

Sonograms, Birdsong and You.

Recording bird calls and using their sonograms to study rare and endangered species is an important technique used by HBOC field studies teams.

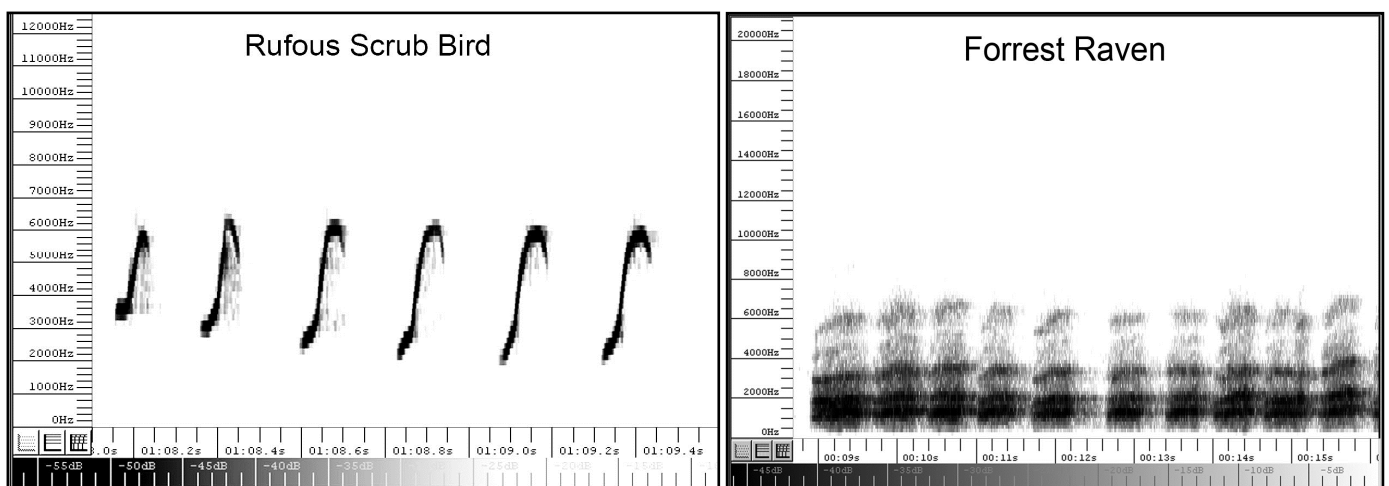
Following the talk given to the HBOC meeting on 11th May, a number of interested HBOC members have sought more details about sonograms, how to read them and how make and view their own sonograms. This article is in response to those requests. It shows how anyone with a computer can use bird call recordings to make their own sonograms and so enhance their birding experiences ... and all at very little cost. It repeats verbatim some information given in the talk to the HBOC but it also includes more details on some areas covered either only briefly on the night or not at all.

Sonograms

Hearing sounds is a fleeting experience – an experience that lasts only from moment to moment. Even when recorded and listened to, part of the sound lasts for only for an instant.

A sonogram is a picture of sound frozen in time. It shows how the sound's pitch (frequency) and loudness change with time. Sonograms allow us to examine sounds at our leisure rather than fleetingly and so sonograms can help to improve our listening skills and greatly enhance our listening pleasure.

Two typical sonogram displays might appear as follows



The sonogram of one of the many Rufous Scrub Bird calls is typical for calls of a simple musical nature, while the Forrest Raven sonogram is typical for those more complex calls, in this case harsh sounding calls.

When a recorded bird call is played, one way to improve listening skills is to play it on a computer using sonogram producing software (see "Raven Lite" below). Look at

and follow the sonogram on the screen while at the same time listening to the call. Next study the stationary sonogram on the screen (i.e. without the sound). Look for any characteristic or interesting features – see “Sonogram reading basics” below. Then replay the call while watching the sonogram once again, listening especially for those features noticed in the sonogram. Repeat these steps as often as you want. In this way you can educate your ear and improve your listening skills both at home and in the field.

Donald Kroodsma in his book¹ says “Personally, I can’t imagine a world without sonograms, as I can’t imagine listening without also seeing. ... Take a CD of bird sounds off your shelf and using suitable software eg Raven Lite play it into your computer, now seeing the songs come to life, appreciating the details and the differences among them. Make your own recordings, bringing them home to gorge yourself on the details of how each bird sings. Or try the ultimate in techie birding - use the appropriate software program on a laptop computer, and a microphone in the field, and you can watch the songs dance across your computer monitor in the great out-of-doors as you listen to birds there. Listen as you see, and you will hear a different world singing to you.”

