CHAPTER NINE

DOING LA CUCARACHA WITH MANTA RAYS IN MEXICO

Manta rays are giant sea animals related to sharks and skates. They look like stingrays but are a lot bigger, are cartilaginous, live in salt water, and belong to the Elasmobranchii subclass of fish. Manta rays are found in tropical waters all over the world, but usually around coral reefs. They rank among the most sought after animals by divers everywhere, particularly during night dives. These magical-looking creatures feed on tiny animals and plants, called zoo and phytoplankton (respectively), and do so while displaying an elaborate swooping dance. Once they find a rich cluster of plankton, they roll on their backs in continuous somersaults, mouths gaping wide open while filtering thousands of liters of seawater through gill-rakers that sift the nourishing plankton from the water. An adult Manta dines on over 30 kilograms (66 pounds) of food a day.

Planktonic creatures, like many others in the oceans, are attracted to light, so here's a cool tip for underwater photography buffs that will get you *the* most amazing underwater shots you ever took: while diving at night in an area known to host Manta rays turn on your flashlight and sit quietly on the bottom. Mantas often seek out plankton shoals near coastal shelves and reefs. Make sure you don't squat down over corals, which are facing perils of their own and don't need you treading on them also.

Soon you will see thousands of little flickering beings swarming around your light; that's plankton in action. Thereafter, if you're *really* lucky, the beam from your torch will be clouded by the dramatic apparition of a gigantic diamond-shaped mass with two horns and graceful pectoral "wings", often spanning 7.26 meters across (25 feet). When that happens you will understand why early seafarers called these creatures "Devil rays" and you will have a warmer wetsuit around the bum to prove it!

Giant Manta rays are also prized by the public aquarium industry. If evolution hadn't developed their spectacular physiognomy, they could be the eerie construct of some Hollywood special effects geek. They evoke the image of flying demons or mythical beings and are so extravagant in appearance they look like they just wandered off the set of the movie *Avatar*.

Despite their other worldly façade, these enormous creatures are incredibly docile, and sometimes express a playful curiosity in divers, possibly drawn by bubbles from the scuba tank. Like their shark cousins, their skin is covered in rough dermal denticles with the addition of a protective mucus. A beautiful and as fascinating as these fish are, I urge my team of biologists when swimming around giant rays not to touch them, since any erasure of the mucus shield leaves the ray's skin open to infection. Their "horns", by the way, aren't really horns in the sense that they are not made from bone. They are, quite the contrary, extraordinary but true fins called "cephalic lobes". These lobes are usually folded inwards as if they were a coil ready to spring and scare someone into stopping their hiccups. The fins unfurl when food is present and act much like shovels, guiding a steady stream of water into the ray's mouth, carrying nourishing plankton with it.

These gentle giants boast multiple accolades, the most prominent being that they rank the highest in the brain to body weight ratio among non-mammalian sea creatures, which simply means they are the smartest in the fish world. Manta rays feature an intricate network of blood vessels around their cerebral cortex, called a *rete mirabile*, (which is Latin for "wonderful net"). This neural membrane allows them to keep their brain's temperature 5, or even 10, degrees above the ambient environment, maintaining functions such as memory, perception, consciousness and reflexive behaviors, even when the animal dives 500 meters in very cold waters.

Csilla Ari, a young Hungarian researcher I had the pleasure of working with in Mexico back in 2002, has studied the complex physiology behind this elaborate system and definitely established how such an evolutionary advantage came with additional brain capacity. *Retia mirabilia* (the plural of the big words above), are countercurrent systems whereby extremely thin multiple blood vessels lie so close to each other that they allow for ion, gas or even temperature exchange to occur.

Quite a few vertebrate fish use this complex function, for example, to keep the inner parts of their bodies at a higher temperature than the surrounding marine environment. Scombrid fish, such as mackerel, or even Lamnid sharks, such as White or Mako sharks, have similar systems and this is the reason why these enormous fish have the capacity to display sudden bursts of speed that you would not think possible in such large animals. Manta rays also do their share of breaching, making high-flying soaring leaps out of the water in a breathtaking display of verve and agility.

