

SAY WHAT? BIVALENT SINGING IN *VERMIVORA* WARBLERS

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Study Description

For millennia, humans have been captivated by the diversity and complexity of birdsong. In *Vermivora* warblers, individuals of one species may sing the song of the other. However, *Vermivora* warblers and most other Nearctic–Neotropical warblers typically learn and sing one primary song over their lifetime. We observed individual *Vermivora* warblers switching between species' songs in subsequent years and even one individual that sang both Golden-winged Warbler and Blue-winged Warbler songs in the same singing bout. Our observations raise questions about the role of song in speciation and hybridization dynamics of the *Vermivora* warbler species complex.

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Photo 1. Golden-winged Warblers (top left) and Blue-winged Warblers (top right) are easily distinguishable by plumage and song yet are closely related and hybridize. First-generation hybrids (i.e., Brewster's Warblers; bottom left) and some offspring from crosses between first-generation hybrids (i.e., Lawrence's Warblers; bottom right) have predictable plumage inheritance patterns. However, extensive backcrossing leads to a spectrum of observed plumage traits in hybrid *Vermivora* warblers (e.g., bottom center). Photo credit: Henry Streby (top left), R. Kyle Pagel (top right), Gunnar Kramer (bottom row).

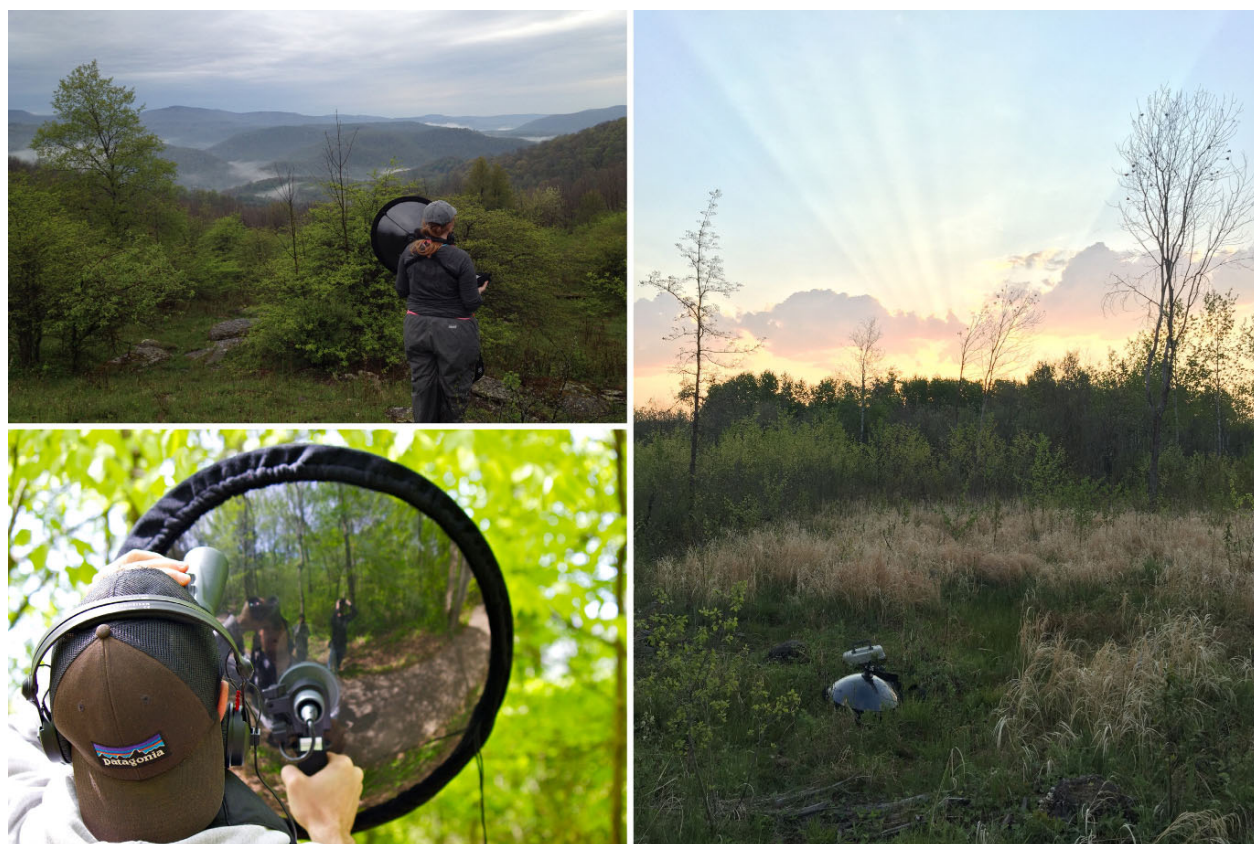


Photo 2. Cassandra Ziegler recording *Vermivora* warbler songs in West Virginia, USA in May 2016 (top left) and Gunnar Kramer recording *Vermivora* warbler songs in Tennessee, USA (bottom left). We recorded songs of *Vermivora* warblers at 22 sites throughout their breeding distribution in eastern and central North America including at Sandhill State Wildlife Area, Wisconsin, USA (right). Our recording setup included a plastic parabola (pictured) that focused sounds toward the microphone in the center. Photo credit: Kate Maley (top left, bottom left), Kyle Pagel (right).

