**PAMGuard Detector Protocol**

**(When settings are pre-done in .psfx file)**

PHASE 1: Running Detectors in PAMGuard beta (standard mode)

1. Start pamuard program



1. Open configuration file

**HIblackfish\_2022\_48kHz.psfx** (SoundTrap Data Only)

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1. Check Binaries

**File > Binary Storage Options.** Confirm **“Binary file folder”** is set to the location where you want the files to save. Files will save as *.pgdf* and *.pgdx* files.

Dependent on

deployment

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1. Check Database

**File > Database > Database Selection< Browse/Create.** Make a newSqlite database file (xxxx.sqlite3) based on the deployment (naming e.g., HI04\_01) and set location to specific location binaries are being saved to. Database will save as a *.sqlite3* file.

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Dependent on

deployment

1. Import audio

NOTE: Make sure your data is divided into folders containing no more than ½ months (15 days) otherwise it will crash.

**Settings < Sound Acquisition < Select Folder with wav files < OK**

(IMPORTANT STEP: Must re-select folder containing audio every time you open PAMGuard even if it is already repopulated with the folder you want from a previous session otherwise it won’t run properly.)

1. Confirm the file naming scheme

The file naming structure needs to match with the number of hashtags included in the “Enter the date/time format to use” box.

**Settings < Sound Acquisition < Click on wheel cog to the right of File date < “Enter the date/time format to use” box**

File name: SanctSound\_HI04\_02\_1207992369\_200203175003

Format: ##############################yyMMddhhmmss####

(30 hashtags in front of string and 4 hashtags after)

1. Import correct hydrophone information

**Settings < Hydrophone Array < Import < Select .paf file for the deployment you want to run**

For each hydrophone there is a corresponding .paf file that has been exported for the specific deployment location (e.g. **HI04** is Kauai SoundTrap) and deployment year (HI04\_**02**).

1. Recheck the amplitude selector range

Test with test file.

**Click Detector tab < right click on Bearing Time Display < Show Amplitude Selector**

Determine lower limit and upper limit of range that includes the entire histogram range. Input range into: **Click Detector tab < right click on Bearing Time Display < Settings< Axis tab < Amplitude Range**

1. Confirm view is accurate

Right click on the spectrogram display. Confirm the following are highlighted so you can see the detections in real time as it is running.

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1. Check file storage options

**File > Storage Options.**

Confirm thecorrect boxes are checked (see below). If the right boxes are not checked, the data will not be stored properly.

Graphical user interface, application

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1. Check settings?

The rest of the settings are pre-set and ready to run! But in case you want to double check see settings, see below. If you change a setting(s), you must click **File < Save Configuration** before running detector.

1. Start running detector

Click on the red circle in the upper left-hand corner of the screen to start running the detectors.



Phase 2: Analyzing data in Viewer Mode (green)

1. Check data output

After the data is done running, check output folder (specified in binaries)

They will be stored in individual folders by date.

Table

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Each day folder will contain detector outputs (including click detector, whistle and moan detector and any other burst pulse detectors). See example below.

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1. Open pamuard viewer mode (green)



To get out of the real-time mode of the program and to start tracking encounters and assessing detections manually, you must be in viewer mode (green).

1. Open sqlite database
2. Set Datagram Settings

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Click Okay in next window and the binary data mapping window will pop up for whistles/moans/clicks/bp. This process will take a while (10 – 15 minutes) to load since so much data!

1. Change the viewing settings for the bearing time display by clicking the downward arrow circled in red below. Jennifer chooses 100% for step size, default is 75 – that is how much it advances with the two arrows forwards and backwards.

