A Deep Dive into Mexican Shark and Ray Conservation

As sharks and rays decline in the Gulf of Mexico, local fishermen hold the clues to a thriving past and a better future.

By Acacia Johnson

In the gauzy light of a tropical sunrise, Angel and Yamil Lopez hauled a Caribbean whiptail stingray out of the murky waters of Términos Lagoon. The animal was much larger up close than I had imagined, five feet of rippling mauve-grey muscle.

“¡Qué grande! ” I exclaimed in my feeble Spanish. The brothers, artisanal fishermen from Isla Aguada, grinned and shouted something to marine biologist Ilse Martínez, seated next to me in their small boat.

“They say this is nothing,” she translated, as the waves lapped around us. “You should have seen the size of the rays they used to catch. Before.”

In Términos Lagoon, people have fished for sharks and rays since Mayan times. Campeche now has the largest ray catches in the Gulf of Mexico, with the southern stingray making up 75% of those catches.

Laguna de Términos, in the state of Campeche on the Yucatán Peninsula, is the largest coastal lagoon in southeast Mexico. From the air, its mangrove forests stretch as far as the eye can see, interspersed with white sand beaches, estuaries, rivers, and bays. Nearly a third of the lagoon is a seagrass meadow, making it a powerful carbon sink and a nursery for at least nine species of sharks and rays. It was my first stop on an assignment for the Save Our Seas Foundation that would take me far out of my comfort zone: my first project with a language barrier, an underwater component, and scorching temperatures exceeding 100°F.

Mexico is home to 217 known species of sharks and rays, nearly 20% of all elasmobranch species on Earth. Although sharks and rays keep the ocean healthy by regulating prey populations, preventing overgrazing of seagrasses, and strengthening fish genetics, they are also threatened. Mexico is a major shark and ray fishing nation, reporting the fourth-highest catches worldwide after Indonesia, Spain, and India. Across the globe, shark and ray populations have declined by over 70% in just 50 years, and a third of them are now considered vulnerable or endangered.

Artisanal fisheries have long sustained coastal communities in Mexico. Shark and ray meat is such a common ingredient in local cuisine that Mexicans even import it. But in the 1950s, the government subsidized the mass development of coastal communities in what became known as the March to the Sea, resulting in a period of severe overfishing. Because shark catches have

long been recorded by size, not species, little data exists about their distribution and life history —making effective fisheries management nearly impossible. Government monitoring only began in the 1970s, and ray catches are not categorized at all. Marine biologist Ilse Martínez is seeking to fill these gaps: by interviewing elder fishermen to recreate missing baseline data through local ecological knowledge.

Mangroves, also a highly effective carbon sink, line the shore of Términos Lagoon.

At 5 am, the Lopez brothers maneuver their boat out from the Isla Aguada harbor. 97% of Mexico's fishing vessels are artisanal , meaning they are operated by local fishing households *that use relatively small boats, make short trips close to shore, and harvest foods mainly for local consumption.*

Martínez views artisanal fishermen as “another kind of scientist”. A lifelong fisherman may spend as much as 70 years at sea, spending vastly more time observing the marine ecosystem than anyone else. Too often, she says, fishing is portrayed as an enemy to conservation. In reality, most local fishers and conservationists want the same thing: healthy seas full of life.

Martínez also understands that community-focused science requires long-term relationships built on communication and trust. Since 2018, she has been repeatedly visiting Términos Lagoon to spend time with fishermen and their families, using her friendliness, humor, and curiosity to form lasting and sincere bonds. Her work has resulted in a documentary film and studies about changes to Campeche’s sharks, including local knowledge of near-extinct sawfishes. The next step: finding a way to integrate this historical information into fisheries management.