Sonogram reading basics (using the sonograms above as examples):

1. Look at the scale under the sonogram and note what one second in time looks like. In the RSB sonogram above, one second extends nearly two thirds the way across the display i.e. the whole display is only about 1.5s across, while in the FR sonogram one second is just a little more than one eighth of the display i.e. the whole display is nearly 7.5s across. You should also take the time to glance at the scale on the left to note the highest and lowest frequencies displayed. In both sonograms above, the lowest frequency shown on the scale is 0 Hz, but this is not always the case. The maximum frequency shown on the scale for the RSB is about 12,500 Hz while the FR sonogram scale tops out at 21000 Hz, which by the way is above the hearing range of almost anybody, young or old.

Now look at the sonogram itself.

2. Sonograms are read from left to right (just like reading line of writing). The part on the left is the start of the sound and the part on the right is the finish.
3. Intensely coloured areas are loud and faint ones soft.
4. The higher the pitch (frequency) of a note the higher up the display and vice versa.
5. In a sonogram, a note which starts as high on the left and ends as a lower note on the right i.e. it slopes down from left to right, is descending or lowering in pitch (frequency). Conversely a note which starts as a low note on the left and ends as a higher note on the right i.e. it slopes up from left to right, is

ascending or rising in pitch or frequency. In the RSB sonogram above each note rises quickly in pitch before a very quick short downturn at the top. This last feature is so fast and of such a short duration that it would be difficult to hear without slowing down the replay of the call. The FR call shows bar like segments each of which consists of a number of simultaneous notes stacked above each other. These combine to produce more complex sounds, in this case a typical harsh crow call. If you look at such a sonogram and listen closely you can see and hear the pitch rise slightly during each segment of the call.

Studying bird call sonograms can be useful in many ways other than training the ear and learning to recognise calls. The number of potential uses is almost limitless. Many books such as the HANZAAB series include sonograms as part of the call description for many species, and so the ability to understand the basics of sonograms is essential. Some other uses for sonograms include studying the same species for regional differences in calls, identifying and following groups or even individual birds, finding out if bird calls are learned or genetically determined, if calls change with the seasons or over the years, or are influenced by other nearby birds of the same species or other species, or for comparing original calls with their mimicked versions, and so on.

What Do You Need?

And so what do you need to make sonograms?

It really depends on how far you wish to go i.e. do you only want to watch sonograms of sounds downloaded from the web, or do you wish to use tracks from CDs or use recordings from an MP3 player using an internal microphone, or from an MP3 player using an external microphone, or from recordings made using a digital recorder in either MP3 format or better still in WAV format using either internal or external microphones which might even be directional?

The first two real essentials are a computer (either a PC or Mac) and some appropriate software. Assuming you already have a computer, the cheapest “good” solution to the software requirement is “Raven Lite” which is free but requires registration. Most other worthwhile software has to be paid for and usually starts at around US\$400 or more.

Raven Lite

Raven Lite is a free software program, produced by the Cornell Lab of Ornithology that lets users record, save, and visualize sounds as spectrograms and waveforms. Raven Lite is intended for students, educators, and hobbyists, and can be used for learning about sounds, as an aid in birdsong recognition, and in musical instruction. Raven Lite can open and visualize tracks from your favourite music or bird song

audio CDs. Other sound file formats supported are MP3, WAV, AIFF, AIFC and any sound format supported by Apple QuickTime. It is available for Windows and Macs.

To enable Raven to open MP3 files and other audio file formats in Windows you need to download and install the QuickTime Player or iTunes which automatically installs the QuickTime Player. On a Mac QuickTime should already be installed. If you already have an older QuickTime or iTunes installed on your computer you may need to run the QuickTimeUpdater.exe program to update your QuickTime installation to add the necessary components that Raven needs, especially "QuickTime for Java".

Note: Most of the above two paragraphs has been taken directly from the Cornell Lab of Ornithology's website².

Along with its more expensive siblings ("Raven" and "Raven Exhibit") Raven Lite can be downloaded from <http://www.birds.cornell.edu/brp/raven/RavenVersions.html>. Documentation and sample sounds can be accessed via the index on the LHS of the above download page.

