



**BatWav file processing procedure
Rev 1.0
15/6/2019**

The Peersonic BatWav (original project name) plays back full spectrum wav files at a 384ks/sec rate.

You would have thought – easy! I just take my best FS recording and play back from there. You could, but the result would be no way optimum.

Reasoning :

Noise:

Your very best recordings will be full of noise, this will swamp the desirable bat call. It will also consume amplifier bandwidth making it dissipate more heat than it needs, the speaker will also play back the noise.

Speaker linearity and equalisation :

An ideal speaker would have a flat linear response over the desired bandwidth, eg 10kHz to 100kHz +.

There is no ideal speaker.

So some compensation for the responsive and less responsive points in the spectrum needs to be introduced. This is done by equalisation.

A curve is applied that attenuates over strongly responsive parts of the spectrum and amplifies more the weaker bands.

Files structure and naming :

Specific to Peersonic BatWav, files need to be saved in the right format. This is less technical, but beware – forget this and the files will not play.

To equalise or not to equalise:

It is important to equalise wav files over the full spectrum range (eg 10kHz to 100kHz).
HOWEVER.

If files being played are in the range 10kHz to about 5-kHz the speakers response is in a reasonably level and linear range. You could forget the equalisation for that (eg some social calls).

BUT.

Files must still be 16bit-PCM , stereo, 384ks/sec and names must have no spaces.

Also, I would suggest attenuating the files to about -10dB max signal as the amp and speaker could saturate.

Tools :

Audacity has been used here as it is currently freely available to all. From time to time there are Audacity upgrades that change some of the tool locations, but all features remain, if repositioned.

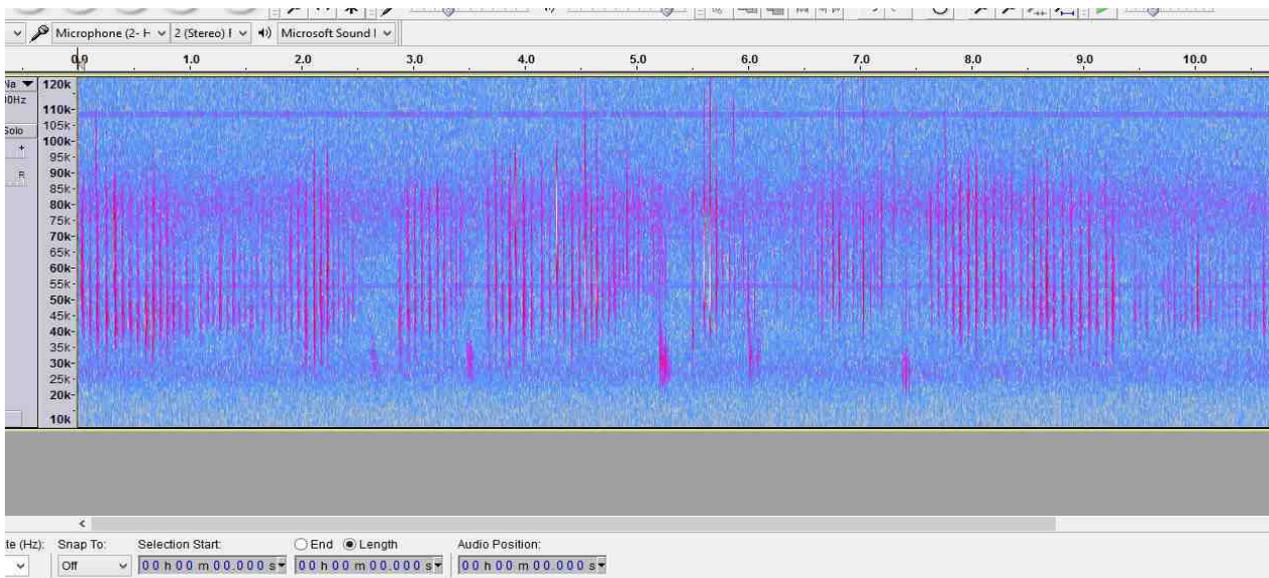
Also of interest, but not shown here, there is the SASlabs software, this demands a purchase price, but I have been reliably informed it is excellent for this kind of audio processing.

Noise reduction :

The first step is to reduce noise. Some decisions have to be made here. For example, it is easier to reduce noise in a horseshoe recording as the call is concentrated in a fairly narrow band. Removing noise either side is not a fussy task/

Highly fm bats require more care, and some noise will remain if you are not to distort the bat call.