Fig 9.1 A Manta ray in flight

Like sharks, rays swim continually, taking in water through their mouths, letting it pass over its gills and allowing it to exit through gill slits on their ventral sides, a process that allows them to breathe and survive. They are extremely graceful swimmers, their languid glide as refined and elegant as the stride of any fashion model in a silk gown. However, their "dress" is subtle and designed for camouflage; the dorsal surface is often brown, grey-blue or even black with their belly a pale white. Some Manta rays are splotched with black and white markings, patterns that marine biologists often record to identify individual rays in a feeding vortex. They are one of the few species that enjoy "grooming assistants". This is a cool interdependency where remoras, angelfish and wrasse perform a major scrub of the Manta's skin and gills while snacking on parasites and dead tissue. They even have their own cleaning "salons" at various

reefs and rock shelves around the world's oceans. The grooming must feel good because divers have reported the astonishing sight of a huge motionless ray with pectoral wings patiently extended getting spruced up by hundreds of busy little fish.

AN INVITATION TO COLLECT MANTA RAYS IN BAJA CALIFORNIA

The subject of Manta rays first came to my attention in La Paz, a fun loving Mexican city way down south in Baja California. Mark Smith, Miguel Oliveira and I were attending the annual American Elasmobranch Society (AES) meeting there and had been lingering for no more than thirty minutes when a car drove by with the popular folk tune 'La Cucaracha' blowing out of the horn. The sight and sound made us all roll on the floor laughing, for we had spent the entire flights joking about the possibility of this happening. Mark struck up a dialogue with John O'Sullivan, curator of collections for the world renowned Monterey Bay Aquarium (MBA). I had met John O' in previous AES meetings and he was by far one of my favorite conference buddies.

The very first time I saw him "in action" was at the festive auction to raise funds for student scholarships that traditionally takes place at the yearly banquet on the last day of the conference. After much ferocious bidding, banquet diners purchase sharky items and the proceeds fund students in need of financial assistance. (I was one of the lucky AES travel award recipients, both in 1995 and 1996.) I met John O though, at my very first conference, in Los Angeles, 1994, a few days before I turned 22 years old. One of the key factors that makes a successful auction is the animator and John O' did a sublime job that year. Shark expert, Ian Gordon was his sidekick and he had already attracted quite a bit of attention to himself some days before by concluding his excellent talk on Sandtiger shark pre-copulatory behavior with these fine words of wisdom, "Better drink beer than the water, because sharks are fuckin' in it".

Ian and John O' were on fire that evening and their wild antics drove the crowds to raise 2,000 dollars (!) for students, which is quite the accomplishment considering there were approximately 100 shark scientists sitting at the dinner tables. Just in case you're wondering, in the great economic ranks of the world, sharks scientists don't earn even close to the salaries of lawyers or doctors, so 2,000 dollars was, trust me, a *very* reasonable outcome. However, the highlight of the evening came when our animators got Kazunari Yano, one of Japan's leading fisheries biology scientists, and a specialist in shark related matters, to do the *Japanese Fertility Dance*.

This consisted of several disorderly untamed men holding long slender objects (such as empty wine bottles of which there were plenty) in front of their groins while mimicking explicit reproductive behaviors and chanting Japanese words. To say the mostly occidental crowd went *wild* is a gross understatement but, sadly, a few conservative types found the festivities too offensive and that was the last time we all enjoyed John O's, or Ian Gordon's, unorthodox behavior on stage. Even sadder is the fact that in 2006 Kazunari Yano succumbed to a fierce battle at age 50 with an aggressive brain tumor that robbed the marine sciences community of a brilliant mind.

In 2000, Mark sat down with John O' in La Paz while the good spirited Californian shared his thoughts on how to catch Manta rays in Baja California and move them some 1,000 miles north to Monterey. Even better, he asked whether the Oceanário de Lisboa, where I was curator of collections at the time, would like to be involved with an expedition that would focus not only on the capture of these animals, but also on researching their behavior, abundance and movement patterns in Mexico's Sea of Cortez. We pondered on the issue for… hmm… one and a half seconds, and then conveyed to John O' how honored we felt that the most prestigious public aquarium in

the world was giving us the opportunity to be involved on such a fun trip. Immediately after returning from La Paz, we all started planning and scheming on the best ways to achieve the expedition's goals.

