ScienceWatch – The Early Bird Misses the Late Worm

Birds around the world coincide their breeding time to match the local peak in food abundance. What happens if this reproductive period is out of sync with the population burst of the prey? What impact might global warming have on breeding dates? A research article published in the March 30, 2001 issue of *Science* indicates that it is crucial for insectivorous birds to breed when their insect prey reaches a maximum.

One of the authors, Jacques Blondel, an evolutionary ecologist at the Centre d´Écologie Fonctionelle et Évolutive in Montpellier, France, and his team, has been studying blue tits (*Parus caeruleus*) for several decades both in the Montpellier woods and in Corsica, an island 78 miles (125 kilometers) away. His earlier work showed that two genetically distinct populations of blue tits exist on Corsica. One breeds in woods dominated by deciduous oaks (*Quercus pubescens*), while the other breeds in woods dominated by evergreen oaks (*Q. ilex*). The growth of spring foliage, and the emergence of the leaf-eating caterpillars fed upon by the tits, occurs four weeks earlier in deciduous than in evergreen oaks. Not surprisingly, the timing of hatching of blue tits within each population is closely synchronized to the local peak in caterpillar availability and appears to result from a different photoperiod response by the birds. Thus, blue tits in the deciduous woods of Corsica breed four weeks earlier than those in the evergreen woods.

In contrast, birds on the mainland make up a single population, and although they typically nest in deciduous oaks, which dominate that landscape, some spill over from the deciduous oak forest into the evergreen patches. However, these birds continue to act as if they are breeding in the deciduous trees and they breed three weeks early relative to the local peak in caterpillar abundance.

How does this mismatch affect these mainland evergreen birds? Are they less successful than evergreen pairs breeding in sync in Corsica? Specifically, are the mainland birds less successful because they need to expend more energy to find food in the evergreen woods when it is less abundant? To get the answers Blondel teamed up with Donald Thomas, a physiological ecologist at the University of Sherbrooke in Quebec, Canada. They devised a test to measure the daily expenditure of breeding birds by injecting minute amounts of isotopically labeled (radioactive) water. (Common water is $^{1}H_{2}^{16}O$, while the labeled water is $^{2}H_{2}^{18}O$). After injection a small blood sample was taken to measure the ratios of labeled and unlabeled hydrogen and oxygen. Birds were recaptured 24 hours later and a second sample was taken for analysis. The extent to which the labeled water was diluted provided a measure of the metabolic activity of the birds. In this manner energy expended by the mismatched continental birds could be compared with those in Corsica that time their breeding to caterpillar abundance.

The results clearly showed that the continental birds were expending almost twice as much energy as the Corsican birds. Was this extra expenditure detrimental to survival and future reproductive success? Apparently yes. The decades worth of data collected by Blondel had already shown that the mismatched continental birds were less than half as likely to return to breed the following year. The lack of prey abundance forces parents

to increase foraging effort beyond their sustainable limit. Overworked and worn out they never make it back to breed again.

These results provide insight into the short-term effects of global warming. While politicians are still debating the possibility that our planet is warming up, most scientists have accepted it as fact. Although many birds have responded to global warming by advancing their breeding date, this study shows those that cannot will be in real trouble as our world heats up.

Saul Scheinbach