Turtles may not be immune to old age, research suggests

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Fredric Janzen, left, and Anne Bronikowski, right, recently published a study showing that female painted turtles in the Mississippi River suffer a steep dip in fertility near the end of their lives. Credit: Christopher Gannon

Researchers at Iowa State University are rethinking the long-held

conventional wisdom that turtles don't suffer some of the ravages of old age.

Nearly 30 years of data collected on painted turtles in the Mississippi River near Clinton, Iowa, show that females suffer a steep dip in fertility before the end of their lives, a finding that flies in the face of what scientists have believed about turtles and aging. A team of ISU scientists recently published its findings in the *Proceedings of the National Academy of Sciences*, a peer-reviewed academic publication.

"Turtles are these icons of longevity," said Fredric Janzen, professor of ecology, evolution and organismal biology. "People assumed there was never a cost to reproduction right up to the end of life."

Janzen has led the efforts at the turtle study site near Clinton, and he's collected reams of data on the painted turtles there over the years. Every year in May and June, high school, undergraduate and graduate students led by Janzen set up camp near the site to study the turtles. The students measure the turtles, take blood samples and count the number of eggs laid by females. They also keep track of how many of those eggs hatch successfully.

Janzen found that the painted turtles enjoy a long period of relatively graceful aging, as the researchers expected. But that long plateau consistently ended with a steep drop in fertility near the end of the females' lifespans. The older females tended to lay larger eggs, which would normally improve the odds of successful offspring, but the data show just the opposite.

"This was a rare opportunity to look at the data and go, 'wow, that's weird.' It's one of those head-scratching moments," Janzen said.

Anne Bronikowski, a professor of ecology, evolution and organismal

biology, has studied senescence, or the way in which organisms deteriorate as they age, in multiple species, including humans. She also happens to be Janzen's wife, and the wealth of turtle data he'd gathered presented an attractive opportunity to run demographic analyses on adult survival rate senescence. But the results of that analysis came as a surprise.

"Similar to the finding that reproduction declines, we also found that survival rates decline as the turtles age but at rates slower than mammals – including humans and non-human primates," Bronikowski said. "Our next steps are to delve into the cellular mechanisms that afford turtles these lower mortality rates."

The researchers recently received a grant from the National Institutes of Health to study the cellular and genetic mechanisms that allow turtles to delay their reproductive aging and the onset of their age-related frailties, she said.

Female painted turtles reach maturity between 5 and 8 years old and can live to reach about 25 years old. The researchers said the turtle lifespan shares some similarities with humans, who also take years to mature and tend to have long lives. That means studying turtle senescence may have implications for human health and aging, Bronikowski said.

More information: Daniel A. Warner et al. Decades of field data reveal that turtles senesce in the wild, *Proceedings of the National Academy of Sciences* (2016). DOI: 10.1073/pnas.1600035113

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