

SHAA





SHARK!

Shark attacks spiked 56 percent over the past four years. Folks on O'ahu and the Neighbor Islands are nervously asking why. HONOLULU dives deep to find out what's going on, and what's different, this time around.

BY DON WALLACE

ILLUSTRATIONS BY KELSEY IGE

GOOD SURF CAME EARLY to the North Shore in September 2015. A nice run of waves kept Colin Cook busy glassing new boards for top shapers who supply some of the world's best surfers. But he loved carving waves himself. When he stepped out of his North Shore house the morning of Oct. 9, the 25-year-old was feeling, he recalls, "a little lazy."

And there was Leftovers, the surfbreak across the street, throwing off some fun waves. He grabbed his 5-foot-6-inch board and paddled out at 7:30 a.m. to join 10 to 15 other surfers. An hour passed, two. In the calming sea he saw turtles, as always. A scatter of small fish broke the surface. As the crowd thinned, there was just Cook, a guy off to one side and, about 200 yards out, a stand-up paddler. Time to go in, get to work.

A tremendous shock, like getting hit by a truck. "Out of nowhere, boom!" Somebody was jumping on him, riding him deep. He felt nothing except a curious numbness. His eyes had shut tight. Now he opened them, underwater. "I saw the shark. Right there on me. I could see the stripes. Tiger. He literally had my leg in his mouth."

Cook had seen sharks before. He'd seen *that* movie. In fact, he says, "It was kind of like watching a movie: Here I am, underwater, thinking, 'This can't be happening to me. Is this for real?'" The tiger began swinging Cook from side to side, "that ragdoll thing, throwing me around underwater. Fight or flight kicked in. I just starting punching it with my right hand and tried to push off with my left."

Blood filled the water. His hands were being shredded as if he'd thrust them into the spinning blades of a blender. "I was able to get free, I swam up to my board." So small it rides underwater when he paddles, the board promised a long slow slog the 150 yards to shore. He dug his bleeding hands into the water.

But the board wouldn't move. Then the surfleash gave a jerk, tightened, and swung the board around, dragging it and Cook out to sea. "He was towing me." The shark had the ankle with his



surf leash attached to it, Cook realized. And the only way that could be happening ... was if the leg was no longer attached to his body. Like Ahab, the native Rhode Islander was being taken on what whalers call a Nantucket Sleigh Ride.

Cook felt himself move in and out of consciousness. Then the leash slackened. *Good.* He saw the stand-up paddler draw close and begin striking the water near Cook with his paddle.

The tiger had returned. "This isn't supposed to happen," Cook remembers thinking, as it circled and lunged. "It was not like most shark attacks: The shark bites and leaves. You hear them say, 'Sharks don't like the taste of humans.' But this shark was sticking around.

"It wanted a meal."

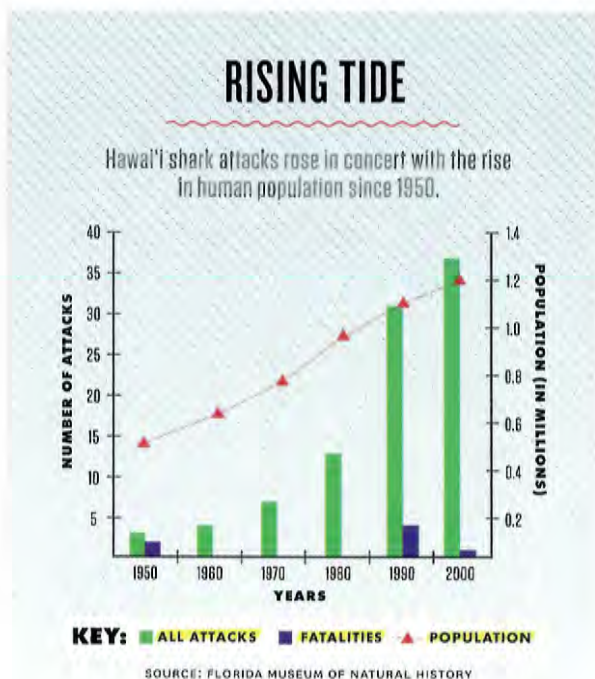


COLIN COOK'S ATTACK was the third serious incident of 2015 and the 36th in four years. By the time the year came to a close the tally would be up to 39, with eight in 2015, including a fatality on Maui and another attack on O'ahu even more severe than Cook's. The trend, beginning in 2012, has attacks up over 50 percent in the Islands; three of the 39 were fatalities. In the four years prior to 2012, there had been zero fatalities and only 11 attacks. Clearly, O'ahu and Hawai'i are on the sharp end of a spike in aggressive shark behavior. The first question is why. The second: Can anything be done about it?

Opinions are plentiful; when it comes to sharks, everyone's an expert. It's what makes Cook's sense of being

wronged by shark lore—"This wasn't supposed to happen"—so poignant. We want to understand sharks. We study them. Many of us honor their place in the ecosystem. In return, we just want them to be predictable. And to leave us alone.

