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Media contact:
Matthew Wright, COMPASS:
mwright@seaweb.org or 617.835.9395

New Research Reveals Shark Superhighways and Hotspots *Insights can inform urgently needed shark conservation strategies*

Boston, Mass.—The world’s sharks are disappearing. These fearsome yet charismatic fish continue to fall victim to overfishing and many are now at risk of extinction as a result. New research shows that open-ocean sharks are particularly threatened from overfishing, and other work shows that the deeper sharks live, the longer it takes for their populations to recover. Yet researchers are just now learning critical details of their behavior, including the fact that some species migrate quickly along “superhighway” routes and congregate at established “stepping stone” sites.

A panel of researchers will discuss these insights, as well as strategies for shark conservation, at a press conference at the American Association for the Advancement of Science (AAAS) Annual Meeting in Boston, MA on Sunday, February 17, at 3pm ET.

Sharks can evoke an image of nomadic loners, patrolling the high seas aimlessly in search of prey. However, new research suggests that shark migration is anything but random, and that these efficient swimmers instead move along fixed “superhighway” routes between well-established gathering places.

Peter Klimley, director of the Biotelemetry Laboratory at the University of California, Davis, has used electronic tags to track scalloped hammerhead sharks along their migration routes in the tropical Eastern Pacific Ocean. Their results suggest that these sharks speed between a series of “stepping stone” sites, near coastal island groups ranging from Mexico to Ecuador.

“Hammerhead sharks are not evenly dispersed throughout the seas, but concentrated at seamounts and offshore islands,” Klimley says. “Hence, enforcing reserves around these areas will go far to protecting to these species, and will provide the public with places for viewing sharks in their habitat.”

The Scalloped Hammerhead is not alone in its habits. The great white shark, perhaps the most universally recognizable species in the ocean, also appears to return to a limited number of sites as part of its seasonal migration.

Salvador Jorgensen, a researcher at Stanford University's Hopkins Marine Station, has teamed with his colleagues in the Tagging of Pacific Predators (TOPP) program to tag nearly 150 great whites found near the coast of central California. In the winter, these sharks leave the seal rookeries where they feed all summer, and set off for warmer waters near one of two tropical "hotspots." One site between Hawaii and Mexico attracts so many of these giants, it has become known as "the white shark café."

"We started calling it the café because that is where you might go to have a snack or maybe just to 'see and be seen.' We are not sure which." Jorgensen says. "Once they leave the café, they return year after year to the same exact spot along the coast, just as you might return to a favorite fishing hole."

Klimley, Jorgensen, and their colleagues continue to map out the migration routes and gathering sites of highly mobile sharks, including some of the most threatened species. As this information becomes available, it can direct conservation efforts by helping fisheries managers to focus on protecting these sites.

"Our oceans are being emptied of sharks, and the scale of the problem is global," says Julia Baum, a marine ecologist at Scripps Institution of Oceanography. Baum, a member of the World Conservation Union (IUCN) Shark Specialist Group recently participated with other shark experts in a workshop to evaluate the threatened status of oceanic sharks. They identified eleven open-ocean shark and ray species that now qualify for the IUCN's Red List of Threatened Species, which includes species listed as Critically Endangered, Endangered, and Vulnerable.

Baum points out that no single conservation strategy can work for all shark species. For those that spend much of their lives on the high seas, Baum cites a recent United Nations General Assembly Fisheries Resolution that recommends science-based catch limits and bans on finning—the practice of removing only a shark's fins and discarding the carcass. Such bans would require sharks to be brought back to land with their fins attached. For coastal species, a network of marine reserves also can be an effective strategy. In both cases, Baum sees consistent and tough enforcement as absolutely crucial.

"As a result of high and mostly unrestricted fishing pressure, many sharks are now considered to be at risk of extinction," Baum explains. "Of particular concern is the Scalloped Hammerhead shark, a coastal species, which will be listed on the 2008 IUCN Red List as globally Endangered due to overfishing and high demand in the shark fin trade."

Though the sharks that live near the ocean's surface frequently get more attention, almost half of the known species live in the cold, dark waters of the deep ocean—below 200 meters. Despite being out of sight, these sharks (and their cousins, the rays and skates) are not out of reach of modern fishing equipment. Bottom trawling in particular is threatening to severely deplete these populations.

New research by Colin Simpfendorfer, a shark researcher at James Cook University in Australia, suggests that deep-water sharks, rays, and skates take much longer to recover from severe

overfishing than their shallow water counterparts. The deeper they live, the slower their recovery, and for some populations, the process could take decades or even centuries.

These latest insights into the biology and ecology of big sharks have revealed how important they are to ocean ecosystems, and how precarious their position might be. But they have also provided important clues as to where management efforts can be focused to greatest effect, and offer hope in the process.

“Many pelagic sharks are getting snuffed out from longliners that target tunas and swordfish, while deep sea sharks are caught in bottom trawls and gillnets,” explains Lance Morgan, a marine scientist from the Marine Conservation Biology Institute and organizer of the AAAS session. “Sharks have nowhere left to hide in an ocean subject to widespread fishing. Catch limits, finning bans and a network of enforced marine reserves are all necessary conservation strategies to protect them.”

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Contact Information

Julia Baum
Scripps Institution of Oceanography
juliakbaum@gmail.com
858.752.0633

Peter Klimley
University of California, Davis
apklimley@ucdavis.edu
530.752.5830

Salvador Jorgensen
Stanford University
salvo@stanford.edu
707.486.0982

Lance Morgan
Marine Conservation Biology Institute
Lance@mcbi.org
707.217.8242

Colin Simpfendorfer
James Cook University
colin.simpfendorfer@jcu.edu.au
719.314.7823