

Half-Century Sharks of Greenland

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At the turn of the 19th century, Thomas Jefferson was elected as the third President of the United States, the first steam train went down the railways, and Beethoven performed his Fifth Symphony. The world's population had just reached the one billion mark, but in the cold, dark waters of the North Atlantic, a Greenland shark had just reached a milestone of her own – her 150th birthday. At just over thirteen feet, she has reached sexual maturity. Several hundred years later and a few feet longer, the same shark is caught in a fishing net and dies. Mystery surrounds the life she lived under the surface, her exact age unknown, but Julius Nielsen is determined to get closer to solving the mystery of the enigmatic, elderly *Somniosus microcephalus*.

Typically, marine vertebrates' birthdays can be accurately determined through examination of small bones or, in other shark species, calcified tissues. However, the challenge Nielsen and his team of researchers face is that the massive Greenland shark – dwarfed only by the Great White as a carnivorous shark – is incredibly soft; attempts to use its cartilaginous vertebrae proved ineffective. Thus another technique was needed, and a creative solution was found – radiocarbon dating. While it's most commonly known as a method for determining the age of organic matter like fossils, Nielsen found a unique application of it for the Greenland sharks.

The eye lens of vertebrates contain crystalline proteins that form at birth, but then the cells never regenerate, remaining the same throughout essentially the rest of life. These proteins have been used to help date other marine mammals, like beluga and bowhead whales.

Using radiocarbon dating, researchers were able to categorize their sample of sharks into two groups: those with radiocarbon signals consistent with species born after the creation of the atomic bomb and those considered “pre-bomb.” This distinction and differing levels is considered part of the phenomenon called the “bomb pulse.” Nielsen's crew found that the sharks born after the bomb were all smaller than pre-bomb sharks, aging them around fifty years. Though the dating of the larger, older sharks was more difficult, it was determined the largest – around sixteen feet – were somewhere in the age range of nearly four hundred years old. Even with confidence varying more or less 120 years at each end, these findings confirm the Greenland shark to be the oldest living vertebrates, surpassing the previous record holder, the bowhead whale, found to live to just over two hundred years old.

Greenland sharks grow incredibly slowly, only about a centimeter per year, thus smaller sharks were found to be younger. Considering it is unlikely that they reach sexual maturity until they are about thirteen feet, passing the century milestone is merely a marker of adolescence for these nearly mystical arctic sharks. Though much is still left to learn to be able to better understand them, to Nielsen it is clear that conservation is necessary to ensure these centuries-old sharks can reproduce and continue to live to their record-holding fullest.

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