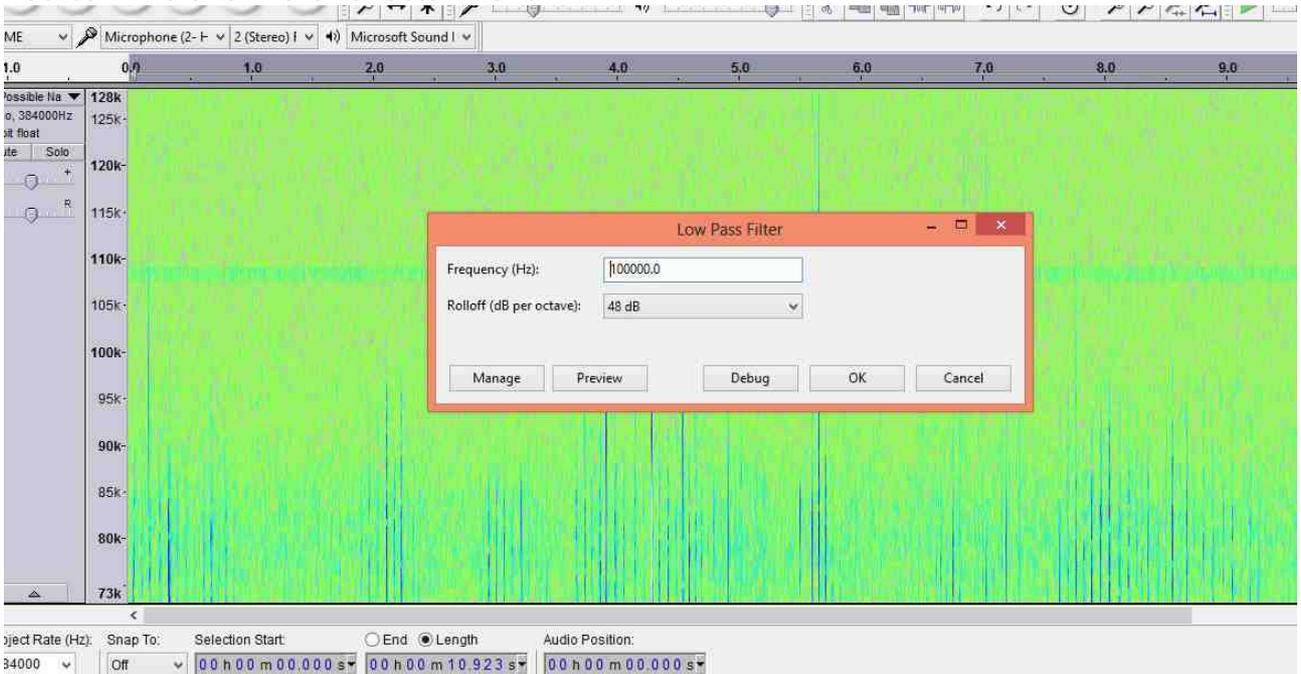
As an example here I use a myotis call. Being a wide fm call it is a good challenge!



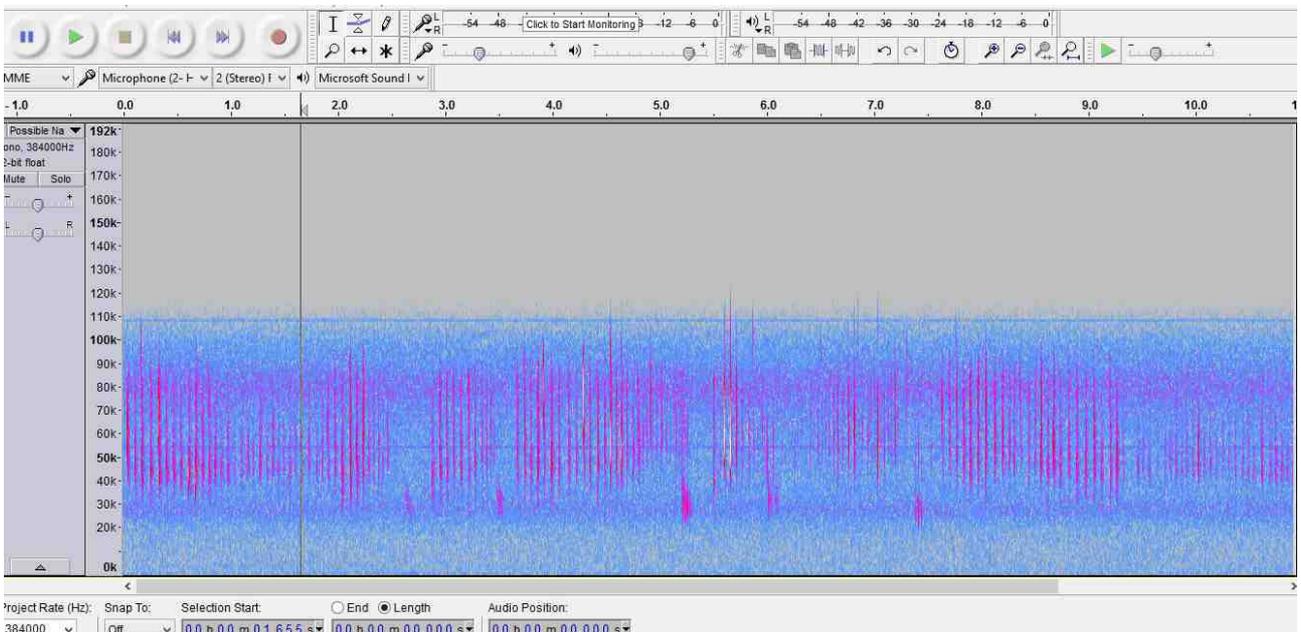
A myotis bat , mono recording 384ks/sec with classic noise.

The first step is to use the filter effects to take away noise from above and below the area of interest. The filter is not going to cut the sound sharply away, sound is attenuated off either side steeply. So if you chose a point that is a bit close to the top of bottom frequency of interest, do not worry.