But consider the odds of a fatal attack (1 in 3,748,067), twice as high as dying from a falling vending machine. Shouldn't we





• Attacked by a tiger at Leftovers, above, Colin Cook was saved when Keoni Bowthorpe, below, risked his life to bring him to shore.

be worrying about much bigger threats, like heart disease (1 in 5) and cancer? Yes, of course. But we *do* live on an island, something statisticians never take into account. And shark attacks *do* make headlines. Human beings seem programmed biologically to fall for shark click-bait, leading to all sorts of reactions to shark sightings—from never setting foot in the ocean again to canceling vacations to launching shark-killing expeditions to show tourists we take their concerns seriously.

In 1958, eight months before Hawai'i became a state, a single fatality before Christmas, that of 15-year-old Billy Weaver, led to 17 years of state-sanctioned shark killing.

“I WAS ACROSS THE CHANNEL from this surfer,” says Keoni Bowthorpe, “when I thought I heard him say something. I turned around, and right then I saw the shark pull him under. I could see the dor-

sal fin and the tail fin breaking the surface. And the sounds that were happening—it could only be one thing.”

Six months before, Bowthorpe had started filming a documentary. *Saving Jaws* was to be about the tragedy of shark-finning, a practice that kills 100 million sharks a year, threatening an entire genus to make soup. The 33-year-old father of “3 under 3” couldn't believe what he was seeing, in light of his interviews with scientists and shark dive tour leaders. “This shark just did everything different from what I've ever been told, or experienced, while making the documentary.” The water was clear, Cook had been quietly waiting out a lull, not splashing or kicking. And the shark kept on attacking.

Once alongside Cook, he pushed the shark away with the paddle. “I didn't hit the shark or beat the shark. My goal was to divert it. One of the scientists I was filming had said that tiger sharks are built for power, not maneuvering. If you can make it miss, you've got 10 to 12 seconds before it turns to make another run.” Bowthorpe put himself between Cook and the shark, adopting a toreador's position, paddle at the ready. The shark turned. “The speed it was coming at us, I was thinking, ‘I'll be lucky to hit it at all.’”

He fended off several passes. “I'm going to pass out,” Cook called to Bowthorpe. “Tell my family I love them.”

Bowthorpe was faced with an impossible choice. Fight off the shark and watch Cook die. Or—“I felt a terrifying wonder,” he recalls. “I thought of my three kids and would I ever see them again.” And then: “I said a prayer and tossed the paddle away.”

He lay down on his board. “Colin climbed on my back and we started to paddle in.” Their weight sank the board below the surface. The beach was still 100 yards away. Several times when he dug in his



hands to make a stroke, "I felt the shark skin brush my arm, like fine-grain sandpaper." Even more terrifying, "I could feel the water displacing us as the shark passed under. I could feel the power of the animal." At any moment, "I knew this could be it."



SO, WHAT'S GOING ON? Why are there so many attacks? Why was the shark so persistent?

There are three types of answers: the scientific, the anecdotal and the Native Hawaiian. Each has its place in the discussion. It turns out that being the nation's No. 2 in shark attacks (72 versus 323 for Florida from 2001–2014) spurs government funding and has made Hawai'i a world leader in shark research. Over the past 30 years, teams at the Hawai'i Institute of Marine Biology on Coconut Island in Kāne'ohe Bay have tagged almost 1,000 sharks, including 14 O'ahu tiger sharks electronically

bugged in 2014. (Tiger sharks are believed to cause most severe bites and almost all fatalities; great white sharks may have caused fatalities, but are rare visitors; Galapagos, sandbar, reef, mako and hammerhead sharks are biters who are not linked to any Hawai'i fatalities.)

HONOLULU contacted two leading researchers who partner together, Kim Holland of the Hawai'i Institute and Carl Meyer of the University of Hawai'i at Mānoa. Holland played a key role in responding to the other shark attack spike, from 1991–1994, when the Islands reeled from 25 attacks, six of them fatal. The duo agreed to take HONOLULU's questions (for a longer interview, go to bit.ly/hnsharks).

We also spoke with a longtime researcher with the National Oceanic Atmospheric Administration, Charles Littnan, whose specialty, monk seals, takes him into shark territory in the Papahānaumokuākea Northwest Marine National Monument and other places. And, in addition to fishermen, divers, surfers and

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WHERE ARE THE ATTACKS?



SOURCE: DLNR, ISAF, GSAF

many others, we talked with kupuna Leighton Tseu. He is a master mariner and cultural practitioner, who once shared a ship's foc'sle with Littnan on a voyage to French Frigate Shoals in the Northwest Hawaiian Islands, where Tseu represented the Native Hawaiian perspective and helped mediate the contentious issue of culling *manō* (shark).

To scientists Holland and Meyer, the story can be told in one graph: "The annual number of shark bites in Hawai'i has increased over time in concert with increases in the human population of the Hawaiian Islands." It's that simple: Population growth, from 600,000 at statehood in 1959 to today's 1.4 million, plus tourism, means more ankles in the water to bite. (See graphic, page 38.)

"Over time," say Holland and Meyer, "we are also inventing new types of ocean recreation, many of which take us further offshore into shark habitat than was previously the case." Take kayak fishing, an idea that upends the famous line by *Jaws*' shark-catching Martin Brody: "You're gonna need a bigger boat." Kayak fishermen go smaller, trading security for excitement. Search YouTube and watch a shark erupt out of the ocean to take Isaac Brumaghim's catch. His viral video spawned a reality show this year, *Pacific Warriors*, which will undoubtedly put even more fishermen into kayaks. The show went on because of, not despite, a fatal attack on a kayak fisherman (not a cast member) off Maui in 2013.

