

Glossary of Acoustic Bat Survey Terms

Acoustic bat survey – bat sampling conducted through recording and analyzing echolocation calls.

Acoustic sampling site – the location where a single bat detector will be deployed to sample bat echolocation calls.

Active recording – a method of recording echolocation calls whereby the researcher actively orients the bat detector to follow bats as long as possible in real time; this method generally results in higher quality pulses and longer call sequences than passive recording.

Atmospheric attenuation – a property of sound that results in the loss of energy in the call with increasing distance, higher frequency in the calls, humidity, and temperature.

Automated bat call ID software – a form of echolocation identification in which recorded files are filtered and identified within a software program; the program compares the statistical properties of a recorded call to a library of known calls to classify to species.

Bat detector – equipment capable of detecting ultrasonic echolocation calls of bats that are above the range of human hearing.

Broadband detector – a bat detector that can simultaneously detect a wide range of ultrasonic frequencies.

Call amplitude (or call intensity) – the energy contained in a bat echolocation call, often measured as the decibels a set distance from the bat.; a characteristic that affects the distance at which a call can be detected.

Call frequency – the characteristic frequency of a bat call in kHz; the ending frequency of the flattest part of a call (the body); one of the most useful call characteristics for identification.

Call library – a collection of bat calls, known to species, that allows comparison to bat calls without known identity.

Call parameter characterization – properties of a call (statistical or qualitative) that aid in describing the shape and frequency range of the echolocation calls.

Call quality – how closely the sequence matches typical search-phase behavior for the species.

Call sequence – a series of bat echolocation call pulses.

Clutter – obstacles present in an area that can affect recording of bat echolocation calls; may be caused by either scattering echolocation calls from sound bouncing off obstacles (thereby reducing call quality) or by bats adjusting their normal search phase calls in response to additional obstacles resulting in changed bat echolocation call parameters.

Cone of detection – the volume of space that is effectively sampled by a bat detector.

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Constant frequency (CF) – a type of bat call that remains at one frequency over the entire call duration, in contrast to frequency modulated (FM) calls.

Decibel (dB) – in acoustics, a measure of the amount of pressure exhibited by a sound wave, often utilized to measure the ‘loudness’ of a call.

Detection probability – the likelihood of detecting the presence of a species when that species is present.

Detection range – the maximum distance, under specific circumstances, that a bat call can be detected; this factor is affected by clutter, atmospheric attenuation, and the frequency and amplitude of bat calls.

Detector sensitivity – measures the ability of a bat detector to detect an echolocation call.

Detector - see “bat detector”.

Directional microphone – a microphone that is more sensitive to sound arriving from certain directions.

Doppler shift – a physical property of sound that results in an apparent change in frequency of sound because of an object’s movement; a sound source moving towards a microphone is perceived as a higher frequency and vice versa.

Echolocation – use of ultrasound and the returning echoes to orient and navigate in the environment.

False negative – the failure to detect a bat species when it is actually present in the area; statistically a type II error in hypothesis testing.

False positive – the detection of a bat species when it is not present; statistically a type I error in hypothesis testing.

Feeding buzz – a phase of a bat echolocation call that results in rapid-fire sound pulses as a bat approaches a potential prey object; these calls typically lack the species-specific characteristics needed for species identification.

Frequency band – the range of frequency that bat calls or detector covers.

Frequency division detector – a type of bat detector that reduces the frequency of echolocation calls of bats so they may be heard by humans or stored more easily by dividing the frequency of sound by a set number called the division ratio (n).

Frequency modulated (FM) – a type of bat call that varies or “modulates” in frequency throughout the call, in contrast to constant frequency (CF) calls.

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Full-spectrum detector – bat detectors in which all desirable information about the recorded sound is preserved, including time, frequency, and amplitude.

Harmonics – whole-integer multiples of fundamental sound frequencies used by bats, which assist in pinpointing an insect's location; overtones.

Heterodyne detector – a type of bat detector that lowers the frequency of echolocation calls of bats so they may be heard by humans or stored more easily by mixing with a known signal frequency, thereby resulting in a narrow-band detector.

High-frequency calls – a general classification of calls that refers to those with minimum frequencies >35 - 40 kilohertz.

High-intensity calls – calls with greater than 110 decibels sound pressure from 10 centimeters; 'loud' calls.

Kilohertz (kHz) – a unit of measure of the frequency of sound; one thousand hertz.

Low-intensity calls – calls with 10-80 decibel sound pressure from 10 centimeters.

Maximum-Likelihood Estimate (MLE) – a statistical method of estimating the parameters of a statistical model. For our purposes, the MLE is a statistical method that can be used to determine species presence or probable absence at a particular site on a particular night by means of a classification matrix.

Microphone sensitivity – the minimal amplitude required at a given frequency for a microphone to detect a sound.

Microphone directionality – the degree to which a microphone is sensitive preferentially to sound arriving from certain directions; see directional microphone.

Microphone orientation – the direction in which the microphone is pointing' thereby affecting the cone of detection.

Narrow-band detector – a detector that can only record bat calls from a small frequency range at a specific time.

Noise – unwanted or extraneous environmental sound or electronic interference detected by a bat detector.

Noise filters – statistical processes that remove noise from bat echolocation pulses.

Omni-directional microphone – a microphone that can detect equally in all directions (i.e. has a spherical cone of detection).

Pass – a single crossing of a bat through a bat detector's cone of detection; see 'call sequence'.

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Passive recording – bat echolocation sampling from a spatially fixed recorder, opposite of active sampling, in contrast to active recording.

Phonic groups – groups of bat calls categorized by their echolocation frequencies; typically grouped as high, medium or low.

Pulse – a brief, continuous emission of sound; see ‘call sequence’.

Preamp gain – the amount that a signal is amplified (increased) before processing.

Qualitative call identification – identification of call sequences through visual comparison with a known call library; accuracy can be highly variable based on researcher experience.

Quantitative call identification – identification of call sequences via mathematical algorithms/statistical models that compare multiple call parameters from unknown calls to those of known calls and assign them to a particular species or other category.

Signal-to-noise ratio – a measure of call quality comparing the relative amplitude of desirable and undesirable components.

Search-phase call – the type of echolocation call emitted as a bat is commuting or looking for food; characterized by regular consistent call characteristics.

10/40 Rule – a method to assess whether a site was sampled effectively; the 10 represents a minimum of 10 individual call sequences being recorded and 40% refers to the percentage of bat sequences that are identifiable to species.

Time-expansion – a type of full-spectrum bat detector that reduces the frequency of recorded calls so they may be heard by humans and stored more easily by electronically stretching the calls over a longer time period.

Ultrasonic/ultrasound – sounds made of frequencies that are beyond the range of human hearing (often arbitrarily set at 20 kilohertz, although most adults have trouble hearing sounds above 15 kHz.)

Ultrasound-conversion techniques – also see “frequency division”, “heterodyne”, and “time-expansion”; the method in which the frequency of recorded calls is reduced so they may be heard by humans or recorded more easily.

Weather proofing – various methods/materials used to protect a bat detector/microphone from the elements (primarily rain).

Zero-crossing detector – a detector type that calculates frequencies by measuring the time between moments of zero sound pressure, which corresponds to the period of the wave.