# Humans May Have Limiting Effect on the Origin of (New) Species

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Humans can threaten species with extinction in many ways, including overfishing, pollution and deforestation. Now a pair of studies points to a new danger to the world's biodiversity: humans may be blocking new species from evolving.

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With human interference, two types of sticklebacks, top, appear to be morphing into one. By contrast, large- and small-beak finches, middle, remain distinct in a remote, unsettled area of Santa Cruz, bottom, in the Galápagos.

New species evolve when old species split apart. Animals living on a peninsula might become cut off from the mainland by rising sea levels, for example.

They would adapt to life on the island and acquire mutations not shared by the rest of their species. If the sea level should drop and the animals could mix together again, the mutations might make it less likely that the two populations could interbreed. They would be on their way to becoming separate species.

A few places provide scientists with a good view of these forces at work. In western Canada, many lakes formed when the glaciers retreated at the end of the last ice age 11,000 years ago.

Fish invaded the lakes from the ocean and were cut off from their marine home. Some of those fish have evolved into new species.

The most striking of the invading fish are three-spine sticklebacks. They have followed the same evolutionary path in six lakes.

In each case, some of the sticklebacks evolved into slender, fast swimmers that hunt in the open water for small invertebrates. The others became bulky bottom feeders living in the shallows.

These pairs of species have split so recently that they can still produce viable offspring. But less than 1 percent of each new generation are hybrids. "There's never really any ambiguity," said Eric Taylor, who is a biologist at the University of British Columbia.

Dr. Taylor and his colleagues suspect that hybrids are rare because the fish prefer to mate with fish that look like themselves. Natural selection may favor that preference, because hybrid sticklebacks cannot hunt for food as well as their specialized parents.

In 1999, Dr. Taylor and other stickleback specialists paid a visit to one of the lakes, Enos, on Victoria Island. When they caught the sticklebacks, they found far more intermediate sticklebacks than had previously been reported.

"We said, 'Wow, they look a bit different,' " Dr. Taylor said.

He and his colleagues set out to test their impression. They began by taking measurements of 887 sticklebacks scientists had collected from Enos Lake from 1977 to 2002.

In the early years, the scientists found, almost all the sticklebacks had one of the two typical body shapes. But from 1994 to 1997 the groups blurred into one broad continuum. "You can see the two clouds coming together into a single mishmash," Dr. Taylor said.

Studies of the DNA of the sticklebacks produced a similar picture. In 1994, big and small sticklebacks could be distinguished by genetic markers. Since then, the markers have become mixed within the entire stickleback population.

"Speciation in reverse" is how Dr. Taylor describes what's happening in Enos Lake. As for what might be driving it, he could not say for sure. But he said he was very suspicious about introduction of the American signal crayfish into the lake shortly before the sticklebacks collapsed.

"Crayfish cause real problems wherever they're introduced," Dr. Taylor said. By disturbing the habitats of the sticklebacks, the crayfish may be driving them into more contact, leading to more interbreeding.

Another scientific team has found signs of a similar transformation on the Galápagos Islands. Instead of fish, the scientists have been studying Darwin's finches, named for Charles Darwin, who described them after his visit to the islands in 1835.

Studies of Darwin's finch DNA show that the birds descended from immigrants that arrived a few million years ago. Since then they have evolved into 14 species found nowhere else in the world.

Along the way, the beaks of Darwin's finches have evolved into a wide range of shapes and sizes, allowing them to feed on different food. The small ground finch has a delicate beak it uses to quickly eat small, soft seeds. The large ground finch uses its heavier beak to crush big, hard seeds. Between those extremes is the medium ground finch, which eats both kinds of seeds.

Some populations of the birds appear to be diverging much like the sticklebacks. On Santa Cruz Island, the birds tend to have either large or small beaks, which they use to specialize on large or small seeds.

Studies of their genes suggest that the two groups tend to mate with birds like themselves.

"If people just looked on this island, they would call these groups separate species," said Andrew Hendry of McGill University in Montreal.

Dr. Hendry noticed that the finches on a part of the island known as Academy Bay seemed to lack the striking difference in the size of their beaks. He and his colleagues measured the birds' beaks and compared them with measurements taken since 1964.

In a study of 1,775 birds, they confirmed their hunch. In the 1960's, medium ground finches in Academy Bay tended to have small or large beaks. But by 1999, the number of average-size beaks had increased significantly. "They're just one big mix,"

Dr. Hendry said.

The scientists then looked at medium ground finches from another site on Santa Cruz Island, El Garrapatero. There the birds split between large and small beaks much as they had once at Academy Bay.

The most important difference between the sites, the scientists said, was the presence of people. Academy Bay has a growing population, but El Garrapatero has remained unsettled.

Humans, Dr. Hendry contends, have made it easier for hybrids to survive. They grow plants and feed the birds rice. "Now an intermediate beak can do fine," Dr. Hendry said.

Ole Seehausen of the University of Bern in Switzerland called the research efforts excellent and said he thought the sticklebacks and finches represented just the tip of a biological iceberg. Much of the world's biodiversity may be made up of equally fragile young species, he added.

He and his colleagues studied lake whitefish, for example, and discovered that the species that emerged after the last ice age outnumbered older ones five to one. In short, most whitefish species are vulnerable to collapse. "You'll probably lose most of the species diversity," he said.

Dr. Hendry added, "If we want to recover biodiversity, we have to preserve these things that aren't that separate yet because they're on their way to becoming separate."