The scientific answer is simple and straightforward. But it seems to satisfy just about no one. On the anecdotal side, many surfers, fishermen, divers and ocean enthusiasts have noticed more sharks around, hunting closer inshore than people remembered, and acting more aggressively around people—even wind- and kite-surfers have reported attacks. Many of these same recreational enthusiasts blame the shark's diet, amid other factors, listed below with a side of scientific opinion:

- **Too many turtles**—since becoming a protected species in 1975, green turtles have gone from nearly extinct to a population estimated at 61,000. ("No one knows for sure ... and some known facts potentially confound this speculative relationship," say Holland/Meyer.)

- **Too many monk seals and whales**, also protected. (With the exception of great whites, "sharks are very cautious of attacking prey that is large; a tiger going up against a 1,000-pound monk seal is a dangerous interaction for the shark," says Littnan; a one-ton, 12-foot baby humpback is as big as any tiger shark.)

- **Too many fishing regulations**—limiting catches attracts sharks to bountiful fish stocks. ("There have been no major changes in the fishing pressure on Hawai'i's coastal areas in recent years and so the amount of food available to sharks has probably remained more or less stable," say Holland/Meyer.)

- **Too few regulations and weak enforcement**—conversely, some argue that overfishing sends ravenous sharks inshore in search of food. (See above.)

- **Too many pregnant females**—pregnant tiger sharks are undoubtedly drawn to pup in Maui's warm shallow coastal plain and are commonly assumed to be ravenous and even desperate eaters. ("We see more shark bites during the fall pupping season for tiger sharks. However ... it is important to remember that shark bites occur in all months of the year, and not all shark bites are caused by pregnant female tiger sharks.")

SHARKBUSTERS!

Over time, people have tried an impressive range of tactics to repel sharks. But do they work? Not well enough ...

>**YE OLDE STYLE:** A 1980 patent for a suit of shark-proof armor was never produced, but it led to Neptunic's chain mail—used by professional divers to ward off bites. Too heavy for hanging 10!

>**WATCH OUT!** Colorful wristbands send out magnetic waves that allegedly disturb sharks' electromagnetic sensors. Said to work best if a whole group wears them. sharkbanz.com/technology

>**GOOD VIBRATIONS:** An electronic device attached to a surfboard and ankle via a surf leash. Shark Shield is used in Australia, where tests show great whites stop at nothing. sharkshield.com/technology

>**STINKY SPRAY-ON:** An aerosol of putrified shark tissues. Yeah, that would keep us away if we were a shark. sharktecdefense.com

>**BLUE MAN SUIT:** If sharks really are colorblind, surely they won't see you in a blue bodysuit. NO, really, you go first. radiator.net

>**SSSSNAKE:** The venomous, striped sea snake strikes such fear in sharks that stripes will keep them at bay. That's the theory, anyway.



• When a 14-foot tiger investigated Juan Oliphant's camera, "I simply pushed her nose back."



The fact is, each of these suppositions ignores the way a tiger hunts: "constantly yo-yo diving between the surface and the seabed," down as deep as 1,800 feet, while ranging sometimes for hundreds and even thousands of miles. Being surface swimmers and divers, we focus on the things we see where we play—turtles and inshore fishes, seals and baby whales—whereas the prey tigers hunt runs deeper and wider than we'd ever go. During the 1959–70s period of culling, of all large tiger shark stomachs examined—over 10 feet, the length at which they lose their timidity and might consider bigger prey—42 percent contained sharks and rays, 40 percent fishes, 35 percent crabs and lobsters, and 25 percent birds. Only 15 percent

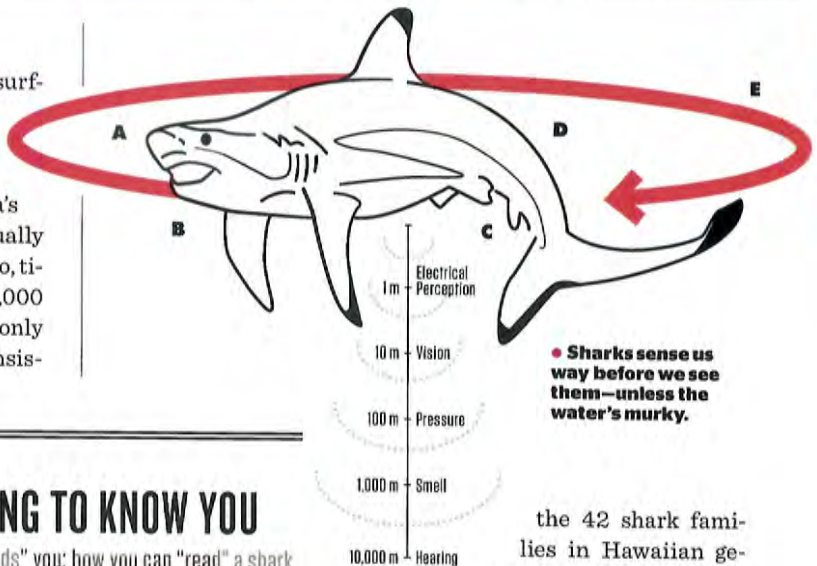
contained turtles.