Graphical user interface, application

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1. To load the spectrogram:

Settings > Sound Acquisition > Check the use offline files box and check include sub folders. Open folder with wav files (e.g., D:\HI04\_02\audio)

**PAMGUARD SETTINGS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **HYDROPHONE ARRAY** | | | | |
| Array Configuration | | | | |
| Array Management | | | | |
| 1. Click “New Array…” button 2. Enter a name for the new hydrophone array [will be the same as the “Streamer Name” (column A in table) – see below] 3. Each hydrophone location will have its own singular streamer since they are each different based on site and year of deployment. | | | | |
| Hydrophone Streamer | | | | |
|  | **24 kHz SoundTrap** | | | **100 kHz HARP** |
| Streamer Name | [See table below – column A] | | |  |
| Reference Position | Fixed location (moorings and buoys) | | |  |
| Click on 3 bars to the right of lat/lon < Edit | | | |  |
| Unit Type | Decimal | | |  |
| Latitude | [See table below – column C] | | |  |
| Longitude | [See table below – column D] | | |  |
| Hydrophone Locator Method | Threading Streamer | | |  |
| Position |  | Position | Error |  |
|  | X | 0.0 | +/- 0.1 |  |
|  | y | 0.0 | +/- 0.1 |  |
|  | Depth (m)  [always + value] | [See table below - column E (not # in parentheses)] | +/- 0.1 |  |
| Sensor | Fixed value | | |  |
| Interpolation | Use the location for the time preceding each data unit | | |  |
| Hydrophone Elements | | | | |
| General Info |  | | |  |
| Hydrophone ID | 0 | | |  |
| Streamer | Streamer 0, x = 0.0 | | |  |
| Hydrophone type | ST500 | | |  |
| Hydrophone sensitivity | [See table below – column H] (negative value) | | |  |
| Preamplifier gain | 0 | | |  |
| Coordinates (m) | X | 0.0 | +/- 0.0 |  |
|  | y | 0.0 | +/- 0.0 |  |
|  | Depth | 0.0 | +/- 0.0 |  |
| Interpolation | Use only the latest value | | |  |
| Channel Configuration | | | | |

<http://www.oceaninstruments.co.nz/wp-content/uploads/2018/03/ST500-User-Guide.pdf>

**PAMGUARD** expects calibration data in terms of gain and ADC range. To work around this, specify a preamplifier gain of the calibration value \* -1.0 (eg -176.0) and specify the Peak-Peak voltage range as 2.0 V.

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| **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** | **J** | **K** |
| **Streamer Name** | **Hydrophone serial #\*\*** | **Latitude**  **(N)** | **Longitude (W)** | **Depth\***  **(m)** | **Recorder Calibration (dB re 1 V)\*\*** | **+** | **Hydrophone Sensitivity (dB re 1V /μPa)** | **=** | **System Sensitivity**  **(dB re 1 uPa)** | **Preamp**  **gain (dB)** |
| HI01\_01 | 671129683 | 20.80756667 | -156.65615 | 64 (67) | - 1.8 | + | 177.3 | = | 175.5 | 0 |
| HI01\_02a/b | 671129638 | 20.807340 | -156.655430 | 59.7 (62.7) | - 1.8 | + | 177.3 | = | 175.5 | 0 |
| HI01\_03 | 671895593 | 20.806983 | -156.654733 | 53 (56) | -1.9 | + | 176.4 | = | 174.5 | 0 |
| HI01\_04 | 1207992369 | 20.80709 | -156.65567 | 54.6 (57.6) | -1.8 | + | 178.4 | = | 176.6 | 0 |
| HI03\_01 | 1208496153 | 21.2852 | -157.5999833 | 77 (80) | -1.9 | + | 176 | = | 174.1 | 0 |
| HI03\_02a | 1208496153 | 21.28542 | -157.60012 | 76.4 (79.4) | -1.9 | + | 177 | = | 175.1 | 0 |
| HI03\_02b | 1208496153 | 21.285420 | -157.600120 | 76.4 (79.4) | -1.9 | + | 176.9 | = | 175 | 0 |
| HI03\_03 | 1208496153 | 21.28542 | -157.60012 | 76.5 (79.5) | -1.9 | + | 177 | = | 175.1 | 0 |
| HI03\_04 | 1208496153 | 21.28532 | -157.60005 | 76.3 (79.3) | -1.9 | + | 177 | = | 175.1 | 0 |
| HI04\_01 | 1207992369 | 22.263528 | -159.586528 | 87 (90) | -1.8 | + | 179.5 | = | 177.7 | 0 |
| HI04\_02 | 1207992369 | 22.26347222 | -159.58638889 | 77.8 (80.8) | -1.8 | + | 178.1 | = | 176.3 | 0 |
| HI04\_03 | 671653928 | 22.263472 | -159.586389 | 77.8 (80.8) | -1.9 | + | 177.3 | = | 175.4 | 0 |
| HI04\_04 | 671129638 | 22.26347 | -159.58639 | 77 (80) | -1.8 | + | 176.9 | = | 175.1 | 0 |
| HI06\_01a/b | 5373 | 19.95072 | -155.9005 | 48.8 (51.8) | -1.9 | + | 177 | = | 175.1 | 0 |
| HI06\_02 | 5373 | 19.95072 | -155.9005 | 48.5 (51.8) | -1.9 | + | 177 | = | 175.1 | 0 |
| \*Hydrophone is 3m above the seafloor. The first number is the hydrophone actual depth (3m off the seafloor) and the number in parentheses is the depth of the mooring.  \*\* Can check sensitivity values on this site: <http://oceaninstruments.azurewebsites.net/App/#/%23> | | | | | | | | | | |

