Research shows that environmental factors limit species diversity

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It's long been accepted by biologists that environmental factors cause the diversity -- or number -- of species to increase before eventually leveling off. Some recent work, however, has suggested that species diversity continues instead of entering into a state of equilibrium. But new research on lizards in the Caribbean not only supports the original theory that finite space, limited food supplies, and competition for resources all work together to achieve equilibrium; it builds on the theory by extending it over a much longer timespan.

The research was done by Daniel Rabosky of the University of California, Berkeley and Richard Glor of the University of Rochester who studied patterns of species accumulation of lizards over millions of years on the four Caribbean islands of Puerto Rico, Jamaica, Hispaniola, and Cuba. Their paper is being published December 21 in the journal, Proceedings of the National Academy of Sciences.

Glor and Rabosky focused on species diversity -- the number of distinct species of lizards -- not the number of individual lizards.

"Geographic size correlates to diversity," said Glor. "In general, the larger the area, the greater the number of species that can be supported. For example, there are 60 species of Anolis lizards on Cuba, but far fewer species on the much smaller islands of Jamaica and Puerto Rico." There are only 6 species on Jamaica and 10 on Puerto Rico.

Ecologists Robert MacArthur of Princeton University and E.O. Wilson

of Harvard University established the theory of island biogeography in the 1960s to explain the diversity and richness of species in restricted habitats, as well as the limits on the growth in number of species. Glor said the MacArthur-Wilson theory was developed for ecological time-scales, which encompass thousands of years, while his work with Rabosky extends the concepts over a million years. "MacArthur and Wilson recognized the macroevolutionary implications of their work," explained Glor, "but focused on ecological time-scales for simplicity."

Historically, biologists needed fossil records to study patterns of species diversification of lizards on the Caribbean islands. But advances in molecular methodology allowed Glor and Rabosky to use DNA sequences to reconstruct evolutionary trees that show the relationships between species.

The two scientists found that species diversification of lizards on the four islands reached a plateau millions of years ago and has essentially come to an end.

Glor said the extent and quality of the data used in the research allowed him and Rabosky to show that species diversification of lizards on the islands was not continuing and had indeed entered a state of equilibrium.

"When we look at other islands and continents that vary in species richness," said Glor, "we can't just consider rates of accumulation; we need to look at the plateau points."

Glor emphasizes that a state of equilibrium does not mean that the evolution of a species comes to an end. Lizards will continue to adapt to changes in their environment, but they are not expected to develop in a way that increases the number of species within a habitat.

Glor believes his work with Rabosky represents the "final word" on the

importance of limits on species diversity over the rate of speciation when explaining the species-area relationship in anole lizards.

Provided by University of Rochester