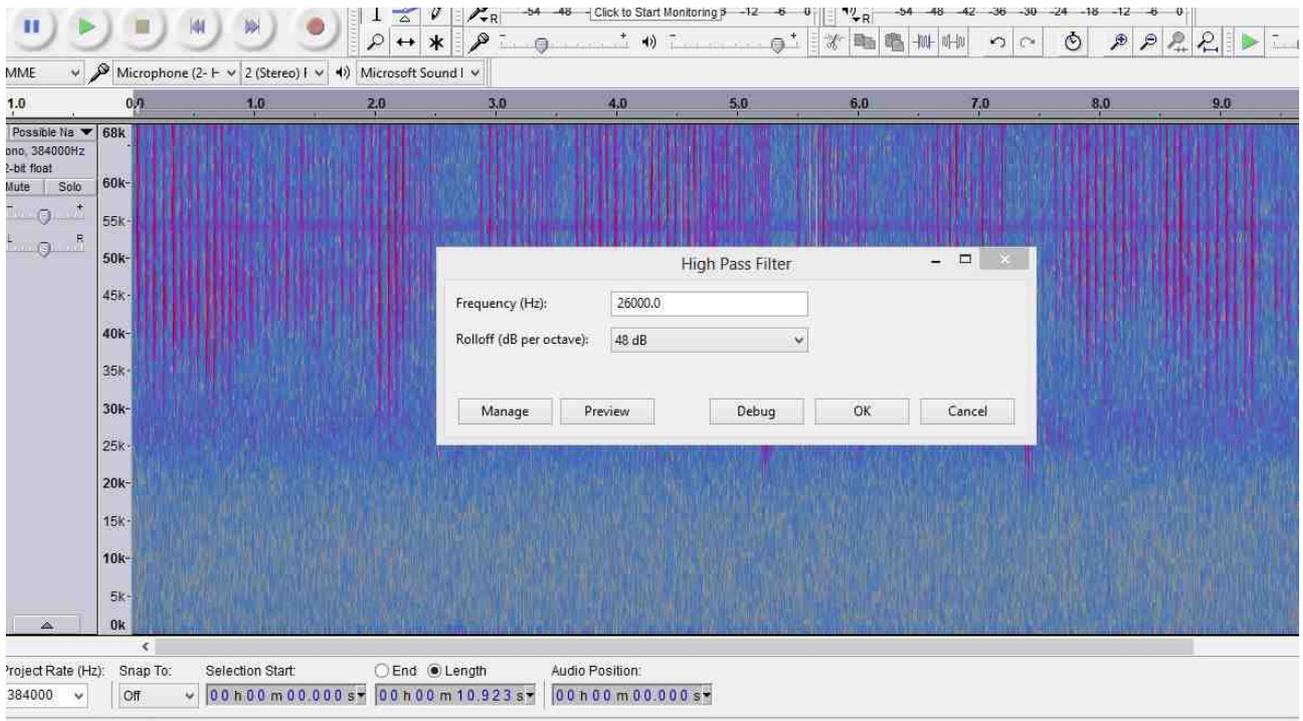
Here we start with the low pass filter, set to 48dB rolloff per octave which is nice and aggressive. The rolloff point here is 100kHz as there is little desired signal above. You can find this in the "effects" menu.



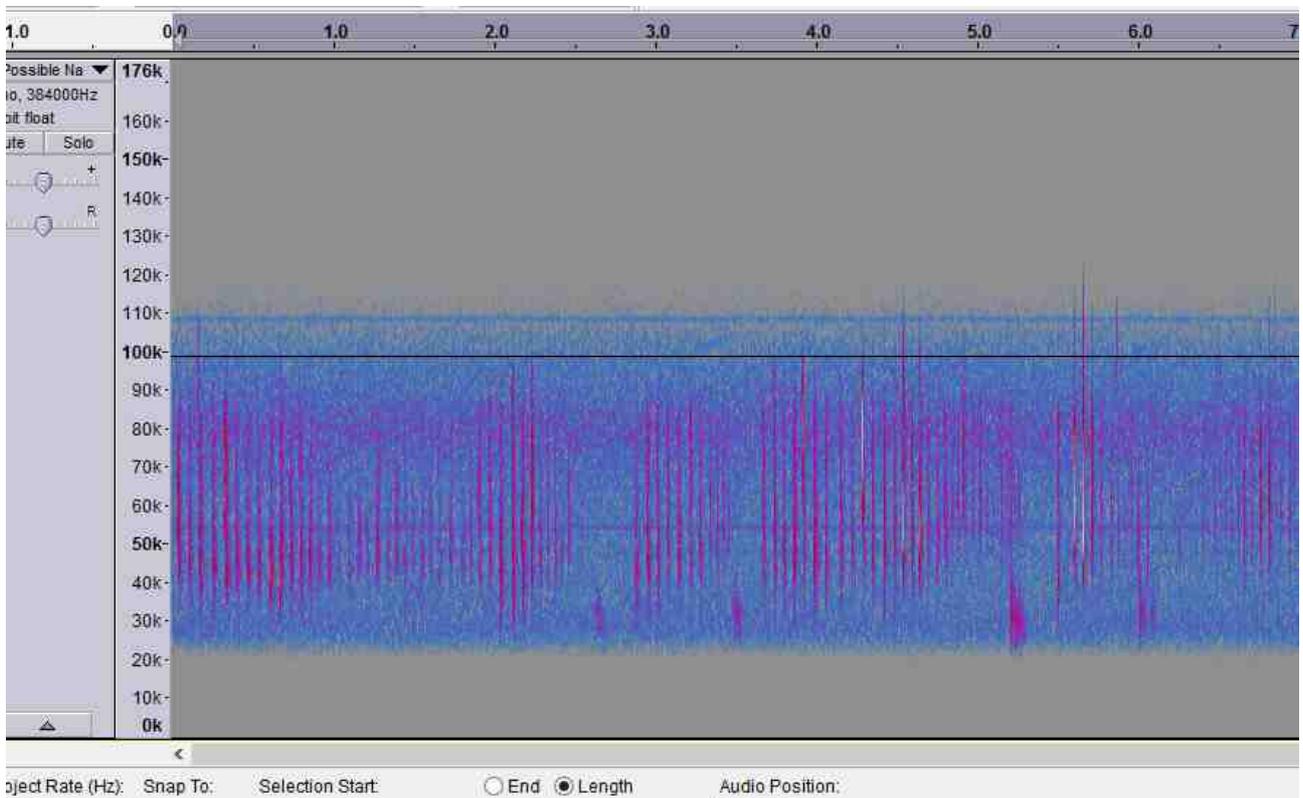
Here is the result.



Now a similar procedure with the high pass filter to remove sound below the desired minimum frequency. 26kHz seems to be a good point.