Another popular hypothesis assumes tigers mistake surfers or bodyboarders for seals. Littnan explains this is an imported theory born out of great white shark encounters with seals in cold-water sites including Northern California's infamous Red Triangle and South Africa's False Bay, both places where surfers wear full-body, usually black, wetsuits. In Hawai'i, such wetsuits are rare. But, also, tigers don't have an appetite for seals. "Compared to the 470,000 pinnipeds in California, in the main Hawaiian Islands we only have a population of 200," Littnan says. "Sharks like consistency in a food source. Seals in Hawai'i aren't sending a strong enough signal. It's a blip on their radar. I've seen seals and tigers swim right past each other."



"TO ME, IT'S NOT THE MENU, it's the desecration," says Leighton Tseu, a career master mariner with Matson and a cultural practitioner whose voyages as an emissary have taken him to Satawal, where he lived with future *Hōkūle'a* navigator Mau Piailug, to the farthest north of the Hawaiian Islands, Nihoa. Like many Native Hawaiians, he's incensed at the carnival atmosphere of the Weaver and 1991-'94 cullings, scenes straight out of *Jaws*, with sharks strung up on the dock for gawking tourists.

In old Hawai'i, things were different when it came to manō. European sailors wrote of seeing Native Hawaiians swimming with large sharks with seeming impunity, batting their noses when they got too close. There were accounts of swimmers riding large tiger sharks after feeding them the mildly narcotic 'awa root. There were shark gods. Certain families considered sharks to be their ancestral spirits, or 'aumakua. Kupuna Tseu, now 68, recalls being instructed by his kūpuna in the lineage of



GETTING TO KNOW YOU

How a shark "reads" you; how you can "read" a shark

>SHARK SCIENTISTS SAY a shark can hear you from 1,000 to 10,000 meters away; smell, see and sense you at from 10 to 100 meters; and perceive you electromagnetically via sensors called ampules de lorenzini at half a meter (50 cm), before switching to direct contact.

Researchers and dive-tour operators can, like any animal trainer or wrangler, "read" sharks from their posture. The tiger above is already showing multiple "agonistic" signs of impending aggression toward another shark or prey: (A) an elevated snout, (B) a gaping jaw,

(C) both fin and tail down, (D) an arched back and, overall, a torso that's shivering or making stiff, jerky movements. A shark in this flank display mode will circle back (E) and engage in various challenges: charges, gill pouch billowing, head shaking, jaw snapping, corkscrewing and ramming. But almost every shark is also ready to make a rapid withdrawal in submission to a dominant shark or rival predator (which could be a swimmer who maintains eye contact and, if necessary, strikes the underside of the snout, preferably with an object, not a hand).



SOURCES: SHARKSHIELD.COM; "A REVIEW OF SHARK AGONISTIC DISPLAYS," MARINE AND FRESHWATER BEHAVIOR PHYSIOLOGY, VOL. 40, ISSUE 1, 2007.

the 42 shark families in Hawaiian genealogy.

"If you study the history of Pearl Harbor, that was the house of manō. Two important manō that lived there, they protected the whole area and people used to see them." But then the Navy came in and constructed a drydock. "They built it on the house," says Tseu. "Since that time, we've seen the destruction of Pearl Harbor; we cannot eat anything; the oysters and clams are pilau; mangroves are all gone; crabs not as plentiful. All that's because of the destruction of the house. Anytime you disturb manō, he'll disappear, but he'll change his

thinking. Now he's more aggressive. They're getting bigger and bigger as they come in to shore, and they're not afraid."

For Tseu, the shark attacks now relate to today's Mauna Kea protest movement, just as the shark attacks from 1991-'94 occurred during the centennial of the 1893 overthrow of the Kingdom of Hawai'i. "To me, [the attacks are] to remind us Hawaiians to wake up, time to change, you're being affected by what's going on around you."

ALERT!



TIGER SHARK

>"NIUHI" runs to 16 feet, is called "garbage can of the sea" for its wide variety of diet, and is responsible for most serious attacks and almost all fatalities in Hawai'i.

LOW RISK



GALAPAGOS SHARK

>NO MAN-EATER except in WWII shipwrecks far offshore, this bottom-feeder snatched seal pups in French Frigate Shoals when lobsters grew scarce—and may bite.

LOW RISK



SANDBAR SHARK

>FREQUENTLY SEEN near shore due to its diet of octopus, squid, mollusks and small reef fishes, the sandbar shark may take a rare bite in murky or low-light water.

• As more people venture farther offshore for recreation, they put themselves into shark territory. Here, pelagic sandbar sharks trail a North Shore kayaker.






ARE SHARK-CAGE TOURS SPURRING ATTACKS? O'ahu's newest tourist attraction actually tries to maximize the odds of shark and man bumping into each other. A relatively recent phenomenon around the world, the tours first exploded in places like South Africa, the Bahamas, Florida, Mexico and Australia. It's a simple idea: Just throw some meat in the water, add tourists in a cage suspended over the side of a boat, and let the carnage begin. There's a lot of money in it, and no regulations, except one: Do not chum, i.e., dump blood, fish parts and meat in the water to attract sharks to the cages, inside the 3-mile limit. Some real trouble started when the shark tours didn't respect this kapu.