In 2023, Martínez and I arrived in Isla Aguada during La Fiesta de la Santa Cruz, an annual Catholic festival honoring Jesús, El Señor del Pescador (Lord of the Fishermen). The streets boomed with parades, church services and festive music, culminating in a procession of decorated boats ferrying an icon of Jesus onto Términos Lagoon. Watching the boats pass under a highway bridge, it was obvious that fishing in Campeche represented far more than just a local economy. It was deeply intertwined with community identity, culture, and in this case, religion.

Martínez and her team use illustrated magnets to identify exact shark and ray species in conversations with fishermen.

Martínez, center, accompanies a group of university students from Ciudad del Carmen into the mangroves of Términos Lagoon. The lagoon provides vital habitat for 1,468 identified fauna species, 30 of which are endemic to Mexico and 89 of which are threatened.

As the boat parade motored off into an afternoon haze, we visited the home of Don Calderón, a celebrated shark and ray fisher whose 70 years of experience have contributed enormously to Martínez's research. In the shade of his home's modest courtyard, four generations of his family gathered around a traditional dish of ray stew. His children and grandchildren listened with rapt attention as he described the character, behavior, and size of the sharks that once frequented these waters, which could reach over nine feet long and weigh over 250 pounds. When he was a younger fisherman, he said, he loved to dive down and watch his children swimming on the surface above him, looking like birds gliding through the sunlit sky.

Left: Calderón's daughter Leydi and his wife, Trinidad, prepare ray stew in Isla Aguada. Right: Don Calderón, 82, poses for a portrait outside his house.

Boats line the shore of Isla Aguada. Although the town of ~6,000 people is known for regular dolphin sightings, the waters of Términos Lagoon are too murky for snorkeling or scuba diving.

Many of the most knowledgeable elder fishermen, Martínez tells me, have already passed away. Once-plentiful species such as sawfishes, a fantastical species of large ray resembling a chainsaw, now face extinction. As Campeche's younger generations increasingly assume the depleted state of their ecosystem is normal—a phenomenon called shifting baseline syndrome stories like Calderón's can provide critical data about what a healthy ecosystem once looked like. A first step towards recovery, she explains, is implementing this data in fisheries regulations and policy.

Tiny sharks, known as cazón, at the Ciudad del Carmen fish market.



Ciudad del Carmen fishermen Meco, Guadalupe, and Zenón, who humored us by contributing these props to an impromptu portrait shoot.

From the Calderón's courtyard, a song from the festival boomed in the distance: en ese barco, Jesús es capitán . (In this boat, Jesus is the captain.) How, I wondered, could a fishing community transition away from an economy so ingrained in their cultural identity—enough for its sharks and rays to recover? What would true sustainability look like here, one that honored the knowledge of its elders and its rich ecological past?

It was an active question, one that would have to be lived into. The song reverberated past the fishing boats, over the milky waters of Términos Lagoon towards the industrial highway bridge, rumbling with cars towards Ciudad del Carmen, where oil platforms blinked offshore.

Over three hundred miles away, on the outskirts of Isla Holbox in the state of Quintana Roo, a former shark fisherman named Carmelo Sabatini stopped his golf cart outside a newly built hotel. Turning away from the modern façade of wood and stone, he led marine biologist Nadia Rubio to a small pond beside the parking lot. In shallow water lined with mangroves, a tiny, colorful fish was engaged in a complex mating ritual. With the energy of a man far younger than his 77 years, Sabatini's face lit up as he described the behavior of the fish with such enthusiasm and detail that several tourists stopped in the street, put down their cell phones, and came to look.

Holbox, much like Términos Lagoon, once teemed with sharks and rays. Thanks to the productive mangroves and seagrass beds of the adjacent Yalahau Lagoon, the island supported a thriving shark-fishing community of about 1,000 people. Yet its marine life dwindled following the March to the Sea, eventually forcing fishermen to travel up to 70 km from shore daily to fish. Ecotourism promised a sustainable alternative to a struggling fishing economy—especially because hundreds of whale sharks gather to feed on plankton off the shore of Holbox each summer.

