Anabat Insight

User Manual

Titley Scientific

Version 2.1

TITLEY SCIENTIFIC CONTACT DETAILS

AUTHORS AND ACKNOWLEDGMENTS

This manual was written by Julie Broken-Brow. I greatly appreciate the time, comments and assistance given by those people who were beta testers for Anabat Insight and this manual. The testing and troubleshooting have improved the software and increased the clarity of the manual.

DOCUMENT HISTORY

Manual Version	Release Date	Software Version	Major Additions and Changes
1.0	01/02/18	1.0	–
1.1	30/04/18	1.0.2	Additional keyboard shortcuts; viewing and splitting zcas; trigger setting display
1.2	18/05/18	1.0.4	Brightness/contrast histogram; smoothness and zc threshold in searches; export species list; add files to projects; new metrics; batch run Bat Classify UK plugin
1.3	10/07/18	1.1.2	Species label hotkeys; moving noise files in zca conversion; new metrics; confidence metadata for BatClassify identification; histogram graph settings
1.4	02/08/18	1.1.3	Custom grouping; memo playback; grouping for species reports; adding folders to a project; BatClassify on Mac; scroll bar on time axis; change headings in project panel; customizable user metrics; marked column; spectrogram de-noising
1.5	30/10/18	1.1.6	Project panel headings; prevent inter-group scrolling; export to .zc; display of metrics; ridge detection trigger; histogram intensity; pulse count/percentage search; project file redundancy; spectrogram denoise
1.6	12/12/18	1.1.7	Power graph; triggering; full spectrum metrics; analysis settings; and/or search; metrics report
1.7	08/03/19	1.8.3	Metrics report; tile slope window; convert ZCA update; disperse report .csv; display call metrics; triggering; editing decision tree; Auto-scroll label; gpx in KML report; BatClassify % in reports
1.8	26/11/19	1.9.1	Adding criteria to decision tree; % pulse labelling in decision tree; keyboard shortcuts; hide filtered dots; adding a filter to searches; auto smoothness
1.9	04/03/20	1.9.2	Custom reports; filter updating in search/decision trees; slope transitions correction
2.0	18/05/20	1.9.3	Floating windows; analysis settings in searches; open last closed recording; edit custom metadata; duplicate species labels
2.1	27/08/20	1.9.5	Metadata lists; edit metadata in panel; cursor metrics; acoustic files; highlight call changes; further metrics details

CONTENTS

GLOSSARY

FFT Window	Fast Fourier Transform (FFT) relating to the time and frequency resolutions
Full Spectrum	A spectrogram which displays the sound frequency (y axis), time (x axis) and intensity (using colour)
GUANO	Metadata system; Grand Unified Acoustic Notation Ontology for bats
Metrics	Predefined measurements taken from the zero crossing analysis
Off Dots	Zero crossing dots which are hidden (either manually or by a filter)
Oscillogram	A visual representation of a sounds intensity (y axis) over time (x axis)
Pass	The series of pulses which are contained in a file, typically from one bat passing the microphone
Pulse	A single echolocation pulse emitted from a bat
Spectrogram	A visual representation of the spectrum of frequencies of sound as they vary with time
Trigger	A defined sensitivity level at which zero crossing occurs

FEATURES OF ANABAT INSIGHT

Anabat Insight is a viewing and reporting software package for sound files which perfectly complements bat call analysis. The program offers the following features:

- Ability to view recordings in full spectrum and zero crossing
- Project management to keep all your calls organised
- Metrics calculations for passes and individual pulses
- GUANO metadata support
- Customizable filters and scans
- Choose between multiple audio modes to listen to calls
- Inbuilt mapping to view tracks and file locations
- Supports open source Auto ID plugins (currently Bat Classify UK)
- Can be used on Windows or Mac

GETTING STARTED

The image below shows some of the main features and tools of Anabat Insight. To open Anabat Insight, double click on the ⩔ Anabat Insight icon on your desktop or program list.
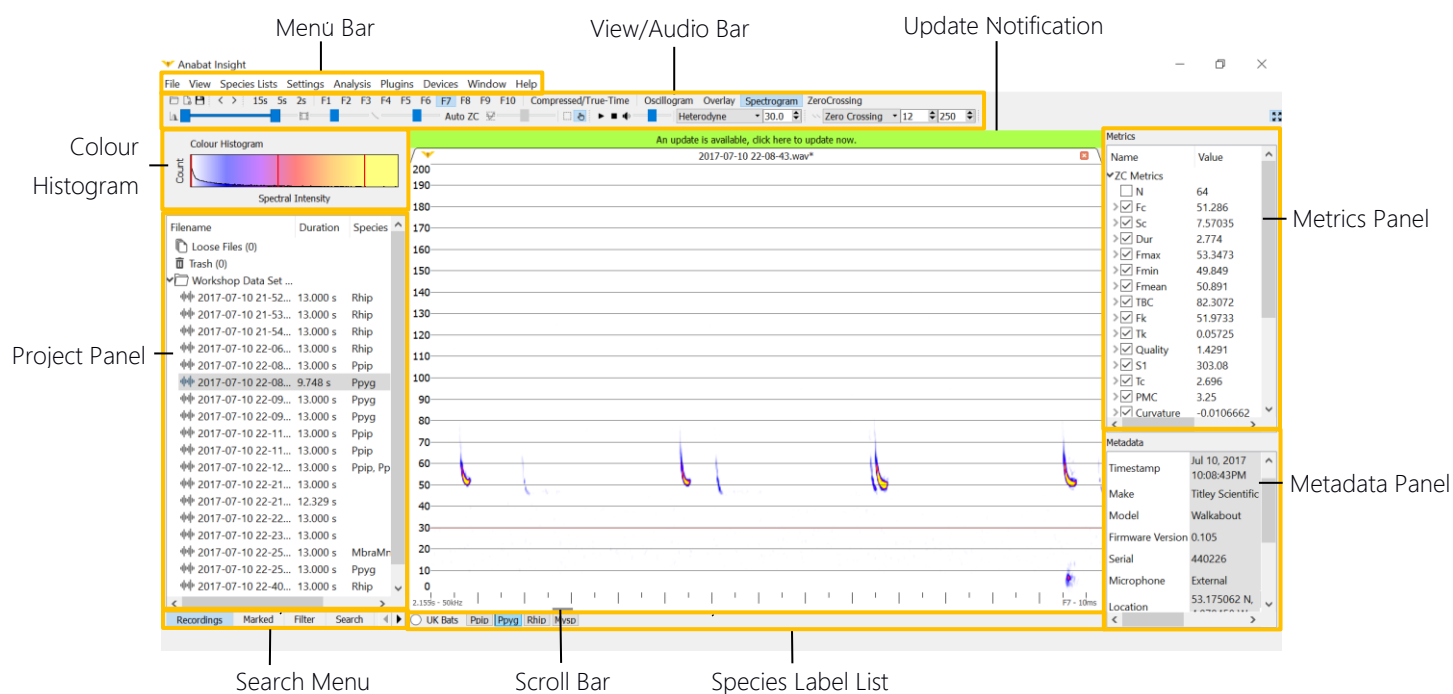
OPENING & CLOSING FILES

You may open entire folders (including subfolders), or single files.

OPENING & CLOSING A DIRECTORY (FOLDER)

To open a folder, click the 🗁 in the **View/Audio Bar**, or click on **File**, then **Open Directory**. Navigate to the folder you wish to open, click on the folder, then press **Choose**. Alternately, you can navigate to the desired file, then double click on the file; this will open the folder which houses the selected file. Alternatively, you can drag and drop a folder, or files, directly into the program.

Once you have opened the folder, it will be displayed in the **Project Panel**. Click on **>** next to the folder to show the contents. Any subfolders will be displayed, and you can display/hide the contents of these folders by pressing the **>** next to the folder.

To open a listed file, double click on the file in the **Project Panel**. The spectrogram will be displayed in the main panel, with the file name in a tab above the file.

To close the directory, right click on one of the folders displayed in the **Project Panel** and click **Close Store**.

OPENING & CLOSING A FILE

To open single files, click on 🗋 in the **View/Audio Bar**, or click on **File**, then **Open...**. Navigate to the file you wish to open, then either click on the file, then press **Open**, or double click on the file itself. You can also drag and drop a file directly into the program.

Once you have opened a directory and displayed the contents of the folder, the files will be displayed with an icon indicating their file type in the **Project Panel**:

⁙ Full Spectrum (.wav)

⋰ Zero Crossings (.zc)

🗀 Folder or ZCA file*

🗎 Memos/Log Files/Other Files

*ZCA files are full-night files recorded on Anabat Express, which are best viewed split up into sequence files. We display each ZCA file as a folder, with the contents of the folder being the split *read-only* sequence files. These files cannot be labelled or altered. To put species labels on ZCA files, you first need to EXPORT/CONVERT ZCA FILES to sequence files.

To open a listed file, double click on the file in the **Project Panel**. The spectrogram will be displayed in the main panel, with the file name in a tab above the file.

To close the file displaying in the main panel, click on ❌ in the tab above the file.

To close single file/s from the directory, right click on **Open Files** in the **Project Panel**, then click **Close Store**.

To open the last closed file press the keyboard shortcut "L", or go to **File** and select **Open last closed recording**.

PROJECT FILES

Please note: We are no longer supporting the creation of new project files. You will still be able to open pre-existing project files, and add files/folders to them.

Project files create one compressed file which contain all of your bat calls for a project in one location. This can be useful to create a copy which can be edited/changed and have files deleted, without affecting the original data on your drive. *Please note: you cannot run the Bat Classify UK plugin on project files.*

To add more files to a project file, ensure the project file is open in the **Project Panel**, then click on **File** in the **Menu Bar**, then select **Add files to Project**, alternatively right-click on the project file in the **Project Panel**, then select **Add files to Project**. Click **Add** to select whichever files to add to the project, you can select as many files as you like, then click **Open**. The files to add will be listed, you can choose to delete files if you have selected incorrectly. Click **Import Add** and the files will be added to the project, this may take several minutes depending on how many files you have selected.

To add a folder of files to a project, drag the folder from windows explorer onto the project file in the **Project Panel**. *Please note: project files do not currently retain subfolders.*

VIEWING MULTIPLE FILES

To open another file, double click on the desired file in the **Project Panel**. The file will automatically open in a new spectrogram window. There will be a tab for each file displayed above the spectrograms, you can change between files by clicking on the corresponding tab.

To view multiple files at once, open two files in the **Project Panel**, click on Window, then select either **Cascade** or **Tile**. Cascade will show smaller windows on top of larger windows. Tile will display the windows next to each other, optimising the screen space.