There is no question that shark-cage dives are controversial—from Florida to South Africa they've been met with bans, protests and even threats. The arguments against shark tourism were summed up in a 1998 paper published by George Burgess, curator of the International Shark Attack File for the Florida Museum of Natural History (and, thanks to *Shark Week*, probably the most quoted shark expert in the world). Burgess cited four interrelated risk factors: "the safety of divers; the likelihood of negative publicity directed at sharks if a shark bites a diver during one of these dives; the possibility for ecological disruption; and potential negative impact on multi-user recreational use of the feeding area."

Hawai'i is vulnerable to each of these risks, and a 2009

attempt to start cage dives off 'Āina Haina in Maunaloa Bay was turned back by protests. As state Rep. Gene Ward said of his constituents at the time: "They've armed themselves with pitchforks and torches. This is the place where you have canoers training. Once you feed those sharks, they associate the sound of the boat's motor with food. Sharks aren't stupid. If you feed them they're going to keep coming around."

PHOTO: JUAN OLIPHANT

<p>LOW RISK</p>  <p>BLACK TIP SHARK</p> <p>>"MANŌ PŌ'ELE" is common near shore, including a heiau sacred to sharks at Pu'ūkohōlā on the Big Island. A biter only in poor visibility or if provoked.</p>	<p>RARE RISK</p>  <p>HAMMERHEAD SHARK</p> <p>>"MANŌ KIHIKIHI" live offshore but give birth to pups in such shallow bays as Kāne'ohe, Waimea and Hilo. Our scalloped hammerhead nips, not bites.</p>	<p>SOME RISK</p>  <p>GREAT WHITE SHARK</p> <p>>"NIUHI" is a name reserved for man-eaters, "with fiery eyes," says a chant; a small number of great whites do make rare visits at long cycles.</p>
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Partly in response to the tension, in 2009 Holland and Meyer created a limited study of the sharks drawn to a North Shore cage tour. After transponders were attached, none of the Galapagos and sand sharks followed the boats back to shore, a major fear of surfers and fishermen. Then again, tigers were not part of the study—they're rarely seen, and harder to tag.

Despite a drop in the number of shark attacks from 2007 to 2011, with no fatalities, the tension on the North Shore actually worsened. During the first three months of 2011, three shark-tour boats based in Hale'iwa Harbor burned in separate incidents. The second boat was torched a week after a federal government suit against its North Shore operator—for illegal feeding captured on video inside the 3-mile limit—was thrown out of court on a technicality. In 2012, North Shore crab fisherman Douglas Zakabi wrote a letter to the editor of the *Honolulu Star-Bulletin* complaining that "My friends and I no longer take our boats to some of our favorite fishing grounds because now when we go out there our boats are surrounded by sharks. This has only happened since the shark tours started. The sharks hear our engines and they come to our boats and think we are going to feed them. Where do

you think they learned that behavior?"

Feeling burned by the media, shark-cage operators (and shark fishing captains like Tiger Bob, who leads midnight forays out of Kewalo Basin) don't take kindly to questions about chumming, or anything. As Tiger Bob—no last name given—growled: "Nothing personal, but nothing good comes of talking about sharks in public." If they do speak, it's to say they go where sharks gather because of previous fishing activity. On the North Shore, they say, that would be the old crabbing grounds.

