During migration birds deal with uncertain habitats, adverse weather, and other potential threats that can lead to high mortality rates. Given the documented declines in many migrant songbird populations, there is a pressing need to develop a more complete understanding of all aspects of migration biology. Many species of songbirds use flight calls during migratory periods. Flight calls are species-specific and are distinct from other vocalizations. There is variation in flight calls among individuals, age and sex groups, and populations. Recent attempts to improve monitoring populations of migratory songbirds include using microphones that record flight call vocalizations of birds as they fly overhead. This information is used to determine the relative abundance of species and determine long-term population trends. However, flight calling behavior is one of the least studied areas of migration biology. This is because of current limitations in data processing. Large amounts of audio data are collected, but there are no efficient methods to find and identify flight call vocalizations within the audio files.

Flight calls vary in structure; some species have flight calls that are very similar while other species flight calls are very unique. For example, calls may differ in a variety of acoustic traits including whether they are pure or modulated tones, rise or fall during the call, and/or contain a single band or include harmonics. Warbler flight calls are commonly split into 6 flight call types based on similarity of structure: buzzy, single banded upsweep, double banded upsweep, double banded upsweep, down sweep, zeep, and irregular.

The goal of this project is to develop software that can identify flight call vocalizations within long audio files that contain other types of sounds (wind, rain, insects, etc.). The software should be able to:

* identify warbler, sparrow, and thrush-like flight calls from within the audio stream and identify the warbler flight calls to species,
* or identify warbler, sparrow, and thrush-like flight calls from within the audio stream and identify the warbler flight calls to a subset of possible species with similar flight call structure, and include some measure of confidence that the flight call belongs to each species,
* or identify warbler, sparrow, and thrush-like flight calls from within the audio streams and identify the warbler flight calls to the types listed above,
* or identify flight calls within the audio streams as warbler, sparrow, or thrush-like flight call vocalizations
* or identify warbler flight calls to species from audio files that have already been identified as flight calls.

Work on this project will be a collaborative effort between the student(s) and Amy Tegeler, the Avian Ecologist and Bioacoustics Lab Manager at Powdermill Nature Reserve, the field station for the Carnegie Museum of Natural History. At least one trip to Powdermill Nature Reserve, Rector, PA will be necessary.

Audio files of flight calls from approximately 15 species of warblers, examples of other background noises, and long audio files that contain flight calls and other background sounds will be provided. The software developed can be tested using long audio files where all the flight calls have been detected, and with manual identification by Amy Tegeler. The software developed for this project will be used by The Carnegie Museum of Natural History, and possibly shared with other land managers, researchers, and educators to enhance the use of flight calls as a method to study the populations of migratory songbirds.