SCROLLING THROUGH A FILE

Once a file is open in the main panel, you can scroll along the file in four ways:

1. Hover the mouse pointer over the main panel display and use the scroll wheel on the mouse.
2. Ensure 🖑 is selected in the **View/Audio Bar**, then use your mouse to click and drag the display left or right.
3. Use the arrow keyboard shortcuts **< >** to scroll left or right.
4. Drag the scroll bar along the time axis.

OPEN NEXT/PREVIOUS FILE

Once you have opened a directory, you can scroll to next/previous files using the **< >** arrows in the **View/Audio Bar**, or you can use the keyboard shortcuts "**[**" and "**]**"**.** To view all of the files in quick succession, hold down the "**[**" or "**]**" key. If you have multiple folders open, and would like to prevent scrolling into the next folder, click **Settings**, then under **File Navigation**, check **Prevent Inter-Group Scrolling**.

Change speed

To change the speed that files are displayed when the "**[**" or "**]**" keys are held down, in the **Menu Bar** click on **Settings**, then **File Navigation**, then **Next/Prev Speed**. Select your desired speed.

OPEN LOG FILE

Log files can be found in the **Other Files** folder in the **Project Panel**. To view a log file, double click on the log file in the **Project Panel**. It will automatically open in the default program your computer is configured to use for that file type.

ACOUSTIC FILES

Acoustic files (sample rate ≤44.1 ksps) will be listed in the store panel. These files can be played back in the free version of Anabat Insight. In order to view the spectrogram of acoustic files, they need to be recorded on a Titley Scientific detector, or you will need to have the paid version of Insight.

EXPORT/CONVERT ZCA FILES

Anabat Express bat detectors record .zca files which contain a full night of recording. These files are displayed as ***read-only*** sequence files in the file directory panel. If you wish to label bat species, add metadata or alter these sequence files, you will need to export the ZCA file.

To export/split the ZCA, first close the store if it contains the ZCA files you wish to convert, then click on **Analysis**, then **Convert ZCA**. The Convert ZCA window will appear.
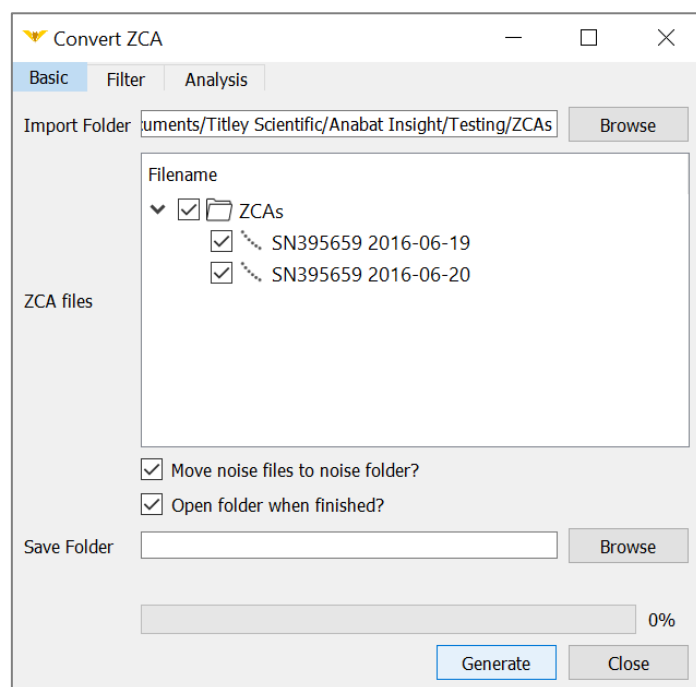
Use **Browse** to select the input folder (containing the .zca files), the ZCA files will be displayed, check the files you wish to convert. Use **Browse** to select the output folder (where the sequence files will be saved to).

During the conversion process, a standard "all bats" filter will be applied to identify bat sequences and remove noise files. To keep these noise files in a separate noise folder ensure "**Move noise files to noise folder?**" is checked in the **Basic tab**. You can alter or disable this filter, by clicking on the **Filter tab** at the top of the **Convert ZCA** window. To disable the filter, click the **Enabled Button**, it will change to **Disabled**. To select your own filter, click on the dropdown menu for recently used filters, or the ⬚ to open a filter. The conversion will also be based off your analysis trigger settings, to view or change these, click on the **Analysis tab** at the top of the **Convert ZCA** window, you can set the minimum and maximum trigger frequency, as well as a smoothness setting.

To automatically open the folder containing the converted sequence files, ensure the "**Open folder when finished?**" is checked in the **Basic Tab**.

To complete the conversion, click **Generate**. Each ZCA file will have a corresponding folder with the split sequence files.

Please note: we highly recommend the use of a noise filter during the conversion process.

EXPORT/CONVERT WAV TO ZC FILES

Anabat Insight allows you to convert full spectrum (.wav) files to zero crossing (.zc). To do this, select the files/folders you wish to convert in the **Project Panel**, then right-click and choose **Export Selected**. Under **Export Mode**, select **Copy and Convert to ZC**, then choose your **ZC Threshold** or choose **Auto ZC** (see Setting the Trigger Threshold for more information). Choose your **Export Location** by clicking $\mathbb{Q}$ then select **Export**. If you wish for the files/folders to be opened in the **Project Panel** once the conversion is complete, ensure **Open when Finished** is checked.

CUSTOMIZE YOUR VIEW

Anabat Insight offers a range of features to customize the display to suit your preferences.

FLOATING PANELS

Floating panels can be isolated from the main program window. All of the panels are available as floating panels (Colour histogram, Stores, Marked List, Filter, Search, Results, Metadata lists – Species lists, Metadata panel and Metrics). To float a panel click and drag on the panel heading, the panel will float and you can move it. To dock a panel, drag it back over the main window, which will highlight when the panel is hovered over a suitable area. Drop the panel in the desired area.

To close a floating panel, click on the ❌ in the heading. To restore a panel, go to **View**, then check the desired panel.

PROJECT PANEL HEADINGS

In the project panel, your files will be displayed under the heading **Filename**. Next to **Filename** will be the headings **Duration**, **Species** and **Marked**. To change the order of these, drag and drop the heading across to the desired placing. To change the headings displayed, right-click on the heading panel, check the headings you wish to display, then click **Resize to Contents**. Alternatively, click on **View**, then under **Store Headings**, choose the panel, then the headings you would like displayed. To change the width of a heading, click and drag the edge of the heading.

PROJECT PANEL GROUPINGS

By default, your store will be grouped into folders. You can change the grouping to **File Type**, **Species**, **Device ID** and **Night**. To change the groups, right-click in the **Project Panel** and hover over **Group by...** then click on your preferred grouping from the drop-down menu.

Alternatively, you can create a custom grouping (for example: 'Night, Species'). To create a custom grouping, right-click in the **Project Panel** and hover over **Group by...** then click on **Add Custom Group** to access the **Custom Grouping Menu**. Select **New Grouping**, then use the drop-down menu to choose the first level of the custom grouping (eg. Night), then click **Add Group**. Then select your second level of the custom grouping (eg. Species), then click **Add Group**. You can add as many levels to the grouping as you like. Then click **Save**.

To remove custom groupings, open the **Custom Grouping Menu** following the instructions above. Select the group you wish to remove, and select **Remove Group**, then click **Save**.

DARK MODE

Dark mode will change the program panels to a dark colour, this may reduce eye strain. To change to dark mode, select **View** in the **Menu Bar**, then check **Dark Mode**. To return to the original light mode, uncheck **Dark Mode**.
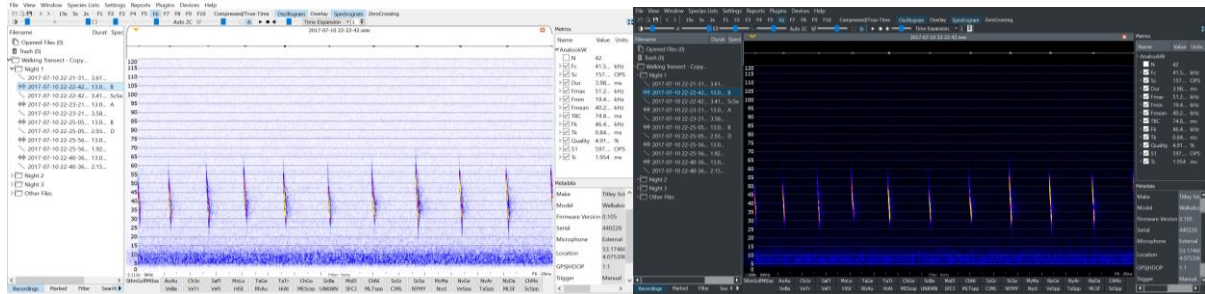
Light Mode	Dark Mode

FULL SPECTRUM, ZERO CROSSING & OVERLAY

You have a range of options to view your files. If you are opening zero crossing files, they can only be viewed in **Zero Crossing**. If you are opening full spectrum files, then you can choose between **Spectrogram**, **Zero Crossing**, both, or an **Overlay**. Please note that is you are viewing full spectrum files in Zero Crossing, you need to ensure the **ZC Sensitivity** is set correctly (see Setting the Trigger Threshold). When both are displayed the spectrogram will be on the top, and the zero crossing graph at the bottom. When overlay is selected, the zero crossing dots will be overlaid on the spectrogram. To select your viewing mode, click on your preferred mode/s in the **View/Audio Bar**; alternatively you can click on **View** in the **Menu Bar**, then check your preferred mode/s.

OSCILLOGRAM

To display the oscillogram on full spectrum recordings, click on **Oscillogram** in the **View/Audio Bar**; or you can click on **View** in the **Menu Bar**, then check **Oscillogram**. The oscillogram will be displayed above the spectrogram.

FREQUENCY SCALE

To change the frequency scale, right click anywhere on the spectrogram, then hover over **Frequency Scale**; alternatively you can click on **View** in the **Menu Bar**, then click on **Frequency Scale**. This will display some preset scales you can select from, or click on **Edit/New Scale**.

You can choose between **Linear** and **Logarithmic**, and set the minimum and maximum frequencies. To save your custom frequency scale, type a **Name**, then click **Save**. Your saved custom scales will be available to select from in the **Frequency Scale** menu.

Changing frequency axis lines

In addition to changing the frequency axis, you can choose where the frequency axis lines should be placed. To do this right click anywhere on the spectrogram, then click on **Frequency Lines**.