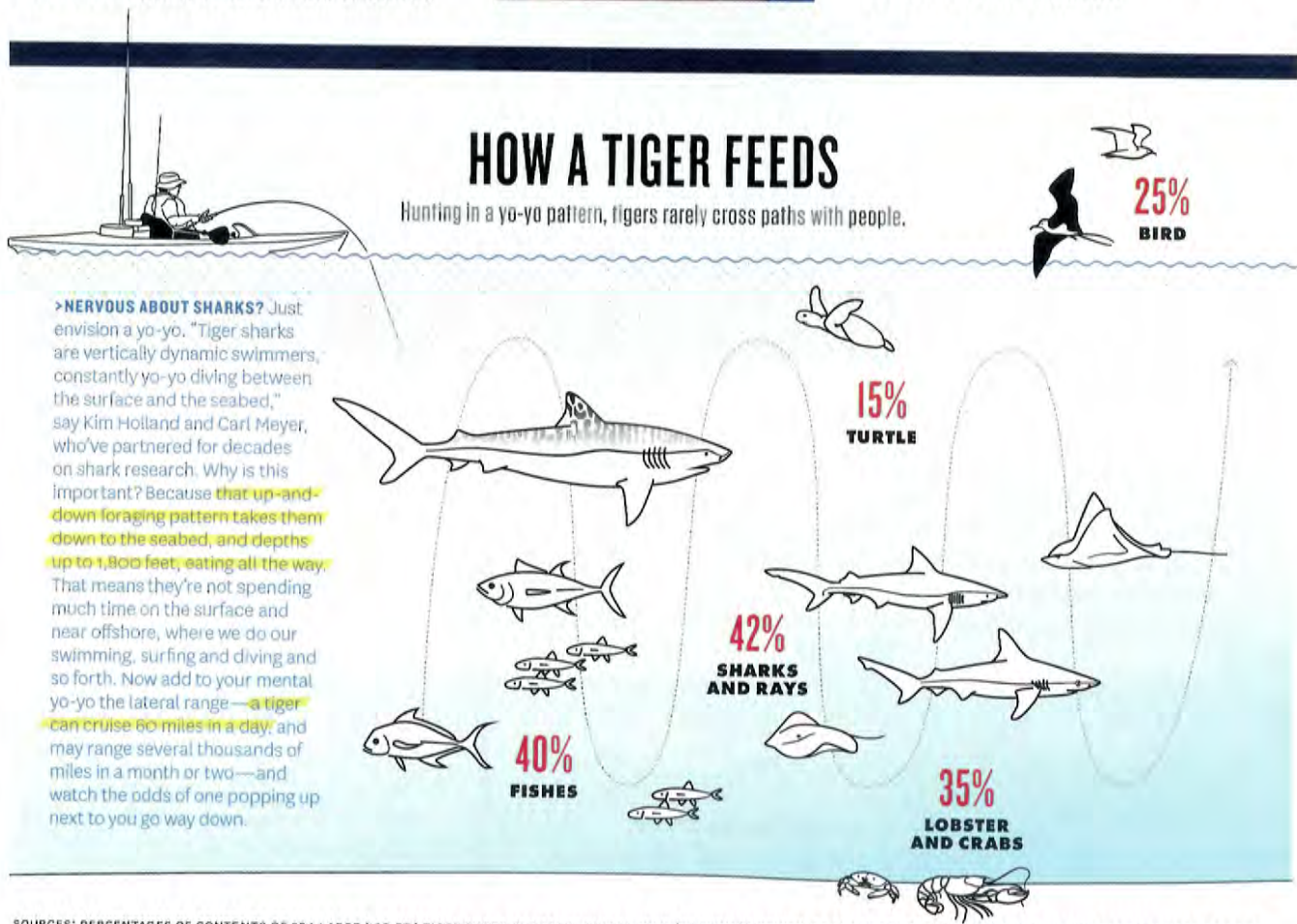
The lull in attacks ended in 2012, the year of crab fisherman Zakabi's letter of complaint. As shark sightings rose, even tours that did not chum or use cages, promising instead a "swim with sharks" experience, came in for criticism. Weren't they turning sharks into cuddly Disney predators for tourist photo ops? It was one such education-oriented dive tour, led by Internet sensation Ocean Ramsey and her partner, "Shark Whisperer" Juan Oliphant, that sparked Keoni Bowthorpe's passion to start his documentary and even place the



• Surfer Rick Gruzinski's 1992 close call; educator-researcher Ocean Ramsey, right, swimming with a tiger to make sure it's safe for divers to enter the water.

HOW A TIGER FEEDS

Hunting in a yo-yo pattern, tigers rarely cross paths with people.



>NERVOUS ABOUT SHARKS? Just envision a yo-yo. "Tiger sharks are vertically dynamic swimmers, constantly yo-yo diving between the surface and the seabed," say Kim Holland and Carl Meyer, who've partnered for decades on shark research. Why is this important? Because that up-and-down foraging pattern takes them down to the seabed, and depths up to 1,800 feet, eating all the way. That means they're not spending much time on the surface and near offshore, where we do our swimming, surfing and diving and so forth. Now add to your mental yo-yo the lateral range—a tiger can cruise 60 miles in a day, and may range several thousands of miles in a month or two—and watch the odds of one popping up next to you go way down.

SOURCES: PERCENTAGES OF CONTENTS OF 554 LARGE (>10 FT.) TIGER SHARK STOMACHS CULLED 1959-'76 FROM "A REVIEW OF SHARK CONTROL IN HAWAII WITH RECOMMENDATIONS FOR FUTURE RESEARCH," *PACIFIC SCIENCE*, VOL. 48, NO. 2, 1994. DUE TO WIDE VARIETY OF FOOD IN STOMACHS, PERCENTAGES ADD UP TO MORE THAN 100 PERCENT.

PHOTO: WARREN BOLSTER, COURTESY OF JIM BORG, TIGERS OF THE SEA; HAWAII'S DEADLY SHARKS



photogenic couple of shark preservationists at its center. An uneasy truce has held on the North Shore, perhaps because there is an environmental argument for shark cages and shark-dive tours. In the Bahamas, they've gained the backing of the Pew Charitable Trusts and preservationists: If you create local jobs based on shark entertainments, then locals will take care to save them. It's the way incentives are created for preserving elephant, gorilla, lion and rhino populations by deputizing local villagers to combat poachers.

Still, none of the game reserves taunt their star attractions with bloody steaks to provoke a satisfying reaction. And people don't go walking out in lion country the way surfers, snorkelers and swimmers share the ocean with apex predators. What will the sharks feed on the days the tour isn't there?

"There is no doubt in my mind that the shark-dive outfits, by operating via chumming, change the behavior of sharks," says NOAA's Littnan. "It correlates with the stuff we saw with the lobster fishery at French Frigate Shoals. The fishermen were putting 700,000 pounds of bait in the water every year. That's a strong signal," that the sharks treated as a food source once massive takings by bottom fishermen depleted the lobster population. Several bans on the fishery culminated in a complete ban in 2000.

