A shark mystery millions of years in the making

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The silhouette of a shark composed of fossil shark dermal denticles described in this study. Denticles are typically 200-500 μm in diameter and vary in morphology considerably between different species of shark. Credit: Leah D. Rubin

The biggest shark attack in history did not involve humans.

A new study by Earth scientists from Yale and the College of the

Atlantic has turned up a massive die-off of sharks roughly 19 million years ago. It came at a period in history when there were more than 10 times more sharks patrolling the world's oceans than there are today.

For now, researchers don't know the cause of the shark die-off.

"We happened upon this extinction almost by accident," said Elizabeth Sibert, a Hutchinson postdoctoral associate in Yale's Department of Earth and Planetary Sciences and the Yale Institute for Biospheric Studies. She is lead author of the new study, which appears in the journal *Science*.

"I study microfossil fish teeth and shark scales in deep-sea sediments, and we decided to generate an 85-million-year-long record of fish and shark abundance, just to get a sense of what the normal variability of that population looked like in the long term," Sibert said. "What we found, though, was this sudden drop-off in shark abundance around 19 million years ago, and we knew we had to investigate further."

How big was the drop-off? Sibert said more than 70% of the world's sharks died off—with an even higher death toll for sharks in the open ocean, rather than coastal waters. It was twice the level of extinction that sharks experienced during the Cretaceous-Paleogene mass extinction event 66 million years ago that wiped out three-quarters of the plant and animal species on Earth.

Adding to the mystery is the fact that there is no known climate calamity or ecosystem disruption that occurred at the time of the steep drop in shark populations. "This interval isn't known for any major changes in Earth's history," said Sibert, "yet it completely transformed the nature of what it means to be a predator living in the open ocean."

Co-author Leah Rubin, an incoming doctoral student at the State

University of New York College of Environmental Science and Forestry, was a student at the College of the Atlantic at the time of the research.

"The current state of declining shark populations is certainly cause for concern and this paper helps put these declines in the context of shark populations through the last 40 million years," Rubin said. "This context is a vital first step in understanding what repercussions may follow dramatic declines in these top marine predators in modern times."

The researchers noted that past discoveries of extinction events have led to waves of new research to learn the origins of the die-off and whether it signaled a larger, previously unknown, perturbance in global ecosystems.

For example, further research might confirm whether the shark-off caused remaining shark populations to change their habitat preferences to avoid the open ocean, Sibert and Rubin said. Additional research might also help to explain why shark populations did not rebound after the die-off 19 million years ago.

"This work could tip-off a race to understand this time period and its implications for not only the rise of modern ecosystems, but the causes of major collapses in shark diversity," said Pincelli Hull, an assistant professor of Earth and planetary science at Yale, who was not part of the study. "It represents a major change in ocean ecosystems at a time that was previously thought to be unremarkable."

More information: E.C. Sibert at Harvard University in Cambridge, MA el al., "An early Miocene extinction in pelagic sharks," *Science* (2021). science.sciencemag.org/cgi/doi … 1126/science.aaz3549

C. Pimiento at University of Zurich in Zurich, Switzerland el al., "When sharks nearly disappeared," *Science* (2021).

science.sciencemag.org/cgi/doi … 1126/science.abj2088

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