To create a new customized frequency line list, click **Add List**, then double click on the **<new list 1>** and type in your preferred list name. Click in the **Current List** box (see image below) and type in your preferred axis lines, pressing Enter after each entry. Click **Save** when you have completed the list. To return to the default frequency lines, click on **Auto**. Click **Close** to return to viewing spectrograms with your selected frequency line list.
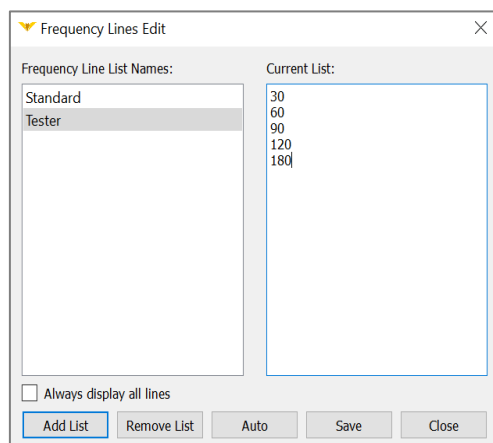
TIME SCALE

Standard Time Scales

You can select between pre-set timescales in the **View/Audio Bar**, displayed as the buttons **F1 to F7**. The time scales referred to the amount of time displayed between tick marks (divisions) on the time axis. You can also choose between **15s**, **5s** and **2s**, which represent

the number of seconds per 40 pixels. It should be noted that compressed mode does not affect the time scale.

F1 – 1 second	**F6** – 25 milliseconds
F2 – 0.5 seconds	**F7** – 10 milliseconds
F3 – 0.25 seconds	**F8** – 5 milliseconds
F4 – 0.1 seconds	**F9** – 2.5 milliseconds
F5 – 50 milliseconds	**F10** – 1 millisecond

COMPRESSED & TRUE-TIME MODE

You can choose to view your files in either True-Time or Compressed mode. True-Time will display the entire contents of the file, whilst Compressed mode will remove the 'spaces' between pulses. In Compressed mode Anabat Insight will display pulses based on your TRIGGER SETTINGS, so ensure these are configured correctly. Files will be displayed in True-Time by default, to change to Compressed mode, click on **Compressed/True-Time** in the **View/Audio Bar**. When Compressed mode is selected, the button will be highlighted. You can use the keyboard spacebar shortcut to toggle between Compressed and True-Time modes.

TRIGGER SETTINGS

Selecting Trigger Mode

A trigger is used to define when a bat call occurs. It is used in compressed mode, for rendering the zero crossing graph from a full spectrum file, and for calculating all metrics. Your trigger settings are displayed in on the right side of the **View/Audio Bar**:

Alternatively, you can click on **Settings** in the **Menu Bar**, then click on **Trigger**, this will open the **Trigger Settings Menu**.

Zero Crossing Trigger: The Zero Crossing trigger occurs every time the incoming signal crosses a preset amplitude level (sensitivity). This level is adjusted so that quiet sounds (background noise) don't cause a trigger event, but loud sounds like bat calls do. This setting must be configured correctly to view full spectrum files as zero crossing graphs, and to calculate the metrics.

Triggering for Metric Calculation

Metrics are calculated based on what is visible in the spectrogram window, and also what trigger threshold is selected. In the case of zero crossing files (.zc and .zca) and full spectrum files (.wav) the zero crossing trigger determines both what is displayed in the window in compressed mode, and also how many zero crossing dots are rendered and available for metric calculations.

Minimum and Maximum Trigger Frequency

You can set the minimum and maximum frequencies that a bat call can be triggered. Usually, you would set the minimum trigger frequency just below the lowest frequency bat call, this will eliminate low frequency noise triggering. The maximum trigger should be above the highest frequency bat call. You can also use the minimum and maximum trigger frequencies like a filter if you are only looking for a specific bat.

Auto ZC Trigger Threshold

You can select Auto ZC threshold which will attempt to automatically determine the optimum level for every individual file. To select this mode, click on the **Auto ZC** button next to the ZC slider in the **View/Audio Bar**. The Auto ZC feature works best when used in conjunction with Auto Smoothness.

Setting the Trigger Threshold

To set the Trigger Threshold, ensure you have selected the appropriate trigger mode. The ZC Trigger Threshold is controlled using the ⋱ slider bar in the **View/Audio Bar** (see below).
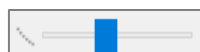
As you drag the slider bar, a corresponding number will be displayed in the bottom left of the program (eg. Adjust Zero Crossing Threshold: 12). To choose an appropriate threshold, open a file containing a bat pass then view the file in compressed mode. As you drag the

slider, you will see more or less of the pass displayed, choose a level which displays all the pulses you deem necessary to see with as little noise as possible. This may not need to be reassessed for each file, but different detectors will need different settings.

GRAPH COLOURS

To change the graph colours, right click anywhere on the spectrogram, then click on **Graph Colours**; alternatively, you can click on **View** in the **Menu Bar**, then click on **Graph Colours**. You can change the colours of the background (black and white), oscillogram, spectrogram colour map, ZC dot, ZC body and Off Dots. ZC dots refer to the dots rendered by the zero crossing analysis, the ZC Body refers to the dots which are determined to be the 'call body' for metrics, and the Off Dots are the dots hidden by a filter (or manually). In addition you can change the ZC Dot Size. Select your preferred colours and click on **Save**.

You can also change the colour histogram **Colour Interpolation** and **Maximum Intensity**. You can choose between and linear and logarithmic scales for the colour interpolation, which reflects the transition between different colours in the spectrogram. The maximum intensity refers to the highest amplitude where the spectrogram will still distinguish between colour values. In simpler terms, the maximum intensity is where the colour becomes constant (anything above that value will be the same colour). You can select a custom value (between 1 and 16,000) or select "**Auto**" and this will be automatically calculated based on each spectrogram. Usually a value of 30 – 100 is suitable.

COLOUR HISTOGRAM, BRIGHTNESS & CONTRAST

You can change the brightness, contrast and spectral intensity of full spectrum spectrograms using colour histogram window and slider bar in the **View/Audio Bar**.
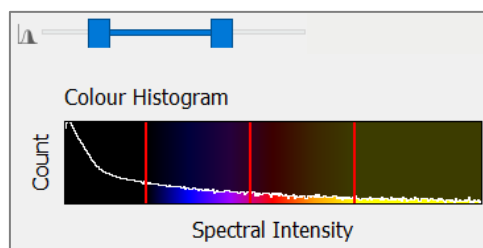
The slider can be used to control the brightness, contrast and colour spectral intensity. Dragging the centre of the blue slider or the middle red line on the histogram to the left will increase the brightness. Dragging the centre to the right will decrease the brightness. Decreasing the distance between the bars (the blue slider ends, or the outer red lines) will increase the contrast, increasing the distance will decrease the contrast (see below for a diagram).
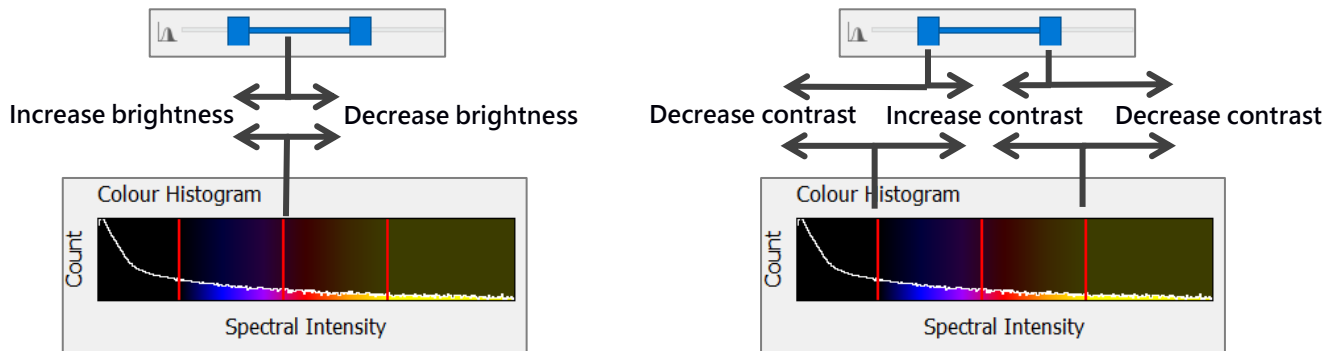
As you move the slider bar, a corresponding number range will be displayed in the bottom left of the program (eg. Adjust spectrogram range: 35 - 53). This may assist in viewing faint calls, or increasing call clarity, you may need different settings for each file.

To edit the settings for the colour histogram, see GRAPH COLOURS.

SPECTROGRAM DE-NOISE

You can reduce the amount of visual noise in a full spectrum spectrogram using the spectrogram de-noise tool. To activate this, click on **Settings**, then check **Spectrogram De-Noise**. This will not affect the metrics or triggers.

FFT WINDOW SIZE

The slider allows you to set the 'window size' of the Fast Fourier Transform (FFT). This setting is a trade-off between time resolution and frequency resolution. A smaller window will produce more accurate results in timing, at the expense of precision of frequency representation. A larger window will provide a more precise frequency representation, at the expense of precision in timing representation. Large FFT windows will also be slower to process. Typically a larger window will be better for viewing constant frequency bat calls

and a smaller window is better for frequency modulated bat calls. As you drag the slider bar, a corresponding number will be displayed in the bottom left of the program (eg. Adjust FFT Window: 10).

You can choose to limit the FFT window width to powers of 2, which will speed up the rendering of spectrograms. To do this, click on **Settings** in the **Menu Bar**, hover over **FFT Window Settings**, and check **Limit FFT width to powers of 2**.

HIGHLIGHT CALL BODY

When your files are displayed in zero crossing, you can choose to highlight the call body to display what the program is identifying as the 'body' of the pulses. See below for a file with and without the call body highlighted.
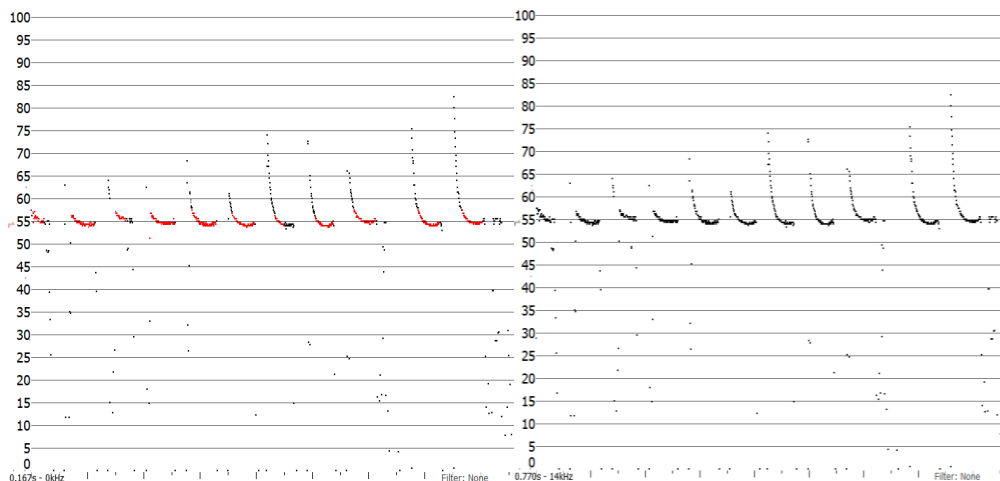
Call Body Highlighted   **No Highlight Call Body**

To highlight the call body, right click on the spectrogram and click on **Highlight Call Body**. Alternatively, you can use the keyboard shortcut of '**m**'. To change the colour of the highlighted dots, see GRAPH COLOURS.

