Big-mouthed babies drove the evolution of giant island snakes

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Some tiger snake populations on Australian islands have evolved to be giants, nearly twice the size of their mainland counterparts. New research in the *American Naturalist* suggests that the need to have big-mouthed babies drove the evolution of these enormous elapids. Credit: Fabien Aubret

Some populations of tiger snakes stranded for thousands of years on tiny islands surrounding Australia have evolved to be giants, growing to nearly twice the size of their mainland cousins. Now, new research in *The American Naturalist* suggests that the enormity of these elapids was driven by the need to have big-mouthed babies.

Mainland tiger snakes, which generally max out at 35 inches (89 cm) long, patrol swampy areas in search of frogs, their dietary staple. When sea levels rose around 10,000 years ago, some tiger snakes found themselves marooned on islands that would become dry and frog-free.

With their favorite food gone, the island snakes "are now thriving on an altered diet consisting of skinks, rodents, and nesting oceanic bird chicks ," said study author Fabien Aubret of La Station d'Ecologie Experimentale du CNRS à Moulis.

Along with the dietary shift came dramatic changes in the snakes' adult body sizes. On some islands, the snakes shrank, becoming significantly smaller than mainland snakes. But other islands have produced giants, measuring 60 inches (1.5 meters) and weighing as much as three times more than mainland snakes.

Aubret hypothesized that the size of available prey on each island was driving the variation in body size. Snakes are gape-limited predators, meaning they swallow their prey whole and can only dine on animals they can wrap their mouths around. This gape limitation would be most pronounced in newborn snakes, when their mouths are at their smallest. Simply put, baby snakes born too small to partake of the local cuisine would have little chance to survive. Where prey animals are larger, selection would favor larger newborn snakes—with larger mouths. That head start in size at birth could be the reason for larger size in adulthood.

To test his idea, Aubret took field expeditions to 12 islands, collecting and measuring 597 adult snakes. He released the males and non-pregnant females, and brought 72 pregnant snakes back to the lab. After the snakes gave birth, he measured each of the 1,084 babies they produced. He then looked for correlations between snake size at birth and the size of prey animals available on each island. He also tested for correlations between birth size and adult size.

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"The results were unequivocal: snake body size at birth tightly matches the size of prey available on each island," Aubret said.

As predicted, where prey animals were bigger, newborn snakes were bigger and they grew up to be bigger adults. Where prey animals were smaller, newborn snakes followed suit, leading to smaller adults.

A New Dimension to the Island Rule?

Ecologists have long been interested in the peculiarities of island animals. Observations of pygmy elephants and giant rats led a biologist named J. Bristol Foster to propose what became known as the Island Rule. In general, Foster surmised, big animals on islands tend to get smaller than mainland counterparts because of limited access to food. Small animals tend to get larger because islands tend to have fewer predators. Since it was proposed in the 1960s, numerous exceptions to Foster's rule have been noted, and scientists now agree that the

ecological factors that influence island body size are far more complex than Foster had imagined.

Aubret's findings add yet another dimension.

"Mean adult body size has always been used as a traditional measure in the literature," he writes. "On the other hand, patterns of variation for body size at birth in island populations have received, to my knowledge, no attention at all."

Aubret's work shows that selection isn't necessarily acting on adult body size.

"This study confirms that adult size variations on islands may be a nonadaptive consequence of selection acting on birth size," he said. "Animals may become either giant or dwarf adults on islands for the simple fact that they were born either unusually large or small bodied."

More information: Fabien Aubret, "Body-Size Evolution on Islands: Are Adult Size Variations in Tiger Snakes a Nonadaptive Consequence of Selection on Birth Size?" The American Naturalist 179:6 (June 2012).

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