Shark Reproduction: and its role in Fisheries Management
OVERVIEW

Sharks have been evolving for over 400 million years into some of the most efficient predators this world has ever seen. There are over 200 species of sharks found throughout the globe. In this presentation we learn how sharks reproduce and see that this process cannot evolve fast enough to survive the pressures of commercial overfishing.
Modes of Reproduction

There are two major ways that sharks can give birth to their young known as pups.

I. Egg laying, or oviparous species.
II. Live birth or viviparous species.

All three modes require internal fertilization just like all mammals.

Here are two Caribbean reef sharks in a mating position.
Outline of Reproductive Systems

Males have modified their pelvic fins, which are located on the belly near the tail, into claspers (see below). Claspers are used to fertilize the female internally.

Females have no claspers, but between their pelvic fins is the cloaca (see above) where the clasper is inserted during copulation.
Outline of Reproductive System cont..

Here are some diagrams of the shark’s internal reproductive structures. On the left is the male’s, and on the right is the female’s. In both diagrams we see an immature system on the left and a mature system on the right.
Egg Laying, or Oviparous Species

Less than half of all sharks lay eggs. The egg cases of these sharks vary greatly in size and structure. On the left we see the Port Jackson Shark and its corkscrew shaped egg. This egg is wedged into the rocks along the shore by the mother after she lays it.
Live Bearing or Viviparous Species

There are two types of viviparity in sharks. The first type is very similar to that of humans, yet not commonly used. It is only seen in the requiem and hammerhead sharks. The shark gains nutrients from the mother through an umbilical cord that is attached to the mother’s womb. This is called placental viviparity.

Bonnethead embryo with umbilical cord.
Live Bearing or Viviparous Species cont..

The other type of viviparity occurs when the embryo feeds off of a yolk sac which is connected to it’s belly. This is also known as aplacental viviparity. Most sharks reproduce in this fashion, including Nurse sharks, Saw sharks, Great Whites, and Dogfish sharks.

Porbeagle embryo with yolk sac.
Ovoviviparity in Some Lamniformes

The order lamniformes includes sharks such as the Great White Shark, Sand Tiger Shark, Thresher Sharks and Mako Sharks. Within this order is a unique type of ovoviviparity. It can be broken down into two groups. Some of these sharks embryos use up their yolk sac and begin to feed on unfertilized eggs that the mother continues to produce. This is called oophagy.

The Sand Tiger shark, shown above, practices canabilism while still in the womb, this is called adelphophagy, and results in one large pup being born from each uterus.
Gestation, and Litter Sizes

Shark litter sizes cover a wide range, from two in sand tigers, to 135 in the blue shark. Typical gestation periods for sharks range from nine to twelve months. Some smaller species of sharks have gestation periods of only three to four months, while the spiny dogfish has gestation periods of two years. Here we see a blue shark with pups.
Maturation Rates

Bony fish mature very quickly and most reproduce at a young age. Sharks, however, take very long to reach sexual maturity. Some of the larger sharks may take as long as eighteen years to mature.

Once reproductive age has been reached, most egg laying species will reproduce every year. Some species that give birth to live young reproduce every other year.
How does this aid the Shark’s Survival?

Sharks have evolved in so many ways to help them survive throughout the ages. They can give birth to many small young to ensure that some will survive, or they can give birth to few large young that are not very susceptible to predation. All of the factors they employ ensure fertilization will take place, and their young will survive in nature. These same factors cause them to be easily overfished.
Sharks invest much of their time and energy into each pup, and this results in a low reproduction rate. The amount of young produced keeps up well with natural causes of death, but cannot compete with man.

The collapse of fisheries for species such as the porbeagle and thresher sharks shows us that these creatures cannot evolve fast enough to deal with severe commercial or recreational pressure.
What is being done?

Data on shark litter sizes, growth rates and reproductive data is complied by the National Marine Fisheries Service (NMFS), and turned into management plans. Only a few countries have plans such as these, Canada, South Africa, Australia, just to name a few. These plans set limits on how many sharks can be caught in a given year. Often these quotas must be updated since overfishing still occurs. Recently a bill was passed to end the finning of all sharks in US waters.

On the state level action is taking place to regulate recreational shark fishing. Most states, such as South Carolina, follow Federal guidelines on size and creel limits.
Conclusion

Through national management plans and local state size limits for recreational and commercial shark fishing, some of the pressure on these fragile shark stocks has been relieved. But sharks don’t live just in US waters. This is a worldwide problem that needs to be assessed by other countries. The plans that are in effect are not the only answer to these problems either. More research needs to be done, and other sources of food must be looked into, the oceans aren’t the answer to all of our problems.


Gilbert, P.W. *Patterns of Shark Reproduction*

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http://www.seaworld.org/Sharks/reproduction.html
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http://www.pbs.org/wgbh/nova/sharks/
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