VIEW POWER GRAPH

The power graph is calculated from the spectrogram, and it shows the distribution of energy across the frequency range, averaged across the time displayed on the screen. ***Please note: The power graph can only be viewed/calculated from .wav files.***

VIEW SLOPE GRAPH

The slope graph is calculated from the zero crossing analysis, it will display the speed at which the call changes pitch over time, and is shown in octaves per second. To view the slope graph, click on **View** in the **Menu Bar**, then click on **Slope**. To change slope settings, see SLOPE TRANSITION SETTINGS. By default, the slope graph will be displayed below the spectrogram/zero crossing window. If you wish to view the slope graph next to the zero crossing window, click on **View** in the **Menu Bar**, then uncheck **Position Slope Graph Below ZC**.

VIEW CYCLES GRAPH

The cycles graph is calculated from the zero crossing analysis, it will display a graph of the frequency (kHz) against the energy (based on the amount of time spent in each frequency band). To view the cycles graph, click on **View** in the **Menu Bar**, then click on **Cycles**. To change cycle settings, see CYCLE SETTINGS.

METADATA

All new Titley Scientific detectors record metadata in the GUANO (Grand Unified Acoustic Notation Ontology) format. This format is now the standard across bat acoustic fields.

VIEWING METADATA

The metadata associated with each file is displayed in the **Metadata Panel**. This may include:

- Timestamp
- GPS location
- Detector make and model
- Detector firmware version
- Detector ID (serial number)
- Microphone input
- Temperature and humidity at time of recording
- Trigger settings
- Species labels and confidence

CREATING AND CHANGING METADATA

In addition to the metadata which was recorded by the detector, you can also add custom metadata. To add a custom metadata field, open a file and scroll to the bottom of the **Metadata Panel**. Click in the field panel to add a field title, eg. Weather, or Site. Then click in the entry box and type in the metadata entry, eg. Raining, or National Park. When you scroll to the next file, it will ask you if you would like to save the changes. You can also check the box to save without asking in future. If you click **Save**, the metadata will be saved with your file.

To change a custom metadata field or entry, just click on the corresponding entry in the **Metadata Panel** and retype it. *Please note: It is only possible to change metadata added by the user, not default file metadata.*

CREATING METADATA LISTS

In addition to adding metadata manually, you can create metadata lists with labels like species lists. First you will need to create a metadata list, click on **Metadata List** from the **Menu Bar**, then select **New/Edit**, type in the **Metadata Type** (eg. Habitat). Click **Add List** and give the list a name (eg. Study Site 1), then you can type in metadata labels (eg. Forest, Grassland); entering between labels. Click **Close** to save your list.
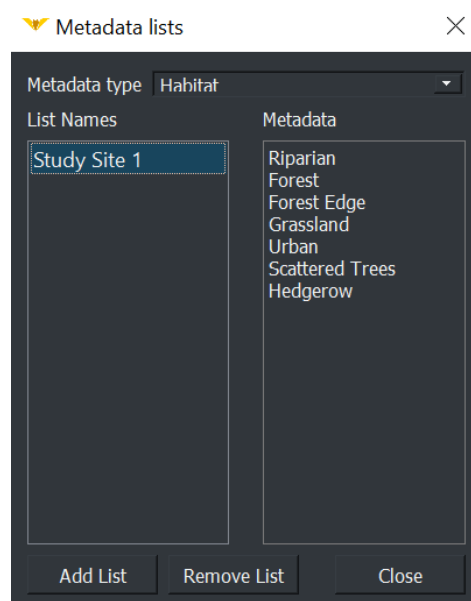
To remove or edit a species list, open click on **Metadata Lists** in the **Menu Bar**, then click on **New/Edit**. Select the preferred list and double click to change the list name, or click on the labels in the metadata column to edit, or click **Remove List** to delete the selected list.

To display a metadata label list, click on **Metadata Lists** in the **Menu Bar**, check the desired metadata list/s, then check **Shown**. Your selected list/s should now be displayed below the spectrogram.

To apply a metadata label, follow the same instructions as **Labelling a File**.

REMOVING METADATA

You can batch-remove metadata from multiple files, including species labels. To do this, select the relevant files in the **Project Panel**, right-click on the files and select **Remove Metadata**, a dialog box will appear. You can select the metadata type and value from the drop-down boxes to be removed, click **Remove**, this will add the batch removal process to the dialog box. You can add multiple metadata removals to one batch. To complete the removal, click **OK**.

If you used a **Metadata List**, you can remove the metadata label by clicking on the label a second time in the metadata list.

METRICS

Anabat Insight calculates a range of metrics for your files, based on the zero crossing analysis. The trigger settings must be correct for metrics to be accurately measured.

Metrics are displayed in the **Metrics Panel** and include:

Metric	Definition
N	This is not a metric, but the number of pulses detected for metrics in the file.
Fc	Characteristic Frequency; the frequency (kHz) at the right-hand end of the portion of the call with the lowest absolute slope (the body).
Sc	Characteristic Slope; the slope of the body of the call, measured in Octaves Per Second (OPS).

Dur	Pulse Duration; the duration of the pulse, measured in milliseconds (ms)
FMax	The maximum frequency (kHz) of the pulse.
FMin	The minimum frequency (kHz) of the pulse.
FMean	The mean frequency; which is a weighted mean, $FMean = (N - 1)D/2d$, where N is number of points counted in the display, D is the division ratio and d is the duration of the call.
TBC	Time between calls; the time from the start of one pulse until the start of the next pulse.
Fk	Frequency of the knee; frequency (kHz) of the junction (point of greatest change in slope) between the initial and pre-characteristic sections
Tk	The time from the start of the call to the knee, measured in milliseconds (ms).
Quality	The average smoothness for the whole call. Smoothness is the absolute value of the difference between the frequency of any point and the average of the frequencies of the points either side of it, divided by the frequency of that point. These values are summed over the whole call, and the result divided by the number of intervals in the call (number of dots minus 1).
S1	The slope of the first five points in a pulse, measured in Octaves per Second (OPS).
Tc	The time from the start of the call to the characteristic section, measured in milliseconds (ms).
PMC	The proportion of maximum frequency to characteristic frequency. $$PMC = 100 \times (FMax - Fc)/Fc$$
Curvature	A measure to characterize the shape of bat calls. If P is a positive number the call is upward curving, if P is a negative number the call is downward curving. This is calculated by logging time and frequency then performing a linear regression to calculate P.
FStart	The frequency at the start of the pulse. In the case of ZC, the frequency of the first ZC dot of the pulse.
Fend	The frequency at the end of the pulse. In the case of ZC, the frequency of the last ZC dot of the pulse.
Smin	The minimum amount of slope occurring over 2 to 5 ZC dots within the pulse, relating to the flattest part of the pulse.
Smax	The maximum amount of slope occurring over 2 to 5 ZC dots within the pulse, relating to the steepest part of the pulse.
Send	The slope of the last 5 ZC dots in each pulse.

USER CUSTOMIZABLE METRICS

In addition to the metrics supplied by the program, you can also create custom derivative metrics. To create a custom metric, click on **Analysis**, then **Edit User Metrics**. Click where it states *Add Expression...* then type in the expression for your custom metric, then type **Enter**. Expressions may use the following: *** / ( ) + -** and the names of all the current metrics. An example expression would be:

(2*Fc)/Sc

You can add multiple new metrics, and save a list of user metrics. To remove a metric expression, click on it then select **Remove Line**. Click **OK** when complete, and your new metrics will be displayed at the bottom of the **Metric Panel**.

VIEWING METRICS

Pass Metrics

The **Metrics Panel** displays the average metrics for the pass displayed (only what is visible on the screen). If you change the display (for example the time axis), or move the call, then the metrics will change to reflect the average for what is displayed on the screen.

Name	Value	Units	Display
∨ ZC Metrics			
☑ N	60		☑
> ☑ Fc	49.7...	kHz	☑
> ☑ Sc	19.1...	OPS	☑
> ☑ Dur	2.09...	ms	☑
> ☑ Fmax	51.5...	kHz	☐
> ☑ Fmin	49.5...	kHz	☐
> ☑ Fmean	33.8...	kHz	☐
> ☑ TBC	137....	ms	☑
> ☑ Fk	51.5...	kHz	☑
> ☑ Tk	0.07...	ms	☐
> ☑ Quality	0.32...	%	☐
> ☑ S1	121....	OPS	☐
> ☑ Tc	1.90...	ms	☐
> ☑ PMC	3	%	☑
> ☑ Curvature	-0.0...		☐
> ☑ Fstart	51.5...	kHz	☐
> ☑ Fend	50.0...	kHz	☐
> ☑ Smin	-23...	OPS	☐
> ☑ Smax	234....	OPS	☐
> ☑ Send	0	OPS	☐

Pulse Metrics

To view the metrics for individual pulses, click on the drop down arrow next to the metric of interest, and a list of pulses in the file will be shown, along with the metric for each individual pulse. The metrics which are greyed out are from pulses which are not currently being displayed. To remove erroneous pulse metrics from the pass average, simply uncheck the box next to that metric. To view which pulse is associated with the metric, click on the metric and the call will be displayed with the pulse of interest on the left of the display. To uncheck, or recheck all of the pulse metrics, check/uncheck the box next to the average metrics.

Name	Value	Units
∨ AnalookW		
☐ N	23	
∨ ☑ Fc	57.727	kHz
☑ 1	57.142	kHz
☑ 2	56.338	kHz
☑ 3	59.701	kHz
☑ 4	57.142	kHz
☑ 5		kHz
☑ 6	57.142	kHz
☑ 7		kHz
☑ 8	58.823	kHz
☑ 9	56.338	kHz

ZC Metrics
N	2
Fc	50 kHz
Sc	22.4 OPS
Dur	2.55 ms
TBC	84 ms
Fk	51.9 kHz
PMC	3 %
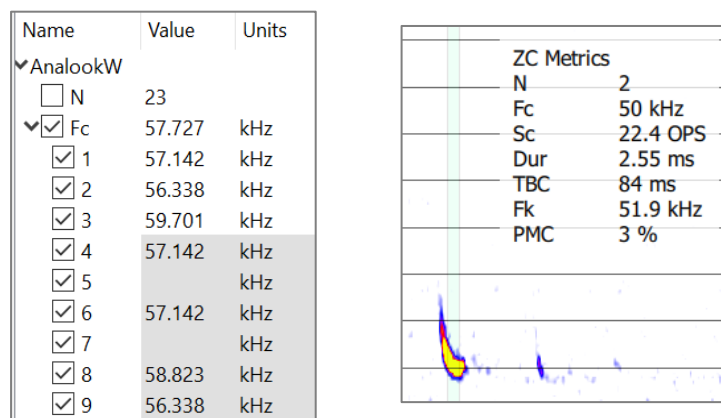
Alternatively you can right click on the spectrogram and check **Show call metrics**. Then as you hover your mouse pointer over pulses, the metrics for that pulse will be displayed. To choose which metrics are displayed using **Show call metrics**, check the box in the **Display column** next to the metric you want displayed on the spectrogram.

