The Outside Story

Migration Takes Guts

By: Todd McLeish

As an avid birdwatcher for more than 30 years, I've long been familiar with the big picture of songbird migration. Tiny blackpoll warblers, for instance, fly 1,500 miles from southern New England to the Caribbean in a single two- or three-day flight across open water with nowhere to land if they get tired. The even tinier ruby-throated hummingbirds cross the Gulf of Mexico in a similar way. But until recently I haven't spent much time wondering how these little birds do it. Don't their flight muscles get tired? How do they replenish their energy reserves in the air?

The answers, according to University of Rhode Island ecologist Scott McWilliams, have everything to do with digestive physiology. Or, as McWilliams likes to say, "migration takes guts." Yes, strong flight muscles and an innate knowledge of what route to take are crucial, but it also takes a digestive system that is highly flexible and adaptable to different conditions and activities.

In preparation for migration, the gut size of many migratory songbirds, including white-throated sparrows, hermit thrushes and red-eyed vireos, expands significantly over several days through the production of new and larger cells. That makes it possible for the birds to dramatically increase their food intake so they can store up extra energy for their long flights.

But the digestive system is made up of the most metabolically demanding organs in the body. It uses large quantities of energy to operate. During migration, birds can shut down their digestive systems so the energy that would have been used to process food can be diverted to fuel flight. The downside is that the birds' guts can begin to atrophy during migration. When birds stop along their migratory route or reach their ultimate destination – a time when they are surely extremely hungry – they are constrained from feeding for a day or two until their digestive system becomes acclimated and can operate efficiently again.

This digestive on/off switch explains why migrants do not immediately gain weight when they pause or complete their migration, and it also provides insight into their dietary requirements. Rather than exclusively feeding on high energy (fatty) foods to sustain flight, birds must also consume proteins to help rebuild their digestive tract.

The adaptability of a bird's gut capacity may be a deciding factor in different species' ability to cope with climate change. In a laboratory experiment, McWilliams found that white-throated sparrows acclimated to a very cold

environment were able to eat two to four times as much food as sparrows acclimated to summer temperatures. The birds were able to accommodate the greater quantity of food they needed to eat to meet their energy needs in the cold and still digest it efficiently.

"That tells us something about their ability to flexibly respond to climate change," said McWilliams. "Plenty of birds migrate south because they have too limited a capacity to respond in this way. But white-throated sparrows have the spare capacity to modify their physiology to deal with substantial environmental change." He said the birds that live in places where temperatures don't change a great deal – like the tropics – have not had to evolve this physiological flexibility, so those species might have more difficulty adapting to changing conditions.

A gallery exhibit featuring Outside Story illustrations and articles is open through November 29 at the Montshire Museum in Norwich, VT. Todd McLeish is an author and natural history writer. His most recent book is entitled, Norwhals: Arctic Whales in a Melting World*. The illustration for this column was drawn by Adelaide Tyrol. The Outside Story is assigned and edited by Northern Woodlands magazine and sponsored by the Wellborn Ecology Fund of New Hampshire Charitable Foundation: wellborn@nhcf.org*

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