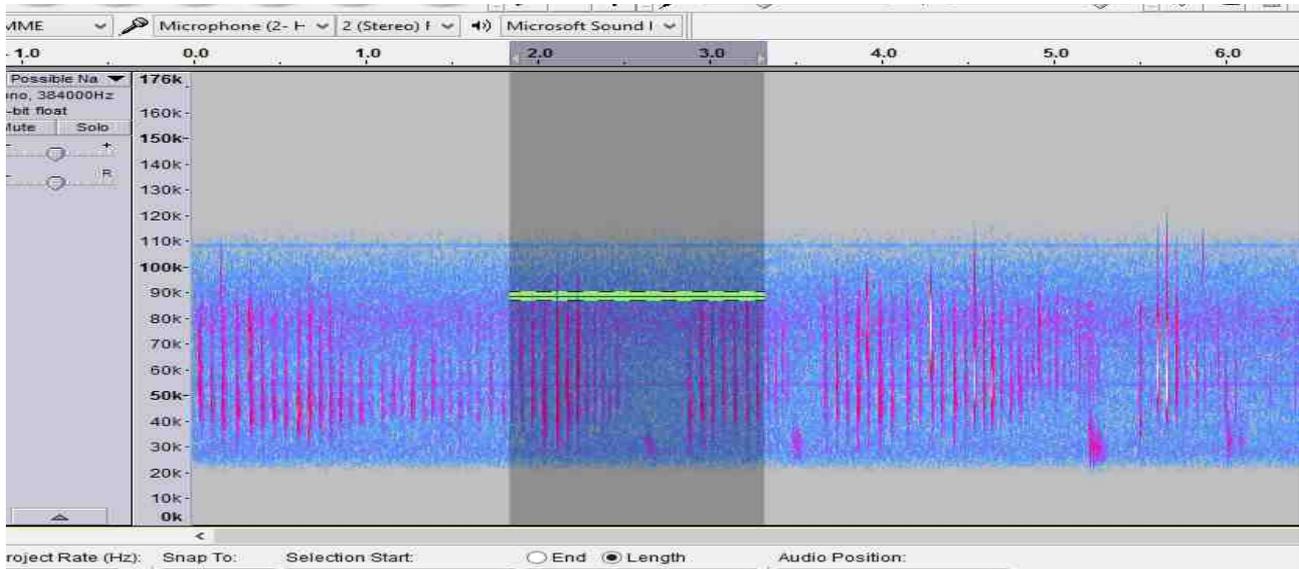
Result. Much cleaner overall, but being Myotis there is a wide area of the spectrum where we do not want to apply a filter. Noise is trapped in between the calls you might say.



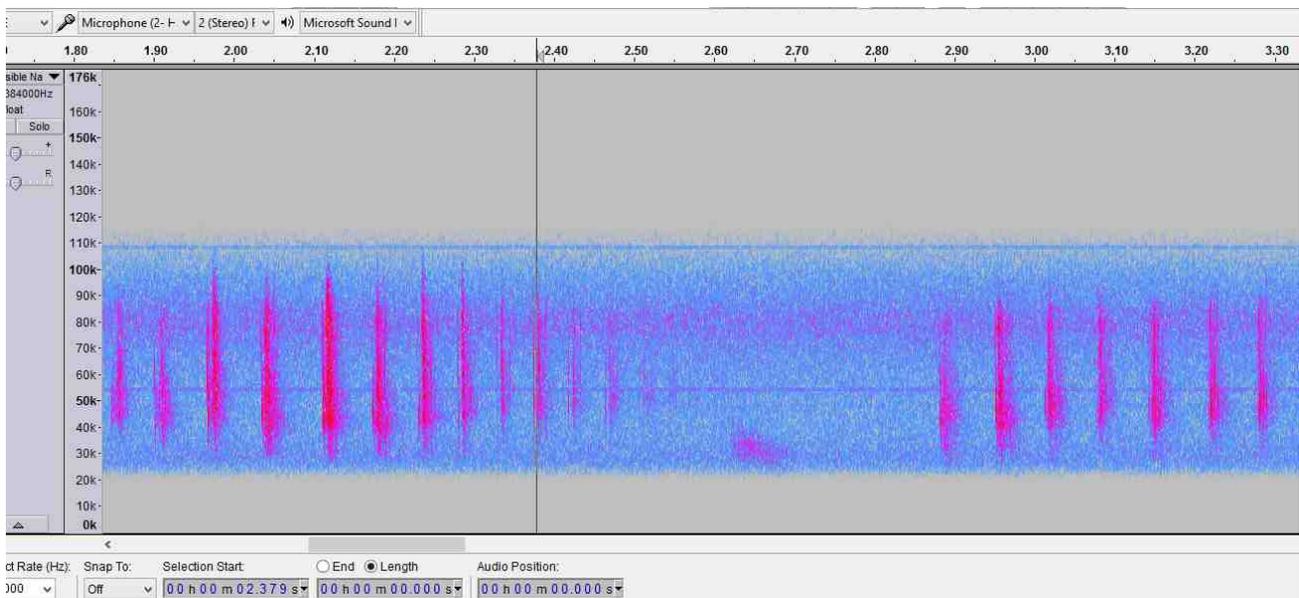
The next tool is "noise reduction". Within Audacity this is a very smart feature, don't ask me how it works.

To use it a sample of unwanted sound must be selected.

