**Dawn Chorus start time variation of Olive-sided Flycatcher**

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Spatiotemporal variation of avian biodiversity is a commonly used indicator of environmental change. Conventionally, such information was derived with human observers (e.g., point counts and mist net), while passive acoustic monitoring (PAM) with autonomous recording units (ARU) is rapidly emerging as an alternative survey method. Given the large amount of acoustic data PAM can potentially collect, effort has been made to develop algorithms to automatically transform acoustic data into interpretable form. Recently, one of the most successful attempts is a deep neural network (DNN) called BirdNET, that is able to identify 984 North American and European bird species by sound.

In this study, we will test the performance of BirdNET on an independent dataset collected in John Prince Research Forest, Canada. Furthermore, we will access the accuracy metrics for individual species and imply future applications of such acoustic data.

**Keywords**: Pacific North West, forest birds, migration, BirdNET

# Objectives

* Evaluate the species-wise performance of BirdNET for selected focal bird species, and recommend suitable parameters for future studies
* Discuss where the error might come from (time of the day, month of the year, location)
* Generate the broad-scale spatiotemporal distribution of the species.

# Method and materials

## Audio data

The audio data was collected in John Prince Research Forest (54° 27'N, 124° 10'W, 700 m a.s.l) in 2020 breeding season. A total of 41 AudioMoth (Open Acoustic Devices, 2020) were evenly distributed across the region (fig. of a map). All AudioMoth was under an identical recording schedule, repeating daily from four to seven am, one minute on, followed by four minutes off. This setting resulted in 36 one-minute recordings per day per AudioMoth. The average working days were ~30 – 60 days between May – July. Given this, 67,301 one-minute recordings were collected and used in the study. All recordings were formatted into a 48 kHz sampling rate and the mono pulse code modulation WAV.

## BirdNET

An automatic bird sound classifier, BirdNET (cite), was developed given the demand of new analytical approaches to efficiently process PAM data (cite). The training data of BirdNET came from two datasets: Macaulay Library, part of the Cornell Laboratory of Ornithology containing over 750,000 avian acoustic recordings (cite), and Xeno-Canto, a community-curated collection featuring more than 500,000 avian acoustic recordings (cite). BirdNET is capable of identifying 984 North American and European bird species by sound. Further, species presence probabilities can be retrieved and stored individually for each three-second sound segment. BirdNET was deployed as a website (<https://birdnet.cornell.edu/>) with its source code provided in a GitHub repository (<https://github.com/kahst/BirdNET>).

There are three parameters that can be set during the analysis: the prediction sensitivity, overlap of segments, and the minimum required confidence. In this evaluation, the prediction sensitivity was set as XYZ given XYZ. Further, an overlap of segments of zero was chosen considering the computer processing power. Finally, no lower confidence threshold was set since a ranking metric was employed. In this study, the BirdNET analysis was run on the Google Colaboratory (Colab), an online platform allowing users to get free access to graphics processing units (GPUs).

## Big data accuracy assessment

## Individual recordings accuracy assessment

## Focal species

Olive-sided Flycatcher

Saw-whet Owl

Barred Owl

Boreal Owl

Great-Horned Owl

Pygmy Owl

# Workflow