In the early morning, Miguel Zapata Jimenez, 77, gathers bait fish on the shore of Holbox before the beach fills with tourists. Zapata is renowned for his prolific career as a shark fisherman before the economy transitioned to tourism.

A passenger rides a moto-taxi to the ferry terminal in Chiquilá, a port town where ferries depart daily to Holbox.

With white-sand beaches, thatched-roof huts shaded by palm trees, and crystal-clear waters where the Gulf of Mexico meets the Caribbean, Holbox (pronounced hol-bosh) was a perfect candidate for the travel industry. Fishermen formed tourism cooperatives where they excelled in new careers as boat captains and guides. Together, they developed local regulations for sustainable whale shark tourism, and in 1994, the Yum Balam Flora and Fauna Protection Area surrounding Holbox was the first nature reserve created entirely at the request of local communities. Every effort pointed towards success.

But Holbox's resulting tourism boom was larger than anyone anticipated. The whale shark watching industry now generates $108 million per year in the Gulf of Mexico, and the influx of people and money has had unintended social and environmental consequences. Holbox frequently receives up to 5,000 visitors per day during the summer season, with new construction expanding faster than its water, waste removal, and electricity infrastructure can support. The white sand beach in front of town, once a nursery for baby sawfishes, is dominated by beach clubs and bars.

Tourists bike past a Holbox hotel near supposedly protected mangrove habitat.

Patrons dine in a lavish Holbox bar.

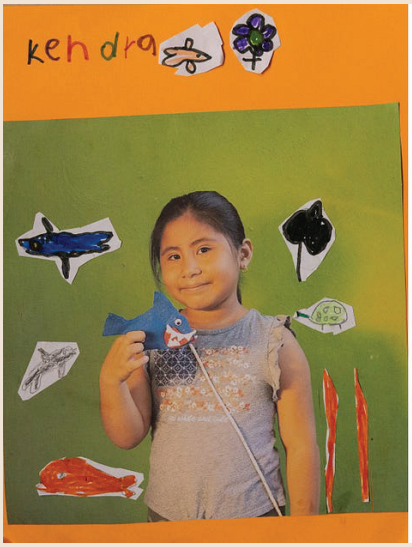
“I came to Holbox for four days, but I’m staying,” a woman in this photo told me. Holbox is experiencing a surge in foreign residents, driven by the global rise in remote work and the allure of a slower-paced lifestyle.

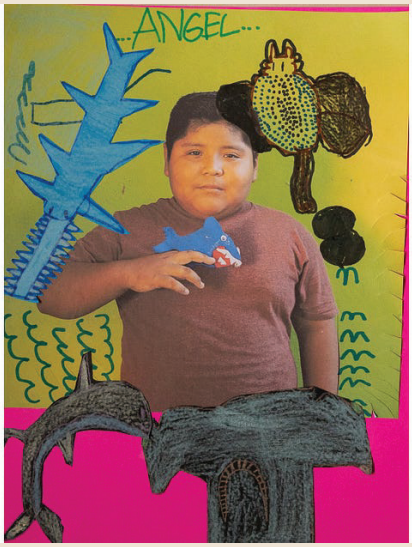
Since 2015, Dr. Nadia Rubio has been tirelessly working with Holbox’s elder fishermen to create a record of what the marine ecosystem looked like when it was still intact. Like Martínez, Rubio gathers local stories to recreate critical baseline data about sharks and rays, relying on her empathy, camaraderie, and deep love for marine life to create lasting relationships. On Holbox, she has identified more than 100 historical fishing areas that were once highly productive, and has pushed to have fishermen’s local ecological knowledge considered equivalent to scientific research. Her work also looks to the future: including educational workshops for kids, collaborations with local environmental educators, and a children’s book about Holbox’s shark fishermen that she created to ensure their stories are passed on.

Top Left: Children in Chiquilà, the port town where tourists depart for Holbox, learn about local marine life at a workshop hosted by Rubio and local educator Chica Antele.