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| **SOUND ACQUISITION** | | | |
| **DAQ SETTINGS** | | | |
|  | **24 kHz SoundTrap** | | **100 kHz HARP** |
| Data Source Type | Audio file folder or multiple files | |  |
| Select sound file folder or multiple files | Select Folder of Files button < select folder with wav files | |  |
| Include sub folders | Leave unchecked. | |  |
| File Date Settings (Click round wheel) | | | |
| Date/Time Format | Click wheel cog | |  |
| Use automatic date format selection | Leave unselected | |  |
| User defined date format | Select | |  |
| Enter the date/time format to use | #########################yyMMddhhmmss####  For the SanctSound data, based on the following nomenclature:  SanctSound\_HI04\_02\_1207992369\_200203175003.wav  [Double check “File date” to make sure it is reading the date correctly.] | |  |
| Time Zone | UTC | |  |
| Use daylight savings | Leave unselected | |  |
| Additional Time Offset | NA, leave at 0.00 seconds. | |  |
| Force PC Time | Leave box unchecked. | |  |
| Merge contiguous files | Checkbox Checked with solid fill | |  |
| Skip Initial: | NA, leave at 0.00 seconds | |  |
| Sampling (pre-entered based on wav files) | | | |
| Sample rate | 48000 Hz (cannot change – dependent on SR of files) | |  |
| Number of channels | 1 (cannot change – dependent on SR of files) | |  |
| Calibration | | | |
| Peak-Peak voltage range | 5.000 V | |  |
| Preamplifier gain | 0.0 dB | |  |
| Subtract DC with | Leave box unchecked. | |  |
| **GPS TIMING** | | | |
|  | DISREGARD |  | |
| Storage Interval | 60 (seconds) |  | |

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| **FFT (SPECTROGRAM) ENGINE SETTINGS** | | | |
| ***FFT*** | | | |
|  | **24 kHz SoundTrap** | **100 kHz HARP** | |
| Raw data source for FFT | Raw input data from Sound Acquisition |  | |
| Channel 0 | Checkbox Checked with solid fill |  | |
| FFT Parameters | | | |
| FFT Length | 1024 *(McCullough, 2021)* | |  |
| FFT Hop | 512 (Default 50%) | |  |
| Window | Hann *(McCullough et al., 2021, is Hanning but abbreviated to Hann in PAMGuard)* | |  |
| Sample Rate | 48000 Hz | |  |
| FFT Length | 1024 bins | |  |
| Frequency Resolution | 46.88 Hz | |  |
| Time Resolution | 21.33 ms | |  |
| Time Step Size | 10.67 ms | |  |
| ***Click Removal*** | | | |
| Supress Clicks | Leave box unchecked. | |  |
| Threshold (STD’s) | NA | |  |
| Power | NA | |  |
| ***Spectral Noise Removal*** | | | |
| Median Filter | Leave box unchecked. | |  |
| Average Subtraction | Leave box unchecked. | |  |
| Gaussian Kernel Smoothing | Leave box unchecked. | |  |
| Run Threshold | Leave box unchecked. | |  |
| Threshold (dB) | N/A | |  |