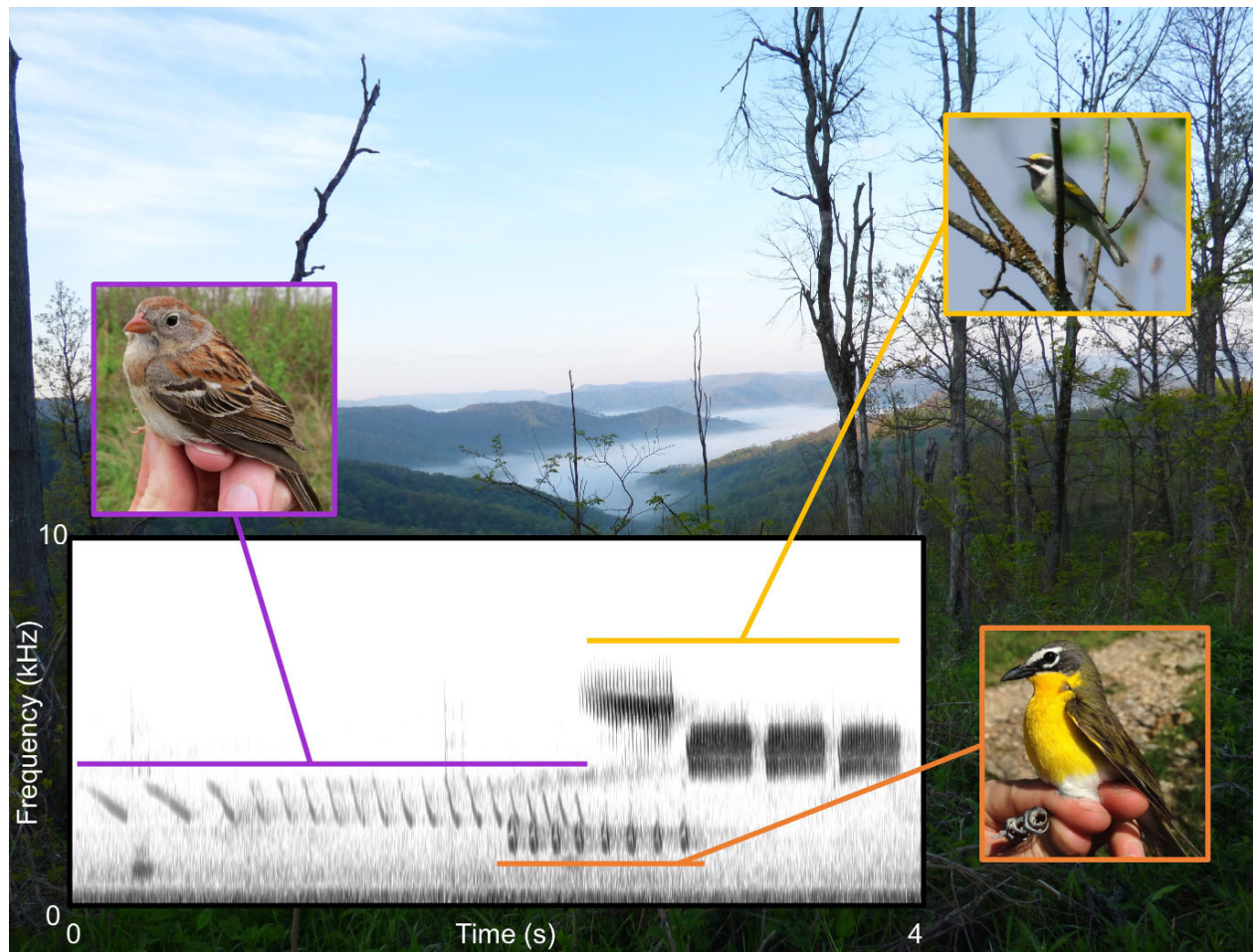


Photo 3. Sonogram of a recording from a study site on Ashlog Mountain in Campbell County, Tennessee, USA (background photo). Visible in the recording is the accelerating song of a Field Sparrow (*Spizella pusilla*; purple), the low chatter of a Yellow-breasted Chat (*Icteria virens*; orange), and the typical buzzy song of one of our focal species, the Golden-winged Warbler (yellow). Photo credit: Gunnar Kramer (background, Golden-winged Warbler, Yellow-breasted Chat) and Henry Streby (Field Sparrow).



Photo 4. We captured *Vermivora* warblers and attached colored leg bands to ensure we could confidently identify individuals in subsequent years. This photograph captures an adult male Golden-winged Warbler leaving its perch and flying toward a mist net where we were simulating a territorial intrusion by broadcasting a recording of the songs of a congener. Photo credit: Gunnar Kramer.

