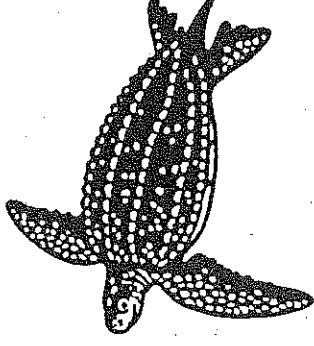


VOYAGE OF THE
TURTLE

In Pursuit of the Earth's Last Dinosaur



CARL SAFINA

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Others took a different approach to explaining the world. The story they started took centuries, and in many ways it is a creation story that will not end.

Pythagoras seems to have first reasoned and written that because the sun and moon are round, and the shadow of Earth during an eclipse is round, Earth, too, may be round. That was cutting edge science twenty-five hundred years ago. About two thousand years later, so the story goes, a young Christopher Columbus noticed that the tops of ships' masts appeared over the horizon before the ships themselves, and deduced a spherical world and the possibility of voyaging to the East by sailing west.

By the time European sails filled with wind were heading west and south, the world's warm and temperate seas were still filled with sea turtles, whose numbers probably ran to billions. It's quite likely that for every sea turtle alive today, there were, within historic times, a hundred. Just within the last century, many populations have declined 90 percent.

The living abundance in the oceans at the starting line of modern times can scarcely be imagined this late in the day. Christopher Columbus's second voyage, in 1492, gave us, for instance, this snapshot: "In those twenty leagues . . . the sea was thick with turtles . . . so numerous that it seemed the ships would run aground on them and were as if bathing in them." On May 10, 1503, during Columbus's fourth voyage, he came in sight of, as his son Ferdinand penned, "two very small and low islands, full of turtles, as was all the sea about, so that they looked like little rocks." They named them the Tortugas, Turtle Islands. Later renamed the Cayman Islands, they harbored possibly the largest Green Turtle rookery within historic times. Such sights clearly conveyed the impression—*always* mistaken—of wildlife inexhaustible. Aboriginal peoples had already depleted some small nesting populations. But that was nothing compared to the coming European onslaught. In the Caribbean, especially, turtles took it hard during the colonial era. Soon after European settlement, Green Turtles—the preferred species and a staple food for ship crews and arriving colonists—became targets of a trade so intense and thorough it triggered a wave of local extinctions at important nesting grounds.

In 1610, a Bermuda settler noted that "*on the shores . . . Turtles, Fish and Fowle do abound as dust of the earth.*" In 1620, only eleven years

after its colonization, Bermuda was already so depleted that its assembly enacted a law protecting younger turtles, possibly the New World's first conservation legislation:

An Act agaynst the killinge of ouer younge Tortoysees

In regard that much waste and abuse . . . by sudrye lewd and impvident persons . . . who in their continuall goings out to sea . . . snatch & catch up indifferentlye all kinds of Tortoysees both young & old litle and greate and soe kill, carrye awaye and devour them to the much decay of the breed of so excellent a fishe . . . therefore . . . from hence forward noe manner of pson . . . shall presume to kill or cause to be killed . . . any young Tortoysees that are . . . Eighteen inches in the Breadth or Dyameter.

The penalty was fifteen pounds of tobacco (half went to government and half to the informer). In spite of this early protection of young turtles, slaughter continued, and by the late 1700s the waves of breeders trickled to a few drops and then ran dry. Bermuda's nesting Green Turtles were essentially gone by around 1800 (though a few survivors lasted into the 1930s). After the "dust of the earth" was turned to ashes, people continued catching sea turtles visiting Bermuda waters. Bermuda finally granted turtles full protection in 1973—two centuries late. (Releases of hatchlings in the 1960s and '70s have so far failed to establish breeders.)

In 1655, with the British colony in Jamaica needing meat, the admiral dispatched one of his ships to the Caymans for turtles. From that day, the Caymans became a killing field for nesting females. One Edward Long wrote of the turtles, "It is affirmed, that vessels, which have lost their latitude in hazy weather, have steered entirely by the noise which these creatures make in swimming, to attain the Cayman Isles. . . . In these annual peregrinations across the ocean they resemble . . . herring shoals. . . . By the gracious dispensation of the Almighty . . . when the fruits of the earth are deficient, an ample sustenance may still be drawn from this never failing resource of turtle, or their eggs, conducted annually as it were into their very hands."