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| **CLICK DETECTOR** | | | | | | |
| **Detection Parameters** | | | | | | |
|  | | **24 kHz SoundTrap** | | | **100 kHz HARP** | |
| ***Source*** | | | | | | |
| Raw Data Source | | Raw input data from Sound Acquisition | | |  | |
| Autogrouping | | One group | | |  | |
| Channel | | Checkbox Checked with solid fillChannel 0 | | |  | |
| ***Trigger*** | | | | | | |
| Threshold | | 14.0 dB *(McCullough, 2021)* | | |  | |
| Long filter | | 0.00001  *(Yack, 2009)* | | |  | |
| Long filter 2 | | 0.000001  *(Yack, 2009)* | | |  | |
| Short filter | | 0.1  *(Yack, 2009)* | | |  | |
| Min triggering channels | | 1 | | |  | |
| Channel | | Checkbox Checked with solid fillChannel 0 | | |  | |
| ***Click Length*** | | | | | | |
| Min Click Separation | 100 samples  *(McCullough tested and verified)* | | |  | | |
| Max Click Separation | 300 samples  *(McCullough tested and verified)* | | |  | | |
| Pre sample | 150 samples  *(McCullough tested and verified. Pre + post samples must equal max click seperation.)* | | |  | | |
| Post samples | 150 samples  *(McCullough tested and verified)* | | |  | | |
| ***Delays*** | | | | | | |
| Unclassified clicks/default | | | | | | |
| Timing Options | Do not change filter | | |  | | |
| 2-15 kHz | Leave box unchecked | | |  | | |
| 15-30 | Leave box unchecked | | |  | | |
| ***Echoes*** | | | | | | |
| Echo Detection Policy | Leave “Run Echo Detector online” box unchecked. | | |  | | |
| Echo Detection | | | | | | |
| Max interval | 0.10000 (seconds) | | |  | | |
| ***Noise*** | | | | | | |
| Noise Sampling | | | | | | |
| Create sample noise measurements | Checkbox Checked with solid fillInterval 5.0 s | | |  | | |
| Sample trigger background measurements | Checkbox Checked with solid fillInterval 5.0 s | | |  | | |
| Mark Observer Options | | | | | | |
| Observe Marks on… | Checkbox Checked with solid fillSpectrogram Display (panel 0) | | |  | | |
| Data to Select | | | | | | |
| *Data name* | *Select* | | |  | | |
| Clicks (click round wheel) | Checkbox Checked with solid fill | | |  | | |
| Click Detector Overlay Marks | Enable | | |  | | |
| Echoes | Use Echoes  Score by amplitude | | |  | | |
| Click Type Selection | *Species* | | *Score* |  | |  |
|  | Checkbox Checked with solid fillunclassified clicks | | 1.0 |  | |  |
|  | Checkbox Checked with solid fill2-15 kHz (orange diamond – designed for sperm whale and Baird’s beaked whale) *(Keating and Barlow, 2013)* | | 1.0 |  | |  |
|  | Checkbox Checked with solid fill15-24 (red circle – killer whales and Risso’s dolphin) *(Keating and Barlow, 2013)* | | 1.0 |  | |  |
| Event Type Selection | Checkbox Checked with solid fillUnassigned events | | |  | | |
|  | Manually detected click trains | | |  | | |
|  | Checkbox Checked with solid fillAutomatically detected click trains | | |  | | |
| Contours | Checkbox Checked with solid fill | | |  | | |
| Select whistles (click round wheel) | | | | | | |
| Min frequency | 2000 Hz | | |  | | |
| Max Frequency | 24000 Hz | | |  | | |
| Min amplitude | 8.0  *(Rankin et al., 2017)* | | |  | | |
| Min length | 546 ms  *(McCullough et al., 2021)* | | |  | | |
| Only whistles with Super-Detections | Leave unchecked | | |  | | |
| Contours | Leave unchecked | | |  | | |
| Localised Contours | Leave unchecked | | |  | | |
| Localised Contours | Leave unchecked | | |  | | |
| Streamer Data | Leave unchecked | | |  | | |
| Tracked Clicks | Leave unchecked | | |  | | |
| Tracked Events | Leave unchecked | | |  | | |
| ***Digital pre filter*** | | | | | | |
| Filter Type | IIR Butterworth *(McCullough et al., 2021)* | | |  | | |
| Filter Response | | | | | | |
| Frequencies | High pass, 2000 Hz | | |  | | |
| Filter parameters | | | | | | |
| Filter Order | 4 *(McCullough et al., 2021)* | | |  | | |
| ***Digital trigger filter*** | | | | | | |
| Filter Type | IIR Butterworth *(McCullough, 2021)* | | |  | | |
| Filter Response | | | | | | |
| Frequencies | High pass, 2000 Hz | | |  | | |
| Filter parameters | | | | | | |
| Filter Order | 4 *(McCullough et al., 2021)* | | |  | | |
| ***Angle Vetoes*** | | | | | | |
| NA | | | | | | |
| ***Click Classification*** | | | | | | |
| Click Classifier Selection | Classifier with frequency sweep | | |  | | |
| Run classifier online | Checkbox Checked with solid fill | | |  | | |
| Discard unclassified clicks |  | | |  | | |
| Click Types | Enable by checking both boxes | | |  | | |
| Save Classifier Set | Checkbox Checked with solid fill | | |  | | |
| ***24 kHz data only***  Graphical user interface, text, table  Description automatically generated  Graphical user interface, text, application  Description automatically generatedGraphical user interface  Description automatically generated with medium confidence    *Based on settings from Keating and Barlow, 2013 but modified since smaller sampling rate.* | | | | | | |
| ***Click Train Identification*** | | | | | | |
| Control | | | | | | |
| Run Automatic Click Train Id |  | | |  | | |
| Min number of clicks per train | N/A | | |  | | |
| Min angle change for TMA | N/A | | |  | | |
| Min interval between updates | 5 s | | |  | | |
| ICI change | | | | | | |
| Min ICI | N/A | | |  | | |
| Max ICI | N/A | | |  | | |
| Max ICI change ratio | N/A | | |  | | |
| Angle changes | | | | | | |
| Max angle error | N/A | | |  | | |
| ***Click Localisation*** | | | | | | |
| ***Algorithm*** | | | | | | |
| Localisation Algorithms | | | | | | |
| Least Squares | Checkbox Checked with solid fill | | |  | | |
| 2D Simplex Optimization |  | | |  | | |
| 3D Simplex Optimization |  | | |  | | |
| Algorithm Limits | | | | | | |
| Limit number of clicks |  | | |  | | |
| Max number of clicks | N/A | | |  | | |
| Max processing time | 200 ms | | |  | | |
| ***Filters*** | | | | | | |
| Maximum Range | | 20000.0 m | | |  | |
| Minimum Depth | | -5.0 m | | |  | |
| Maximum Depth | | 5000 m | | |  | |
| ***Audible Alarm*** | | | | | | |
| Alarm Options | | | | | | |
| Alarm 1 | | Windows Beep | | |  | |

