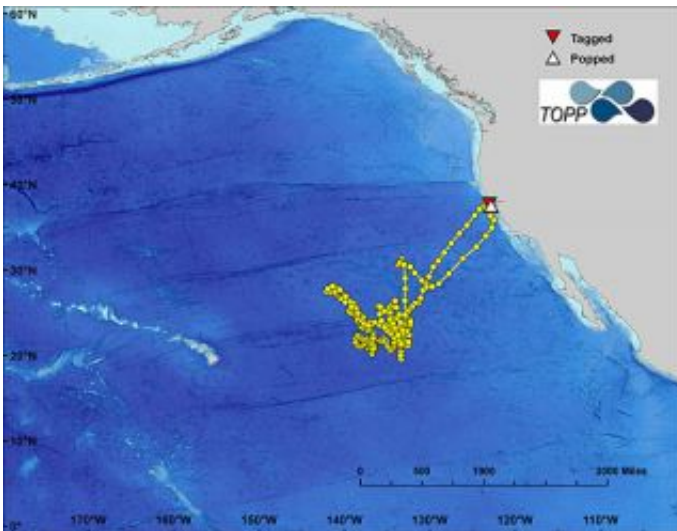


# Electronic tracking system allows scientists to tail white sharks more effectively

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This graphic shows the route of a single tagged white shark as it swam from the Farallon Islands, off the central coast of California, to the mid-oceanic area known as the “White Shark Café” and then back. Credit: Stanford University

It's hard to study a creature when you only catch fleeting glimpses of it. Up until recently, that was one of the big stumbling blocks for marine biologists and ecologists, but advances in electronic tracking technology have allowed them to peer farther across, and deeper under, the surface of the oceans than ever before.

Satellite tracking systems and acoustic sensors are giving researchers insights into the behavior and lifestyles of some very elusive animals in

the ocean, including the fabled white shark.

Researchers from several institutions, including Stanford University, have joined their efforts in a Census of Marine Life project called Tagging of Pacific Predators (TOPP). Since the project began in 1999, they have attached more than 3,000 tags to sharks, seals, whales, tunas, squids, turtles, albatross and more. For the first time, these TOPP researchers are getting a glimpse of a pelagic ecosystem from the California Current to the North Pacific at daily, seasonal and yearly time scales.

Along with the white shark, the TOPP researchers also have been studying the routes and habits of two cousins of the white shark: the salmon shark, whose range extends from the glaciers of Alaska down to Baja California, where it crosses over the white sharks' territory along the continental coast, and the mako shark, which resides along the continental shelf off California. The team also has tagged thresher sharks and blue sharks.

Sharks are a vital part of oceanic ecosystems. As the top predators in the food chain, they regulate the populations of the species below them. If shark populations get in trouble, it can trigger a cascading effect all the way down the food chain. The TOPP team has used several distinct tag technologies to get a simultaneous view of how these sharks divide up the ocean turf.

Salvador Jorgensen, a postdoctoral researcher at Stanford University's Hopkins Marine Station and the Monterey Bay Aquarium, is part of the group that has been tagging and monitoring white sharks, more popularly known as great white sharks.

Jorgensen discussed the team's work Sunday, Feb. 17, at the American Association for the Advancement of Science (AAAS) annual meeting in

Boston.

What they have found has opened up a whole new vista in the white shark's world. It turns out white sharks are quite the sightseers.

Jorgensen and his colleagues have tagged more than 100 white sharks along the central California coast. Home to numerous seal and sea lion rookeries, the area along the continental shelf is practically one long lunch counter for the white sharks. But in spite of the fine dining available there, the sharks exhibit an urge to roam.

Through tracking the tagged sharks, the TOPP team has found two distant destinations that the sharks favor, both of which they visit on a regular, annual travel timetable. Each winter the white sharks head out from the California coast, with some going to the Hawaiian Islands. Most, however, head to another hotspot, out in the middle of the Pacific Ocean. This second location is roughly 1,300 miles from the mainland—about half the distance to Hawaii—and a few hundred miles to the south of the direct route to the islands. Dubbed "the white shark café" by the researchers, just what the attraction is out there remains something of a puzzle. But what is clear is that all the sharks that summer along the California coast show remarkable fidelity; when they return to the mainland, they head for the same local neighborhoods that they favor every summer.

"These animals appear again and again at very specific areas," Jorgensen said. Despite the sharks' ability to move through the ocean to wherever they please, they stick to consistent routes and destinations. It is a striking finding, because white sharks are found off South Africa and Australia, in addition to the West Coast of North America, but what the TOPP team and other researchers have found is that the populations do not appear to mix. New data presented by the TOPP team indicate that even between Pacific Ocean basin populations there are genetic

differences. This means that white sharks, at least the females, have maintained long term isolation in the Eastern Pacific.

"This is really important in terms of management, so that management can focus on these population units," Jorgensen said. "And this really sets the stage for us to census the population, now that we know it is a confined population in the eastern Pacific."

There is another group of white sharks that tend to congregate near Guadalupe Island, offshore from Baja California, south of the California population that the TOPP team has been studying, but it is not yet clear whether they are distinct from the central California group.

Most of the tags used by the TOPP researchers have been electronic tags that are monitored by satellite. Those tags provide location data when the sharks are on the high seas. The other tags are acoustic tags; sensors installed along the California coast pick up the signal whenever one of the tagged sharks swims by.

The TOPP program maintains a live access server that gives regular updates on the locations of the sharks that have been tagged. "My favorite activity is to wake up and check where the sharks are," said Barbara Block, the Charles and Elizabeth Prothro Professor in Marine Sciences at Hopkins Marine Station.

Block is one of the researchers on the TOPP team and Jorgensen is doing postdoctoral research in Block's lab. TOPP partners in the shark research consortium include scientists from the University of California-Davis, the National Oceanic and Atmospheric Administration, PRBO and the Pelagic Shark Research Foundation.

Source: Stanford University

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