

Warm, dry El Nino weather puts baby sea turtle at risk

May 23 2012

When leatherback turtle hatchlings dig out of their nests buried in the sandy Playa Grande beach in northwest Costa Rica, they enter a world filled with dangers. This critically endangered species faces threats that include egg poaching and human fishing practices. Now, Drexel University researchers have found that the climate conditions at the nesting beach affect the early survival of turtle eggs and hatchlings. They predict, based on projections from multiple models, that egg and hatchling survival will drop by half in the next 100 years as a result of global climate change.

"Temperature and humidity inside the nest are significant factors affecting egg and hatchling survival," said Dr. James Spotila, the Betz Chair Professor of Environmental Science in Drexel's College of Arts and Sciences, and senior author of the study reported today in the journal *PLoS ONE*. Spotila and colleagues, including lead author Dr. Pilar Santidrian Tomillo of Drexel, therefore examined the relationship between regional climate patterns with leatherback turtles' nesting success over six consecutive nesting seasons at Playa Grande. This beach is the major nesting site for leatherback turtles in the eastern Pacific Ocean, containing more than 40 percent of nests.

"We have discovered a clear link between climate and survival of this endangered sea turtle population," said Spotila.

The turtles' hatching success and success emerging from the nest was significantly correlated with weather patterns associated with the El Niño

Southern Oscillation (ENSO). ENSO is an irregular pattern of periodic climate variation, shifting between "El Niño" periods with warmer sea surface temperature conditions in the eastern tropical Pacific, and "La Niña" conditions with cooler sea surface temperatures, with ENSO neutral conditions in between. The El Niño cycle is known to influence many ecological processes that vary from location to location.

The researchers found that warmer, dryer El Niño conditions were associated with significantly higher mortality for eggs and hatchlings. Using projections of global climate change due to global warming over the next 100 years, they predicted that El Niño conditions will become more frequent and hatchling success will decline throughout the 21st century at Playa Grande and other nesting beaches that experience similar effects.

As climate conditions change, leatherbacks nesting at Playa Grande cannot move to other beaches. Spotila noted that the beach characteristics and off-shore ocean currents move hatchlings to feeding grounds on a kind of "hatchling highway" that makes Playa Grande an optimal nesting location for leatherbacks that other beaches cannot replace. Spotila was senior author of a modeling study demonstrating this pattern, led by Dr. George Shillinger of Stanford University and published in the June 2012 issue of Proceedings of the Royal Society B.

Spotila has conducted research with nesting leatherback turtles at Las Baulas Park in Costa Rica, where Playa Grande is located, for 22 years. He recently joined the faculty of Drexel's new Department of Biodiversity, Earth and Environmental Science (BEES), formed as a result of the University's unique affiliation with the Academy of Natural Sciences, the oldest natural history museum in the U.S. and a world leader in biodiversity and environmental research.

"The focus on field research and experiential learning in the BEES

department will enable more research in environmental science in more places around the world," Spotila said. "As in our long-term leatherback studies, more research by Drexel and Academy students and scientists will contribute to a better understanding of what actions are needed to protect species and environments in critical danger."

Leatherback turtles, Spotila says, are in critical need of human help to survive. "Warming climate is killing eggs and hatchlings," Spotila said. "Action is needed, both to mitigate this effect and, ultimately, to reverse it to avoid extinction. We need to change fishing practices that kill turtles at sea, intervene to cool the beach to save the developing eggs and find a way to stop global warming. Otherwise, the leatherback and many other species will be lost."

More information: Santidria'n Tomillo P, Saba VS, Blanco GS, Stock CA, Paladino FV, et al. (2012) Climate Driven Egg and Hatchling Mortality Threatens Survival of Eastern Pacific Leatherback Turtles. *PLoS ONE* 7(5): e37602. [doi:10.1371/journal.pone.0037602](https://doi.org/10.1371/journal.pone.0037602)

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