Faithful to a fault about a place that had worked for millennia, generations of Green Turtles returned to beaches that had broken their promise. During nesting, May to September, turtles coming to dig nests found themselves turned onto their backs on the beaches; their flippers, for the first time in their long lives, unable to gain the purchase of either water or

sand. By 1670, forty sloops from Jamaica were taking turtles year-round. Outside the nesting season the boats pursued and hounded them in their feeding grounds among the shoals and sea-grass flats and cays. Each time the sailors lifted their glasses to ring in the New Year, another thirteen thousand turtles had gone to feed Jamaican settlers.

By 1711, with Caribbean turtles showing an exhaustion that Columbus and his men could never have envisioned, the government of Jamaica enacted a law prohibiting turtle-egg collection from any island belonging to Jamaica, including the Caymans. It was never enforced, either on the beaches or in Jamaica's markets. Turtle was Jamaica's main meat, and permanent settlers lived and worked on the Caymans, mining the ancient mariners.

In the late 1700s, the Caymans' Green Turtles finally buckled. Only a few turtles crawled from the sea to lay doomed eggs on the Caymans each year. Eight or nine boats still hunted for Jamaican appetites, but now they sought their turtles mostly around Cuba's southern cays.

By 1830, Cuba was depleted, and the focal point of Caribbean turtle hunting shifted to the coast of Nicaragua and Honduras. By 1900 hunters had largely depleted those areas; in the next decades they turned to Pacific Mexico.

Originally, Caribbean Green Turtles numbered in the tens of millions, perhaps several hundred million; likely far more than the number of American Bison before the New World heard its first gunshot. They've never substantially recolonized the Bermuda or Cayman rookeries, and nowadays Caribbean colonies hold only an estimated 5 percent or less of their pre-Columbian Green Turtle numbers.

Nonetheless, all seven species of sea turtles made it through the twentieth century and into the twenty-first century. The question is, Will they make it out?

Sea turtle expert Jim Spotila summarized some estimates of original adult turtle populations worldwide: Of Green Turtles, six hundred million. Half a billion Olive Ridleys. Tens of millions of Loggerheads. Four or five million Hawksbills. Leatherbacks probably numbered one to five million worldwide.

Most species today likely stand at fewer than 5 percent of those numbers. Today we derive relief hearing that Kemp's Ridley Turtles have increased from 300 females to 2,500. That hard-earned relief is warranted. But backlit by past numbers of perhaps 500,000 Kemp's Ridleys, it's a pale shadow.

Turtles once played an important role in ocean communities. Nowadays, their scarcity is more significant. Sea-grass beds that would once have been grazed short by Greens have become overgrown and diseased. Hawksbills' main food in the Caribbean, a sponge called *Chondrilla nucula*, is now overgrowing coral reefs and in Belize has been called "one of the major threats to corals." Caribbean specialists Karen Bjorndal and Jeremy Jackson derive a "very conservative" estimate of 540,000 adult Hawksbills in that region before Europeans arrived, but about 27,000 today. Bjorndal and Jackson conclude, "The virtual ecological extinction of sea turtles in the Caribbean must have resulted in major changes in the structure and function of the marine ecosystems they inhabited." Leatherbacks eat jellies, jellies eat fish larvae, and fish larvae grow into fish that people eat. So fewer Leatherbacks means more jellies, which means fewer fish. Are the numbers significant? No one can say; there are no turtle-filled, fish-filled oceans left to compare with. The point is that under the sea, out of sight, various sets of dominoes are falling.

There's no question that turtle populations were once much higher, but the trends are important. As we've seen, Florida's Greens, nearly gone by the 1980s, now annually dig as many as 2,500 nests—an exponential increase. Caribbean Greens have greatly improved from the lows of the 1970s and '80s. On the east coast of Mexico, Green Turtle nest counts have risen from only a couple hundred nests annually in the 1980s to nearly 3,000 clutches now. Greens on Costa Rica's Caribbean side have increased massively, quintupling between 1970 and 2004 at the famed Tortuguero beach, where up to 37,000 female Green Turtles now annually dig more than 100,000 nests, depositing about 10 million eggs—possibly the largest Green Turtle population in the world. They've increased despite some continued poaching of both eggs and adults, and jaguars preying on a few dozen nesting females annually—and despite hungry Nicaraguans annually taking about 10,000 Greens of various sizes from their waters to their cook pots.

The main message about sea turtles in the Atlantic is that, despite a bumpy ride, in the last few decades they're generally doing much better. That's not true in the Pacific or Indian Oceans.

