

Study IDs key birds that host Lyme disease bacteria in California

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The Golden-Crowned Sparrow, one of the 53 species of birds tested in the UC Berkeley study and a common sight in suburban areas, was revealed to be an important host of the Lyme Disease-causing bacteria *Borrelia burgdorferi*.

Credit: Michael McCloy

Birds are more important than previously recognized as hosts for Lyme disease-causing bacteria in California, according to a study led by researchers at the University of California, Berkeley.

The findings, to be published Wednesday, Feb. 25, in the journal *PLOS ONE*, shine a light on an important new reservoir in the western United

States for the corkscrew-shaped bacterium, *Borrelia burgdorferi*, responsible for Lyme disease. Wood rats, western gray squirrels and other small mammals have been identified in previous studies as wildlife hosts of the Lyme disease spirochete bacterium in California, but fewer studies have looked at the role of birds as reservoirs.

"The role of birds in the maintenance of Lyme disease bacteria in California is poorly understood," said study lead author Erica Newman, a UC Berkeley Ph.D. student in the Energy and Resources Group and the Department of Environmental Science, Policy and Management. "This is the most extensive study of the role of birds in Lyme disease ecology in the western United States, and the first to consider the diversity of bird species, their behaviors and their habitats in identifying which birds are truly the most important as carriers."

Moreover, the birds in the study that were found to be important hosts of Lyme disease bacteria, such as American robins, dark-eyed juncos and golden-crowned sparrows, are coincidentally ones that are commonly found in suburban environments.

According to the Centers for Disease Control and Prevention, Lyme disease is the most commonly reported tick-borne illness in the United States. There are approximately 30,000 cases reported each year, with the large majority occurring in the eastern United States. However, because actual cases are often underreported to the CDC, the agency notes that the number of people in this country diagnosed with the disease every year may be 10 times higher.

Mobile birds could spread disease

Morgan Tingley, an ornithologist who was not part of this UC Berkeley-led study, underscored the significance of discovering which birds are carriers of Lyme disease bacteria. Tingley, now an assistant professor of

ecology and evolutionary biology at the University of Connecticut, conducted studies on range shifts in birds in response to climate change while he was a graduate student at UC Berkeley.

"Birds are much more capable of carrying diseases long distances than the small-mammal hosts typical of Lyme disease, and so may constitute an underappreciated component of Lyme disease ecology," said Tingley. "Particularly as we look to the future, birds may end up playing a larger role in disease ecology than other animals because of their ability to quickly and easily move long distances and to new habitats. In the same way that airplanes can help spread disease across nations, birds do the same thing for our ecosystems."

Lyme disease is spread to humans through the bite of infected ticks. The black-legged deer tick (*Ixodes scapularis*) transmits *B. burgdorferi* in the eastern and north-central regions of the United States, while the western black-legged tick (*Ixodes pacificus*) spreads the bacteria in the West.

The bird and tick samples in this new study came from 14 sites within the UC Hopland Research and Extension Center in northwestern California. The study included multiple natural habitats, ranging from savannas and grasslands to chaparral and dense woodlands.

Co-authors Lars Eisen and Rebecca Eisen, both UC Berkeley postdoctoral researchers at the time, took blood samples from 623 birds representing 53 species. The Eisens, both now at CDC's Division of Vector-Borne Diseases in Fort Collins, Colorado, also carefully removed and identified any ticks they found on the birds. They collected a total of 284 juvenile ticks - more than 99 percent were western black-legged ticks - consisting of 192 larvae and 92 nymphs.

Birds as Lyme disease reservoirs

Lyme disease spirochetes were detected in 57 of the 100 birds that carried ticks. Among the ticks themselves, 13 percent of the larvae and nearly 25 percent of the nymphs were infected with *B. burgdorferi* or related spirochetes.

Among the 23 species of birds that were infected, the study authors highlighted the lesser goldfinch, oak titmouse and dark-eyed junco as birds that harbored more subtypes of Lyme disease bacteria than others. In addition, the golden-crowned sparrow was infected more frequently than other species.

Previous studies that tested birds have identified the dark-eyed junco as a likely source of Lyme disease bacteria for ticks that feed on them.

Perhaps one of the most surprising results of this study is that "another species of Lyme disease spirochete closely related to, but distinct from, *Borrelia burgdorferi* was detected in birds for the first time anywhere in the world," said study co-author Robert Lane, a medical entomologist and UC Berkeley Professor of the Graduate School, and a leading expert on ticks and Lyme disease.

That spirochete, named *Borrelia bissetii*, has been known to cause a Lyme disease-like illness in people in central and southern Europe. Furthermore, this bacterium was the most common of the *Borrelia* species found in birds.

"The fact that we found this particular bacterium for the first time in birds in California is notable because of the ease with which birds can distribute spirochetes to different regions," said Lane. "It is worth watching to see if this spirochete expands in this state."

Tick-infested birds were found in all types of habitat studied, but the researchers unexpectedly found that chaparral correlated with the lowest

counts of larvae and nymphs on birds among the ecosystems studies.

"Other studies have shown that there are plenty of ticks in chaparral, but that was not translating to transmission of Lyme disease bacteria in birds," said Newman. "This is important because part of the fire management strategy in this state is to remove fire-prone chaparral. What this means for [birds](#) is that many species that only live in chaparral are then replaced by species from other habitats, some of which we also now know are more important carriers of Lyme disease bacteria. Our study suggests that by removing chaparral, we may be increasing the spread of Lyme disease in California."

More information: *PLOS ONE* [DOI: 10.1371/journal.pone.0118146](https://doi.org/10.1371/journal.pone.0118146)

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