Migratory patterns of eastern Golden Eagle population revealed

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Eastern Golden Eagles face threats such as habitat loss and wind energy development. Credit: D. Brandes

Eastern North America is home to a small population of Golden Eagles (*Aquila chrysaetos*), but despite their potential vulnerability to habitat

loss and other threats, little information has been available on the patterns of their annual migration. One big question is whether or not they exhibit "migratory connectivity," where individuals from the same breeding area also migrate to the same wintering area; strong connectivity means that a population is divided into small subpopulations that are especially vulnerable to environmental changes.

For a study forthcoming in *The Condor: Ornithological Applications*, authors David Nelson of the University of Maryland Center for Environmental Science, Todd Katzner of the U.S. Geological Survey (formerly West Virginia University), and colleagues traced individual eagles' movements through isotopes in their feathers to identify their breeding areas and to assess the population's migratory connectivity. They found that eastern Golden Eagles exhibit a moderate degree of what's known as "leapfrog migration": the birds that bred farthest north also spent the winter farthest south, "leapfrogging" over others in the middle.

Between 2006 and 2014, Nelson, Katzner, and their colleagues trapped 42 migrating and wintering eagles, outfitted them with GPS trackers, and collected feather samples from those same birds. Different geographic areas have different proportions of hydrogen isotopes in their water, and by analyzing the isotopes in the eagles' feathers, the researchers were able to match them to the areas where they were eating and drinking when their feathers formed and thereby determine their summer ranges. Data from the GPS units helped confirm that the conclusions they drew from feather isotopes were accurate.

The study's authors suspect that the leapfrog pattern they found could be due to a tradeoff between the favorability of southern breeding locations and the harshness of northern wintering locations. The pattern means that different groups of eagles are likely to be vulnerable to different threats—for example, eagles that summer in southern Canada also winter

primarily in the northeastern Appalachian Mountains, where increasing numbers of new wind energy facilities are being built.

"Golden Eagles are a priority species for conservation. In eastern North America their populations are small and poorly known, and we know that in other locations they can be negatively impacted by renewable energy development," says Katzner. "Although we previously knew that Golden Eagles in eastern North America breed in Canada and winter in the Appalachians, this study helps us to understand the relationships between summering and wintering habitat use and how management and habitat loss may impact eagles throughout their breeding range."

"Stable isotopes are a powerful tool for understanding patterns of animal migration," adds Nelson. "It's amazing to think about Golden Eagles performing leapfrog migration: northern breeders migrate through the breeding and winter areas of the southern breeders, whereas southern breeders don't usually even see the breeding or winter habitat of the northern breeders."

Brian Millsap, the National Raptor Coordinator for the U.S. Fish and Wildlife Service, welcomes new findings that will help inform future Golden Eagle conservation efforts. "Effective conservation of Golden Eagles requires that we know which regional populations are affected by various human activities in particular locations. Because Golden Eagles are so wide-ranging, individuals from many source populations can co-mingle in winter, making it virtually impossible to assign the effects of an activity like a wind energy development or a power line to the impacted source population," says Millsap, who was not involved in this study. "Methods such as the stable isotope assignment approach in this paper are extremely important because they give us a starting point for making these kinds of assignments, and pave the way for more effective and targeted management of Golden Eagle populations."

More information: "Stable hydrogen isotopes identify leapfrog migration, degree of connectivity, and summer distribution of Golden Eagles in eastern North America" will be available August 12, 2015 at www.aoucospubs.org/toc/cond/117/3

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