For one thing, most sea turtles nest more frequently and lay more eggs in the Atlantic than the Pacific. Leatherbacks nest roughly every other year in the Atlantic and every four years in the Pacific. Leatherback

clutches average eighty-five eggs in the Atlantic, sixty-five in the Pacific. Similarly, female Green Turtles nest every two to three years in Florida and the Caribbean, whereas in the Pacific they grow more slowly, mature later, and nest every four or five years. Likewise, Loggerhead Turtles return for nesting every three years in the Atlantic, every four in the Pacific. That's probably because the Pacific's vast intercontinental distances produce sparser food. For Leatherbacks in the Pacific, the difference means only about three-quarters as many eggs in each nest and half the number of nests during a life. In difficult times, that could have real consequences. And with fisheries, beach development, and egg poaching, these are difficult times.

For example, various Green Turtle populations in the Pacific, Indian Ocean, and Mediterranean are down 30 to 98 percent in the last few decades. The main Pacific and Indian Ocean bright spots are places known for conservation: the Galápagos (stable), Australia (up by around 50 percent), and Hawaii (tripled since the Endangered Species Act kicked in). Throughout Southeast Asia, people eat about 100,000 juvenile Green Turtles annually, an unsustainable rate. (People also eat many kinds of land and pond turtles in parts of Asia. *Ten million* turtles like the now-endangered Three-Striped Box Turtle get traded into China annually. Turtles are now wiped out near human population centers, and half of Asia's ninety turtle species are endangered.) Nowadays the Indonesian island of Bali hosts perhaps the world's largest centralized sea turtle slaughtering place, with as many as 20,000 Green Turtles brought into the markets annually. Boats scour the sea for up to two months for enough turtles to fill their boats, hunting them as far away as Borneo and Sulawesi. The pressure threatens nesting populations over a large region. The trade is deeply rooted in tradition and custom, and you can see how difficult it is to just say "Stop." Balinese Hindus hold turtles sacred—but eat them. The mainly Muslim turtle hunters are not allowed to eat turtles—but can kill them. For weddings, pregnancies, cremations, temple purification, teeth filing (not filling), and other ceremonial rites of passage, any proper Balinese host wants turtle on the table, signaling wealth and prestige. They say it is part of being Hindu. (In India, where Hinduism originated, turtles are not religiously sacrificed.) One boat captain argues that his business benefits the environment because turtle hunting keeps his employees from their previous occupations: piracy and reef fishing with explosives. One of his men says that until he became a

turtle hunter, he often threw fifty homemade bombs into the sea each day, blowing up corals, so that he could rake up the dead and dying fish that appeared at the surface. "If there is another job that can provide enough income for me, I will change jobs," he said. "But for now, I can only catch turtles." One former turtle hunter found work at a turtle-breeding center in Bali. He says he is haunted by the image of turtles being butchered. Like everything about its life, a turtle dies slowly, often remaining alive and moving well after its throat is slit and its shell opened. "It's a torture to the sea turtle," the former hunter said. "Maybe if it could speak, it would ask for mercy."

There's good reason to believe Leatherbacks could actually vanish throughout the Pacific and Indian Oceans. Leatherbacks had disappeared from India before 1930 and declined to near zero in Sri Lanka by 1994. The few Leatherbacks that had nested in Australia went extinct in the 1990s. And the Leatherback's former western Pacific fortress, its Malaysia population, fell from thousands in the 1950s to survivors you can count on one hand today. Malaysia was home to 10,000 to 15,000 adult female Leatherbacks. Of that total, 3,000 females nested annually, laying several million eggs. Of those, local people took nearly every egg—for fifty years. Partial protection and artificial incubation came late and the wrong incubation temperatures, resulting in either all females or sterile intersex individuals. When those animals returned years later, their eggs didn't hatch. New trawl-net fishing nearby in the early 1970s coincided with a sudden further nesting decline of 20 percent per year. That tails-pin accelerated to 30 percent annually with the introduction of forty-mile-long Japanese drift nets, plus mortality from gill nets and fish traps. In recent years the nesting count has fallen as low as two females for the whole season. The population has essentially been eradicated. New Guinea's northwest tip, with about 500 to 1,500 females nesting annually, constitutes Leatherbacks' last stronghold in the whole span of the Pacific and Indian Oceans. It too appears to be declining, from rough estimates of 1,400 or so turtles in the 1980s to perhaps half that now—severe, though certainly not the free fall of other places.

The eastern Pacific fares no better. In 1990 about 1,400 individual female Leatherbacks nested on Pacific Costa Rica's most key beach. A decade later only about 100 returned, and by 2005, under 50—a decline of about 97 percent. In the early 1980s an estimated 75,000 female Leatherbacks

used Mexico's Pacific coast for nesting. By the late 1990s, as few as 250 remained—a decline of well over 99 percent. (That early 1980s estimate was quick and rough, but even if it was overestimated by a factor of ten—which is highly unlikely—the decline is still 97 percent. And there's also the possibility that it was underestimated.) At one Mexican beach where thousands of females nested in the early 1980s, two decades later only four females used the beach.

