PROTOCOL

1. Random order locations
2. Random order song recordings
3. Analysis order: Field season recordings 2017 clear, Field 2017 buzzy, Xeno Canto and Macauley
4. Read the collection data for the chose song recording, to make sure it isn’t a duplicate bird (for Xeno-Canto or Macauley) or that there are multiple birds in the recording
5. Number all songs with high enough quality to analyze in the recording on the jpeg images of spectrogram
   1. Signal is not obscured by other bird songs
   2. No large amount of noise obscuring signal
   3. Song distinct, all notes are loud enough to create dark outlines
   4. IF THERE ARE MULTIPLE BIRDS IN RECORDING, listen to recording to determine which song corresponds to what bird
6. Randomly choose 3 songs from eligible songs to analyze
7. Adjust window size to 512 and contrast and brightness to have clearest image
8. Create spectrogram splice – set window size to 512, and auto-apply other settings (click bottom left button)
9. Listen to the song
10. Determine syllable and note structure of the song, and enter that information into the “Song\_measurements\_2017” spreadsheet
11. Create a box around the song and each syllable
    1. use amplitude graph to help determine the left and right boundaries of the box (duration)
    2. use spectrogram splice view to help determine the upper and lower boundaries of the box (max and min freq)
       1. drag the purple vertical line on the spectrogram view to the time point with the highest and/or lowest frequency. The spectrogram splice view will give you an output of the relative amplitude at each frequency at the time point where the purple line is. Create the margin of the box where the amplitude decreases to the noise level.

Song characteristics being measured:

1. Total number of syllables
2. Total number of unique syllables
3. Total number of notes per each syllable
4. Total number of unique notes per each syllable
5. Number of repetitions of each syllable

For each song and syllable:

1. Maximum frequency
2. Minimum frequency
3. Duration
4. BW 90%- The bandwidth (frequency range) of a note, containing 90% of the energy of that note. Gives a measure of bandwidth that is very insensitive to measurement error
5. Center Freq - The frequency at which 50% of a note's energy lies above, and 50% lies below. Not sensitive to measurement error and spectrogram settings.
6. PFC slope - The slope of a note, measured as the change in peak frequency per change in time, calculated for each time step within the note and averaged over the duration of the note. Not sensitive to measurement error.
7. Component slope- The slope of a component within the note, measured if a note contains multiple components, in which cases the PFC slope will not reflect the true shape of the note. Only calculated for components of at least 0.01s in length due to the limits of the spectrogram's frequency accuracy over very short time periods.
8. Freq 95 - The frequency containing 95% of the power below it
9. Freq 5 - The frequency containing 95% of the power above it