The Bat Conservation Trust

Which Mini Bat Detector?

Mini bat detectors have come a long way since the first commercial detector produced by QMC in the seventies and there are many makes and models on the market. For novices taking their first faltering steps into the twilight world of bat detecting, choosing a detector can be a daunting experience.

This guide should shed some light on the merits of each detector allowing you to come to a more informed decision about which to purchase. Many NBMP surveyors already own a detector with the most popular make being the Bat Box III.

For monitoring it is VERY important that the same detector is used on repeat surveys, otherwise biases could occur. However, we accept that technological advances will mean that newer detectors will be used over older detectors as time goes by. We therefore periodically conduct a calibration study of different bat detectors to ensure that a calibration factor can be used to adjust figures where large differences in the type of bat detector used occur.

Comparing detectors

There are a number of factors to consider when assessing detectors:

- Sensitivity (at various frequencies)
- Bandwidth
- Tuning dial (tuneability and readability)
- Size
- Background noise
- Calibration
- Loudspeaker output
- Price

Sensitivity

The sensitivity of a detector is an important aspect to consider because it has a dramatic effect on the number of bat passes heard. However because the peak frequency of each species varies, sensitivity needs to be gauged over a range of frequencies.

What frequencies are important when listening to bats?

- Horseshoe bats use almost pure frequencies at 83kHz (greater) or 109 kHz (lesser)
- Noctules / serotines / Leisler's use peak frequencies between 18 & 35 kHz
- Pipistrelles use peak frequencies between 39 & 60 kHz
- *Myotis* species use frequencies between 80 kHz and 30kHz with peak frequencies generally between 40 & 50 kHz.

Therefore unless you live in or close to the distribution area of horseshoe bats and are particularly interested in surveying them, detector sensitivity between 18 and 60 kHz is most important. If you are particularly interested in noctules / serotines / Leisler's, you should go for a detector that has good sensitivity at lower frequencies. If you want to survey mainly for pipistrelle and *Myotis* species, detector sensitivity between 39 and 60 kHz is most important.

The type of microphone (transducer) used in detectors has a major influence on the sensitivity of the detector at various frequencies. At present there are 3 types of microphone used to capture ultrasound:

1. Piezo

This is the cheapest microphone available as it is often used in burglar alarms. It is particularly sensitive at 40 kHz but the sensitivity drops off as the dial is tuned away from this frequency i.e. sensitivity at 20 kHz and 100 kHz is much reduced. It also produces little background hiss.

2. Electret

This microphone is used in hearing aids and is more expensive than piezo microphones. It is less sensitive at 40kHz than a

piezo microphone but more sensitive at 20 and 100 kHz. It also produces quite a lot of background noise.

3. Myca

This is the most expensive microphone available and is normally assembled by hand. It has a flat frequency response, which means it is equally sensitive to all frequencies. However although it is by far the most sensitive microphone at 100kHz it is less sensitive at 40 kHz than either the piezo or electret. Sensitivity at 20kHz is better than the piezo and similar to the electret. The background hiss is intermediate.

By knowing the type of microphone used in the detector you will have a better idea of its likely sensitivity at particular frequencies. However, to improve the sensitivity across the range some manufacturers have used 2 or even 3 microphones of different types.

Which microphone does each bat detector use?

The table underneath shows the microphones used in each detector.

Manufacture	**Transducer type**		
	Piezo	*Electret*	*Mycra*
Bat Box III [1]	*		
USA		*	
Tranquility			*
Magenta	*		
Skye		*	
Pettersson [2]	*	*	

Note 1: The BatBox III detector uses two piezo microphones to increase the sensitivity

Note 2: The Pettersson detector employs 3 microphones: two piezo similar to the BatBox III and 1 electret to increase the sensitivity at high and low frequencies.

Bandwidth

This refers to the amount of frequencies the detector grabs. Large bandwidth detectors take in +/- 8 kHz whereas small bandwidth detectors take in +/- 2 kHz.

Bandwidth has three influences on surveying:

- Small bandwidths make it easier to judge where a call starts or finishes. For example a 55 pipistrelle does not produce any sound below 49 kHz and a small bandwidth detector tuned at 46 kHz won't pick any sound up but a large bandwidth detector will.
- Large bandwidths make it easier to survey for both pipistrelles simultaneously *i.e.* by tuning at 50 kHz the bandwidth covers 45 and 55 at the same time
- The ability to tune in accurately to the best frequency of a pipistrelle is NOT influenced by the size of the bandwidth of the detector

Tuning dial

There are two important elements to consider when comparing detectors.

Readability

The best dials to read are LED as they require no external light source and can be clearly seen.