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| **DECIMATOR** | | |
|  | **24 kHz SoundTrap** | **100 kHz HARP** |
| Input Data Source | NOT NEEDED!! SKIP DECIMATOR |  |
| Channel 0 |  |  |
| Decimator Settings | | |
| Source Sample size |  |  |
| Output sample rate |  |  |
| Interpolation |  |  |

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| **WHISTLE AND MOAN DETECTOR** | | |
| ***Detection*** | | |
|  | **24 kHz SoundTrap** | **100 kHz HARP** |
| Source of FFT data | FFT Spectrogram Engine |  |
| Channel/Sequence list and grouping | | |
| Auto Grouping | One group |  |
| Channel | Checkbox Checked with solid fillChannel 0 |  |
| Connections | | |
| Min Frequency | 2000 Hz *(McCullough et al., 2021)* |  |
| Max Frequency | 24000 Hz *(McCullough et al., 2021)* |  |
| Connection Type | Connect 8 (sides and diagonals)  *(Rankin et al., 2017)* |  |
| Minimum length | 10 time slices *(546 ms; McCullough et al., 2021)* |  |
| Minimum total size | 50 pixels  *(Rankin et al., 2017)* |  |
| Shape ‘stubs’ | Checkbox Checked with solid fillRemove small stubs |  |
| Crossing and Joining | Re-link across joins  *(Rankin et al., 2017)* |  |
| Max Cross Length | 5 time slices  *(Rankin et al., 2017)* |  |
| ***Noise and Thresholding*** | | |
| Median Filter | | |
| Run Median Filter | Checkbox Checked with solid fill  *(Rankin et al., 2017)* |  |
| Filter Length  (should be odd) | 61  *(Rankin et al., 2017)* |  |
| Average Subtraction | | |
| Run Average Subtraction | Checkbox Checked with solid fill |  |
| Update Constant | 0.020  *(Rankin et al., 2017)* |  |
| Gaussian Kernel Smoothing | | |
| Run Gaussian Kernel Smoothing | Checkbox Checked with solid fill |  |
| Thresholding | | |
| Run Thresholding | Checkbox Checked with solid fill |  |
| Threshold (dB) | 8.0  *(McCullough tested and verified)* |  |
| Below threshold - > 0. Set above threshold data to … | Use the input from the raw FFT data |  |

