



ScienceWatch – You Go Your Way And I’ll Go My Way

For us to actually see the formation of a new species is worse than watching grass grow. It can take thousands of human lifetimes to see one species split into two. The key to speciation is **reproductive isolation**, which occurs when some

individuals mate amongst themselves and not with the rest of the group.

This usually occurs when a physical barrier (mountain range, island formation) arises to keep them separated long enough for each group to change in its own ways so that when (and if) they subsequently encounter each other they can no longer mate or if they do no offspring results.

Although speciation is difficult to observe while it is happening, scientists now have several instances where they can see it occurring. For example, two races of European corn borer (*Ostrinia nubilalis*), a pest (the “worm” you occasionally find in an ear of corn) in the US as well as Europe, are splitting into separate species. Although they look alike and may live in the same field, one continues to prefer corn, while the other eats hops and mugwort. Since they each make different sex attractants (pheromones) it appears that they no longer mate with each other.

The marine three-spined stickleback (*Gasterosteus aculeatus*) moved into landlocked freshwater lakes after the last ice age. Their descendents became isolated from each other and lost the spines they once used as body armor. In the open ocean long spines pointing downward helped avoid predation by other fish, but in lakes the major predator is the dragonfly larva, which attacks from below by grabbing the spines. So the fish have shed their spines. Researchers have documented that a mutation in just one gene, controlling development, caused this change. Today’s sticklebacks have evolved into dozens of spineless species scattered among freshwater lakes.

Another fish, the sockeye salmon (*Oncorhynchus nerka*) was introduced into Lake Washington in Washington State and then moved into the Cedar River, which feeds the lake. Over the last 50 years male salmon living and breeding in the river have become more slender so they can withstand the swift river current when they must turn sideways during courtship. Furthermore, river females have become larger so they can dig deeper nests to prevent their eggs from being swept away. DNA studies indicate that river fish have stopped breeding with lake fish and two separate salmon species are forming.

And now there is clear evidence that one bird species is becoming two due to different migration patterns. A study published in the October 21, 2005 issue of *Science* by a team of researchers headed by Stuart Bearhop, an animal ecologist at Queen’s University Belfast, UK, shows that the European blackcap (*Sylvia atricapilla*) is splitting into two separate breeding populations. The bird is a small warbler that ranges from the Cape Verde Islands off the coast of West Africa to northern Europe. It breeds primarily in Germany and Austria, and spends the winter in Iberia and North Africa. Since 50 years ago birders in Britain and Ireland have noticed



more and more blackcaps overwintering there instead of Iberia and North Africa.

Earlier studies begun in the 1990's by a member of the current team, ornithologist Peter Berthold, from the Max Planck Institute for Ornithology, Radolfzell, Germany, showed that blackcaps overwintering in the UK arrive at the breeding grounds about 10 days earlier than those overwintering in Iberia and North Africa. He postulated that the difference in arrival time would lead to two separately breeding populations and has been watching for it ever since.

The latest study sought to discover if the earlier arriving birds were mating primarily with each other or equally with those arriving later. The team took advantage of a technique that has been used in other studies of bird migration - see *ScienceWatch – Timing is Everything for Redstarts* (March 2005). It relies on the fact that the amount of a hydrogen isotope, deuterium, in rainfall 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. By measuring the deuterium levels in the tissue of a blackcap on the breeding grounds, one can determine whether it has spent the winter in Iberia or the UK.

During 2002 and 2003 team members measured the deuterium levels from claw clippings of blackcaps at wintering grounds in the UK and Iberia. Birds from the UK had deuterium levels significantly lower than those from Iberia, as expected. They also captured breeding pairs of blackcaps in Germany and Austria as soon as the mates established a territory, and measured deuterium levels to determine where each bird of the pair had spent the winter.

The results showed that the birds were not randomly mating. Instead, males from the UK were 2.5 times more likely to breed with females also from the UK. Since these birds are arriving earlier than those from the southern wintering grounds, they get the choicest territories and the females lay more eggs. This means the UK population should continue to increase and diverge from the Iberian population. Earlier work by Berthold also showed that divergence is likely to continue because when birds from the two populations mate, the resulting hybrids fly off in the direction of the Atlantic Ocean at migration time, making it unlikely they ever get to either wintering area.

The blackcap story tells us that changes in migration pattern can rapidly cause speciation in birds, something that has probably happened many times before and currently may be happening elsewhere. The Canada goose (*Branta canadensis*) was recently split into two species based on size and markings, and may be split yet again based on migration patterns. As for the blackcaps, they are well on their way to complete reproductive isolation, and the lack of hybrid survival should greatly speed up the speciation process. Currently, it is timing that prevents interbreeding, but just small changes in courtship behavior would prevent interbreeding even if the two blackcap populations once again mate at the same time. Start thinking of a name for the new species.

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