Most detector readouts employ a plastic dial with marks for the frequencies. If the dial is small it can be hard to read the frequency accurately.

An important consideration is the backlighting. Some detectors have a small light underneath the dial so that no external light is required to see it. Poorly designed detectors require an external light source before a reading can be taken. This can be annoying in the field as using a torch at night reduces surveyor's night vision.

Tuneability

Small dials need several turns when scanning between 20 and 100 kHz whereas large dials can be rotated much more quickly. You would need to rotate the dial constantly between 20 and 109 kHz to survey for all species. Thus if you are involved in simultaneous multiple species surveys, dial characteristics become important.

Other considerations are whether both hands are required when tuning the detector or if it is a single-handed operation. Little details like this make a difference if the detector is used often.

Calibration

It is important that the machines are calibrated properly. On some detectors the readout is taken from a separate system so the machine is always automatically self-calibrated.

Kits or self-assembled detectors should always be calibrated against a known ultrasound frequency before using them in the field.

Manufactured detectors are calibrated before being sent out and are generally accurate. However they can go off tune so it is advisable to calibrate them at the start of every new field season.

Background noise

Constant, loud background noise like hissing is distracting in the short term and a pain if the detector is used continuously. Some detectors have low hiss whilst others are very noisy.

Loudspeaker output

Headphones cut out the speaker and give a better sound quality than through speakers. Cutting out the speaker also prolongs battery life and this can save a lot of money over a field season.

However if detectors are used on bat walks then high speaker power becomes more important to allow people to listen simultaneously. Power is expressed as Watts.

Size

Size of detector becomes important if they are used a lot. Small, light detectors that fit easily in the hand can be used for extended periods whereas large bulky detectors are too cumbersome to use for extended periods.

Price

If you are on a limited budget or are just starting out then detector kits offer outstanding value, but you will need some electronics skills or know of someone who does in order to construct them. The two main detector kits are from Magenta and Maplin. Unfortunately the Maplin kit is not available at this time although it may be reintroduced in a new format for the future.

At present there are no kits available that use the type 3 microphone.

The table overleaf summarises all the above information and can be used as guidance when comparing detectors.

Choosing a detector

First of all decide what you are likely to use a detector for and how you will use it. For example:

- If you use it for extended periods of time then the level of background noise becomes important.
- If you need detectors for bat walks then you want something cheap and loud that can be distributed amongst the crowd
- If you are interested in surveying horseshoe bats then a detector sensitive at high frequencies is important.
- If you are interested in pipistrelles and *Myotis* bats then good midrange sensitivity is required and an easy to read tuning dial helps separate the pipistrelle species.
- If noctules and serotines are important then sensitivity at low frequencies becomes important.
- If surveying multiple species is important then a detector with good sensitivity (and tuneability) at all frequencies is useful.

Summary of detector characteristics

Which to consider?

All of the detectors mentioned above can be used on NBMP surveys. Although the **Pettersson D100** is one of the more expensive detectors its use of both piezo and electret microphones means it offers the best sensitivity across the range of any detector.

The **BatBoxIII** is slightly cheaper and has a powerful speaker with high quality sound output and good midrange sensitivity. However it does lack sensitivity away from the midrange especially at high frequencies.

Both the Pettersson and BatBox suffer from fiddly, hard to read tuning dials. The **USA Mini III** has a superb tuning dial and offers good sensitivity across the range although it is not quite as sensitive as either the BatBox or Pettersson in the mid range. I find the small bandwidth helpful for differentiating pipistrelle species. The level of background noise can be distracting if used for long periods. The **Skye SBR2100** has an LED readout that is easy to read and very accurate (self-calibrating). Its sensitivity characteristics are similar to the USA but it suffers from excessive background noise that is distracting even in the short term. Its bulky size means it is tiring to use for extended periods.

The **Tranquility** has an LED readout that is easy to read and accurate. Although its midrange sensitivity is poorer than the other detectors it offers superb sensitivity at high frequencies and good sensitivity at low frequencies. Its poor loudspeaker means it is best to use in conjunction with headphones. It offers value for money if you use its time expansion capabilities.

The **Magenta kit** has a great price and excellent midrange sensitivity although high and low range sensitivity is poor. The speaker output is very good and excellent for bat walks. Terrible tuning dial requiring torch to read (estimate?) frequencies and finished quality isn't as good as manufactured detectors. Overall offers great value for money and a cheap way to get started. The Magenta is also available ready built for a small price increase.

Whichever detector you plump for bear in mind that, as human beings always do, we get used to the machine we use regularly

and can overcome their disadvantages. Remember whichever detector you have, your ears are your most valuable asset...