How to track a shark: New research reveals where, why and how sharks and game fish overlap

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An international team of researchers, led by the University of Massachusetts Amherst, has compiled a massive dataset that overlays

years' worth of information on the position, migration and interaction of sharks and game fish. This research has immediate relevance for anglers, who have been reporting increased contact with sharks over the years. The research, recently published in *Ecological Applications* and which relies on an innovative use of acoustic telemetry and machine learning, gives us the clearest window yet into complex ecological relationships and promises to be a useful tool in ongoing conservation efforts.

"It's so rare to observe multi-species interaction in the ocean," says Lucas Griffin, the paper's co-lead author and a postdoctoral researcher in environmental conservation at UMass Amherst. That's because species such as the ones the researchers focused on—great hammerhead and bull sharks, permit and Atlantic tarpon—can range over hundreds of square miles of open ocean. There has long been anecdotal evidence from the game-fishing community that instances of depredation—when a shark eats a fish that has been hooked—are on the rise, but to date there's been no hard data to support whether or not such encounters are indeed increasing and, if so, why.

For this study, the researchers focused on the coastal regions of the Florida Keys. Over a three-year period, the collaborative team deployed nearly 300 acoustic receivers and tagged 257 fish (including 73 sharks) with transmitters. Every time one of the tagged sharks or fish swam within range of the receiver, its presence was recorded and tagged with the date and time. This approach, called acoustic telemetry, gave the team unprecedented access to the migratory, reproductive and feeding patterns of sharks and gamefish. The team then ran their raw data through a cutting-edge machine-learning algorithm to model the incredibly complex interplay of environmental factors, such as time of year, lunar cycle and water depth and temperature.

"Combining acoustic telemetry and machine learning helped us to answer a host of questions about predators and prey," says Grace

Casselberry, the paper's other co-lead author and a graduate student in the program in marine sciences and technology in UMass Amherst's Department of Environmental Conservation. It turns out that tarpon and permit are returning to the same spawning grounds, at the same times of year, every year. Sharks know this: "they seem to remember where and when the tarpon and permit aggregate," says Casselberry. So do anglers who, through years of word-of-mouth reporting on when the fish are biting where, wind up trying to hook the same fish that sharks feed on. Knowing this, fisheries managers can tailor their management strategies to best protect the interests of sharks, game fish and anglers.

Finally, the team's research is innovative not just for its methods, but for its cooperation. A wide range of institutions shared data from tagged fish, including research institutions, like the University of Miami and the Bimini Biological Field Station in The Bahamas, to state agencies, like the Florida Fish and Wildlife Conservation Commission, and the nonprofit environmental groups, Bonefish & Tarpon Trust. "We also worked extensively with the local fishing-guide community to help tag game fish and sharks, and figure out where to place the receivers," says Griffin. "Our lab very much embraces a collaborative and cooperative spirit," says Andy Danylchuk, professor of fish conservation at UMass Amherst and one of the paper's senior authors. "We are grateful for our research partners and hope our science will help to hone conservation and management strategies for both game fish and sharks."

More information: Lucas P. Griffin et al, Predator–prey landscapes of large sharks and game fishes in the Florida Keys, *Ecological Applications* (2022). DOI: 10.1002/eap.2584

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