

Sharks can reproduce asexually

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As if sharks weren't scary enough, it seems they are capable of a feat out of a science fiction movie.

Females can reproduce without the normally essential step of engaging in sex.

Researchers, led by two scientists from Nova Southeastern University's Oceanographic Center in Dania Beach, used DNA testing to document the unusual phenomenon in a bonnethead shark born in an equally unusual place, Nebraska.

The sperm-free pregnancy, called parthenogenesis, amounts to an extraordinary "virgin birth." The peer-reviewed discovery, to be published today in the British journal "Biology Letters," rewrites the reproductive rules for the ocean's most feared and fascinating predators. It also solved a biological mystery that captivated shark experts:

How did a celibate shark living in a tank at the Henry Doorly Zoo in Omaha manage to produce a baby in 2001, when for years the only companions of its species were two other females? "Of course, when that shark was born in the zoo, everybody was scratching their heads about it," said Mahmood Shivji, a conservation biologist at Nova's Guy Harvey Research Institute. He co-authored the study with Demian Chapman, then a Nova Southeastern doctoral student, and researchers from Queen's University in Belfast, Northern Ireland, and the Omaha zoo.

The leading theory seemed to be that one bonnethead, a common species of hammerhead, might have mated in the wild and stored the sperm until it was old enough to conceive.

Sharks have been known to retain sperm for up to a year, but zoo director Lee Simmons said the three sharks had been captured in 1998 in Florida waters as mere pups themselves, weighing only a few pounds, and delivered to the zoo.

Crossbreeding with a male leopard shark in the same tank was another possibility, but Simmons once likened that to a ``Chihuahua impregnating a St. Bernard."

Researchers found the answer in tell-tale genetic markers called "micro-satellites," which are repeated sequences of DNA, Shivji said. They matched the mother with the pup shark -- but ``much to our surprise, found the baby had no parental DNA at all."

No father, no sex, no sperm.

"In the absence of males, this shark, we have proven genetically, was able to have her egg developed into a fully formed embryo," Shivji said. It was parthenogenesis, an unfertilized egg activated by a small, nearly similar cell that Chapman said ``is kind of acting like a sperm."

It's not an exact clone because the offspring, for reasons not understood, receives only about half its mother's genes.

University of Miami professor Samuel "Doc" Gruber, an internationally recognized shark expert, said the study confirmed what had been a "total surprise" to biologists. "Sharks have such complicated sexual systems," he said. ``They're kind of like mammals in a sense, especially this one."



This shark was born in 2001 in Omaha, Neb., in captivity to a mother that did not have sex.

When the pup was born, many scientists had suggested the possibility of asexual reproduction, but it was considered low on the list.

"I was betting against it myself," said Chapman, adding that it's most common in simpler, smaller species such as frogs and lizards but had never been documented in sharks studied for decades. The habits of bonnetheads are scrutinized by so many marine biologists that Chapman joked they're known as the ``lab rats of the shark world."

The baby bonnethead, about seven inches long, was born perfectly formed, Simmons said, but it died the same day -- likely from "a munch" by a stingray.

The following year in a Detroit aquarium, a white spotted bamboo shark that hadn't shared a tank with a male in six years produced two "virgin" offspring.

Because bamboo and bonnethead sharks are distantly related, researchers believe that other sharks, including large predators such as bulls and great whites, probably share such asexual ability.

While scientists said more research is needed, they suspect it would likely be more rare in the wild than with sharks isolated by captivity.

It could even be a trait retained only as what Chapman called "a fallback form of reproduction," a last-ditch breeding option for creatures that have survived for hundreds of millions of years. It also might add to troubles for shark populations decimated by commercial fishing, mainly to supply the Asian shark fin soup trade.

One other significant finding is that DNA from the bonnethead pup's carcass showed it suffered what Shivji called a genetic "double whammy." Not only did it lack genetic input from a father, but it lost half of the genes a mother would normally pass on.

In the long run, Chapman said, more asexual offspring could reduce the genetic diversity of sharks, weakening immune systems and introducing congenital defects.

"It's horrible inbreeding within one generation," said Chapman, now head of shark research at the Pew Institute for Ocean Science at UM.

Scientists can't say yet what might trigger such a birth in a species. None of the bonnetheads in Nebraska has reproduced since. But given the public appetite for shark yarns, he wouldn't be surprised if a sci-fi film takes a shot at exploring the phenomenon.

"Yeah, the attack of the clone sharks," he laughed.