To detect burst pulses, the Whistle and Moan Detector module identified cepstral contours with a minimum duration of 68 ms between 2 and 37 kHz. A frequency range of 2–37 kHz in the cepstral space corresponds to an ICI between 0.36 and 6.7 ms or equivalently harmonics separated by 150–2750 Hz. (*McCullough, 2021; where do I encorporate this?) (McCullough, 2021)*

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| **BURST PULSE**  **(A.K.A. RENAMED WHISTLE AND MOAN DETECTOR)** | | |
| ***Detection*** | | |
|  | **24 kHz SoundTrap** | **100 kHz HARP** |
| Source of FFT data | Cepstrum Data |  |
| Channel/Sequence list and grouping | | |
| Auto Grouping | One group |  |
| Channel | Checkbox Checked with solid fillChannel 0 |  |
| Connections | | |
| Min Frequency | 2000 Hz |  |
| Max Frequency | 24000 Hz |  |
| Connection Type | Connect 4 (sides only)  *(Rankin et al., 2017)* |  |
| Minimum length | 7 time slices *(Rankin et al., 2017)* |  |
| Minimum total size | 10 pixels  *(Rankin et al., 2017)* |  |
| Shape ‘stubs’ | Checkbox Checked with solid fillRemove small stubs |  |
| Crossing and Joining | Discard branched regions  *(Rankin et al., 2017)* |  |
| Max Cross Length | OFF |  |
| ***Noise and Thresholding*** | | |
| Median Filter | | |
| Run Median Filter | Checkbox Checked with solid fill |  |
| Filter Length (should be odd) | 61  *(Rankin et al., 2017)* |  |
| Average Subtraction | | |
| Run Average Subtraction | Checkbox Checked with solid fill |  |
| Update Constant (e.g., .02) | 0.020  *(Rankin et al., 2017)* |  |
| Gaussian Kernel Smoothing | | |
| Run Gaussian Kernel Smoothing | Checkbox Checked with solid fill  *(Rankin et al., 2017)* |  |
| Thresholding | | |
| Run Thresholding | Checkbox Checked with solid fill |  |
| Threshold (dB) | 12  *(McCullough tested and verified)* |  |
| Below threshold - > 0. Set above threshold data to … | Use the input from the raw FFT data |  |

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| **CEPSTRUM SETTINGS** | | |
|  | **24 kHz SoundTrap** | **100 kHz HARP** |
| FFT Data Source | FFT (Spectrogram) Engine |  |
| Channel | Checkbox Checked with solid fillChannel 0 |  |

# Views

(Right click < Make sure three-wheel cog are selected)