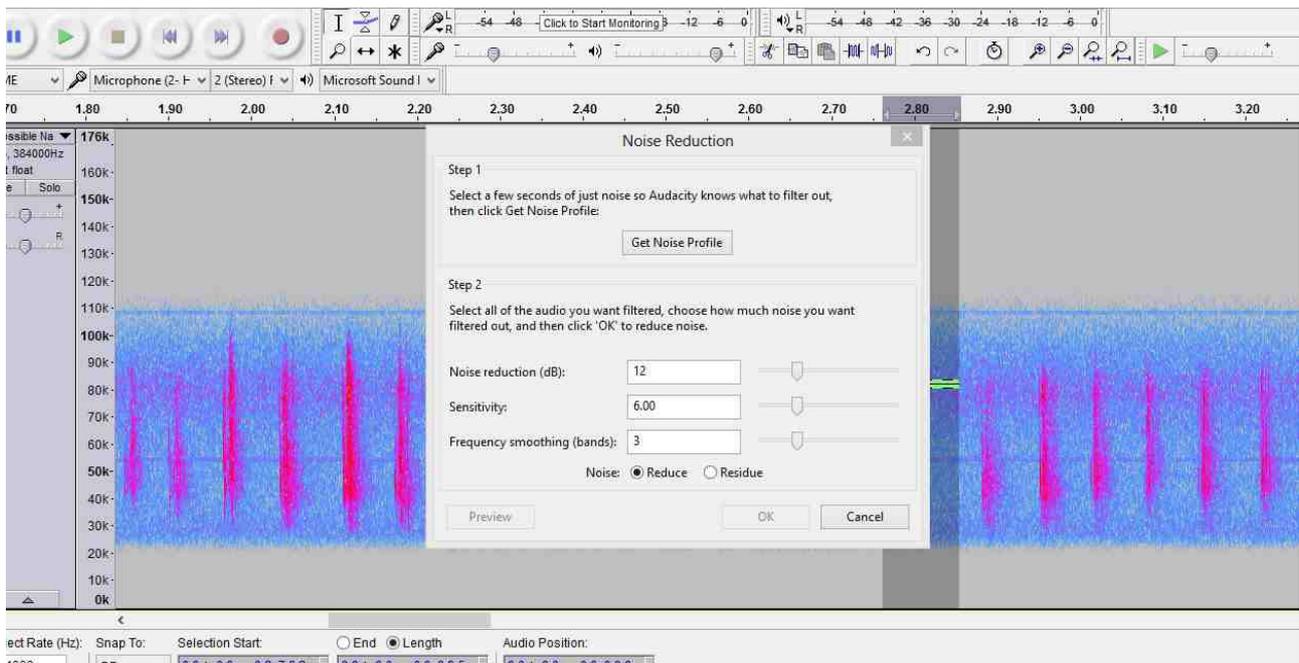
So zoom in closer and inspect the sound file for areas where there no bat call but plenty of unwanted signal.



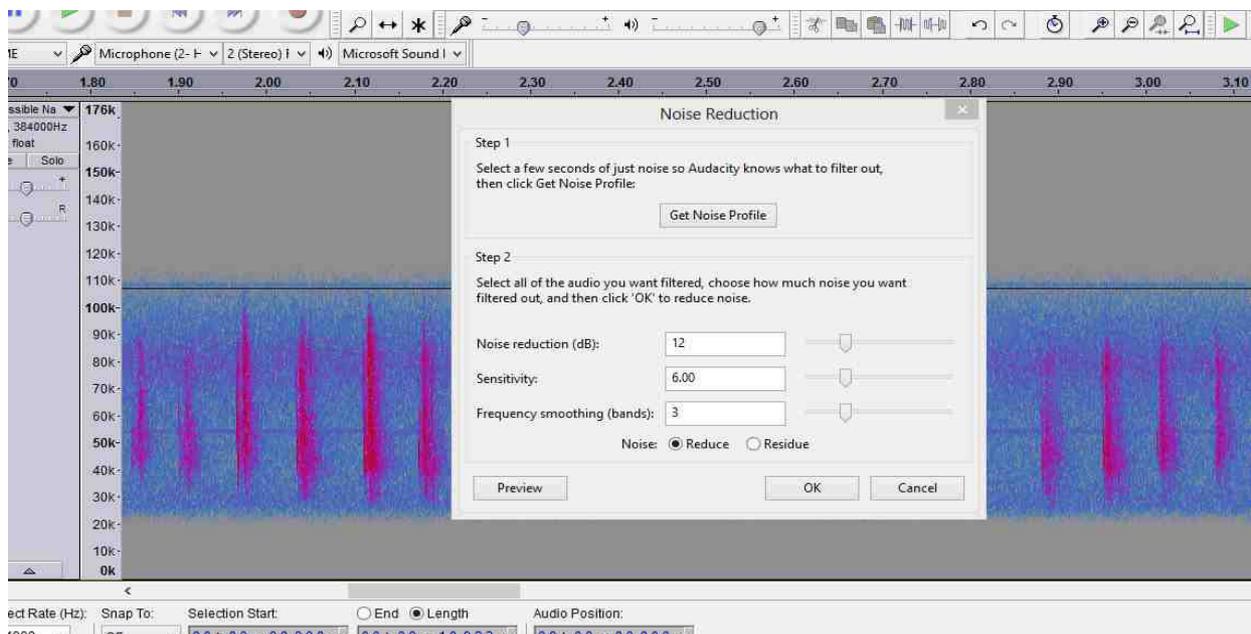
Looking closer now.



