Breeding flexibility helps migratory songbirds adjust to climate warming

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A Dartmouth-led study finds that the black-throated blue warbler, a common migratory songbird, has a natural flexibility in its breeding time that has helped stave off the impact of climate warming on its food availability, at least for now. Credit: Trisha Shears

Phenological mismatches, or a mistiming between creatures and the prey and plants they eat, is one of the biggest known impacts of climate change on ecological systems. But a Dartmouth-led study finds that one common migratory songbird has a natural flexibility in its breeding time that has helped stave off mismatches, at least for now.

The results suggest this flexibility provides a buffer against climate warming for the black-throated blue warbler in eastern North America and potentially for other migratory forest birds in temperate zones, but such resilience probably has limits.

The study appears in the journal *Oikos*. The research included scientists from Dartmouth College, Norwegian Institute of Nature Research, Smithsonian Conservation Biology Institute and Wellesley College.

"Understanding the effects of climate warming on ecological systems is critical for the conservation of forest bird species and their habitats," says lead author Nina Lany, who conducted the study as part of her doctoral degree at Dartmouth and is now a postdoctoral researcher at Michigan State University.

The researchers studied the causes and consequences of year-to-year variation over 25 years in the breeding time of the black-throated blue warbler in the Hubbard Brook Experimental Forest in the White Mountains of New Hampshire. They compared its breeding time and success to the timing of spring leaf-out and the availability of the leaf-feeding caterpillars eaten by birds. The timing of spring leaf-out varies by as much as a month from year to year in hardwood forests of the northeastern United States. This variability poses a challenge to migratory birds that migrate from the tropics and then time their breeding to maximize reproductive success.

The study's results show that black-throated blue warblers are remarkably adept in timing their nesting relative to spring leaf-out of trees. In years when leaf expansion is completed 10 days earlier than usual, the birds tend to lay their first egg about six days earlier than usual. The birds do not match the changes in spring leaf-out exactly. Rather, they shift by the amount needed to maximize their breeding success —on average, birds produced fewer offspring in years when they nested earlier or later than the typical adjustment. The arrival time of these migratory birds in spring isn't very sensitive to the timing of budburst (only 1.6 days earlier than usual when budburst is 10 days earlier). At present, even in the earliest springs, birds have been returning in time to start breeding at the optimal time, but this could change as springs come much earlier.

Phenological mismatches between birds and the insects they eat can threaten species in a warming

world. But in the temperate zone, ecosystems already have high natural variability in phenology and species that live there may be well adapted to this variability.

"Our studies documented flexibility in the timing of nesting by a migratory bird species that allows most breeding pairs to adjust the timing of nesting in spring to just the amount needed to maximize breeding success," says Lany. "Such flexibility, although clearly beneficial at present, might have limits that could be exceeded as warming continues."

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