CURSOR METRICS

You can user the cursor to take measurements on the spectrogram. In the bottom left of the spectrogram window, the time and frequency of the cursor point will be displayed.

To take a measurement of the change in time or frequency, choose the **box select tool** ⬚ in the **View/Audio menu** and draw a box from the start to the end of the area of interest. The change (Δ) in time and frequency over that area will be displayed at the bottom of the spectrogram.

LISTENING TO FILES

Bat calls are typically ultrasonic and outside of the human hearing range, Anabat Insight offers a variety of audio modes which will make the ultrasonic calls audible.

AUDIO MODES

You can choose between Heterodyne, Pitch Shifting, Comb Filter, Frequency Division and Time Expansion.

Heterodyne: This mode shifts down a portion of the ultrasonic band into the human hearing range by mixing the signal with an internal reference frequency. This reference frequency is adjusted by the user to suit the frequency of bat calls of interest. The bandwidth of the heterodyne mixing is about ±8 kHz, so bats calling at a significantly different frequency to the reference frequency will not be heard.

Pitch Shifting: This mode compresses the ultrasonic spectrum down into an audible band by shifting the pitch of the sound. Harmonic components and amplitude of the bat calls are kept in this process.

Comb Filter: This mode can be thought of as multiple heterodyne detectors operating simultaneously, all tuned to different frequencies to cover more of the ultrasonic range.

Frequency Division: This audio mode divides down frequency of the incoming ultrasonic signal by a preset ratio (typically 16) so as to allow ultrasonic sounds to be heard by the human ear. This mode is based on zero-crossing and thus only the loudest frequency component will be heard. No harmonics can be heard and the amplitude of bat calls is not retained, so all sounds will be of the same volume level.

Time Expansion: This mode works by playing back a recorded sound at a slower than normal speed (typically 1/10th). This has the effect of lowering the frequency of the sound. All amplitude and frequency components are retained.

To select your preferred audio mode, click on the audio drop down menu in the **View/Audio Bar**. If you select Pitch Shift, Heterodyne, Frequency Division or Time Expansion and addition menu will appear next to the audio mode. This can be used to tune or control the audio playback, for example in Time Expansion you will select the time expansion factor.

You can then use the audio controls to ► play and ■ stop the audio. The volume bar controls the volume of the audio playback.
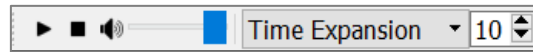
To play the call from a specific start point, ensure the oscillogram is displayed above the spectrogram. Then click at the desired start location in the oscillogram then press ►.

VOICE MEMOS

If there is a voice memo recording in your folder, it will automatically be recognized as such. When you open the file, the voice memo spectrogram will be displayed, but when played back, it will automatically play without downshifting.

SPECIES LISTS AND LABELING FILES

Anabat Insight allows you to create or import species lists to label files. Lists created in AnalookW can be opened directly in Anabat Insight.

CREATING A SPECIES LIST

To create a new species list, click on **Species Lists** in the **Menu Bar**, then click on **New/Edit**. Select **Add List** then type your list name (eg. Southern Region). Click in the **Species** column and type in your species, one label per line (see below). Click **Close** when complete.
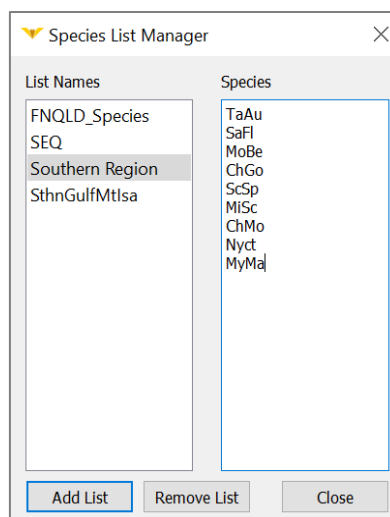
To remove or edit a species list, open click on **Species Lists** in the **Menu Bar**, then click on **New/Edit**. Select the preferred list and double click to change the list name, or click on the species in the species column to edit, or click **Remove List** to delete the selected list.

To export a species list, click on **Species Lists** in the **Menu Bar**, then click on **Export**. Select the list you wish to export, then choose your destination folder/location. The list will be saved as a .ars file.

OPENING & DISPLAYING A SPECIES LIST

To display a species label list, click on **Species Lists** in the **Menu Bar**, check the desired species list/s, then check **Show Species Labels**. Your selected list/s should now be displayed below the spectrogram.

LABELLING A FILE

To apply a species label to a file, with the file open in the spectrogram window, click on the desired species label from the list. You can add more than one label per file. When you move to the next file, a prompt will appear to ask if you would like to save your changes, click the **Save** button to save your species label to the metadata of the file. The species label will be displayed next to the file duration in the **Project Panel**, and also in the **Metadata Panel**. To remove a species label from a file, click on the label in the species list with the file open. Alternatively, you can batch remove species labels, see REMOVING METADATA.

You can also use species label hotkeys, which are keyboard shortcuts to your first 10 species labels. You will notice on the displayed species label list, a series of numbers in brackets (1 – 0), these hotkeys correspond with the 1 – 0 keys on your keyboard. For example, using the species list below, pressing the "7" key would automatically label the file with "ChGo".


To add duplicate labels of the same label (eg. [2] ChGo), hold the **Shift key** while clicking on the species label.

You can also use the auto-scroll feature to speed up your labelling. To activate this feature, go to **Settings**, then **File Navigation**, and check **Next on Species Label**. This will

automatically scroll to the next file when a species label is selected (either by clicking the label button, or by using the hotkey).

SPECIES AUTO ID PLUGINS

Anabat Insight currently offers Bat Classify UK as a plugin, Bat Classify is developed as an open source auto-ID tool. If other open-source auto-ID tools become available, we may add these as plug ins. To enable the Bat Classify plugin, click on **Plugins** in the **Menu Bar**, then hover over **Bat Classify** and click **Enable**. Ensure a file is open in the spectrogram window, and the **Bat Classify toolbar** will appear below the spectrogram window.
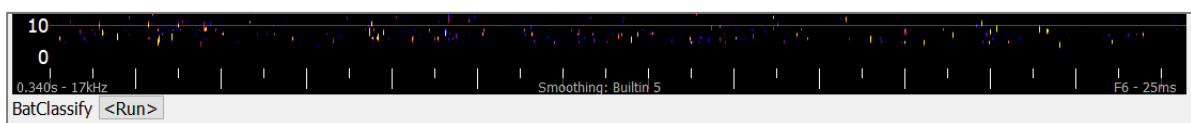
To identify one file, open the file and click the **<Run>** button in the **Bat Classify toolbar**, the potential species and a confidence percentage will appear as buttons, you can then click the button to apply the species label (you can select more than one), scrolling to the next file will save the species label.

To batch run Bat Classify plugin, right-click on the folder, or select multiple recordings in the **Project Panel**. Select **Run Species AutoID Plugin**, then select **Bat Classify**. Choose your **ID Tag Certainty Threshold**, this means that any species with a certainty percentage above that number will automatically be labelled. The higher the threshold percentage, the more certain the results. If more than one species label is present above your certainty threshold, then multiple species labels will be added to the file. Then click **Run AutoID**, it may take several minutes, depending on the size of your dataset. Your files will automatically be labelled with the species identified by Bat Classify UK. When viewing the species metadata in the **Metadata Panel**, it will also include the confidence level after the species, eg. Ppip (98%). *Please note: Bat Classify can ONLY run on full spectrum files, and you cannot run the Bat Classify UK plugin on project files. Bat Classify will now run on a Mac.*

If you wish to produce a report which includes the Bat Classify % confidence, select a **REPORTS** based on species. The example below shows the .csv based on a metadata extract report, with multiple species labels per file.

	A	B	C	D
1	File	Species	Species	Species
2	2017-08-25 17-06-49.wav	MbraMmys (89%)	Mnat (76.8%)	NSL (99.5%)
3	2017-08-25 17-07-13.wav	Mnat (95.87%)	Paur (65.3%)	
4	2017-08-25 17-07-56.wav	Mnat (96.66%)		

MARKING FILES

In Anabat Insight, you can mark files to perform actions on later such as view, export, view in external application, add metadata or send to trash.

MARKING A FILE

To mark a recording you can right click on the recording filename in the **Project Panel**, then select **Mark Recording**. Alternatively, if the recording is open in the spectrogram window you can use the keyboard shortcut **X** or **Alt M**. To unmark a recording, either use the keyboard shortcut again, or right click on the file and select **Unmark Recording**. You can also mark/unmark multiple files by selecting more than one file in the **Project Panel**.

VIEWING MARKED FILES

To view your marked files, click on the **Marked tab** at the bottom of the **Project Panel**. A list of marked files will be displayed, which you can open and scroll through. When a file is marked a new column, **Marked**, will appear in the **Project Panel** next to **Species**. An **M** will appear next to marked files.

EXPORT OR DELETE MARKED FILES

To perform actions on marked recordings, select the recordings in the **Marked tab** (to select all, click one recording, then press CTRL+A), then right click; this will display the options menu.

- To *view* the marked files, click **Open Selected**. The files will be displayed as tabs in the spectrogram window.

- To *copy/move/export to zero crossing*, click **Export Selected** and follow the prompts.
- To *view the files in their folder*, click **Show in File Explorer**.
- To *open the files in another application* of your choice, click **Show in External Application**.
- To *delete* the files, click on **Send to Trash**. This will send the selected recordings to the trash, you will need to empty the trash to permanently delete the recordings.
- To *unmark* recordings, click **Unmark Recordings**.
- To *add metadata*, click **Add Metadata**, then enter the Type (eg. weather), then Value (eg. raining). Click **OK**.
- To *add a species label*, hover over **Add Species**, then select the appropriate species label. If no species are displayed, ensure you have selected a species list (see OPENING & DISPLAYING A SPECIES LIST).