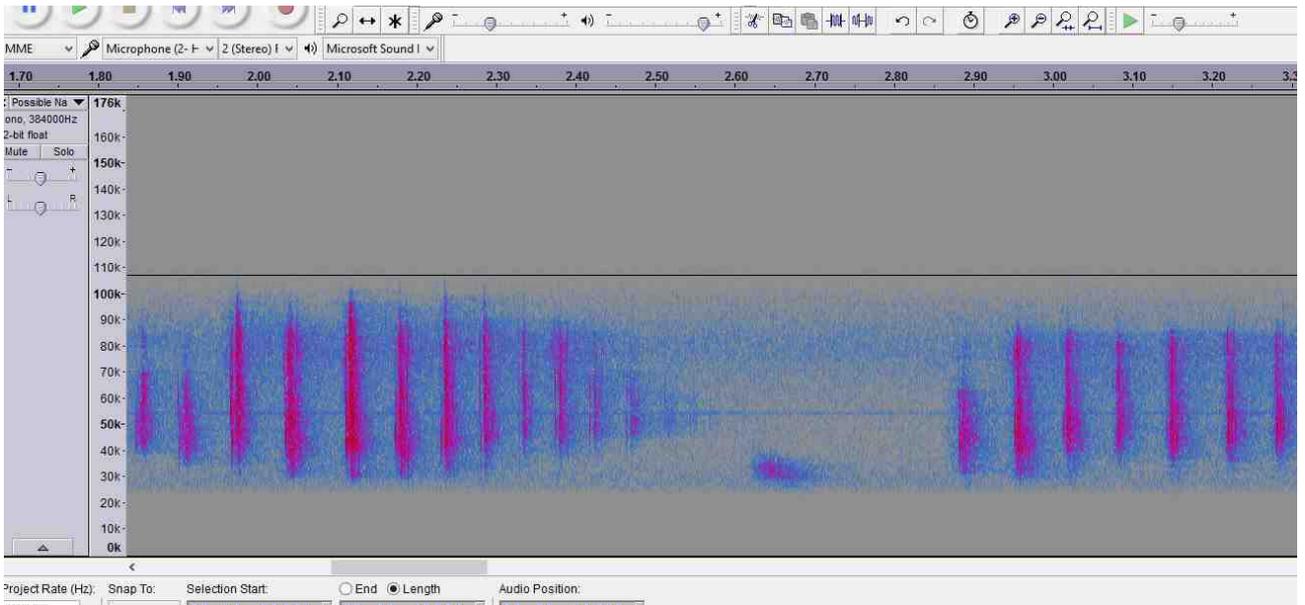
I decide to select the highlighted area and invoke the noise reduction tool, to "get noise profile". Apologies here , my screen grabber does not show the selected area.



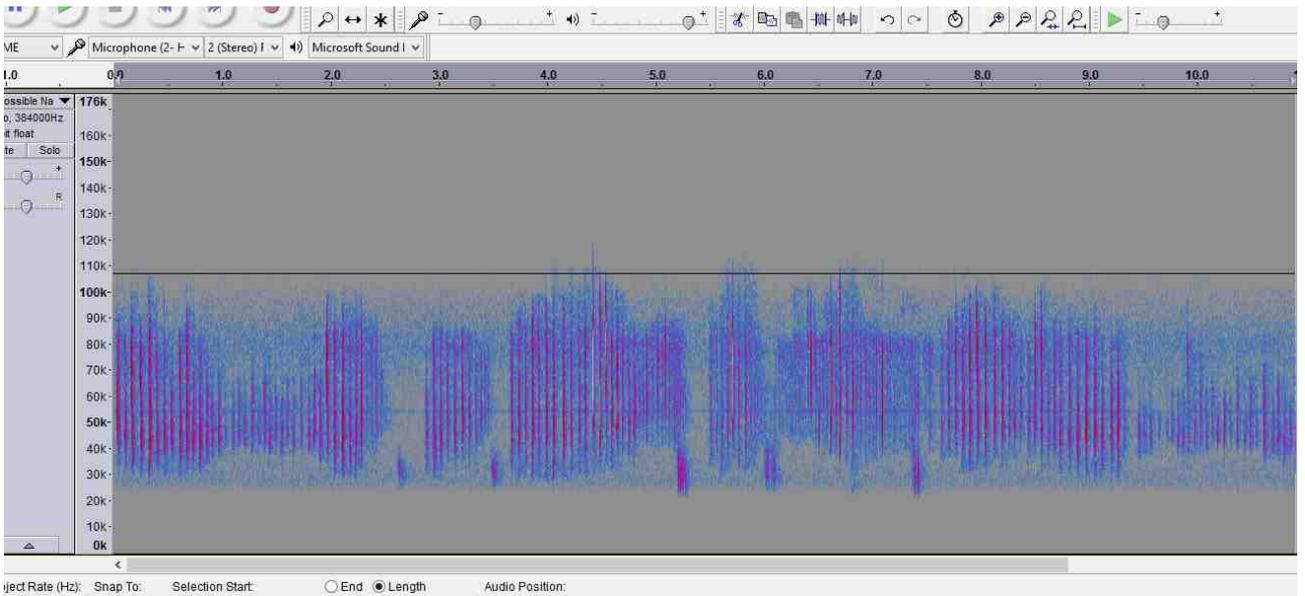
Having sampled the noise profile. Click away from the noise band so that the entire file is once again fully selected. Then invoke the noise reduction tool again and click on OK.



