ScienceWatch – Timing is Everything

When you are a migrating bird the timing of your migration assumes critical importance. For example, American redstarts (*Setophaga ruticilla*) that can claim the high quality wintering sites in the Caribbean eat better all winter. This allows them to arrive at northern breeding grounds earlier and healthier. These early arrivals get choice nesting sites and can produce more clutches than their less robust brethren (see *ScienceWatch - When Habitat is Limited the Early Bird Gets It All*; March 1999).

Events like breeding, migrating and molting are energetically costly and birds often walk a delicate tightrope in trying to balance the energy drain from these activities. So it is not surprising that a team of avian ecologists headed by D. Ryan Norris at Queen's University, Ontario, Canada show that the timing of the fall molt is linked to the energy invested by birds during breeding. Writing in the December 24, 2004 issue of *Science* Norris *et al*. find that male redstarts that have larger broods and breed later into the summer, molt later in the fall, often during migration, than those with less reproductive success.

Before this study it was impossible to follow individual birds during their migration; however, the team broke new ground in the study of migratory birds. They took advantage of an earlier report showing that the amount of a hydrogen isotope, deuterium, in the environment varies systematically with latitude. More is present as one heads south. The isotope is stable so it enters the food web, and ends up in top consumers like birds. Once formed feathers are inert, and their levels of deuterium can be used to determine where along the birds' north-south range each bird molted.

To discover this the team captured male redstarts at their Ontario breeding grounds over successive years. Each bird was uniquely banded after removing the 3rd retrix tail feather and then monitored for breeding success. Twelve males were successful to varying degrees and nine failed to rear any fledglings. Each tail feather was analyzed for its deuterium content. The following season the new 3rd retrix was plucked from all 21 and analyzed for isotope levels to estimate the molting latitude in the prior year. The birds undergo a complete molt each year during late summer to early fall so tail feathers plucked at breeding sites were grown the year before.

The team found that the males most successful in breeding molted their tail feathers farther south along the migration path than those that failed to reproduce. In addition, the most successful males as measured by brood size and fledging date, molted farther south than the less successful males. Moreover, the tail feathers produced by the later molts contained less orange-red coloration, which results from carotenoid pigments and is an indicator of male robustness (see *ScienceWatch - If You've Got It, Flaunt It!* June 2003).

Thus male redstarts that have invested energy in breeding are unable to molt before migration, at a time when non-breeding males regularly molt. Late breeding males molt even later and farther south along their migration route. The simultaneous occurrence of these two energy-demanding activities causes at least one and maybe both to suffer. The

energy-drained males cannot lay down the pigments that healthy ones can and drabber birds may be less successful during the following breeding season. Whether or not such males fail to migrate successfully is unknown, since any males that failed to make it back were eliminated from the study.

What is clear is that Neotropical migrants like redstarts face severe pressures at both ends of their life cycle, and even in between. For example, redstart populations in the Adirondacks have plummeted 38 percent in the past 10 years and it is not enough just to protect their breeding grounds. The Caribbean lost about 10% of its mangrove forests in the 1980's and continues to lose about 1% per year. Do you see a connection here?