

Study: Female Sharks Fertilize Own Eggs

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DUBLIN, Ireland -- Female sharks can fertilize their own eggs and give birth without sperm from males, according to a new study of the asexual reproduction of a hammerhead in a U.S. zoo.

The joint Northern Ireland-U.S. research, being published Wednesday in the Royal Society's peer-reviewed Biology Letter journal, analyzed the DNA of a shark born in 2001 in the Henry Doorly Zoo in Omaha, Neb. The shark was born in a tank with three potential mothers, none of whom had contact with a male hammerhead for at least three years.

The baby was killed within hours of its birth by a stingray in the same tank. Analysis of its DNA found no trace of any chromosomal contribution from a male partner.

Shark experts said this was the first confirmed case in a shark of parthenogenesis, which is derived from Greek and means "virgin birth."

Asexual reproduction is common in some insect species, rarer in reptiles and fish, and has never been documented in mammals. The list of animals documented as capable of the feat has grown along with the numbers being raised in captivity -- but until now, sharks were not considered a likely candidate.

"The findings were really surprising because as far as anyone knew, all sharks reproduced only sexually by a male and female mating, requiring the embryo to get DNA from both parents for full development, just like in mammals," said marine biologist Paulo Prodohl of Queen's University of Belfast, Northern Ireland, a co-author of the report.

"As is typical with scientists, we doubted our own results and so we did it again, and then a third time using a new technique with new genetic approaches. This confirmed there was no DNA of any male," said Prodohl, an expert in fish genetics with specific knowledge of hammerhead DNA.

Before the study, many shark experts had presumed that the Nebraska birth involved a female shark's well-documented ability to store sperm for months. This seemed the most plausible scenario even though the sharks had arrived at the Nebraska zoo as immature pups.

The lack of any paternal DNA in the baby shark ruled out this possibility.

"This phenomenon has now been demonstrated in all major vertebrate groups except for mammals. Birds do it, reptiles do it, amphibians do it, fishes do it, and now sharks are known to do it," said Bob Hueter, director of the Center for Shark Research at the Mote Marine Laboratory in Sarasota, Fla., who was not involved in the project.

The report's other co-author, Mahmood Shivji of the Guy Harvey Research Institute in Dania Beach, Fla., said the finding explained growing numbers of anecdotal reports of male-free shark births in captivity.

Shivji said the research "may have solved a general mystery about shark reproduction," because it suggests that sharks can "switch from a sexual to a non-sexual mode of reproduction." But he said this was not necessarily a positive ability because baby sharks produced only by the mother suffer from reduced genetic diversity.

Genetic diversity makes living creatures better able to adapt to threats, such as disease and climate change.

Prodohl said if self-impregnation was occurring in the wild because female sharks cannot find male partners amid rapidly declining shark populations, it would represent "an evolutionary dead end that compromises the survival of the species."

He said he suspected this was "already a problem in the real world," and noted the population of blue sharks off the west coast of Ireland had fallen by 90 percent in the past 12 years.

But Hueter said he doubted it was happening anywhere besides in captivity. He also argued that the power to self-impregnate represents "an evolutionary strategy to keep the population and species going when all else fails. Genetically, it's a last resort tactic because it leads to genetic uniformity, and eventually that will catch up with the population and make it less fit.

"But as a short-term alternative to extinction, it has its benefits," he said.