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| --- | --- | --- | --- |
| **Spectrogram** | | | |
| ***Data Source*** | | | |
|  | **24 kHz SoundTrap** | | **100 kHz HARP** |
| Source Data | FFT (Spectrogram) Engine | |  |
| Resolution  (cannot change – dependent on SR of files) | Sampling Rate | 48000 Hz |  |
| FFT Length | 1024 bins |
| Frequency Resolution | 46.88 Hz |
| Time Resolution | 21.33 ms |
| Time Step Size | 10.67 ms |
| Channels | | | |
| Number of Panels | 1 | |  |
| ***Scales*** | | | |
| Frequency Range | | | |
| Min | 0 | |  |
| Max | 20880 | |  |
| Amplitude Range | | | |
| Min | 30.0 dB re µPa/Hz | |  |
| Max | 72.0 dB re µPa/Hz | |  |
| Colour model | Grey (black and white) | |  |
| Time Range | | | |
| Window Length (s) | Select, 30.0 | |  |
| Scrolling | Wrap Display | |  |
| ***Plug ins*** | | | |
| Select additional panel display panels… | Leave all unchecked | |  |
| Mark Observers | | | |
| Click Detector\_Spectrogram Display  (panel 0) | Checkbox Checked with solid fill | |  |



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| --- | --- | --- | --- | --- | --- |
| **Click Detector** | | | | | |
| ***Bearing Time Display Settings***  ***(right click on plot < Settings)*** | | | | | |
|  | **24 kHz SoundTrap** | | | | **100 kHz HARP** |
| Confirm only these two are checked: | Graphical user interface, application, Word  Description automatically generated | | | |  |
| Axis | | | | | |
| Axis layout | Amplitude | | | |  |
| Bearing Range | Leave unchecked | | | |  |
| Angle Rotation | N/A | | | |  |
| Show ICI for unassigned clicks | N/A | | | |  |
| ICI range | N/A | | | |  |
| Amplitude Range | 120 to 150 dB  *(McCullough tested and verified - Range deteremined by running example file and looking at bearing time display (Right click < Show amplitude selector< check “Display only clicks over set amplitude < Min amplitude = 130 dB). Then able to view a histogram of the data. Red lines appear and can move them on plot to find the beginning and ending of histogram. Range must include the entire histogram. Found that 120 was the lower limit and 150 was the upper limit. Need to uncheck the box before closing the Aplitude selector window so the data doesn’t go away.)* | | | |  |
| Gride lines | 0 | | | |  |
| Show tracked click markers in border | Checkbox Checked with solid fill | | | |  |
| Click Size | | | | | |
| Click Length (pixels) | min | 12 | max | 12 |  |
| Click Height (pixels) | min | 12 | max | 12 |  |
| Species | | | | | |
| Echoes |  | | | |  |
| Show echoes | Checkbox Checked with solid fill | | | |  |
| Species selection |  | | | |  |
| Show unclassified clicks | Checkbox Checked with solid fill | | | |  |
| 2-15kHz | Checkbox Checked with solid fill | | | |  |
| 15-24kHz | Checkbox Checked with solid fill | | | |  |
| Event Selection | Leave box unchecked | | | |  |
| ***Wigner Plot***  ***(right click on plot < Plot Options…)*** | | | | | |
| Transform Length |  | | | |  |
| Limit transformation length around peak | Checkbox Checked with solid fill | | | |  |
| Transform length | 128 bins | | | |  |
| Tip: to zoom into plot, click on blue space and scroll up. Only works on this plot in PAMGuard. | | | | | |
| ***Click Waveform Display***  ***(right click on plot < Plot Options…)*** | | | | | |
| Options | | | | | |
| Separate waveform plots | Select | | | |  |
| Single waveform plot | Leave unchecked | | | |  |
| Constant time scale | Checkbox Checked with solid fill | | | |  |
| Show waveform envelope | Leave unchecked | | | |  |
| Show Filtered Waveform | Leave unchecked | | | |  |
| ***Click Spectrum***  ***(right click on plot < Plot Options…)*** | | | | | |
| Plot Type | | | | | |
| Show spectrogram | Select | | | |  |
| Show Cepstrum | Leave unchecked | | | |  |
| Scale | | | | | |
| Log Scale | Checkbox Checked with solid fill | | | |  |
| Scale Range (dB) | 15  *(McCullough tested and verified - making use of less white space)* | | | |  |
| Options | | | | | |
| Channels | Show indivdual channels | | | |  |
| Smooth data with | Checkbox Checked with solid fillwith 51 bin filter | | | |  |

