New study suggests shark declines can lead to changes in reef fish body shapes

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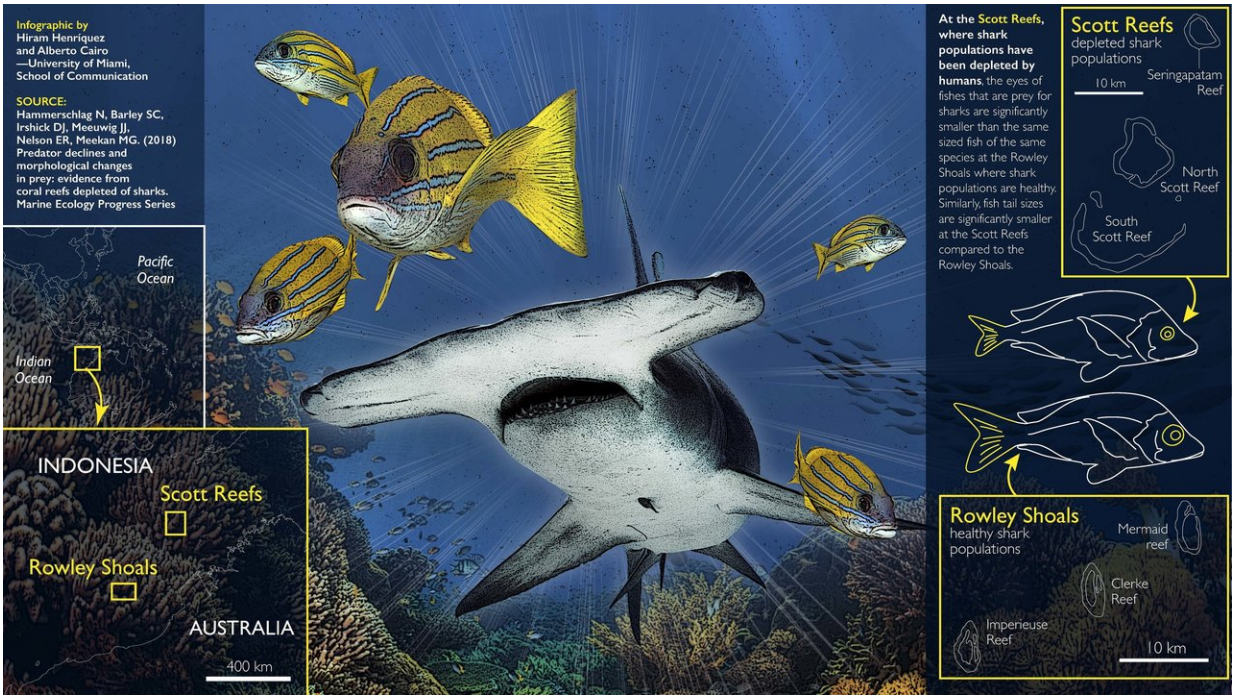

For these reef fish, eye size is critical for detecting sharks, especially under low-light conditions, and tail size is important for escaping sharks with burst speed. Credit: Hiram Henriquez

Scientists studying nearly identical coral reef systems off Australia discovered something unusual on the reefs subjected to nearly exclusive fishing of sharks—fish with significantly smaller eyes and tails. The study is the first field evidence of body shape changes in fish due to

human-driven shark declines from overfishing. These findings shed new light on the cascading effects the loss of the ocean's top predators is having on marine ecosystems.

The University of Miami (UM) Rosenstiel School of Marine and Atmospheric Science-led collaborative research team analyzed seven different fish species from two neighboring coral reef systems off the coast of northwestern Australia to uncover this unusual effect. The coral reef systems, known as the Rowley Shoals and the Scott Reefs, are each comprised of multiple atoll-like reefs, are nearly identical biologically and physically in all but one way— the coral reefs in Rowley Shoals are protected from fishing, while the coral reefs in the Scott Reefs have been subjected to nearly exclusive commercial shark fishing for centuries. Targeted shark fishing has intensified in the region in recent decades to fuel the demand of shark fin soup. As a result, shark populations have been decimated at the Scott Reefs, but remain healthy at the Rowley Shoals.

The research team collected 611 fish of seven species across multiple sites from different coral reefs within the Rowley Shoals and the Scott Reefs. They then took photographs of each fish and digitally analyzed photographs, measuring body length, body width, eye area and tail area of each fish.

The researchers found that at Scott Reefs, where shark populations have declined, the eyes of fishes that are normally prey for sharks were on average up to 46 percent smaller compared to the same sized fish of the same species on reefs at the Rowley Shoals where shark populations are healthy. The same pattern was true for fish tail sizes, with the overall size of fish tails being on average up to 40 percent smaller at the Scott Reefs compared to the Rowley Shoals.

"Eye size is critical for detecting predators, especially under low-light

conditions when many sharks usually hunt, and tail shape enables burst speed and rapid escape from sharks," said the study's lead author Neil Hammerschlag, a research assistant professor at the UM Rosenstiel School and UM Abess Center for Ecosystem Science and Policy. "Our results suggest that removals of sharks by humans have potentially caused a reduction in the size of fish body parts that are important for shark detection and evasion."

"These patterns were consistent across seven fish species that vary in behavior, diet and trophic-guild," said study coauthor Mark Meekan, a principal research scientist at the Australian Institute of Marine Science. "These results are particularly important since sharks are among the most threatened marine animals and the consequences of their global removals due to fishing is not well understood and has been a topic of significant speculation, debate and concern."

"The differences in fish body shapes we measured between the two coral reef systems could have consequences for energy flow throughout the ecosystem, ultimately impacting the food web," said study coauthor Shanta Barley, a postdoctoral fellow at the University of Western Australia.

"There is an urgent need to understand the potential cascading ecosystem consequences of shark declines, especially on coral reefs that we rely heavily on for tourism, food and recreation," said Hammerschlag.

More information: N Hammerschlag et al, Predator declines and morphological changes in prey: evidence from coral reefs depleted of sharks, *Marine Ecology Progress Series* (2017). DOI: 10.3354/meps12426

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