Atlantic Leatherback populations, by contrast, stand far stronger. The 2,600 adult females that nest on Central American beaches appear stable or only slightly declining. Leatherbacks using the northern Caribbean (1,100 adult females), Florida (250 females), and Brazil (50) are all increasing. Gabon and Congo on Africa's west coast host the world's second-largest Leatherback population, with about 10,000 females. (These are estimates of total living adult females that use those beaches in their nesting years, not annual nesting female numbers or annual nest numbers. Each female takes several years off between nestings, but in a nesting year lays about seven clutches.) Africa's west coast still also maintains significant nesting populations of Loggerheads, Olive Ridleys, Hawksbills, and Greens. Villagers in some areas kill two-thirds of nesting females for food, while along one stretch of Ghana's coast local people worship the turtles, which respond by nesting at high densities. West Africa's Leatherbacks seem stable in recent years. The world's largest current Leatherback nesting population, around 14,000 adult females, stretches from Trinidad to French Guiana. Leatherbacks come ashore more densely at their Trinidad nesting sites than at any other beach in the world.

Given what we know collectively, globally, about the fall of turtle populations, their continued declines in many places, their obvious vulnerability, and the difficulty of reestablishing them once major populations vanish, two things remain remarkable: One, in most of the world people continue to kill adults, take eggs, and deploy fishing gear as if there will be no tomorrow. Two, people working to protect sea turtles are actually succeeding. Some populations are recovering. The list of recovering populations is not trivial: In the western Atlantic, certain Green, Loggerhead, Hawksbill, and Leatherback populations, as well as the Kemp's Ridley Turtle, are more abundant now than in 1980, with, as we've heard, some populations increasing exponentially. In the eastern Pacific, Olive Ridleys are recovering after decades of overexploitation. We will hear more as we

drop into the Pacific. These facts show that some people never learn, but others do, and that what people do, good and bad, matters.

WORLDWIDE, FIFTEEN MILLION PEOPLE FISH COMMERCIALLY. THE MOST dangerous occupation, fishing kills workers at rates eighteen to thirty times higher than national averages of on-the-job deaths. The fish they land are worth about \$80 billion annually at the dock. But depletion from overfishing marginalizes the profits, and mechanization is reducing employment. Many longline boats operate on thin margins or take losses. The average U.S. Atlantic and Gulf of Mexico longline boat loses \$7,000 annually.

Into this picture stroll conservationists, usually pale and plump, asking—nay, often demanding—that fishers use new and unfamiliar gear, rerig their boats, or change their hook styles. Or stop fishing. But shutting down Hawaii-based long-liners would cost sixteen hundred jobs, for instance. So politicians would likely oppose any proposal to eliminate the industry.

The courts offer a different route.

Peaceable though they be, all sea turtles currently pack the punch of the U.S. Endangered Species Act. Whenever a species that goes by the title “endangered” or “threatened” might be affected by an action of the U.S. federal government, the U.S. Fish and Wildlife Service or the National Marine Fisheries Service must issue a “biological opinion” saying whether the activity is likely to “jeopardize the continued existence” of the species. If so, officials are supposed to lay out steps toward eliminating the jeopardy. Solomon in his glory could only have hoped for such wisdom.

But neither the U.S. government nor its citizenry is Solomon, so disputes arise. The game is usually played like this: the government tries to squeeze out the narrowest, rosier interpretation, while conservation groups try to force a sweeping assessment that takes every problem into account. In the case of Hawaii long-lining, the Fisheries Service issued no fewer than five biological opinions between 1985 and 1998. Each had, shall we say, issues. In 1985 the service considered the fishery out to only two hundred miles, and issued it permission to “take” 50 Loggerheads and 50 Leatherbacks and to kill 25 of each. In the legalese, “take” means, basically, mess with in any way, including catching and releasing. Due to crashing fish populations on the U.S. East and Gulf Coasts, many

wreckage of what was. Whether the embers will reignite or be snuffed is a story yet to play out. Laura says, "Every time we get a good year, it is not as good as the last good year. Every bad year is the worst ever. This year is a good year—but it is the worst good year we've had."

Nonetheless, extinction is not as imminent—and not as certain—as it seemed last year. There's more to work with. A little more time to train fishermen, dissuade poachers, buy nesting beaches. A little more time for trying to save the Leatherback.