Top Right: Since the port town of Chiquilá lacks the resources that Holbox has, Francisca "Chica" Antele, a local biologist and avid birder, organizes environmental education for kids in Chiquilá - often out of her own home.

Rubio presents about native sharks and rays at a children's workshop in Holbox, part of an educational project she founded through her nonprofit Mar Sustenable.





Collages made by children in Rubio and Antele's Chiquilá workshop, featuring their favorite sharks and rays native to the Holbox area.

When Rubio and I arrived in Holbox in 2023 to visit her collaborators, it was clear that the community she once knew was rapidly changing. The allure of high profits had caused politicians to look the other way as rampant development wreaked havoc on the environment, and the selling of communal lands had divided the people. Riding with fisherman-turned-boat-captain Carmelo Sabatini on his golf cart across the island, we watched a bulldozer plow through a protected mangrove forest to make way for a new hotel. A whale shark guide described his dismay at finding the once-pristine beach littered with beer bottles and sometimes cocaine. The marine park's boat, the only form of regulatory enforcement for the wider Yum Balam reserve, had been out of service for two years.

Top Left: Holbox shark fisherman Miguel Zapata Jimenez and his wife Etelvina, both 77, in the doorway of their family bungalow. Once on a quiet sand street shaded by palm trees, it is now surrounded on all sides by concrete, hotels and restaurants.

Top Right: Catfish school in the Yum Balam Flora and Fauna Protection Area. The area provides a habitat for jaguars, American manatees, and Baird's tapirs, among many other species of land and sea animals.

On a calm May morning, with Sabatini as our boat captain, we departed from Holbox in pursuit of whale sharks. The massive, endangered filter-feeders gather offshore to feed each summer, and the chance to swim with such an animal is a major driver of tourism. On the sea, Sabatini and Rubio were electric with camaraderie and joy. Even Sabatini's little dog Loca barked with glee at the dolphins, the spotted eagle rays, and the sea turtles that broke the surface of the clear waters. This was the ocean they wanted to protect.

And then we found a whale shark—and on the count of three, plunged into a face-to-face encounter with an otherworldly and prehistoric animal the size of a school bus.

Our few minutes in the water with the shark, watching it glide past us with a speed and agility we could never match, felt like a small eternity. We returned to the boat gasping with adrenaline and awe. But watching the 15 other boats waiting their turn to swim with the same animal, I couldn't help but wonder about the cumulative effects of such constant human presence. According to Mongabay, conservationists counted 400 whale sharks in the waters around Holbox in 2009; by 2023, a Pronatura biologist reported fewer than a dozen.

Whale shark guide Vicente Cáceres and boat captain Carmelo Sabatini depart from Holbox Island in search of whale sharks. Swimming with the sharks has become highly regulated, and both guides and captains must go through extensive training.

That afternoon, snorkeling off the eastern tip of Isla Holbox, Sabatini told us that its brain corals and seagrasses paled in comparison to the groupers, turtles, sharks and rays that had once flourished there. The coral-studded seafloor, fluttering with rays, was but the smallest glimpse of what has been, and what could be. The potential of Holbox's tourism was clear. What it needed were constraints, and according to Rubio, for the local ecological knowledge of its community elders to be taken seriously.

Considered "gentle giants," whale sharks are the largest species of fish on Earth.

Mangroves in a channel off the northeast tip of Holbox Island.

A southern stingray swims along the sea floor near Cabo Catoche.

Marine biologist Nadia Rubio snorkels at Cabo Catoche.

Some stories ask questions more than provide answers. This assignment was one of them. The road to environmental recovery is long, and in both Términos Lagoon and Holbox, highly complex. Yet in the years since this assignment, both Nadia Rubio and Ilse Martínez have co authored studies proposing pathways to incorporate traditional knowledge into fisheries decision-making. Their work makes me hopeful: for a world where marine conservation centers the knowledge of local people, who know their home ecosystems better than anyone else.