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Great white shark study

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The ferocious great white sharks of Northern California spend their time devouring sea lions, traveling, mating and, occasionally, touring San Francisco Bay, but they never socialize with sharks from other regions, according to a Stanford University-led study released Tuesday.

The magnificent predators, which have for years struck fear in Bay Area surfers, abalone divers and swimmers, have been isolated from other white shark populations for so long that they are genetically unique to the world, the researchers concluded.

The scientists tracked the snaggle-toothed predators between 2000 and 2008 from the Bay Area to San Diego, Hawaii and back as the sharks followed a route that was carried out with surprising precision and under a strict time frame.

The sharks lived in the deep ocean near Hawaii between January and July and in Northern California between August and December.

Surprisingly, the researchers found, the great beasts occasionally strayed from their Northern California feeding grounds for jaunts under the Golden Gate Bridge into San Francisco Bay, apparently in search of snacks.

The study, the largest and most detailed analysis of the great white sharks of North America, was published today in the scientific journal *Proceedings of the Royal Society B*.

"What we see on our acoustic monitoring devices is that the sharks stay pretty close to pinnipeds," said Barbara Block, a professor of Marine Sciences at Stanford's Hopkins Marine Station and a co-author of the paper. "It gives me more confidence knowing where the white sharks are going to be."



A great white swims off the Farallon Islands, one of the Northern California spots where the sharks are found.

Photo: Courtesy Stanford University



Researchers tagged 179 great whites along the coast, including near the Farallon Islands.

Photo: Courtesy Susie Anderson

The study was conducted by scientists from Stanford, UC Davis, the Point Reyes Bird Observatory and the Pelagic Shark Research Foundation. The researchers used a decoy to lure the sharks to their boat, where they took tissue samples and used a dart attached to a pole to affix satellite and acoustic monitoring devices to 179 great whites along the coast.

Wide range of sharks

The sharks, tagged around the Farallon Islands, Año Nuevo Island, Point Reyes and Tomales Point, ranged from adolescent to fully grown sharks weighing 4,000 pounds. Acoustic listening receivers were placed at dozens of locations across the ocean floor at known shark hot spots. Whenever a tagged shark came within 850 feet of a receiver,

a code for that particular shark would be transmitted.

The tags revealed that although they are loners, the sharks all follow pretty much the same route and hang out in the same places. After feasting in Northern California, they hit the waters around Hawaii and take a yearly respite in a mysteriously alluring mid-ocean spot that researchers are calling the "white shark cafe."

What they do in the shark cafe, which is halfway between the Baja Peninsula and the Hawaiian Islands, is a mystery, but sex is believed to play a part.

"What we know," said Salvador Jorgensen, a postdoctoral fellow at the Hopkins Marine Station who co-authored the study, "is that all of them leave the coast in the winter and all of them end up either in the cafe or offshore in Hawaii."

Jorgensen believes the pattern of migration has been so consistent over thousands of years that white sharks in the northeastern Pacific Ocean have become a genetically distinct species.

The DNA samples showed that local white sharks descended from a relatively small number of sharks in the South Pacific between Australia and New Zealand in the late Pleistocene era, some 200,000 years ago, but have not mixed with other populations since then.

Great white sharks, known scientifically as *Carcharodon carcharias*, can reach lengths of 20 feet and weigh 3 tons. They live worldwide in cool, coastal waters and have a well-developed sense of smell and eyesight. They have an innate ability to sense changes in water pressure and electrical pulses, which helps them find prey.

When in Northern California, they feed on seals and sea lions. The area they roam has been known for years as the red triangle, a scary-sounding name that many marine biologists shun because it seems to bolster the notion that great whites are killing machines like the beast in the movie "Jaws."

The scientists hope this study will shed more light on these fierce yet sophisticated hunters and their important role in the ecosystem. The fact that they are genetically isolated from other white sharks makes them all the more vulnerable, researchers said.

They visit the bay

Still, it can't be comforting for swimmers at Aquatic Park to know that the acoustic tags recorded five great whites inside the entrance to San Francisco Bay in 2007 and 2008. The researchers don't know what the sharks did or how long they stayed, but it does suggest to swimmers that flopping around in the water between August and December might not be a good idea.

"Think about it like this: We've got this great big ocean and these are some of our best-known predators and yet we hardly knew anything about where they went or their movements until now," Block said. "This research can lead to decreased interactions with sharks and help us ensure their protection for future generations."

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Please note, more images and a video clip are available online at:
<http://sfgate.com/cgi-bin/article.cgi?f=/c/a/2009/11/04/MN751AE8D7.DTL>

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