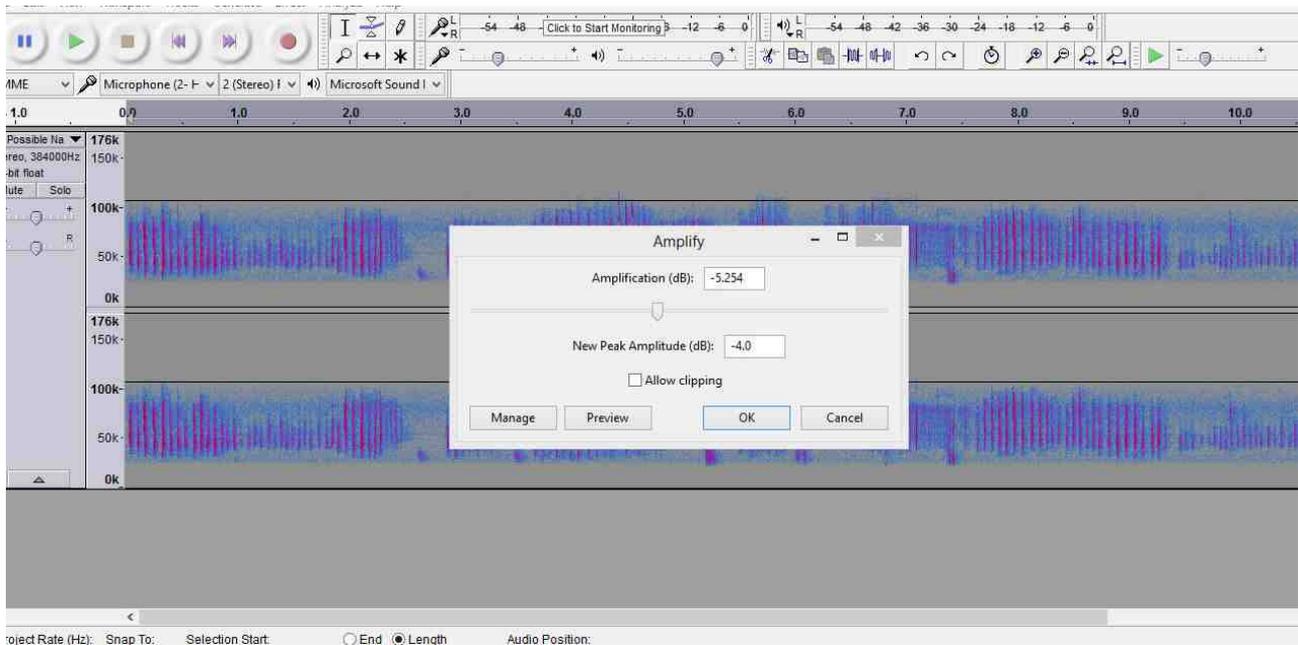
At last! A cleaned up signal. Still some noise visible, this can be adjusted by experiment within the Audacity tool. This sample looks good to me, not damaging the bat call but clobbering the noise.



So , lookng at the whole file now.



Having done all this work, the overall amplitude might have suffered. It needs to be taken up to about -4dB of the ceiling. This is done using the "Amplify" effect. Quite easy -



File Formatting :

The Peersonic BatWav requires files to be not only 384ks/sec sample rate, but also stereo, and saved as 16bit PCM (not floating point).

To convert from mono to stereo -

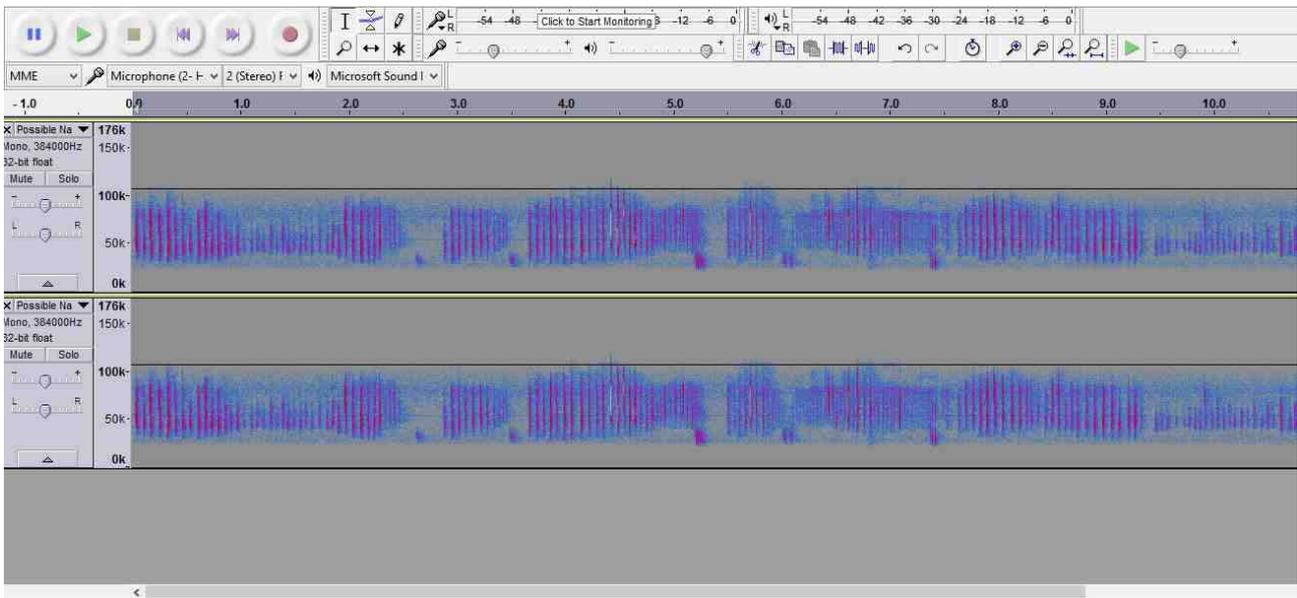
From "edit" in the top menu select "duplicate".
Now you have two mono recordings.

From the "Audio Track" menu which is to the left side of the displayed recording one recording can be made "left channel" and the other "right channel".

So following that again from the "Audio Track" menu select "make stereo"

Lastly from the "Audio Track" menu chose "format" and select 16bit PCM.

Note : Audacity has a habit of reverting to 32bit float, so its worth rechecking this setting just before your finally save the file, or else it could save as 32 bit float and will not play.



Noise reduced 16bit PCM 384ks/sec stereo.