FILTERS

Filters can be used in a number of ways to streamline your analysis. You can use filters to compress your files to only view pulses of interest, remove noise from view, observe which pulses in a file meet certain metric conditions, search for certain species/pulses in a dataset, and build custom decision trees for auto-identification. It is important to ensure that the trigger is set correctly for filters to work well.

LOADING A FILTER

To load a pre-existing filter, click on the **Filter tab** under the **Project Panel**. Click on ☐, then select your filter. Anabat Insight can load filters created in AnalookW. Once a filter is loaded, the metrics will be displayed. Anabat Insight will remember your recently used filters, to load a recent filter, click on the **Recent Filters** drop-down menu and select the relevant filter.

CREATING A FILTER

To create a filter, click on the **Filter tab** under the **Project Panel**. Click on ⬚ to begin creating a new filter. Enter the range of metrics, ensuring the filter is enabled ✅ and the relevant metrics are checked ☑. As you enter the metrics, you can observe what is passing the filter on the spectrogram if you have selected either compressed mode or highlight call body (see VIEWING WITH A FILTER). To save the filter, click 💾 and follow the prompts.

EDITING A FILTER

To edit a filter, first load the filter you wish to change, then alter the relevant metrics. You can then save these changes by clicking 💾, or save the changes as a new filter by clicking 💾. *Please note: If the filter is being used in a Search/Decision Tree, you will need to update the filter*.

VIEWING WITH A FILTER

There are three ways you can view a filter working: 1) compressed mode, 2) highlight call, and 3) zero crossing.

1) *Compressed mode*. This will remove the gaps and pulses which do not meet the filter parameters from the display, this will include a non-bat buffer around the pulses, **Highlight Calls** will still show what has passed the filter. Select **Compressed** mode, and ensure your filter is enabled.

2) *True Time mode with Highlight Calls*. This will highlight the pulses which pass the filter (in green or red). First ensure you are in **True Time** mode, and then ensure the **Highlight Call** box is checked in the Filter tab. Alternatively, if you are viewing in zero crossing and in True Time mode, you can check Hide Filtered Dots in the Filter tab, this will hide the dots outside of a triggered pulse.

3) *Zero crossing*. This view is best when you want to remove noise from the display, because the dots which do not pass the filter are hidden. When a filter is applied and you view the call in zero crossing mode, all of the erroneous noise dots which do not pass the filter are not displayed.

SMOOTHNESS FILTERS

There are built-in smoothness filters which can be applied to your calls to help remove noise and poor quality pulses. Smoothness is calculated by looking at adjacent dots and seeing how smoothly connected they are. Ideally the 3 (previous, current and next) dots will make a straight line for perfect smoothness, but you can set the threshold on how 'smooth' or 'line-like' they need to be. To select a built-in filter, click on **View**, then **Smoothness**. Select the level of smoothness filter (from 0 to 9).

Alternatively you can select Auto Smoothness, which is optimized to each file. The Auto Smoothness filter works best when used in conjunction with Auto ZC Trigger Threshold. To select Auto Smoothness, click on **View**, then **Smoothness**, select Auto; alternatively use the keyboard shortcut Alt+-.

SPECTROGRAM DE-NOISING

We have developed a tool which can reduce the ambient noise in a spectrogram. To activate the de-noising filter, click on **Settings**, then check **Spectrogram De-Noise**. Please be aware that spectrogram de-noise may reduce the appearance of constant frequency bat calls (eg. *Rhinolophus* sp.). The de-noise filter will not affect the zero crossing conversion of a spectrogram or triggering.

SEARCHES & DECISION TREES

You can use the search tool to search for files in your dataset based on a filter, or on the metadata. The decision tree tool can be used to create a customisable key to analyse your calls. For example, you can use the search tool to search for any files recorded in a particular date range, or to search for all the files which pass an "All bats" filter.

For some important tips on creating a decision tree see DECISION TREE TIPS.

CREATING A SEARCH

To begin, click on the **Search tab** under the **Project Panel** (see below), and ensure the **Search** button is selected. Select the **Recording Store** you would like to search using the drop down menu. Choose your **Criteria Type** using the drop-down menu (eg. filter, species, time, date, device ID, pulse count, pulse percentage). Parameter windows relating to your criteria will appear. For a filter criteria, click **Select**:

- The most recently used filters will appear in the **Recent Filters** drop-down menu;
- To open an older saved filter, click **Load Other...** in the Recent Filters drop-down menu;
- To create a new filter for this search, enter the metric parameters, give the filter a name, then press **Import**.

Then use the **Accept** drop-down menu to select whether you want to see results which match your criteria, or do not match. Then click **Add**. If it is a second criteria and you would like to search for files that pass one or another criteria, select **Or**.

Please note: If you change the filter in the filter tab, this will NOT change the filter in the search. You need to update the filter in the search.

If you wish to apply multiple filters to a single search, you can choose to see files which pass both filters (select **And**) or files which pass either filter (select **Or**). ***Please note: if you select Or, the results will not indicate which filter the file passes, for this functionality use the decision tree.***
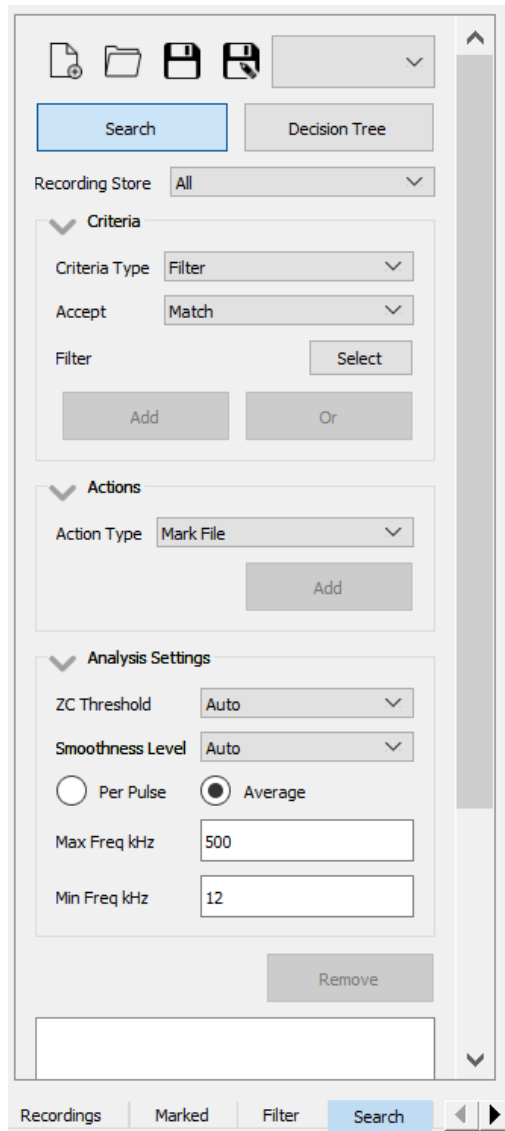
Your search criteria will appear in the search box, you can add multiple search criteria to one search. The **Analysis Settings** will determine your trigger and zero crossing rendering of the files to be searched, for more information see **Setting the Trigger Threshold**. For example, a ZC Threshold of 20 and Smoothness Level of None will search the data as it was recorded, whilst a ZC Threshold of 17 and Smoothness Level of 7 will search based on the smoothed and filtered results of these settings. In practice, your search analysis settings should match your viewing settings so that you produce the results you expect.

You also need to choose between **Per Pulse** or **Average** searching. With **Average** selected (default), it runs the search based on the average metrics for the entire file. Whilst **Per Pulse** will run each pulse in the file through the filter, and if one pulse passes, then the file will pass. *Please note: this will result in files being displayed more than once in the Results Tab.*

Click **Run Search**, this will take you to the **Results tab**, where all the files which pass your search criteria are displayed.

You can save search parameters to use again another time by clicking ⊟. To load a search you have previously saved, click ▭.

CREATING A DECISION TREE

A decision tree is a tool which passes files through a dichotomous tree. Each file either 'passes' or 'fails' criteria, before moving down to the next branch of the decision tree. At each branch of the decision tree you can assign actions. You can use this tool (in combination with filters) to create your own Auto-ID tree.

To begin, click on the **Search tab** under the **Project Panel**, and ensure the **Decision Tree** button is selected. Select the **Recording Store** you would like to search using the drop-down menu.

Start with the first branch of the decision tree. Choose your **Criteria Type** using the drop-down menu (eg. filter, pulse count, pulse percentage, species, time, date, device ID). Parameter windows relating to your criteria will appear. For a filter criteria, click **Select**:

- The most recently used filters will appear in the **Recent Filters** drop-down menu;
- To open an older saved filter, click **Load Other...** in the Recent Filters drop-down menu;
- To create a new filter for this decision tree, enter the metric parameters, give the filter a name, then press **Import**.

Then use the **Accept** drop-down menu to select whether you want to see results which match your criteria, or do not match. Then click **Add**. You will see several lines appear in the search box:

```
⌄ If Pass filter X
        None...
⟩ Else
```
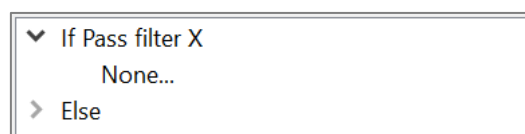
If you would like to add a second branch, or action, to the files passing the first criteria, then click **None** below the first "**If Pass**...", then you can add an action or another search

criteria. If you would like to add a second branch, or action, to the files which fail the first criteria, click the drop-down arrow next to **Else**, click **None**, then you can add an action or another search criteria. Here is an example tree:
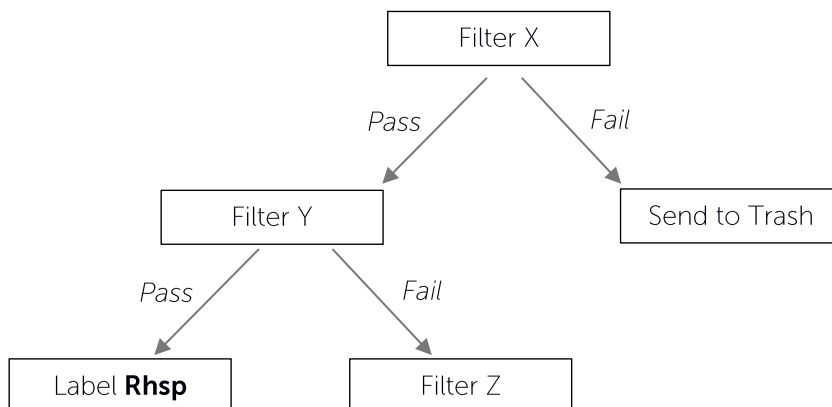
The decision tree above would look like the following in the search box:
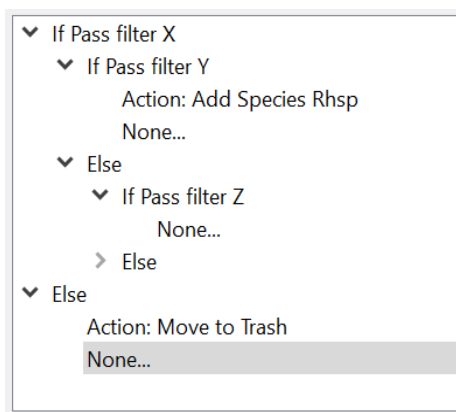
Then click **Run Search**, this will take you to the **Results tab**, where all the files from the selected store are displayed under the branch node where they end.

