

birdnetTools: An R package for working with BirdNET output

Sunny Tseng¹ and Stefan Kahl^{2,3}

¹ Natural Resources and Environmental Studies, University of Northern British Columbia, Prince George, BC, Canada ² K. Lisa Yang Center for Conservation Bioacoustics, Cornell Lab of Ornithology, Cornell University, Ithaca, NY, USA ³ Chemnitz University of Technology, Chemnitz, Germany ¶ Corresponding author

DOI: [10.xxxxxx/draft](https://doi.org/10.xxxxxx/draft)

Software

- [Review](#)
- [Repository](#)
- [Archive](#)

Editor: [Open Journals](#)

Reviewers:

- [@openjournals](#)

Submitted: 01 January 1970

Published: unpublished

License

Authors of papers retain copyright and release the work under a Creative Commons Attribution 4.0 International License ([CC BY 4.0](#)).

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).

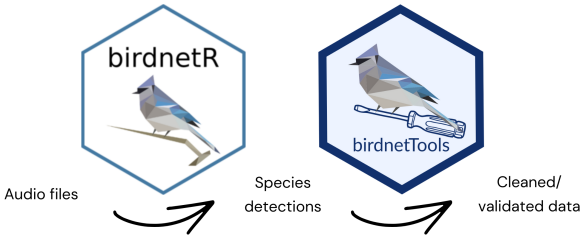


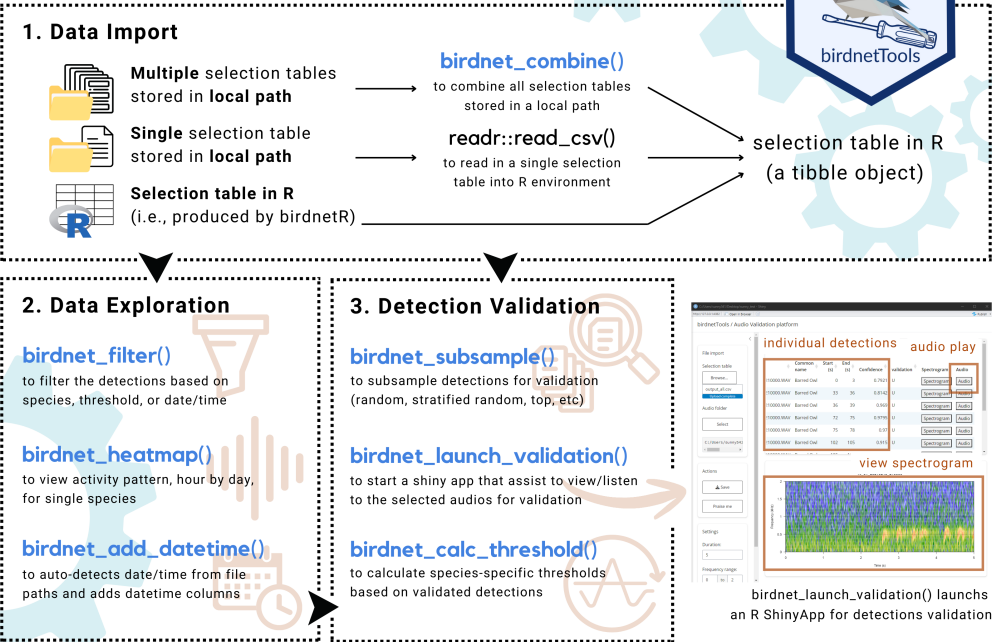
Figure 1: Integration of BirdNET R packages. `birdnetR` produces species detections from audio recordings, while `birdnetTools` provides tools for post-processing, data cleaning, and validation.

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).

birdnetTools::work flow



birdnetTools workflow updated 2025 Sep.15th

Figure 2: Workflow of the `birdnetTools` R package.

Acknowledgements

The birdnetTools project was supported by the Michael Smith Foreign Study Supplements, funded by the Natural Sciences and Engineering Research Council of Canada (NSERC). We thank all members of the BirdNET team for their valuable contributions, and we are grateful to Connor M. Wood and Trey Ursillo for their insightful feedback in improving the package.

The development of BirdNET is supported by the German Federal Ministry of Research, Technology and Space (FKZ 01|S22072), the German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (FKZ 67KI31040E), the German Federal Ministry of Economic Affairs and Energy (FKZ 16KN095550), the Deutsche Bundesstiftung Umwelt (project 39263/01) and the European Social Fund.

References

- Bota, G., Manzano-Rubio, R., Catalán, L., Gómez-Catasús, J., & Pérez-Granados, C. (2023). Hearing to the unseen: AudioMoth and BirdNET as a cheap and easy method for monitoring cryptic bird species. *Sensors*, 23(16), 7176. <https://doi.org/10.3390/s23167176>
- Funosas, D., Barbaro, L., Schillé, L., Elger, A., Castagneyrol, B., & Cauchoux, M. (2024). Assessing the potential of BirdNET to infer european bird species from acoustic data. *Ecological Informatics*, 164(112146). <https://doi.org/10.1016/j.ecolind.2024.112146>
- Günther, F., & BirdNET Team. (2025). birdnetR: Deep learning for automated (bird) sound identification. In *GitHub repository*. GitHub. <https://birdnet-team.github.io/birdnetR/>
- Kahl, S., Wood, C. M., Eibl, M., & Klinck, H. (2021). BirdNET: A deep learning solution for avian diversity monitoring. *Ecological Informatics*, 61. <https://doi.org/10.1016/j.ecoinf.2021.101236>
- McGinn, K., Kahl, S., Peery, M. Z., Klinck, H., & Wood, C. M. (2023). Feature embeddings from the BirdNET algorithm provide within-species classification of acoustic events. *Ecological Informatics*, 74(101995). <https://doi.org/10.1016/j.ecoinf.2023.101995>
- Pérez-Granados, C. (2023). BirdNET: Applications, performance, pitfalls and future opportunities. *Ibis*, 165(3), 1068–1075. <https://doi.org/10.1111/ibi.13193>
- Tseng, S., Hodder, D. P., & Otter, K. (2024). Using autonomous recording units for vocal individuality: Insights from barred owl identification. *Avian Conservation and Ecology*, 19. <https://doi.org/10.5751/ACE-02680-190123>
- Tseng, S., Hodder, D. P., & Otter, K. A. (2025). Setting BirdNET confidence thresholds: Species-specific vs. Universal approaches. *Journal of Ornithology*, 166. <https://doi.org/10.1007/s10336-025-02260-w>
- Wood, C. M., & Kahl, S. (2024). Guidelines for appropriate use of BirdNET scores and other detector outputs. *Journal of Ornithology*, 165. <https://doi.org/10.1007/s10336-024-02144-5>