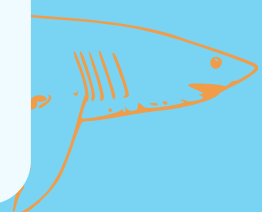
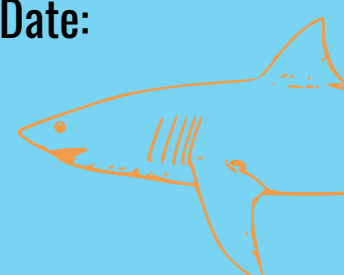




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# First insights into the population characteristics and seasonal occurrence of the great hammerhead shark, *Sphyrna mokarran* (Rüppell, 1837) in the Western Tuamotu archipelago, French Polynesia



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## Abstract

The occurrence and seasonality of the Critically Endangered great hammerhead shark, *Sphyrna mokarran*, is data deficient in the Central Pacific region. Using photo-identification and laser-photogrammetry, we describe the seasonal population of great hammerhead sharks in the Tiputa pass (Rangiroa atoll) and Tuheiava pass (Tikehau atoll) in the Tuamotu archipelago of French Polynesia. During the austral summer of 2020 and 2021, we recorded a female-biased aggregation of at least 55 individuals (54 females; 1 unknown sex), representing an unprecedented number of *S. mokarran* in one study. All measured sharks were likely mature with pre-caudal lengths ranging from 147 cm to 297 cm ( $n = 35$ ). Videos from citizen scientists recorded over a 15-year period enable us to identify 30 additional individuals between 2006 and 2019, with strong evidence of sexual segregation during the year. Our findings revealed seasonal residency ( $n = 32$ ) of up to 6 days/month and for up to 5 months at the study site during the austral summer. We also demonstrated site fidelity with 32 individuals returning to the same atoll for up to 12 years between the first and last sighting, and with limited evidence of connectivity between the two sites. Our analysis also provides preliminary insight into the environmental factors driving *S. mokarran* aggregation in the Tiputa pass, suggesting a marked influence of the lunar cycle and of ocellated eagle rays (*Aetobatus ocellatus*) abundance. This study, conducted in situ with non-invasive methods offers a unique opportunity to study a great hammerhead shark population in a near-pristine ecosystem and provides important life-history elements for the Central Pacific region.

## Cite this article:

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Photo Credit: Jillian Morris

## Summary

Great hammerhead sharks are an apex predator found in tropical or temperate latitudes. They are highly mobile and migratory, and especially vulnerable to the effects of commercial and recreational fisheries. They are considered a K- selected species, meaning they mature later in their lives, have low fecundity (produce few offspring), grow slowly, and have a long gestation period. They also face challenges with high levels of post-release stress, and even mortality. This combination of factors makes them susceptible to fishing threats, and has resulted in population decline and them being deemed as critically endangered.

In the Central Pacific Ocean, sharks generally endure less fishing pressure and there are more protected species, however there is a lack of data regarding the great hammerhead sharks' occurrence and seasonality in the area. French Polynesia, specifically, has one of the highest shark abundances in the world, which provides economic value to the area in the form of diving opportunities. A non-governmental organization, called the Mokarran Protection Society has taken advantage of diving opportunities and prompted citizen science surveys to collect data to inform conservation and management decisions. Over a 15- year period, videos recorded by citizen scientists have allowed scientists to identify 30 individual great hammerhead sharks between 2006 and 2019, with strong evidence of female sharks gathering at certain times during the year. By combining that data with photo-identification and laser-photogrammetry studies, these scientists were aiming to find out where these sharks spend their time and at what parts of the year they are there.

These surveys were conducted at two different sites- Tiputa pass (Rangiroa atoll) and Tuheiava pass (Tikehau atoll). These sites were found to be seasonally important during the austral summer (mid- Nov- mid- May), with mostly identified females residing in the area. Not only were these female great hammerhead sharks aggregating at these sites and remain in the area, they would return year after year to the sites. The demonstrated seasonal residency and site fidelity of these female great hammerhead sharks implies the importance of the site in relation to their life history needs. There is a proven link between the timeframe the sharks reside at the sites with the water temperature and their intended prey abundance in the area.

This study demonstrates great hammerhead shark behavior and habitat utilization in a pristine environment with a non-invasive study method. The results highlight the importance of these atolls for the conservation of great hammerhead sharks, during the time-frame in which they occur in high numbers.



# Check Your Understanding

Why is it important for the local community to be involved in the collection of data that informs conservation and management?

What are the benefits of using a noninvasive research method in studying different shark species?

Why would male and female sharks use this space differently at different times of the year?

**Did you know....**  
Males were primarily sighted from August to October and females during the austral summer months from November to May.

## Glossary of Key Terms

**Austral summer-** “Traditionally in the Polynesian culture, the austral summer is called Matariki (from mid-November to mid-May) and represents a season of abundance (Henry, 1951) during which the reproduction of many reef and lagoon fishes occurs (Sissons, 2014).” (Boube et al, 2023).

**Site fidelity-** An animal's tendency to return to a previously occupied place

**Seasonal residency-** Individual’s preference for an area where it decides to stay over a specified and usually extended period, which is mostly occupied uninterruptedly

**In situ-** In place or position; situated in the original, natural, or existing place or position