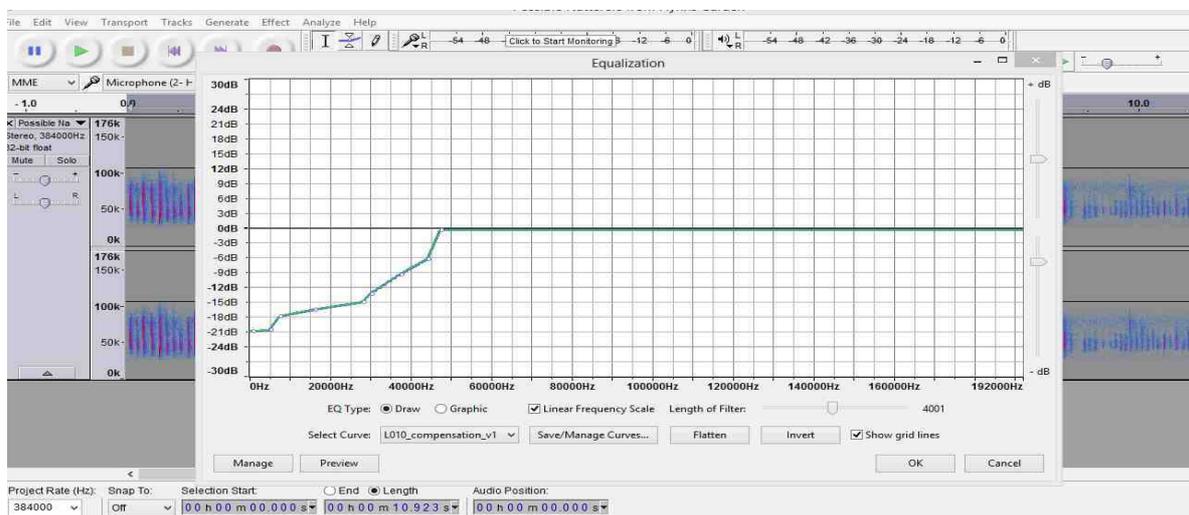
Speaker compensation :

The Peersonic BatWav can drive a variety of speakers, and as they are remotely housed this gives future options. Initially the speaker uses is called L010, housed in a turned nylon enclosure with a tripod thread for ease of deployment.

Response is good up to about 55kHz but slowly attenuates above that point. So, equalisation is applied to the signal to ensure it is stronger at the higher frequencies where the speaker needs a greater drive strength. Effectively it attenuates the lower frequencies as cacluated from a frequency test curve.

The Audacity effect "equalisation" requires a speaker characteristic compensation curve, specific to the speaker type used. This is free from Peersonic. In this case we use - L010_compensation_v1 which must be imported into the equalisation curve menu.

Simply, import and "OK" the effect.



At last!

Now the file can be saved.

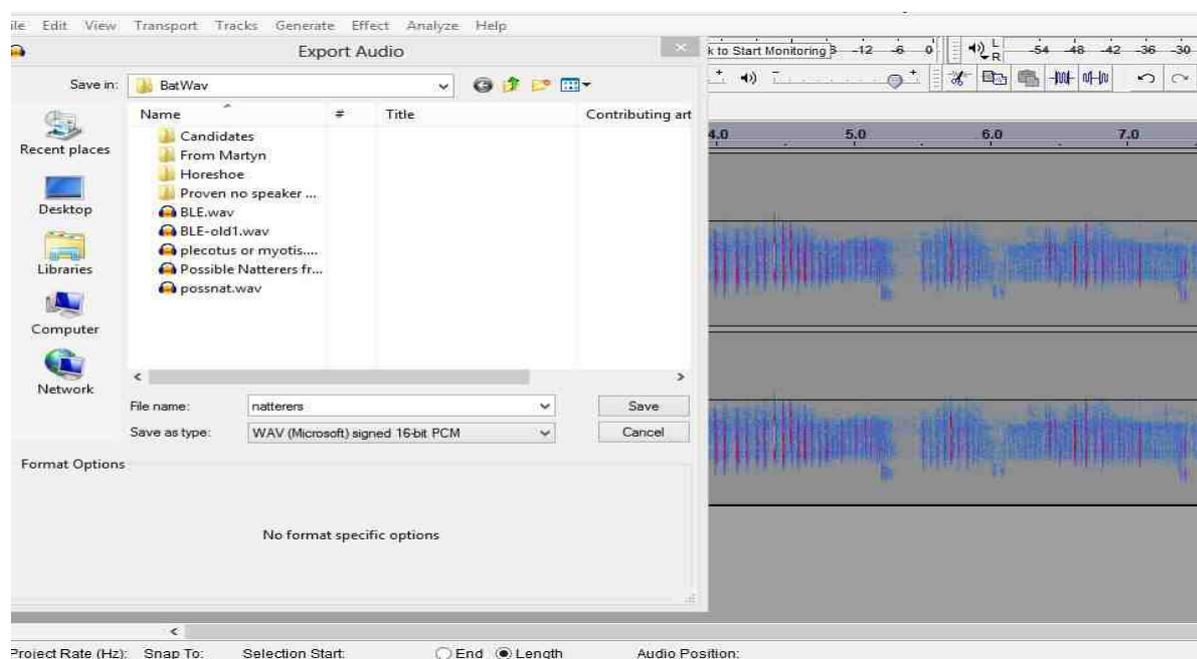
Before doing this check back in the "Audio Track" menu to see that the file is still 16bit PCB and has not been modified by Audacity.

To save , use "export" in top bar File menu.

Beware the rules !

Save files with no spaces. Eg

Common_pip_social not ~~Common Pip social~~



This is all quite a lot of work, it to me at Peersonic quite a while to sort it all out. So my plan here is to offer a free library of files that will be added to up to some point of general satisfaction.

User specific recordings I will process at no charge for 2019 so long as I am not sent too many in one go. These will be added to the free library. Unless they are proprietary , in which case a processing fee will be applied.

After that, and assuming I have a decent library, there will be a small processing fee per file, or as agreed otherwise.