

Man's Best Friend? Sharks



“To be great is to be misunderstood.” - R. W. Emerson

Sharks appeared 450 million years ago, 200 million years before dinosaurs and 50 million years before trees. During that immense time span the 500-plus known species of sharks evolved into a highly successful and

diverse group with extraordinary adaptations.

Greenland sharks (*Somniosus microcephalus*) live in the Arctic Ocean where water temperature is -2°C (28°F). They avoid freezing because their tissues contain an otherwise toxic chemical that acts like antifreeze. Whale sharks (*Rhincodon typus*) filter microscopic plankton and their filters never clog. Sharks and their relatives, rays and chimaeras, have a sixth sense unimaginable to us called electroreception. Electroreceptors in their head sense the electromagnetic field all creatures radiate and they use it to detect prey and mates.

Some sharks are warm-blooded, enabling them to be fast swimmers. The great white (*Carcharodon carcharias*), longfin mako (*Isurus paucus*) shortfin mako (*Isurus oxyrinchus*), and salmon shark (*Lamna ditropis*) attain speeds of 35 mph, 35 mph, 46 mph and 45 mph, respectively. Their warm-bloodedness stems from a remarkable circulatory system adaptation that conserves heat—the miraculous net. In sharks without it, blood warmed by swimming muscles quickly loses its heat when it moves through the gills which are in intimate contact with colder surrounding water. Warm-blooded sharks stay warm even during deep dives because the miraculous net acts like a heat exchanger, transferring heat from warmer to cooler blood that is returning to the body before it is lost in the gills.

Now a report in *Science*, May 12, 2023, finds that a shark lacking the miraculous net uses a simple behavioral solution to stay warm during deep dives. It holds its breath. This “behavioral thermoregulation” allows it to dive to 3,000 ft or more where water temperature can be 5°C (41°F) to reach food like deep sea squid without appreciable heat loss.



A team led by Mark Royer, University of Hawai'i at Mānoa, Kāne'ohe, HI, fitted scalloped hammerhead sharks (*Sphyrna lewini*) with sensors to measure muscle temperature, body orientation, surrounding water temperature and how deep the animals were swimming.

Seven sharks were recorded making 106 deep dives. Each dive took about an hour, but only about four minutes were spent at depth where the sharks were presumably feeding, as evidenced by increased muscular activity. During each dive core body temperature of 25°C (77°F) was maintained until the sharks began their ascent. Then it dropped slowly as they climbed, and

more rapidly as they approached the surface. Even though they experienced a 20°C (36°F) water temperature drop, core body temperature only dropped an average of 2.8°C (5.0°F).

These results indicate that the sharks hold their breath for about 17 minutes during the deepest and coldest part of the dive and begin breathing as they approach warmer, more oxygenated surface waters. That explanation is supported by video showing scalloped hammerheads swimming at 3,400 ft with gill slits closed.

“It was kind of like attaching a Fitbit to a shark said Royer. “It allowed me to get precise details on what the shark was doing. It was unexpected for sharks to hold their breath to hunt like a diving marine mammal. It is an extraordinary behavior from an incredible animal.”

Incredible animals we have demonized. Hysterical headlines aside, sharks kill an average of just ten people per year worldwide. Last year 57 people were bitten and five died. By comparison, hippos kill about ten per day, and our “best friend” kills an astonishing 30,000 people each year. Yet these attacks never get the same publicity.

Meanwhile, we are slaughtering sharks for their fins, cartilage, oil, meat and for sport. Incredibly, 100 million sharks are killed worldwide each year. Great white shark numbers are down 75%. Many others, like the scalloped hammerhead, are critically endangered from overfishing. In the U.S. only Hawai'i has banned shark fishing. Sharks are apex predators, keeping prey species at healthy levels. Imagine shooting all the lions, leopards and cheetahs in the Serengeti. Unchecked herbivores would create a desert. That imbalance is happening in the oceans right now.

So, who is more dangerous, sharks or us?

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