The first order of business was compiling a thorough bibliography on Manta rays, which still isn't particularly extensive but certainly was less abundant in 2000. John O' had commissioned Joe Bizarro, a student from Moss Landing Marine Laboratories for the task but we took it upon ourselves to do some homework on the subject also. We learned there are two genuses of Manta rays: *Manta* and *Mobula*. The first includes two species and the second nine, and all are listed below:

Manta alfredi (Krefft, 1868) Alfred manta

Manta birostris (Walbaum, 1792) Giant manta

Mobula eregoodootenkee (Bleeker, 1859) Longhorned mobula

Mobula hypostoma (Bancroft, 1831) Lesser devil ray

Mobula japanica (Müller & Henle, 1841) Spinetail mobula

Mobula kuhlii (Müller & Henle, 1841) Shortfin devil ray

Mobula mobular (Bonnaterre, 1788) Devil fish / Devil ray

Mobula munkiana - Notarbartolo-di-Sciara, 1987 - Munk's devil ray

Mobula rochebrunei (Vaillant, 1879) Lesser Guinean devil ray

Mobula tarapacana (Philippi, 1892) Chilean devil ray

Mobula thurstoni (Lloyd, 1908) Smoothtail mobula

The *Manta birostris*, or giant manta ray, is the one we've all come to know, and love, from multiple Discovery Channel and National Geographic productions. These grow to a wingspan of approximately 8 meters. They are hard to catch and challenging to move from the wild. Exhibiting such a magnificent animal to the public is every

collection manager's dream. However, the joint MBA and Oceanário de Lisboa expedition would focus on the much smaller *Mobula munkiana*, *Mobula japanica* and *Mobula thurstoni*, which were the most abundant species in Bahia de Los Angeles, a small fishing town on the western shore of the Sea of Cortez, halfway down the peninsula of Baja California. These smaller animals, especially *Mobula munkiana*, also are known for their schooling behavior,

The thought of a huge mass of the tiny Munk's devil ray (which don't grow over one meter in wingspan) swimming across MBA's massive Outer Bay exhibit, amidst the monumental Bluefin tuna, like a gigantic flock of birds, was the image we all had to guide our efforts. John O' had a phenomenal contact for a small research station down in LA Bay, as we came to refer to it, so we quickly decided this would be our base of operations.

The adventure began with multiple emails fired across the Atlantic, all the way to the Californian Pacific shore, and the plan grew stronger over the year. A departure date was set, iconic to say the least: July 4, 2001 -- the day Mark and I were to start assisting John O' in Monterey with last minute preparations before our road trip down to San Diego and then Bahia de Los Angeles. At the very last minute, however, I had to change my travel plans because Leonor, (my wife at the time) was defending her master's thesis on July 5, on the growth of Mediterranean slimehead roughies, *Hoplostethus meditterraneus*. I had forfeited her Marine Biology undergrad senior thesis presentation in 1995 to undertake a research survey while working for the Portuguese Marine Research Institute (then called "IPIMAR"), and therefore had vowed to the Academic Gods that, come Hell or high water, I would not miss her Master's defense.

However, the Gods played the most evil, dirty trick on the proceedings. At the very last minute, a member of Leonor's thesis Committee suddenly cancelled. This reset her presentation for the following week, smack in the middle of our planned expedition to LA Bay.

I had already caused a commotion with my team by delaying my departure for three days and risked everyone's wrath by delaying it one week further. Saddened by the vicious curve ball the Gods had thrown me, I had to say goodbye to my ever-understanding wife and boarded a plane to Newark, NJ, on July 6, followed by another flight to Los Angeles, and finally the small twin-engine commute to Monterey where I arrived minus my luggage. "This is just great!" I thought, feeling less than amused and broken by forces I couldn't control. I did the only logical thing and finished my jet-lagged evening with "Scary Movie 2" at a local theater with a head-sized bucket of popcorn drenched in butter. *Nothing* puts me in a better mood than a trip to the movies.

