Study: Ecological effects of biodiversity loss underestimated

November 30 2010

Children aren't the only youngsters who are picky eaters: More than half of all species are believed to change their diets -- sometimes more than once -- between birth and adulthood. And a new study by ecologists at Rice University and the University of California, Santa Barbara, finds this pattern has major implications for the survival of threatened species and the stability of natural ecosystems.

With thousands of species facing Earth's sixth major mass extinction, there is little doubt that the planet's biodiversity is in rapid decline. But many questions remain about how natural ecosystems will respond to the lost diversity. The new study, published online this week in Ecology Letters, challenges one of the standard assumptions that ecologists have used for decades to analyze the effects of biodiversity loss on ecosystems. That assumption -- that all food resources used by a species are interchangeable among all members of the species -- fails to account for the fact that diets change as young animals develop into adults, said Rice ecologist Volker Rudolf, one of the study's co-authors. The findings by Rudolf and co-author Kevin Lafferty suggest that changing dietary needs within species have important implications for ecosystem health.

"If a species has three resources in an ecosystem, and we take away one, conventional wisdom suggests that that species should be fine," said Rudolf, assistant professor in ecology and evolutionary biology. "But if the missing resource is crucial for a particular developmental stage of the species, that just doesn't work. You can't take away all of the adults,

for example, or all of the larvae, and assume that the species will persist."

He said the new study was made possible by a wealth of information from recent datasets collected by Lafferty and colleagues at UC Santa Barbara. The datasets cover seven food webs --each representing the network of connections between dozens and, in some cases, hundreds of species in an ecosystem. Rudolf said Lafferty's food webs include data about specific resource requirements for particular developmental stages within species, in some instances for as many as 50 percent of the species in the ecosystem.

"With this data, we were able to estimate the percentage of resources that are actually shared among developmental stages," Rudolf said. "In addition, we were able to show how this affects the stability of natural ecosystems.

"We found that in most food webs, the individual stages of a species typically share less than 50 percent of their resources," he said. "And within certain subgroups, like metamorphic species, that number is sometimes less than 10 percent."

The researchers used the information to formulate computer models that simulated how the loss of species affects natural ecosystems. One important implication of the finding is that natural ecosystems are much less stable than previously assumed, and many at-risk species may face an even greater likelihood of becoming extinct than ecologists previously thought.

"Our results suggest that the increasing loss of biodiversity -- due to changing climate, habitat destruction and other causes -- will likely have much more devastating effects on natural communities and result in a greater number of species extinctions than previously believed," Rudolf

said.

Provided by Rice University