|  |
| --- |
| **Notes** |
| ***N/A*** |
| Select Parameter Descriptions:   |  |  | | --- | --- | | **Parameter** | **Description** | | Update Constant | *A decaying average spectrogram is computed and subtracted from the current spectrogram value. The smaller the number, the greater/longer the averaging.* | | Max Cross Length | *Threshold used when analyzing crossed whistles. Where whistles cross, two separate branches of a connecting region merge, then re-separate. If number of time partitions in merged section is < max cross length, it is assumed it is a real whistle crossing and connected region is separated into 2 whistles. If merged area is longer, region is split into 4 separate components (2 entering merged region and 2 leaving it.* | | Filter Length | *Within each spectrogram slice, the median value about each point is calculated and subtracted from that point. The greater the median filter length, the greater the number of points used to calculate the median.* | | Crossing and Joining  *(how detector deals with overlapping whistles)* | *Leave branching regions intact:*  *Branching regions will be left itnact and may contain more tan one actual sound; Discard branch joins: any region that has more than one detected frequency peal in any time slice will be discarded; Separate all branches: all branches will be sperate and passed on as indivisual sounds;*  *Relink across joins:*  *algoithm will attempt to re-join individual tones across joins. The sound is broken up as above and the individual fragements are then re-joined according to set of fules – see help files.* | | Connection Type  *(which pixels will be examined when trying to trace out whistle fragment)* | *Connection type 4 – algorithm will connecct with pixels above, below, to the left or to the right of ucrrent pixels; Connection type 8 – also adds the diagonal pixels to the potential search area.* | | Minimum Total Size | *Whistle fragments shorter than min total size, measured in pixels, will be discarded.* | | Minimum Length | *Whistle fragments shorter than the min length will be discarded.* | | Median Filter Length | *In each spectrogram slice, the median value about each point is calculated and subtracted from the original data point. The larger the MFL, the greater number of points needed to calculate the median.*  *The median filter is used to enhance tonal peaks in spectrogram by flattening spectrum across entire frequency range.* | | Click Detector pre-filter | *Low pass filter intended to remove unwanted ship noise* | | Click Detector trigger filter | *Used to optimize detections in the frequency band of interest. For multiple species detections, the trigger filter band needs to be wider.* | |
| References:  Keating, J. L., & Barlow, J. (2013). Summary of PAMGuard beaked whale click detectors and classifiers used during the 2012 Southern California Behavioral Response Study.  McCullough, J. L., Simonis, A. E., Sakai, T., & Oleson, E. M. (2021). Acoustic classification of false killer whales in the Hawaiian islands based on comprehensive vocal repertoire. *JASA Express Letters*, *1*(7), 071201.  Rankin, S., Archer, F., Keating, J. L., Oswald, J. N., Oswald, M., Curtis, A., & Barlow, J. (2017). Acoustic classification of dolphins in the California Current using whistles, echolocation clicks, and burst pulses. *Marine Mammal Science*, *33*(2), 520-540.  Yack, T. M., Barlow, J., Rankin, S., & Gillespie, D. (2009). Testing and validation of automated whistle and click detectors using PAMGUARD 1.0. |

**Set-up Information**

***Installing PAMGuard***

1. Go to <https://www.pamguard.org/>
2. Click on “Download” tab
3. Fill out online form at <https://www.pamguard.org/download.php?id=118> and Click “Download” button to start process.
4. To operate Viewer mode and open the database, you will need to install SQLiteStudio

**Troubleshooting**

* ***PAMGuard stopped running or won’t start running when I hit the red circle button***

Check the black command window that opens with PAMGuard. If there is a box with stars around it, that means you need to close the program and re-open PAMGuard because it has stopped functioning and will not let you proceed unless you re-start.

* **Certain features (like the “Save classifier set” box) are not showing up?**

Locate PAMGuard file folder. For my laptop it was in (C:\Program Files\Pamguard).

* + Copy and paste the .ini files onto my desktop
  + Open each file
  + Edit the second line to read “ -Xmx8000m” because we want to include the value that is half the overall RAM (I have 16000 (16 GB) so half would be 8000). This will work better and make the program happier.
  + Add one line after the jar line which is “-smru”
  + Save all files
  + Cut and paste back into PAMGuard program folder and delete the old versions.
  + In the future, this problem can be solved during the download process. When downloading the parameters box pops up, you must type in “-smru” and it will automatically add that to .ini files.