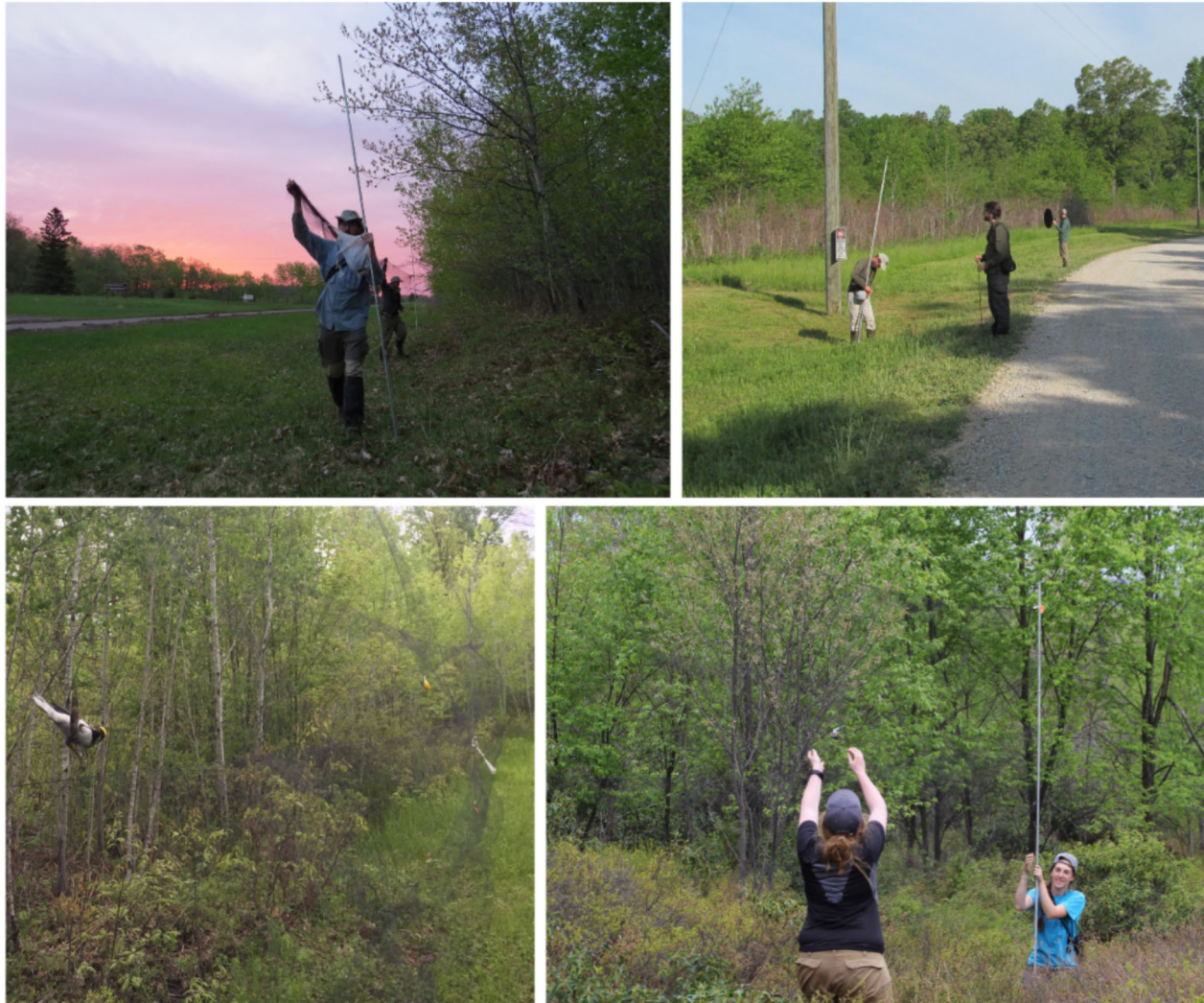


Photo 5. Researchers set up mist nets to capture *Vermivora* warblers at Rice Lake National Wildlife Refuge, Minnesota, USA (top left) and Fort Campbell, Tennessee, USA (top right). At sites with high densities of both Golden-winged Warblers and Blue-winged Warblers like Sandhill State Wildlife Area, Wisconsin, USA, capturing both species in the same net was common (bottom left). At other sites where densities were lower, capturing *Vermivora* warblers can be more difficult. In Pennsylvania, Cassandra Ziegler rushes to extract a recently captured Golden-winged Warbler from a mist net being supported in part, by Kate Maley (bottom right). Photo credit: Henry Streby (top left), R. Kyle Pagel (top right), Gunnar Kramer (bottom left, bottom right).

These photographs illustrate the article “Say what? Bivalent singing in *Vermivora* warblers” by Gunnar R. Kramer, R. Kyle Pagel, Kate Maley, Cassandra Ziegler, Sean M. Peterson, David E. Andersen, David A. Buehler, and Henry M. Streby published in *Ecology*. <https://doi.org/10.1002/ecy.2881>