You can save a decision tree by clicking 💾. This will save the decision tree and all of it's associated filters in one file. To load a decision tree you have previously saved, click 🗁.

When you save a search or decision tree, the analysis settings will also be saved so the search/decision tree can be replicated. *If you open a saved search/decision tree, it will prompt you to change the viewing settings to match the analysis settings.*

EDITING A DECISION TREE

To edit a decision tree, click on the criteria or action you wish to change, the criteria or action will open in the relevant section of the search panel. Edit the criteria (change the filter, or edit the criteria parameters) or change the action, then click the **Update** button. You will see the criteria or action has updated in the tree.

Please note: if you change a filter in the filter panel, you will need to update the filter in the decision tree.

To remove a criteria or action, click on the relevant criteria/action in the decision tree, then click the **Remove** button. *Please note: this will remove everything below that branch on the decision tree.*

VIEWING SEARCH & DECISION TREE RESULTS

Your search or decision tree results are shown in the **Results tab** under the **Project Panel**. You can open a file by double clicking on it in the list. Then when you scroll through files using **[** and **]**, you will be scrolling through the search results. You can also open/export/delete/add metadata to the recordings. Simply select the recordings (to select all, click one recording, then press CTRL+A), then right click; this will display the options menu.

- To *view* the result files, click **Open Selected**. The files will be displayed as tabs in the spectrogram window.
- To *copy/move/export to zero crossing*, click **Export Selected** and follow the prompts.
- To *view the files in their folder*, click **Show in File Explorer**.
- To *open the files in another application* of your choice, click **Show in External Application**.
- To *delete* the files, click on **Send to Trash**. This will send the selected recordings to the trash, you will need to empty the trash to permanently delete the recordings.
- To *mark* recordings, click **Mark Recordings**.
- To *add metadata*, click **Add Metadata**, then enter the Type (eg. weather), then Value (eg. raining). Click **OK**.

- To **_add a species label_**, hover over **Add Species**, then select the appropriate species label. If no species are displayed, ensure you have selected a species list (see OPENING & DISPLAYING A SPECIES LIST).

ADDING ACTIONS TO SEARCHES AND DECISION TREES

The following actions can be added to a Search or Decision Tree:

- Mark file
- Move to trash
- Add species
- Add note
- Add humidity
- Add temperature
- Add light
- Add custom metadata

To add an action, first enter the search/decision tree criteria, then select an **Action Type**. A relevant action box will appear to select the specific action (eg. choose a species label). Click **Add**, and the action will appear beneath the search criteria in the **Search Box**. You can add different actions for different search criteria. When you save a search, the actions will also be saved.

DECISION TREE TIPS

Here are a few helpful tips when creating/using decision trees:

1. If you are using metrics (eg. characteristic frequency filter) as a main criteria, ensure every frequency is covered in the tree. For example, one filter should cover characteristic frequencies 10khz – 30khz, another filter should cover 30khz – 60khz. If the second filter started at 31khz, then any file with Fc of 30.XX would not pass through the decision tree.
2. When using an **average** decision tree, add a 'catch-all' to every empty Else statement to check for decision tree errors. For example, if you add an action to

Mark files, then you can check all your marked files after running a tree to see what is being missed. Do not do this on per pulse decision trees.

3. If you change your decision tree, ensure to **REMOVING METADATA** and **MARKING** A FILE before rerunning the search. Otherwise you will end up with multiple labels, or incorrect labels/marking from the previous search.

4. When you add a filter to a decision tree, this adds all the metrics associated with that filter. However if you change the filter using the filter tab, this filter will not automatically be updated in the decision tree, you will need to manually update this yourself.

FILE EDITING

You can edit a file by cropping it, or in the case of zero crossing files you can also Hide/Show ZC Dots and Show Off Dots. You can use the Hide ZC Dots to improve the metric calculations by removing erroneous dots.

CROP A FILE

To crop a file, choose the box select tool ⬚ from the **View/Audio Bar**. Then draw a box over the area you wish to crop on the spectrogram. Right-click on the spectrogram and select **Crop File**. *Please note: this will only crop the time scale, not the frequency.* The cropped file will appear as a new file tab in the spectrogram window. To save the cropped file, click 💾 in the **View/Audio Bar**. The original file will be preserved in the original tab in the spectrogram window.

HIDE/SHOW ZC DOTS

To hide/show ZC dots, ensure you are viewing the file in **Zero Crossing**, and choose the box select tool ⬚ from the **View/Audio Bar**. Then draw a box over the dots you wish to hide/show on the display. Right-click and select either **Hide ZC Dots** or **Show ZC Dots**, a window will appear to ask if you would like to edit the file temporarily or save a copy of your changes.

To reset the dots to the original file, right-click on the display and select **Reset All Dots**.

SHOW OFF DOTS

When you have a smoothness or saved filter applied to a file, or have hidden ZC dots, you can choose to show the Off Dots (the hidden dots) in a different colour (see figure below, with Off Dots in red). This may be helpful to check if bat pulses are being filtered out. To show Off Dots, right-click on the display and select **Show Off Dots**. To change the colour of the Off Dots, see GRAPH COLOURS.
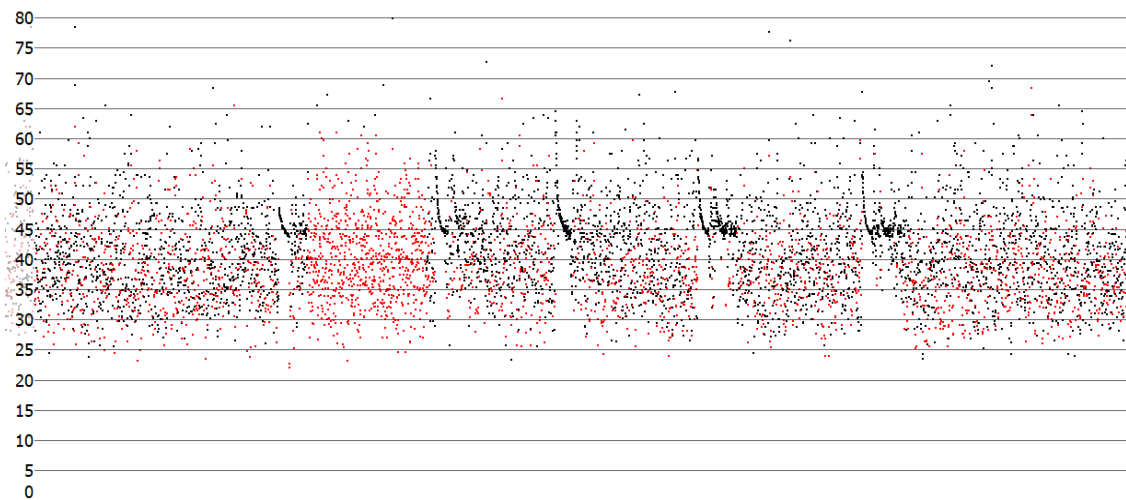
SAVE AN IMAGE

You can choose to save the spectrogram window as an image (.png). Simply right-click on the spectrogram, select **Save as Image**, and choose the destination folder for the image.

SETTINGS

The settings menu allows you to change the **Trigger** (see Selecting Trigger Mode), reset the program to default settings, change the slope transition and cycle settings, choose a file navigation speed (see Change speed), and limit the FTD Window width (see FFT WINDOW SIZE).

SLOPE TRANSITION SETTINGS

The slope transition settings refer to how many transitions the slope graph uses to display data. The transitions are in practice an averaging of the zc period dots whilst accounting for their division ratio. For example a 80 transition setting, with division 8 zc periods, would average 10 periods for a single slope point. To change your slope settings, click on **Settings** in the **Menu Bar**, then hover over **Slope Transitions** and then choose between **40**, **80**, **160**, or **320**.

CYCLE SETTINGS

The cycle settings refer to how many dots are averaged for one data point in the cycle graph. To change your cycle settings, click on **Settings** in the **Menu Bar**, then hover over **Cycle Settings** and then choose between **1**, **3**, or **5**. In addition, you can check Cycle Dots/Time, which changes whether the cycles graph is showing total dots or total time.

RESET SETTINGS

If you would like to reset all settings to the factory default, click on **Settings** in the **Menu Bar**, and then click **Reset Settings**. This will not close your store, or change any pre-existing Search/Results.

REPORTS

Anabat Insight currently offers a number of default reporting features, and the option to create custom reports. To generate a default report, click on **Analysis** in the **Menu Bar**, then click **Generate Reports**.

Select the data store which you would like to generate a report for; all (everything in the store), opened files (files which are individually listed in the **Opened Files** section of the **Project Panel**), marked files, or specific folders. You can then choose which type of report to generate:

- *Metrics*. Generates a .csv file which shows the average metrics for each file. You can also generate the metrics for each pulse in files by checking the **Per Pulse** box. You will need to set your analysis settings for the metrics report, including ZC level (sensitivity), smoothness, minimum and maximum trigger frequency. These settings will default to your viewing settings. For more information on choosing your analysis settings, see Setting the Trigger Threshold.

- *Species Count*. Generates a .csv file displaying each of the species identified in the dataset and how many files attributed to each species. You can choose to break the species counts up into time periods (1, 5, 10, 15, 30mins, and 1hr), and also group counts based on metadata (folder, file type, device ID, night, date, or **PROJECT PANEL GROUPINGS**)

- *Metadata Extract*. Generates a .csv file showing each file, and the selected metadata associated with that file (species, location, temperature etc.). Use a metadata extract based on species to view BatClassify % confidence along with species labels.

- *KML Map*. Generates a .kml file containing all of the GPS information in the selected store, including waypoints and tracks. Each file is stored in the KML file with species labels. This file can be opened by Google Earth or any GIS application.

- *Disperse Report*. Generates an .anl (Anabat List File) or .csv displaying each file and a count of the species labels contained in the file. Select your report format (.csv or

.anl). The Anabat List File can be opened as a TSV file in Microsoft Excel, or the .csv can be opened directly into Microsoft Excel.