THE JOURNEY TO THE SEA OF CORTEZ

Monday morning, July 9 we hopped into three vehicles fully loaded with supplies and slowly made our way south in California to San Diego, where we slept and prepared for next day's journey through the hot July Mexican desert. One of the three vehicles was John O's broken down, and very old, orange Volkswagen Beetle. To this day, I am still amazed at how well that rickety looking machine managed to survive through the unforgiving heat. Crossing the U.S.A. / Mexican border in San Diego is one of those rare travel moments one doesn't forget. A single white line on the ground divides the opulence and richness of a society motivated by success and attaining a decent lifestyle from one of abject poverty and starvation.

Leaving San Diego in the rear view mirror and pulling into Tijuana is a "before and after" experience I highly recommend to all those folk who complain about long lines at Six Flags Great America or even McDonald's. Just try spending *one afternoon* being Mexican in Tijuana and then see if you don't develop a sudden appreciation for the daily comforts we've all come to love up here in the northern hemisphere. However, that, I suppose, is the reason why traveling is so wonderfully fascinating. Once you cross a border, you enter a *different* world. Moreover, *different*, at least in my book, is a cool heading to have despite the wild variables one encounters.

Fig. 10.2 – A Map of Baja California shows relevant landmarks, north to south: Tijuana, Rosarito, Ensenada, San Quíntin, Bahia de Los Angeles, La Paz and San José del Cabo.

Fig. 10.3 – John O's Volkswagen Beetle (notice the custom fitting for moving fish drums in the back), which Manny Ezcurra, one of John O's staff, drove all the way from Monterey in Northern California, U.S.A., to Bahia de los Angeles in Baja California, Mexico over two days.

As we drove south, we made a quick stop in Ensenada, where we picked up Oscar Sosa Nishisaki, another good spirited Mexican researcher from CICESE (*Centro de Investigación Científica y de Educación Superior de Ensenada*, or the Center for Scientific Research and Superior Education in Ensenada). A few hundred miles later, we pulled over for lunch in San Quíntin, where from a stand on the side of the road I had the finest fish tacos my taste buds ever met. John O' often made habitual stops there and treated ten of us for lunch for less than 10 U.S. dollars. The group from the Monterey Bay Aquarium included: John O' and his super cool assistant, Joe Welsh, (who performed for us a mean version of Jimi Hendrix's "Hey Joe" with a silicone gun in his hand); Manny Ezcurra, supervisor of the Outer Bay tank; Scott Greenwald, a great aquarist I quickly became good friends with; and Alan Young, another aquarist with a

gift for mechanical problem solving. Oscar brought along Alberto and Juan Carlos, two of his students from CICESE, and Mark and I rounded out the team.

We got to our headquarters in LA Bay after some ten hours of driving through the extraordinarily hot, albeit impressive, Mexican desert. The journey felt like parading through a postcard, with all the cactuses pointing their fingers up, as they do in Hollywood westerns; at one point I could have sworn I saw cowboys and Indians fighting off in the distance.

Carolina Herrera was the lab manager who took us through some orientation rules, which immediately sparked flashbacks from my times at the Sharklab in Bimini back in 1994 and 95. Every day one of us was the "duty person" in charge of colorful jobs such as scrubbing toilets and assisting with food prep, washing dishes and overall cleanup of the station. Nevertheless, we all felt it was such a wonderful opportunity being part of a cool field expedition like that, that toilet scrubbing was done with a smile. (Except if someone had had a gastric meltdown involving a demonic burrito.) Then the smile would fade quicker than a one-hit-wonder's career in show business.

Fig. 10.4 – The Mexican desert while driving in Baja California.

Later that same evening, Heidi Dewar and Ellen Freund joined us after driving in Heidi's car from San Diego as well. These two young researchers had recently completed their doctorates in tuna physiology while working with the reputed Barbara Block, the world's leading researcher on bluefin tuna physiology and ecology. Heidi and Ellen were the scientific staff of our team and brought data loggers we were to deploy on Manta rays to help us all understand their movement patterns around the LA Bay area. Next day, Randy Hamilton, general curator of the MBA, Jon Hoesch, a senior staff member, and Joe Bizarro, the research student joined us. Also included in MBA's gang was Dave Powell, a charismatic then 74 year-old guru in the collections world who had just recently launched his awe-inspiring memoirs *"A Fascination for fish"*. (Once you're done with this book, you should read Dave's work, which features decades of adventurous moments with Great White sharks and other fun little animals.)