What was good for the lobster was bad for the monk seal. "Before the bait was removed, we didn't lose seal pups at French Frigate Shoals," Littnan explains. "After, we started to lose pups. The sharks adopted a diversity of foraging strategies. It got so you could slap the surface of the water and Galapagos sharks would be there in seconds." The speed of shark adapta-

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FOLLOW THAT SHARK!

Hawai'i's scientists lead the way by tagging tigers, whose tracks hint of close encounters—and journeys as far off as Mexico.

>THANKS TO RECENT ATTACKS, shark science has entered a golden age. You can see how tagged tigers roam Island waters (and far offshore), due to ongoing efforts by Carl Meyer and Kim Holland (pictured at right) and teams at the Hawai'i Institute of Marine Biology. Over 450 sharks, including 174 tigers, are monitored by various sensors. Tagging revealed that tiger shark growth and reproduction rates here are double the norm elsewhere and that our tigers "have large home ranges that typically include several islands, but each individual shark is most frequently found around a "core" island."

But a killer app is the Pacific Islands Ocean Observing System (oos.soest.hawaii.edu/pacificos/projects/sharks), it shows the date, time and location whenever one of 28 tagged tigers' dorsal fins broke the surface from late 2013 to July 2015. The tagging was in response to a "higher number of unprovoked shark attacks than in previous years" in Maui waters, including reports from "local spear fishers ... of increasing boldness in large sharks encountered." We clicked on Tiger #137070, a 12.1-foot



male, whose home turf is between Ka'ena and Kahuku points, with hang time in the Kaiwi Channel between O'ahu and Maui. On Nov. 4, 2014, he shows up right off Pipeline; visits Mokolē'ia on Nov. 5; and on Dec. 11 travels from far out in the Kaua'i Channel to Waikiki, where by 4:45 p.m. on Dec. 19 he's hovering near the Waikiki Aquarium outfall (locations are accurate up to a mile). Then it's off to Kea'au Beach Park and the Kaua'i Channel before spending New Year's far off Kāne'ohe.

In Western Australia, where great-white attacks are also on the rise and fatalities are far more common, tagged sharks and sightings are logged immediately via Twitter in the government's SharkSmart app. Sign us up!

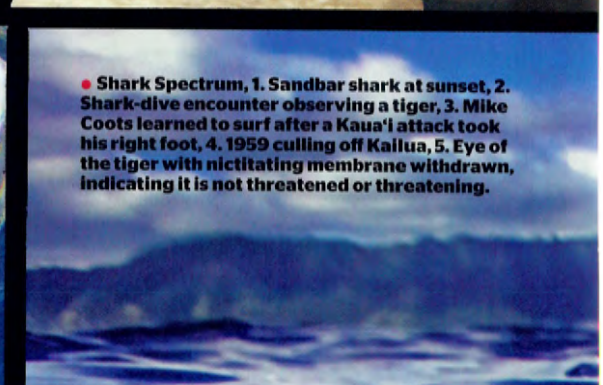


SHARK SEASON

>In October begins Makahiki, the Hawaiian harvest festival, dedicated to Lono, god of fertility, when gravid tiger sharks come to the warm, shallow waters between Maui and Kaho'olawe to feed and give birth, when Captain Cook arrived, the time in which, as a traditional Hawaiian poem says, "the wiliwili tree blooms, and the shark bites." Pre-contact Native Hawaiians mostly stayed out of the water, taking part in games and rituals on land.



PHOTOS: JUAN OLIPHANT, COURTESY OF CARL MEYER



● Shark Spectrum, 1. Sandbar shark at sunset, 2. Shark-dive encounter observing a tiger, 3. Mike Coots learned to surf after a Kaua'i attack took his right foot, 4. 1959 culling off Kallua, 5. Eye of the tiger with nictitating membrane withdrawn, indicating it is not threatened or threatening.

ion has been the subject of scientific and cultural controversy, especially since a small group of Galapagos sharks began hurling itself onto dry land in order to snap up seal pups. A vision out of *Sharknado*, the never-before-observed behavior was termed "learned"—the way bears can be lured into camps by the scent of garbage cans, the way raccoons open refrigerators.

WHAT CAN WE DO ABOUT ATTACKS?

The standard practice, before Billy Weaver's death in 1958, was to set a few hooks at the attack site for a couple of days. When Weaver's body was laid out before a crowd of Christmas season swimmers on Lanikai Beach, the response stirred something deep. In that year before statehood, when the jet plane was opening the Islands to the world and many people anticipated a tourist bonanza, the last thing needed was a shark attack. Weaver's death set off a state-sanctioned shark culling, or catching and killing, that lasted two years, and was renewed five times, until 1976.

But, in 1993, when researchers Bradley Wetherbee, Christopher Lowe and Gerald Crow (current curator at the Waikiki Aquarium) examined the data to assist the state in its response to the 1991-'94 attack spike, they found that the percentage of tiger sharks in the 1959-'60 catch actually went *up* after culling, to 12.5 percent. When culling from 1967 to 1969 took "534 sharks from O'ahu waters, 75 from the Honolulu/Waikiki area, of which 18 were tiger sharks," the percentage of tigers went

up yet again, to 16 percent. Results of a culling in 1971 startled most: The number of tigers shot up to 50 percent. Had culling the biggest tigers opened the door for many more younger tigers to swarm up the food chain? Was culling making things worse?