CREATING CUSTOM REPORTS

To access custom reports, under **Report Type**, select **Custom Reports**. There are a number of preset custom reports including **Example Species Count** (produces Species Count), **Example Count by Columns** (produces Disperse), **Example ECO OBS**, or recent report templates Use the **Custom Report** drop-down menu to select these preset options. You can also select these options and modify them.

To create a new custom report select **New Template** in the **Custom Report** drop-down menu. This will open the **Create Custom Report** window. Add inputs and select your outputs, an **Example Report Layout** from your data will be displayed. You can drag and drop columns in the Example Report Layout. Click **Add** to choose inputs. To remove an input column, click on it, then click **Remove**. Use the **Output columns** drop-down menu to select an output. You can drag and drop columns to reorder.

- **Input columns** refer to every column before an output column/row. Includes: metadata, filename, folder, day/night, date, location, time and timegroup. See the table below for more information and options.
- **Output columns** refer to the final column/columns in the spreadsheet. Includes: total count, count per time period, count per metadata, and count per species. See the table below for more information and options.

Save your report template by clicking **Browse** to select a location, and give the report template a name, then click **Save**. Then click **Generate** to produce the .csv report.

Alternatively, you can load a pre-existing report template click **Load**, find the report template file, then click **Open**.

Input and Output Column Options

Input Columns		
Type	**Options**	**Explanation**
Temperature		Temperature at time of recording
Species	Row per individual species	One row for each species (eg. Ppip)
	Row per unique species combination	One row for each label combo (eg. Ppip, Ppyg)
Filter		Filter (HP or LP) on
Min Event		Minimum event trigger setting
Trigger Min Freq		Minimum frequency trigger setting
ZC Sensitivity		Zero crossing trigger setting
Custom Metadata		Custom metadata added post-recording
Filename	Without extension (default)	Display each file name only
	Include Extension?	Display each file name with extension (eg. .wav)
Folder	Folder Path	Display the folder path (eg. Survey/Site1)
	Expand Folder Path?	Displays each folder level as separate columns
Day/Night	Day	Date column (midnight to midnight)
	Night	Date column (midday to midday; best for bats)
Date		Date as recorded in metadata
Location	One column (default)	Display lat. & long. in one column
	Separate column for lat. And long.?	Display lat. in one column, and long. in another
Time	Time only (default)	Timestamp column
	Include Date?	Date and timestamp in one column
Time Group	Period (min)	Group by time period (default 60mins)
Output Columns		
None		No count data included in spreadsheet
Total Count		Total number of files
Count per time period	Time period (5 mins default)	Number of files per time interval (eg. 5 mins)
	Start and End Time	Choose the start and end time for each recording period (eg. 18:00 – 05:00)
	Include missing times?	Include every time period, even if it does not contain bats
Count per metadata	Metadata Fields (eg. Temp. or Site)	Count per metadata field (eg. Site A, Site B)
	Include all metadata?	Include metadata columns, even if it does not contain bats
	Add non-listed column	Manually add a new metadata column
Count per species	Include confidence levels?	Create a second column per species for confidence level (requires Filename as an input)
	Include all metadata?	If not checked, select the species to include
	Add non-listed column	Manually add a new metadata column

MAPPING

Anabat Insight comes with built-in mapping features using Open Street Maps and the ability to export GPS data.

To view where a file was recorded, open the file from the **Project Panel**, once the file is open in the spectrogram window, click on 📍 in the **Metadata Panel** next to **Location**. This will open a new tab in the spectrogram window, showing the location the file was recorded.

To view a .gpx track, double-click on the track in the **Project Panel** (it is shown under **Other Files** by default). This will open a new tab in the spectrogram window, showing the track on the map.

To view all the GPS data in a folder (waypoints and tracks), right-click on the folder in the **Project Panel**, select **Show On Map**. Files will be shown as 📍, and the track will be displayed in green on the map. To export the GPS data to a .kml file, see REPORTS.

To view a file from the map, click on the corresponding 📍, a grey header bar will appear at the top of the map listing the file name/s, select **Click to Open**. The selected file will open as a new tab in the spectrogram window.

To export the GPS data to a KML, see **REPORTS**.

UPDATING DETECTOR FIRMWARE

To update **Anabat Swift** firmware:

1. If you are using a Windows PC you will also need to install the Anabat Swift USB driver package (available from www.titley-scientific.com).
2. Ensure the detector has fresh batteries installed and is turned on
3. Connect the detector to the computer via the USB cable.
4. Open **Anabat Insight**.
5. On the **Anabat Insight** menu bar, click **Devices**, then **Swift**.
6. Click **Download** to get the latest firmware version.
7. Once the update is downloaded, click **Start**. The detector will then be updated.

8. When the update is finished, unplug the USB cable and restart the detector by removing then reinserting the batteries.

You can subscribe to receive email alerts of new Anabat Swift firmware updates using this website: http://eepurl.com/cSS6Mf

SOFTWARE VERSION & UPDATES

Anabat Insight is regularly updated to improve features and address any issues. If you do find a problem, please report it to us, and include the software version you are using.

CHECK THE SOFTWARE VERSION

To check which version you are running, click on **Help** in the **Menu Bar**, then click **About**. A dialog box will open displaying the version number.

CHECK FOR UPDATES

If you are connected to the internet, Anabat Insight will automatically check for updates. If there is an update available, a green bar will appear above the spectrogram window stating "**Update Available. Click to Update**". To update, click on the green bar and follow the prompts.

INSTALL YOUR LICENCE

If you have purchased a full licence for Anabat Insight, you will need to enter your licence activation key. To do this, click on **Help** in the **Menu Bar**, then click **Licence Management**, enter your activation key and click **Activate**. You must be connected to the internet to activate your licence.

KEYBOARD SHORTCUTS

There are a range of keyboard shortcuts you can use with Anabat Insight to streamline your analysis.
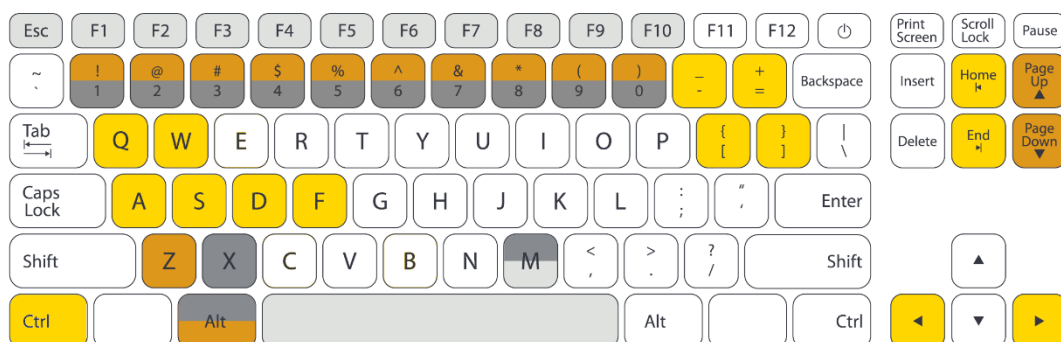
Display	
Escape	Reset to default display
Space	Toggle true/compressed mode
M	Toggle call body on/off

Horizontal zoom (time per tick)			
F1	1s (zoomed out)	F6	25ms (optimal)
F2	500ms	F7	10ms
F3	250ms	F8	5ms
F4	100ms	F9	2.5ms
F5	50ms	F10	1ms (zoomed in)

Filters	
Alt+ 1...9	Load built-in noise filters 1 to 9
Alt+ 0 or Page Down	Clear filter
Page Up	Load previous filter
Z	Increase call smoothing only
Shift+ Z	Decrease call smoothing only

Marking/Labelling Files	
Alt+ M	Mark/unmark current file
X	Mark/unmark current file
1...0	Species label hotkeys

Navigation between and within files	
Q or [	Go to previous file
W or]	Go to next file
-	Go to previous marked file
+	Go to next marked file
Shift+ [	Go to previous labelled file
Shift+]	Got to next labelled file
◄	Go to previous trigger
►	Go to next trigger
Ctrl+ A, S, D, F	Jumps forward/back along time axis: A ⅛, S ¼, D ½, F full screen width
HOME	Jump to start of file
END	Jump to end of file

TROUBLESHOOTING

I can't get the red highlight bar to appear

First, check that you are in **True-Time Mode**; second, ensure the **filter is enabled**; thirdly, ensure **Highlight Calls** is checked in the filter tab. Also try checking other files, just in case the file you are viewing doesn't have any elements which pass the filter.

My map isn't working, the waypoint is appearing in a grey "ocean"

This is most likely due to Insight being blocked from the internet by antivirus software or firewalls. Here are a few troubleshooting points to try:

1. Try scrolling on the map to zoom in and waiting a few minutes for the map to load.
2. Go to **Settings**, then select **Reset Settings** (this will change your display settings back to factory default).
3. Check if Insight has access to the internet by selecting **Help**, then **Check for Update**. If the window appears with an error message, Insight is being blocked from the internet or you are not connected to the internet. Ensure your internet connection is working, if it is, then try disabling any antivirus software or firewalls. Once they are disabled, see if the maps load. You may need to create exceptions for Anabat Insight in your antivirus software.

Compressed mode isn't working

The most likely reason it appears compressed mode isn't working is because the ZC sensitivity is too high, try **lowering the sensitivity**, using the Auto ZC Trigger Threshold or **changing the trigger settings**. If these are set correctly and compressed mode is still not working, try **applying a built-in smoothness filter** or create a noise filter.

Filter doesn't seem to be working

Firstly, ensure the **filter is enabled**, then ensure the relevant filter metrics are checked. Also make sure you are using a **suitable filter viewing mode**. Also consider whether you are wanting to **view in compressed mode** (remove information which doesn't pass the filter), or use the **Highlight Calls** tool to observe what does and doesn't pass the filter.

I can't put species labels on my ZCA files

If you have opened a .zca file in Anabat Insight, but have not yet converted the file(s) to .zc sequence files, it will be displayed as **Read Only** in the project panel. You will not be able to add species labels, metadata or alter these files until they are converted to sequence files.

Bat Classify UK plug in isn't working

You cannot run the Bat Classify UK plugin on **PROJECT FILE**. If you would like to use Bat Classify UK, then you will need to run it on files stored directly on your drive. Secondly, ensure a file is open in the spectrogram window, the Bat Classify UK button will appear beneath the window.

FAQS

Q. What is the difference between the free version and full licence?

A. All of the ultrasonic features in a full licence are available in the free version; the only difference is that the full licence allows you to open/view/analyse files from any detector (including non-Anabat detectors). If you are viewing non-Anabat acoustic files (sample rate ≤44), then the paid version is required to view the spectrogram.

FURTHER INFORMATION

For further information please visit the Titley Scientific website: www.titley-scientific.com