Laura had shown us computer graphs of sea turtle trends. They're decidedly mixed. Olive Ridleys account for Pacific Mexico's main improvement. From the 1960s to the 1980s they annually dug about 200,000 nests in Mexico. When a slaughterhouse that had killed turtles to make leather and other products closed in 1990, Olives started increasing sharply. Now they dig about 1.4 million nests annually on Pacific Mexico's beaches.

For Mexico's Pacific Green—or "Black"—Turtle, the last twenty years show low numbers and little trend, but in recent years they're up some. Inasmuch as *all* of Mexico's nesting turtles were doing poorly a decade or two ago, one might see the increases of two species as a trend turning positive.

The two nesting species in real trouble on Mexico's Pacific coast are the Hawksbill and Leatherback.

Pacific Mexico's Hawksbill population is now nearly nonexistent, under twenty nests per year. Occasionally toxic because of their toxic sponge diet, thus seldom eaten by people, Hawksbill Turtles are nonetheless too beautiful for their own good. Hunted for millennia, their shells can be worked like plastic. In Japan, where Hawksbill shell—often erroneously called "tortoiseshell"—is referred to as *bekko*, the craft reached its pinnacle. Bekko processing got started in Japan during the late 1600s in the Edo era. Artisans and craftsmen transformed mere turtle shells into combs and hair ornaments beyond the means of average women, worn by wives of feudal lords and so-called high-class prostitutes. By the end of the nineteenth century overseas exhibitions featured the famed Japanese bekko products, including ornaments, jewelry, cigarette cases, model ships, and the like. In Japan I once saw a magnificent bekko rooster with a luxuriant ten-foot tail made entirely of Hawksbill shell, from perhaps dozens of turtles.

In 1977 most countries agreed to stop international commerce in

Hawksbills and their shells. They did this under a treaty called the Convention on International Trade in Endangered Species (CITES), the same vehicle that brought elephants the relief of banned ivory. Japan, epicenter of world turtle-shell demand, exempted itself. Japan imported roughly forty thousand kilograms of Hawksbill shell annually in the 1970s and "limited itself" to thirty thousand kilograms annually in the 1980s. One average-sized Hawksbill turtle yields about one kilogram of workable shell (most get caught as juveniles), so that's something like three-quarters of a million turtles in twenty years. In some countries Hawksbill populations thinned to the vanishing point. Japan belatedly, showing its characteristic grudge against nature, in 1994 closed its ports to Hawksbill shell. But, working with Cuba, Japan has repeatedly tried getting CITES countries to allow trade at least between Cuba and Japan.

They've pushed this proposal several times, so far unsuccessfully. (In open defiance of another global ban, Japan continues killing increasing numbers of whales, driven by a misguided nationalistic identity, similar to America's insistence on wasting energy as part of its national character. The main difference is that in America almost everyone loves to waste energy while in Japan hardly anyone cares to eat whale meat, making it interesting to weigh which of those ironies is worse.) While many Caribbean countries are working to restore the region's sea turtles, Japan and Cuba's continued proposals encourage continued illicit killing and stockpiling in hopes of eventual reopening. Meanwhile, smuggling continues.

Laura's twenty-year graph of the Pacific Leatherback shows its now-familiar crash. Pacific Loggerheads nest only in Japan and Australia but visit Mexico in significant numbers. They're crashing, too.

On the Atlantic side, however, the graphs look different. There's the Caribbean Green Turtles' rally and big increase. Also, as Kemp's Ridley recovers from catastrophic decline, the graph tracks the species' rise from its low of a few hundred nests annually between the 1960s and the 1980s to eight thousand nests now, and climbing. At this rate they could conceivably regain their historic numbers of tens of thousands of nests. And in parts of the Caribbean, even Hawksbills are increasing.

Of *Laid*, Laura clicked open several graphs at once, saying, "Look at the Caribbean, look how the Virgin Islands Leatherbacks are increasing rapidly. Now, compare that to places in the Pacific, like, look—Malaysia, crashed. In the 1970s they had several thousand nests a year, too, just like Mexiquillo did. Now, they have, like—*pfft*—nothing."

Today, as we rise from Zihuatanejo airport over the ocean, Laura observes, "It is a very shiny day." We again expect some high-density Leatherback beaches, and we start racking up Leatherback nests as soon as we're over the beach—about one or two per minute.

Suddenly Laura adds, "Six dead Olive Ridley Turtles."

Sandy, looking down at the beach, says she hasn't seen turtle remains piled like that for a long time.

