit was £48.99, and the self-assembly kit was £34.99. An additional £3.00 p&p for standard delivery, or £6.99 for next day delivery, is payable. Magenta Electronics can be contacted on 01283 565435.

If you are in North Cornwall, this bat detector is available for purchase at the Visitor Centre in Boscastle. Before you travel any distance to buy one from here, telephone 01840 250010 to check they are still in stock.

Technical Stuff

The ultrasounds were recorded on a Hewlett Packard iPAQ 1910 Pocket PC (held about 10cms from the detector's speaker), using 'ProTone' v1.42 recording software developed by Pocco Software. The bit rate was 43Kbits/second, with a sample rate of 22Khz. The Voice Activated Start, Auto Stop, and Compression (cut), were all disabled. Under Audio Settings, the Microphone Environment was set to Short range Recording.

The song diagrams were produced by importing the resulting WAV files into 'Creative Wave Studio' v4.21.02 sound editing software developed by Creative Technology Ltd, and capturing the screen image. The image was cropped and the scale lines added.

And finally...

It is a bat detector, so don't forget to listen out for the bats as well!