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birdnetTools: An R package for working with BirdNET output

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Summary

`birdnetTools` is an R package for post-processing outputs from BirdNET, an open-source neural network developed by the Cornell Lab of Ornithology and Chemnitz University of Technology for detecting and identifying bird species from audio recordings (Kahl et al., 2021). The `birdnetTools` package streamlines workflows for cleaning and combining multiple BirdNET selection tables, filtering detections by species, confidence, or date/time, visualizing temporal and spatial patterns, and validating results using an interactive Shiny app. It also supports species-specific and universal confidence thresholds, enabling reproducible threshold-setting workflows.

Statement of need

Automated acoustic monitoring is increasingly used in ecology and conservation (Pérez-Granados, 2023), with BirdNET being one of the most widely adopted tools for bird sound identification (e.g., Funosas et al. (2024), McGinn et al. (2023), and Bota et al. (2023)). Although BirdNET was developed in Python, most of its primary users are ecologists who conduct analyses primarily in R. This language difference can limit accessibility for some research teams. While the `birdnetR` package (Günther & BirdNET Team, 2025) enables R users to run BirdNET classifications, there is no dedicated framework in R for post-processing these outputs.

The `birdnetTools` R package fills this gap by providing functions built on workflows commonly used in published studies (e.g., Tseng et al. (2024)) and by incorporating threshold-setting and validation methods developed in recent research (i.e., Tseng et al. (2025); Wood & Kahl (2024)). By consolidating these tools, `birdnetTools` streamlines analysis and lowers barriers for ecologists and conservation practitioners adopting BirdNET in large-scale monitoring projects (Figure 1).

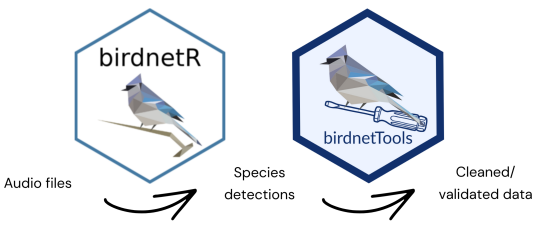

Figure 1: Integration of BirdNET R packages. birdnetR produces species detections from audio recordings, while birdnetTools provides tools for post-processing, data cleaning, and validation.

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Key functionalities

Functions in `birdnetTools` fall into three categories: data import, data exploration, and detection validation (Figure 2).

1. Data import: `birdnet_combine()` integrates BirdNET outputs into R, supporting formats from the BirdNET GUI, Raven Pro, and the `birdnetR` package.
2. Data exploration: `birdnet_filter()` enables filtering by species, threshold, or date/time; `birdnet_add_time()` extracts temporal metadata; and `birdnet_heatmap()` visualizes activity patterns.
3. Detection validation: an R ShinyApp was developed, implementing threshold-setting approaches, including the precision-based method of Tseng et al. (2025) and the probability-based method of Wood & Kahl (2024).

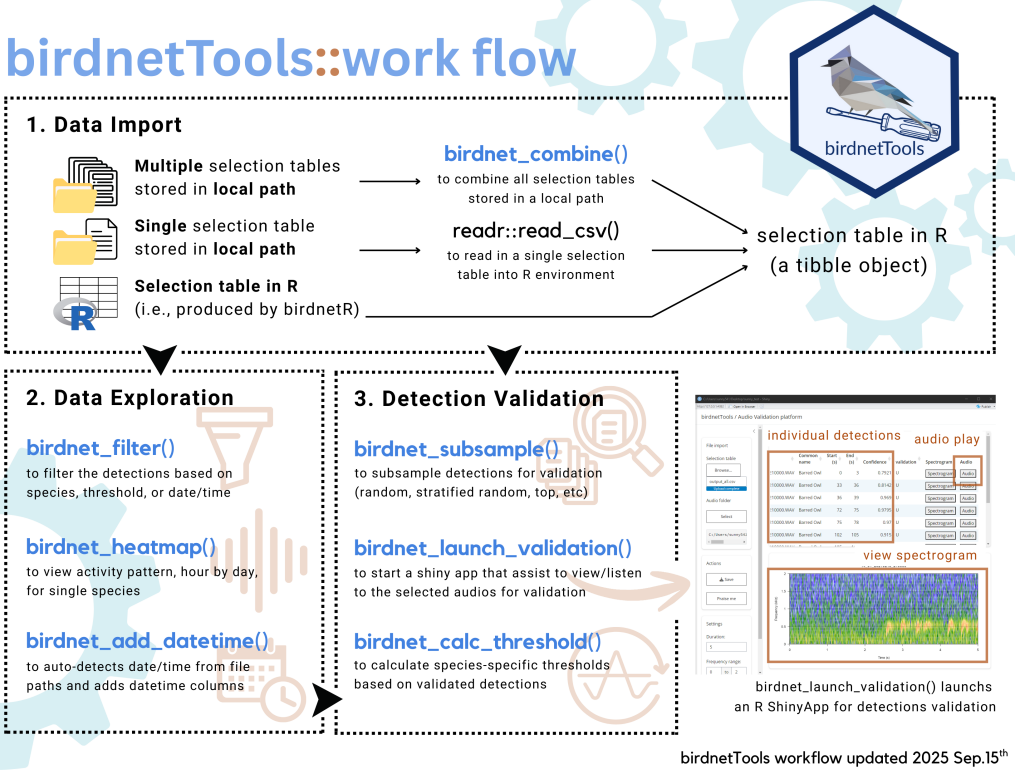

Figure 2: Workflow of the birdnetTools R package.

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