Ten minutes later we see another turtle carcass pleasing vultures. We skirt another headland and *Laúd* nests again start coming every mile or so.

Into my headphones Laura calls three dead Leatherback adults. Duly noted; positions entered. Something here loves death.

I ask Laura if she thinks all these dead turtles have been killed by people.

She suddenly turns from the window—breaking her concentration for the first time all week—and looks at me as if I can't be serious. Then she says, "Yes—of course, killed by people." She again turns her concentrated scrutiny to the beach streaming by below, adding, "This area is worse than Michoacán. *Muy broncos*—many rough people. They are lawless. They do anything they want. They kill turtles on the beach. They kill people in the roads. There are drugs and rebels. Is really bad here."

Five or six minutes later another dead turtle lies among a string of nests.

Laúd nests continue coming every mile or so. At two miles per minute, that keeps us pretty busy. Meanwhile, six big commercial shrimp boats are working the area. One of the boats has recently raised its net, and now it pulls behind it a train of seabirds squabbling over the many thousands of small fish a crewman is shoveling overboard. In Mazatlán a couple of nights ago, Laura's friend the wildlife geneticist Alberto Abreu had told us how shrimping is intensifying on this coast: "Too many boats, and the reason is, there's a crisis in the countryside: more new people, not enough new land. So the population is overflowing to the coast, fishing and drug running. These are not traditional fishermen. They are the type of person who does everything illegally. Their nets are catching turtles; some they sell, others they discard. In one week this year over fifty dead turtles washed up on the beach. Twenty-five years ago we thought we would save the world by working with turtles on the beach. Now I believe the key to conservation is eliminating the causes of poverty."

A few miles down the beach, four men and a boy, their horses waiting patiently, are digging *Laúd* eggs, near the remains of two adult *Golfinas*.

We seem to be flying fast, but the world is traveling at nearly 9,000 new babies per hour—more than 2 per second. Each year 76 million new persons reach Earth's surface. That's 2 million more than the recent populations of New York, Tokyo, Beijing, Rio de Janeiro, Mexico City, Moscow, Delhi, London, and Cairo combined. The rate will slow, but by midcentury, we'll still be adding 34 million new persons annually. The world's population will increase from today's 6.5 billion to 9.1 billion in 2050. The poorest, least developed countries will saddle themselves with almost all that new hunger and demand. But that pressure will look for relief in the world's less pressured places.

A few days ago I asked Laura what she thinks caused the Leatherback's Pacific flameout. Was it fisheries bycatch, egg poaching, killing nesting females for food, a combination—? Many environmentalists and some scientists believe increased longline fishing has caused the Leatherback's decline. The circumstantial evidence is largely in the timing; the crash coincided with sharply increased long-lining. And long-lining kills turtles, no question. Some blame increased netting for Swordfish off California and South America. Nets kill turtles, no question. Others think that what happens on nesting beaches is the main problem. So I wanted to know what Laura, who lives it, thinks.

Laura replied, "The *Laúd*'s decline was so sudden it had to be caused mainly by near-total nesting failure." Laura believes that starting ten to twenty years before the observed crash in returning adult nesting females, hatchling production fell to near zero as nest poaching became a long-term problem.

But people living here knew of nesting turtles for a long time, so how could catastrophic nest poaching have happened suddenly?

"Roads" was Laura's surprising reply. "In the 1960s, many new roads went into the states of Guerrero and Oaxaca. In the 1970s, new roads went into Michoacán. Suddenly, people from outside could easily get to the beaches to buy eggs, to sell in cities."

This sounds familiar. From the great forests of the Pacific Northwest to the coral reefs of Micronesia to New England's giant tuna to rhinos and tigers and bears, to turtles and beyond, a familiar pattern: when distant markets suddenly arrive offering new cash fueled by insatiable demand

from outside, long-standing local use of nature intensifies to fires of overexploitation, and populations crash.

And, Laura added, "when the demand for eggs increased, often they killed the nesting female so they would not have to wait for her to lay."

Waiting for a female means risking you'll miss the next turtle. But since each turtle returns repeatedly to the same beach in the same season, and since killing an adult is equivalent to erasing all the eggs she would have laid in all the years she would have lived and returned, such poachers cut not just the turtles' throats but their own. More poverty results, a spiral of nature destruction, self-depletion, increasing desperation, and shrinking options. In the long term, crime doesn't pay. But in the moment, it can seem the best option.

