**Criteria used to mark elephant rumbles**

An elephant rumble consists of a stack of harmonics which appear as narrowband signals in the spectrogram. The number of harmonics that are visible in spectrograms varies (depending on the distance of the elephant from the recording unit and the source amplitude). A large percentage of the rumbles in *nouabale ele s*ound files have only one harmonic. There are far more rumbles per hour in the bai sounds, and a much higher percentage of them have multiple harmonics.

Although most rumbles are easily recognizable in spectrograms, several other signals can easily be mistaken as rumbles (vehicles, flapping wings of birds or insects, thunder, gorillas, buffalo). Also, there is a gradation in the signal-to-noise ratio (SNR) and the duration of the rumbles. The lower the SNR and shorter the signal, the more difficult it is to be sure whether it is an elephant rumble or not. Because of these difficulties, we have guidelines for what we accept as a rumble:

* The duration must be at least 1s.
* If only one harmonic is visible, it must within the 10 – 75 Hz range if it has frequency modulation, or within 10 – 50 Hz if it is flat.
* If multiple harmonics are visible, the distance between adjacent harmonics must be between 6 and 40 Hz.

In addition, we try to maintain a standard regarding the SNR. Absolute measurement of the SNR is not feasible in our current workflow, so all analysts refer to a set of example rumbles with low SNR that have been tagged as acceptable or not.

These are all hand-browsed, by us or our ELP student helpers. The students go through a training and periodic checking. As noted above, it is extremely difficult to maintain a standard regarding whether a potential rumble should be accepted or not. This is true not only between observers, but within them! That, together with inevitable mistakes, means that these tables are not and cannot be taken as 100% truth!

Selection boxes: We don’t impose strict rules about how a selection box should be drawn around a rumble so the time and frequency bounds of the box cannot be used to infer the time and frequency bounds of the rumble. The guideline is to draw the box so that it starts a fraction of a second before the rumbles and ends a fraction of a second after the end of the rumble, and to draw the top of the box a few Hz above the highest observable harmonic (which is very subjective), and the bottom a few Hz below the lowest observable harmonic.

As noted elsewhere, there are far more rumbles in the bai elephant sounds than in nouabale.