

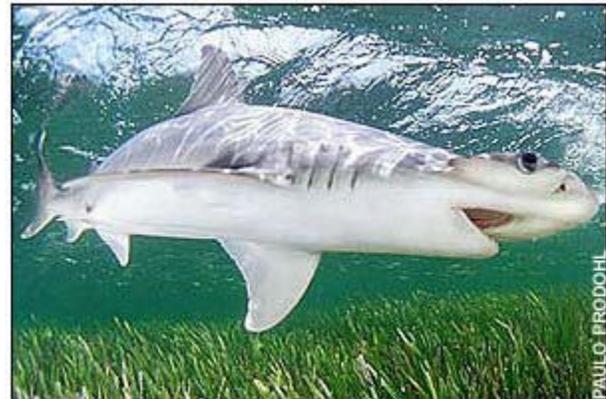
Shark's virgin birth stuns scientists

By Roger Highfield, Science Editor
Last Updated: 12:01am BST 23/05/2007

Birds do it. Bees do it. Now it seems that sharks are the latest, and largest, creatures that are able to reproduce without having sex, a finding that could have important implications for conserving these endangered fish.

A female hammerhead shark has given birth without the help of a male, after genetic tests revealed that its baby shark had no paternal DNA.

An international team reports that the shark's "virgin birth" was down to an unusual method of reproduction known as "parthenogenesis", where an egg starts to divide without being fertilised.



Shark populations are in decline worldwide

This is the first scientific report of male free asexual reproduction in sharks.

The study is reported in the journal *Biology Letters* by a team from the Queen's University Belfast, the Guy Harvey Research Institute at Nova Southeastern University, Florida and the Henry Doorly Zoo, Nebraska.

Head of the Queen's team, Dr Paulo Prodöhl, said: "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."

"The discovery that sharks can reproduce asexually by parthenogenesis now changes this paradigm, leaving mammals as the only major vertebrate (backboned creatures) group where this form of reproduction has not been seen."

Given shark populations are in decline worldwide, and that parthenogenesis probably occurs where female sharks have difficulty encountering suitable males, "it raises concerns about the long term viability of some shark species (especially those under extensive fishing pressure)" said Dr Prodöhl.

"Incorporating this new information into our management and conservation efforts will be imperative to prevent further declines in genetic diversity for an intensely, and many instances over exploited, group of fishes."

The gene tests were prompted by the unexpected birth of a baby hammerhead shark in an aquarium at the Henry Doorly Zoo in December 2001: none of the three candidate mother hammerheads in the tank, all of whom been caught in Florida waters as babies, had encountered any male hammerheads in captivity.

By using DNA profiling to examine the genetic makeup of the baby hammerhead and the three candidate mothers, the researchers were able to identify which of the three was the actual mother.

There was no DNA of male origin in the baby shark, which eliminated the possibilities of earlier mating with a male hammerhead followed by sperm storage.

Parthenogenesis is only very occasionally seen in some vertebrate groups such as birds, reptiles and

amphibians.

However, it has never before been seen in other major vertebrate lines such as mammals or sharks.

Co-author Dr Mahmood Shivji, said: "Our findings suggest that parthenogenesis is the likely explanation behind the anecdotal but increasing observations of other species of female sharks reproducing successfully in captivity despite not having contact with males.

"Unfortunately, this occurrence is not benign because it results in reduced genetic diversity in the offspring since there is no new genetic variation introduced from the paternal side."

The discovery raises concerns about the genetic and reproductive health of dwindling shark populations.

Coauthor Dr Demian Chapman said: "Not only does it experience reduced genetic diversity because it has no father, but around half of the genetic variation present in the mother is not passed on to the offspring.

"Female sharks might reproduce like this more often when they have difficulty finding mates at low population densities. This could hasten the erosion of population genetic diversity and perpetuate the production of genetically disadvantaged offspring."

From an evolutionary viewpoint (i.e. long term survival of populations and species), sexual reproduction is always better than asexual reproduction.

This is because sexual reproduction allows for increased genetic diversity which enables a population and ultimately the species to adapt/change/evolve to ever changing environmental pressures, from disease to climate change.

Scientists with the World Conservation Union, which publishes the Red Lists of Threatened Species, recently upgraded the "threat" category of several sharks.
