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Study links overfishing and human pressures to the absence of sharks on Caribbean reefs

Strong fishing regulations prevent the loss of sharks



Key West, Florida. 1940's. Monroe County Public Library

An article published in the August 2010 issue of the international scientific journal PLoS One reveals that human pressures in coastal zones have lead to the broad-scale absence of sharks on reefs in the greater-Caribbean. The full article is open-access and can be found at [plosone.org].

Shark populations have declined throughout the world's oceans

Sharks are major top predators in reef ecosystems and play an important role in the structuring of these unique communities. In recent decades, however, shark populations have declined dramatically throughout the world's oceans with increased fishing pressure. Says lead author Christine Ward-Paige from Dalhousie University in Canada: "Shark populations have declined drastically in the Caribbean Sea, and today only occur in regions with low human population, strong fishing regulations or large and enforced marine protected areas. Our study provides information on the health of local ecosystems and the relative success of management effort."



Figure 1. Large-scale absence of sharks on reefs.

Sharks still occur on reefs in areas with strong fishing regulations and marine conservation – albeit at a fraction of their original abundance. These maps of the greater-Caribbean show: A) All shark species combined, B) All sharks excluding the most common and rarely fished nurse shark. Coloured points represent number of dives where sharks were seen – red indicates high abundance and grey indicates that no sharks were observed in that region.

Human Population Stressors

Sharks on reefs can be particularly vulnerable to the pressures of growing human populations. Sharks are susceptible to even mild levels of fishing pressure, given their late age of maturity, slow growth, and slow reproductive rate. In the greater-Caribbean, there has been a long and ongoing history of the exploitation of sharks, which accelerated during the 20th century, when reef sharks were targeted intensively for their liver, skins, meat and fins. Excessive harvesting of juveniles in recent years likely has exacerbated the effects of decades of fishing. Beyond direct exploitation, human settlements can lead to shark habitat degradation and destruction. Similarly, overfishing of reef fish, which is related to human population density, may reduce the prey population available to sharks.



Figure 2. Sharks only occur in areas with small human populations. Shown here are sighting frequencies of A) All sharks, B) All sharks excluding nurse sharks and C) Nurse sharks only.

Despite a long history of exploitation, the status of sharks on coral reefs remains largely unassessed. The authors of this study set out to explore the distribution and sighting frequency of sharks on reefs in the greater-Caribbean and the possible role of human pressures such as fishing mortality on observed patterns. They used a unique and non-destructive dataset composed of scuba diver observations from the greater-Caribbean. Overall, they analyzed 76,340 underwater surveys carried out by trained volunteer divers between 1993 and 2008. The study team documented that today's sharks occur only at a small fraction of their original distribution and abundance. Reviews of historical narratives, however, indicate that sharks have been extremely abundant and were "expected anywhere at anytime". The current absence of sharks was strongly correlated with human population density. Sharks only occur where human population approaches zero, or where strong fishing regulations (such as bans on indiscriminate longline and gillnet fishing in the Bahamas, and the enforcement over decades of large marine protected areas in Florida) are in effect. To further explore the causes of decline, the researchers used shark fertility characteristics and fishing pressure to show decli

that current fishing mortality is unsustainable; in fact, pristine populations would decline to less than 1% of their original population in less than 30 years under current fishing pressure.

One goal of the analysis was to utilize a non-destructive and cost-efficient source of data to resolve the population status of sharks in the reef environment. To date, most of the data existing on shark populations in the Caribbean comes from fisheries data in offshore waters. As well, because this source of data is extractive and kills the sharks in the process of sampling, these methods are not useful for assessing population status where protection measures such as marine protected areas are in place. Divers also provide the added benefit of sampling across fishing gradients and allow for the assessment of the success of different management regimes.

The findings contribute to a growing body of scientific evidence indicating that global shark populations are in a state of decline and that many may be at risk of extinction. Says co-author Camilo Mora from Dalhousie University: "Our study suggests that exploitation alone could explain the large-scale absence of sharks in the Caribbean. However, this pattern is likely to be worsened by additional human stressors, such as pollution and habitat degradation."

"Urgent conservation measures are needed to protect the sharks that still exist in the greater-Caribbean, such as those in the Bahamas and Florida, to ensure the capacity to rebuild populations in the future" says co-author Heike Lotze, also from Dalhousie University.

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