Laura's conservation workers now protect all the most important Leatherback beaches in Pacific Mexico, plus some of the smaller beaches. Her assessment: "I would say that now we are protecting maybe seventy-five percent of the nests on the whole coastline. Of those twenty-five percent we are not protecting, I would say, yes—nearly all those get poached."

All sea turtles in every ocean once ushered from a sandy nest on a somewhere beach. They are among the few groups of animals that descended from land ancestors and reentered the ocean. Their last trace of land-oriented existence—the females' need to return to shore to lay eggs—is their Achilles' heel.

Antaeus, son of the earth-goddess Gaia and the sea-god Poseidon, was a giant whose extraordinary strength derived from contact with his mother, Earth. He became vulnerable—and was killed—when Hercules severed his contact with the ground. Substitute poachers for Hercules, and it's apparent that the Leatherback stands an Antaeus beast indeed. Sever the leathery waiterlord from contact with the ground by getting between a turtle's eggs and the sand, and—despite long-proven resilience—the mighty giant teeters.

A hurricane can wash away hundreds of turtle nests, destroying a year's nesting on an entire section of coast. But hurricanes do not destroy *each* year's nesting on *every* beach for *every* turtle. Only people pack that kind of fury.

Laura is fighting this human storm. Each time we land for fuel she returns cell-phone messages and makes necessary calls. Laura is a conservation field marshal, deploying biologists to the turtle camps and hatcheries

throughout the country, reinforcing good news with encouragement, rallying shaky morale in the face of real danger and despair.

No one should expect Laura Sarti to save the Leatherback by herself. This shore of harried conservation workers, contested nests, and poached eggs seems an omelet of scrambled motives, where a mix of apathy, appetite, and affirmation will somehow determine the destiny of turtles and people.

Sandy suggests that it's not necessary to have hope all the time, that to carry you over short hopeless patches anger will do. Being acquainted with anger, I turn this thought over in my mind. I have accomplished things with anger. Yes, you can get places on anger, as long as you're not going far.

Past Acapulco the beach *looks* like the earlier stretches, yet this one runs without trace of turtles. We span long minutes of emptiness in silence that mounts to miles. Scenery streams: coconut plantations pattern the coastal plain; riverbanks host thatched shacks; and skiffs called *pangas* lie upon the sand.

At a place called Playa Ventura, Leatherback nests suddenly reappear—like an abrupt downpour. Laura calls them in groups: "One nest . . . five nests . . . one . . . six . . . nine, no, *twelve* nests . . ." Sandy works constantly to implement the simple two-button GPS "save current position" process—while also piloting—as I struggle to scribble the corresponding entries. Like this, nests whiz by for twenty-six kilometers, or sixteen miles, wherein the Leatherbacks have placed the faith of 250 clutches of eggs.

At Tierra Colorada, a small band of turtle monitors streak from their open-sided, grass-roofed camp, waving wildly in greeting. Unlike the S.O.S. at Mexiquillo, they've written "*Hola! We Want a Ride!*"

We zoom around small rocky headlands and on the next few beaches Laura clicks off 304 more nests. We also add 5 dead adult Leatherbacks whose reproductive output for this season might have been 20 or so nests—about 7 percent of the total there.

At one-thirty, when we land for a break at Puerto Escondido, I remove the heavy headphones and my ears resume their normal shape. Stiffly we disembark our cramped plane cabin. Our day's total stands at just under 1,500 Leatherback nests.

By the lowered standards of the last few years, that tally is impressive. It has actually exceeded our hope that in this "good year" Leatherbacks

of the eastern Pacific could make this strong a show of their remaining reserves.

When, in 1981, renowned turtle scientist Peter Pritchard followed rumors of nesting Leatherbacks on Mexico's Pacific coast, he wrote, "We were unprepared for the abundance or wide distribution of the nesting." He estimated the breeding population at possibly over 70,000 individual females. But the many carcasses of freshly killed adult females indicated "a distressingly high level of poaching." It would be comforting if that was all in the past. But the continued killing of breeding females is disturbing. At this point, they really can't afford it.

We take a taxi into town. Because taxi drivers are the first line of insider information in any town, for curiosity's sake I ask the driver if he can bring us somewhere to eat turtle. "No," he answers. "We never bring tourists." Mexico first banned consumption of sea turtle eggs in 1927. Our driver gripes, "Turtle eggs are harder to get now. They now cost fifty pesos a dozen if you buy direct from a digger; in a restaurant, about a hundred and fifty pesos a dozen" (roughly U.S.\$15). In 1972, Mexico declared it illegal to catch turtles or consume the meat or possess the skin, with certain exceptions. Our driver explains that he doesn't much like turtle eggs anyway. "I prefer the turtle's meat, sliced thin, sprinkled with lemon and dried for a day, then grilled." In 1990, Mexico placed a total ban on using any part of any sea turtle. "With tortillas and a little salsa—that is the best." In 1994, all sea turtles were protected under Mexican law. A decade later, our driver laments, "I haven't tasted turtle for a long time—about eleven months."

