

Female Sharks Can Reproduce Alone, Researchers Find

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A team of American and Irish researchers have discovered that some female sharks can reproduce without having sex, the first time that scientists have found the unusual capacity in such an ancient vertebrate species.

Their report that sharks can reproduce asexually through the process known as parthenogenesis is being published online today in the British journal *Biology Letters*. Researchers have observed parthenogenesis in certain species of birds, reptiles, amphibians and bony fishes, but the new finding suggests that vertebrates' ability to reproduce without sex evolved much earlier than scientists had thought.

Scientists began their investigation after a female hammerhead shark was mysteriously born at Omaha's Henry Doorly Zoo in December 2001, in a tank that held three adult, female hammerheads but no males. The seven-inch-long baby was killed within a day of its birth, apparently because another fish in the tank, probably a stingray, attacked it.



Photo credit: D. Chapman

Though the three females had been caught before they reached sexual maturity and held in captivity for more than three years, researchers initially thought one had stored sperm from a male shark before fertilizing an egg. But the team -- which included scientists at Nova Southeastern University in Florida, Queen's University Belfast and the zoo -- determined that the baby shark's genetic makeup perfectly matched one of the females in the tank, with no sign of a male parent.

Mahmood Shivji -- Nova Southeastern's Guy Harvey Research Institute director and one of the paper's authors -- said that he and his colleagues determined that a byproduct formed when sharks produce eggs, known as a sister polar body, had fused with an unfertilized egg to produce the baby shark, whose DNA had only half as much genetic variability as the mother.

"Yes, indeed this is a virgin birth," Shivji said in an interview, adding that this could help explain why other sharks have suddenly been born in captivity, like a bamboo shark that appeared in Detroit's Belle Isle Aquarium in 2002.

"We have now demonstrated that sharks are actually able to use an alternative, previously unknown reproductive pathway, which is parthenogenesis. The problem here is that this alternative reproductive pathway results in offspring that have much lower genetic diversity," he said.

The paper's lead author, Demian Chapman, who did the genetic analysis while pursuing his doctorate at Nova Southeastern and now directs the shark program at the Pew Institute for Ocean Science, said the reduced genetic variability might pose a problem over time if males become scarce under intense fishing pressure and females resort to asexual reproduction. This, in turn, would result in "genetically disadvantaged offspring," he said.

Still, Chapman added, the virgin birth does serve as a testament to sharks' resourcefulness. Mammals cannot reproduce asexually.

"It just goes to show, life will find a way," he said, adding that during his research in Belfast he bet several other scientists the answer to the Omaha shark mystery would turn out to be something other than parthenogenesis. "I lost so many pints of Guinness over that one," he said.