One thing the authors could say: If you were looking to stem shark attacks, the culling had "no measurable effect." Culling was a ritual—an exorcism of the horror. For this, 4,668 sharks died.

Colin Cook, meanwhile, is out of the media spotlight and struggling to adapt to his prosthetic leg. He's gotten calls and support, including fundraising to defray health care costs, from the North Shore surfing community and advice on moving forward from fellow shark amputees Bethany Hamilton and Mike Coots, both of Kaua'i. "I don't have any bad shark feelings," he says. "They interest me and I've got nothing but respect for them. I can't wait to get back in the ocean."

Ten days after Cook's attack, there was another severe shark attack off the Mokulua Islets, near where Billy Weaver died in 1958. Tony Lee, a medical devices entrepreneur, lost a leg while swimming offshore. The other leg, hanging by a thread, was reattached by surgeons. He has emailed swimmer friends to say the road to recovery will be long, but that he will be back in the water someday. Disturbed by the spate of attacks, however, a couple of Los Angeles financial backers of Keoni

Bowthorpe's documentary pulled out. So while there will be no *Saving Jaws* this year, at least there has been no call for culling, either—only hopes for an uneasy truce with manō. **PAU**

“ I DON'T HAVE ANY BAD SHARK FEELINGS,” COOK SAYS. “THEY INTEREST ME AND I’VE GOT NOTHING BUT RESPECT FOR THEM. I CAN’T WAIT TO GET BACK IN THE OCEAN.”

[9] TIPS ON AVOIDING SHARK ATTACKS

We asked the experts for tips on staying clear of sharks. Warning: No guarantees!

[1] Swim, surf and dive with other people, and stay together.

[2] Stay out of the water at dawn, dusk and night, when sharks move inshore to feed. **Top bite times in Hawai'i are at 7:30 a.m. and 3:30 p.m.**

[3] Do not enter the water if you have an open wound or are bleeding. "Any bodily fluid is probably attractive to sharks,"

says George Burgess, curator of the International Shark Attack File. "Does that mean a menstruating woman is setting herself up" by going into the ocean? "No."

[4] Don't swim or surf near people fishing or spearfishing, or cleaning their catch. When spearfishing, tow your catch a safe distance behind.

[5] Avoid murky waters,

harbor entrances, steep dropoffs, channels and stream mouths (particularly after heavy rains); sharks frequent these in search of prey. Streams and rivers often wash dead animals into the sea.

[6] **Don't wear high-contrast-color clothing or shiny jewelry.**

[7] Don't splash around or swim with pets, because any erratic move-

ments attract sharks.

[8] If turtles or fish behave erratically, or if you see dolphins, leave the water.

[9] If you see a shark, leave the water calmly and quietly. Look at it directly; don't turn your back. If it approaches, hit its snout. Don't approach even small sharks. Heed lifeguard warnings and "Shark Sighted" signs.



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Shark attacks have spiked 56 percent over the past four years. Folks on O'ahu and the Neighbor Islands are nervously asking why. HONOLULU dives deep to find out what's going on, and what's different, this time around.

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Or an adventure that started with a bet with singer Arlo Guthrie over a pinball game in Missouri, then ricocheted through the decades to Kailua-Kona and Honolulu.

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Five years after declaring bankruptcy, the Hawai'i Symphony Orchestra is not only on budget, it's traveling to perform on the Neighbor Islands again, hosting internationally renowned guest musicians and attracting new audiences. What happened?

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HONOLULU Magazine helps you find the dentist you need, whether it's for a routine checkup or more specialized work, with this list of 250 dentists in the Islands, as recommended by other dentists.

You never know what's just under the surface, especially around dusk. For the full shark feature, turn to page 36.

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OCEAN RAMSEY

COVER PHOTOGRAPH
"SHARK!"

» Growing up aquatic in Hawai'i and San Diego, Ocean Ramsey swam into a career as a Hale'iwa-based shark conservationist. "If more people knew the truth about sharks, they would not stand by passively and allow them to be slaughtered ... They really are incredible." Find her at oneoceandiving.com.



JUAN OLIPHANT

PHOTOGRAPHER
"SHARK," PAGE 36

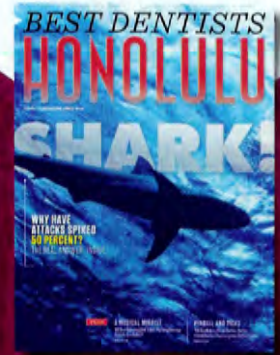
» Co-owner with Ocean Ramsey of One Ocean Diving, Juan Oliphant is an award-winning photographer, divemaster and captain. He's worked on conservation campaign vessels and as a safety diver on over 50 film productions. Find him at waterinspired.org and @juansharks on Instagram. He grew up on Chun's Reef.



VIDHYA NAGARAJAN

ILLUSTRATOR
"A RAMBLIN' ROAD," PAGE 48

» Vidhya Nagarajan is an illustrator in St. Louis, MO. Her drawings have appeared in *The New York Times*, *The Wall Street Journal* and *Newsweek*, among others; and her work has been recognized by the Society of Illustrators L.A. and 3x3. She also teaches at Washington University, her alma mater.



ON THE COVER

Photo by Ocean Ramsey. For the full feature on sharks, turn to page 36.

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