Study of shark virgin birth shows offspring can survive long term

January 25 2010

Shark pups born to virgin mothers can survive over the long-term, according to new research published Jan. 25, 2010 in the *Journal of Heredity*. The study shows for the first time that some virgin births can result in viable offspring.

Genetic analysis led by a Field Museum scientist working with numerous colleagues has confirmed the first known case of a virgin female shark producing multiple offspring that survived. Two daughters of the white-spotted bamboo shark are now more than five years old. Earlier research proved that reproduction occurred in two other shark species without aid of male sperm, a phenomenon called parthenogenesis, but the offspring did not survive in those cases.

Dr. Kevin Feldheim, manager of the Pritzker Laboratory for Molecular Systematics and Evolution at the Field Museum, analyzed the sharks' genetic material to rule out any paternal reproduction assistance.

"Examination of highly variable sections of the genome prove that these young sharks had no father," Feldheim said. "These findings are remarkable because they tell us that some female sharks can produce litters of offspring without ever having mated with a male.

"We compared several sections of the genome between two of the young sharks and their mother. It turned out that all the genetic material in each of the young ones came from the mother, proving there was no father."

Although the shark mother was kept in a tank at the Belle Isle Aquarium in Detroit where only another female of a different but related species resided, genetic testing was required to rule out the possibility that the female shark could have encountered male sperm earlier in her life.

A second analysis using more general techniques to examine more than a hundred additional regions of the genome was performed by Séan Fitzpatrick, Ph.D. Student, and Dr. Paulo Prodöhl, head of the Fish Genetics and Molecular Ecology Laboratory, of Queen's University in Belfast, to confirm Feldheim's finding.The analysis found that the young sharks didn't share all their mother's genetic material and aren't true clones of her, but more like "half-clones," said Feldheim.

Parthenogenesis occurs when an egg or ovum fuses with a cell called a sister polar body, a byproduct of ova production, rather than with male sperm, to promote cell division. The sister polar body is nearly genetically identical to the ovum, said Dr. Demian Chapman of the Institute for Ocean Conservation Science at Stony Brook University, co-author of the current study and lead author in earlier studies of virgin shark births.

Despite the lack of genetic diversity involved in omitting sperm from the process, "parthenogenesis may not be as much of a dead-end mode of reproduction as we thought for these sharks," Chapman said.

Douglas Sweet, who formerly worked at the Detroit aquarium, decided to incubate the bamboo shark eggs when he discovered an apparent virgin had produced them because of earlier experiences elsewhere that suggested virgin shark reproduction.

Sweet, now superintendent of the London State Fish Hatchery in London, Ohio, said that studies have confirmed asexual reproduction in sharks that bear offspring live and those that deposit eggs. This leads to

interesting genetic and conservation implications.

It could mean that a bamboo shark finding herself isolated on a small reef with no male in the vicinity could produce offspring in hopes that male suitors may eventually find their way to her daughters. "Sharks have been around for hundreds of millions of years," Sweet said. "I suspect they have some pretty interesting survival strategies that we are only now becoming aware of."

Provided by Stony Brook University