Huge hamsters and pint-sized porcupines thrive on islands

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From miniature elephants to monster mice, and even Hobbit-sized humans, size changes in island animals are well-known to science. Biologists have long believed that large animals evolving on islands tend to get smaller, while small animals tend to get bigger, a generalization they call "the island rule."

A new study by researchers at Duke University and the National Evolutionary Synthesis Center in Durham, NC puts that old idea to the test in island and mainland rodents.

"Some of the size changes observed in island animals are pretty dramatic," said Paul Durst, a doctoral student at Duke and the lead author of a study appearing in the April issue of the American Naturalist . The fossil remains of dwarf elephants found on the Mediterranean island of Cyprus, for example, suggest that they shrunk by more than 90 percent over evolutionary time. Island giants are impressive too -- an extinct group of West Indian rodents known as giant hutias are estimated to have weighed up to 440 pounds, or as much as an American black bear.

But some animals still prove a puzzle. "Large animals like elephants and deer have a pretty consistent pattern. They all tend to get small. But it's more complicated for other animals such as rodents," Durst said.

Over the years, a number of scientists have questioned the generality of the island rule, arguing that size trends on islands aren't as consistent as

originally thought. Researchers have proposed a number of hypotheses to explain why some island animals get big and others get small, but no single variable explains them all.

Size changes in island animals are likely determined by multiple factors, researchers say. Durst and co-author Louise Roth, a professor of biology and evolutionary anthropology at Duke, wanted to understand just what those factors are, and which ones are most important. So they focused their analyses on rodents, a group of animals for which the patterns are far from clear.

The researchers compiled data for 73 species of rodents on 55 islands across the world, ranging in size from the tiny 0.2 ounce Eurasian harvest mouse on the South Korean island of Cheju to the 45-pound North American beaver on Vancouver Island.

"Some rodent species get bigger on islands, and others get smaller," Durst explained. Coues' rice rat on the Mexican island of Cozumel, for example, has grown to more than twice the size of its mainland counterparts, whereas Finlayson's squirrel on the Thai island of Ko Lan has shrunk by half.

Using a method called classification tree analysis, Durst and Roth measured the importance of several factors, including natural history, habitat and interactions with other species. In addition to size, they looked to see whether something else about the species in question -- such as its diet -- might explain why some species of rodent get big and others get small. They also asked whether something about the island itself -- such as how big the island is, or how far from the mainland, or how many species call it home -- explains why some islands breed giants and others breed dwarfs.

Previous studies have tested some of these factors in isolation, but this

study is one of the first to measure the relative importance of multiple factors simultaneously.

The key factor in determining which rodents got bigger and which got smaller, they found, is original size on the mainland. Rodents above a cutoff size of 253 grams -- a group including beavers, groundhogs, squirrels and hamsters -- generally got smaller over time, whereas those that started out below 253 grams generally got bigger.

The original version of the island rule -- that small animals get big while big animals get small -- holds up within rodents. "Size is a good starting point," Durst said.

But size wasn't the only factor. Other features of the island itself, such as island area, precipitation and temperature also played minor roles. Figuring out why some factors are more important than others will take much more work, the researchers say. But the methods developed here could help scientists test additional factors in the future.

More information: Durst, P. and V.L. Roth (2012). "Classification tree methods provide a multifactorial approach to predicting insular body size evolution in rodents." *American Naturalist*. DOI: 10.1086/664611

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