We now had a total of fifteen souls working diligently to seek out and collect the nicest looking Mobulids we could possibly find and to deliver them to the MBA. During those unforgettable days, we woke before sunrise to be greeted by a huge flock of pelicans whooshing over our heads as if moved by an internal clock that would put the Japanese train system to shame. The heat was too intense for sleeping under a roof so we all bedded down outside. No sleeping bags, no sheets; just us resting on military-style cots and the star-studded sky above us.

We began our work by setting up a round swimming pool with an inlet pipe that pumped water in from the ocean. This was to be a comfortable holding tank for the rays. We sunk the suction end of the pipe way out from shore to avoid sand from boat activity, which otherwise would clog the intake pump and drive us all to bucket-carrying duty (a not so fun job considering the pool held in excess of 20 cubic meters of water). That means, for the metrically challenged, 20 thousand liters, or 5,263 U.S.

gallons (i.e. simply divide liters by 3.8 to get your result in U.S. gallons). The pool was then covered by an oriental style PVC-built pagoda that brought much needed shade. We started our water quality monitoring right away, ensuring the temperature and salinity were adequate for holding small devil rays.

Fig. 10.5 – The holding pool, in Bahia de Los Angeles, set up for temporarily housing small Mobula munkiana before moving them north to the Monterey Bay Aquarium. On the right is the intake pipe that we linked to the ocean. On the left is the oxygen cylinder that provided dissolved oxygen to the water as needed. After this picture was taken, a pagoda was built above the rim to provide shade.

The workload in LA Bay was heavy but exceedingly rewarding. We deployed teams of two who continuously sailed out with local fishermen searching for devil rays. The team assisted them by setting a gill net some 200 meters long. We would then go back along the net to search for fish caught in it. Immediately we realized the area was more severely depleted than we anticipated as the nets were trapping little more than extremely young Guitarfish, of the genus *Rhinobatus*, which means the adults were long

gone, a deadly and confirmed sign of overfishing. But the scariest moment was the realization that after one day, two days, three days, ten days into the fishing we were collecting *zero* Mobulids.

The chief fisherman, Manuel, told us the area had been fished intensely during the previous months, which most likely explained the complete absence of devil rays in the area. For hours we would zoom around Isla Coronado, Isla Ángel de la Guarda, and others, with one of the fishermen driving the *panga*, a two manned boat used by the locals, while the other stood tall on the bow carefully scanning the surface of the water to locate the much desired wingtips that signal devil rays' presence.

Devil and Manta rays often swim so close to the surface that their wingtips break it. This behavior makes sense because phytoplankton (the miniscule plants that make up plankton) is photosynthetic; it depends on light to survive and mostly hovers near the surface. Zooplanktons, which are the tiny animals that form the rest of the plankton colonies, feed on phytoplankton and therefore do their best to stay near them. The definition of the word "plankton", mind you, means these creatures lack the ability to counter water movement; they are compelled to go wherever the water goes, just like Jellyfish, the largest members of this group. "Nekton", on the contrary, is the word used for aquatic organisms that *can* counteract currents, which means just about every fish in the world is considered a "nekton", while the tiny elusive creatures that swarm in giant clouds along with jellyfish, are "plankton".

Fig. 10.6 – Manny (far left) and Heidi (sitting on the right) join two fishermen in their panga as they deploy nets in the waters off Bahia de Los Angeles in their search for the elusive Devil rays.

As days progressed, a major discouraging feeling slowly settled over all of us. We spent hours cruising the nearby waters in the *pangas*, wishfully hoping to see the much-craved wingtips breaking the water, and yet nothing happened. It wasn't all bad, though, because these searches came with multiple waits that we used for jumping in the warm Sea of Cortez and snorkeling all over the place. But, as our expedition drew to a close, the general feeling, despite the nightly doses of "liar's dice" soaked in *José Cuervo* (*Añejo*, no less) and mescal, was that overfishing had robbed us of any chance of setting our eyes on a Devil ray. Then it happened…

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