Raven Lite first starts by displaying sonograms in black and white, but a number of different colour palettes can be selected from the menu. In addition each sonogram may require changes to a number of control settings to show it to its best advantage, or there may be some different settings needed for the same sonogram to show different features. The controls are mostly simple however – contrast, brightness and ones to expand or contract the time scale and the frequency scale are the main ones. However please note that while Raven Lite is very good for a free program, it does not have all the features of its more expensive cousins. One feature that is lacking is the ability to scroll smoothly and quickly through large sound tracks – scrolling usually results in blank sections appearing. It takes only moments to fill these sections from the sound file, but you do have to pause a moment until this happens. But for the price (i.e. free) it has no equal. Commercially priced software offering more and better features includes Raven at US\$400 and Song Scope³ at US\$500, but obviously you would only consider these options after trialling sonograms and Raven Lite for some time in order to make sure that type of expenditure will be worthwhile.

Getting Bird Calls to Look At and Listen To

Many websites allow you to download bird calls and other wildlife sounds. The Cornell Lab of Ornithology offers some birds calls amongst other sounds to support sales of their software but of course these are all North American species. However more and more Australian sites are storing bird call sound tracks which can be downloaded, saved and viewed. Googling for these should bring results.

Thus far, apart from having to have a computer, everything above can be done at zero expense. But to get superior examples of Australian bird calls it is hard beat CDs, of

which many exist. Some examples include Fred Van Gessels many CDs in the “Australian Bird Call Series”, the BOCA ten CD set “Field Guide to Australian Birdsong”, David Stewart’s “Australian Bird Calls”, and so on. And Raven Lite will load them straight from the CD.

Recording Your Own Calls

If you wish to record your own bird calls, starting with those birds around your own home, then there are a vast number of alternatives depending on how far you wish to go.

The simplest alternative is to use an existing MP3 player which has a built-in microphone e.g. I know that iPod touch, iPhones and iPads all have microphones of sorts, as do probably some other brands of players. Of course these are far from ideal but they are a “cheap start” alternative if you already have one.

Next up the line is a digital recorder. These can vary from cheap MP3 recorders at fifty dollars or less, up to those costing tens of thousands of dollars. These should all have at least an inbuilt microphone and ideally provision to attach an external microphone. The cheapest will save recordings only in MP3 format. The advantage of MP3 is that you can save lots of recordings in a relatively small memory or disk space. However MP3 is a “lossy” compressed format i.e. during compression some information is lost. Such recordings are acceptable but not the best. A recorder which also allows you to save your recordings as WAV files is ideal because this format is lossless, but these usually cost more. External microphones are a further extension, but this is a vast topic which I have neither the space nor expertise to cover. And if you get wrapped up in the recording aspect, rather than sonograms, then you might think about joining the Australian Wildlife Sound Recordists Group (AWSRG). Whatever digital recorder and format you use, the recordings will need to be transferred to a computer for use with the sonogram software. This is usually via a USB connection or via a memory card and card reader.

I think that covers the basics, and I don’t think I can do any better than to conclude with another two paragraph quotation from Donald Kroodsma’s book, this time from the preface:

“Ten thousand species strong, their voices and styles are as diverse as they are delightful. Some species learn their songs, just as we humans learn to speak, but others seem to leave nothing to chance, encoding the details of songs *in their* DNA. Of those that learn, some do so only in early life, some throughout life; some from their fathers, some from eventual neighbours ..., some only from their own kind, some mimicking other species as well. Some species sing in dialects, other not. It is mostly he who sings, but she sometimes does too. Some songs are proclaimed from the treetops, others whispered in the bushes, some ramble for minutes on end, others

are offered in just a split second. Some birds have thousands of different songs, some only one, and some even none. Some sing all day, some all night. Some are pleasing to our ears, and some are not.

It is this diversity that I celebrate. How the sounds of these species differ from each other is the first step in appreciating them of course, but those questions quickly give rise to “why” questions. Why do some learn and others not? Why do dialects occur in some species and not others? Why is it mainly the male who sings? It is these and similar “why” questions that so intrigue us ... as we try to understand the individual voices that contribute to the avian chorus.”

Ian Martin, May 2011

References

1. Kroodsma, Donald (2005). “The Singing Life of Birds: The Art and Science of Listening to Birdsong”. (Houghton Mifflin, Boston, NY)
2. Cornell Lab of Ornithology. Website: <http://www.birds.cornell.edu>
3. Wildlife Acoustics. Website: <http://www.wildlifeacoustics.com>