THE BEACH IS PEPPERED RIM TO RIM WITH NEST DEPRESSIONS, AND NO end in sight. This beach—Escobilla, in Oaxaca—isn't just Mexico's largest Olive Ridley Turtle nesting site; it's just about the greatest sea turtle nesting beach in the world. Only Costa Rica's Olive Ridleys at Ostional slightly outnumber these. During their periodic mass-nesting arrivals, or arribadas, about five hundred *thousand* Olive Ridley Turtles come ashore here over a three-day period. They collect outside these beaches for days until some cue triggers a mass landing like the assault at Normandy. Turtle grandmaster Peter Pritchard says, "If you haven't seen an arribada, you need to. To go to a beach where, anywhere you sit, you get hit by a turtle is very reassuring."

Arribadas remain in many ways mysterious. Only the two Ridley species stage mass nestings, yet many individuals nest singly. Before an

arribada, turtles gather off nesting beaches for weeks before something sends them onto the shore. Scientists aren't sure what the cue is. Ridleys have scent glands no other sea turtles have, so it's probably a chemical message suddenly shouting, "Okay, let's go!"

Olive Ridley arribadas were apparently unknown to science until the 1970s. Though Olives nest along the tropical Pacific, Indian, and South Atlantic Oceans, they stage arribadas at only a handful of beaches. In the closing decades of the twentieth century, near-total eggging and drowning in shrimp nets wiped out or depleted large arribada populations in Nicaragua, Guatemala, El Salvador, and elsewhere. The only place Olives now stage such mass nestings outside Mexico and Costa Rica is India's state of Orissa, where they perform arribadas at three sites. India's Olive Ridley populations have also declined sharply. India had 600,000 Olive Ridleys well into the 1990s, whereas the number is around 135,000 recently. Fishing boats dragging trawl nets near Indian nesting beaches kill large numbers of Olives—about 10,000 annually—yet Indian trawler captains have resisted using turtle-escape devices. Along the Indian Ocean people use turtles for meat, animal feed, aphrodisiac and medical potions, bait, and leather. In India and in Pakistan, villagers feed turtle eggs to cattle, camels, and goats. (In Iran, coastal people eat turtle eggs and use them as pain relievers and aphrodisiacs, and feed them to sheep and camels as well.) Olives nest in Malaysia, too, but, like the Leatherbacks there, their numbers have crashed, dropping from a quarter million nests to well under 200.

In the 1950s, likely over 10 million Olive Ridleys inhabited the eastern Pacific off Mexico. We fly right over the turtle slaughterhouse that closed its doors around 1990. This place was responsible for killing in the neighborhood of 80,000 Turtles annually. For a strip of skin along the flippers, over several decades starting in the 1960s leather processors killed several million adult female Olive Ridleys. Most of the leather went to Europe to become Italian shoes and the like. As a result, three of Mexico's four arribada populations fell apart. The only surviving mass-nesting phenomenon was here at Escobilla. By the late 1980s, the number of nesting females here had also fallen sharply. As soon as the slaughter ended, the Olive Ridley Turtles' increase was meteoric, quintupling in about a decade. Nest protection and hatcheries paid off, and the population has soared to nearly half a million females nesting annually. Seasonal total right here in recent years: 1.2 million nests. It's the Pacific's best sea turtle turnaround.

GEOGRAPHY 370 MEXICO AND CENTRAL AMERICA

Reading questions from Carl Safina, Voyage of the Turtle

Study questions for pages 188-193

Background: turtles have become increasingly scarce in the past centuries

Explain how this scarcity affected sea grass beds. (191)

Explain how Hawksbill scarcity, through *Chondrilla nucula*, is a threat to coral reefs in Belize.

Explain how fewer Leatherback turtles is believed to be associated with fewer fish.

What did Columbus say about turtle abundance in 1492?

What happened in Bermuda from 1610 to 1620, and what did its assembly do in response? What was status of Bermuda's Green Turtles by 1800?

Nowadays Caribbean Green Turtle colonies hold an estimated ___ % or less of their pre-Columbian numbers.

Describe the numerical changes in the Costa Rican Tortugero Beach Green Turtle population from 1970-2004.

Why are the Pacific sea turtle populations generally doing worse than the Atlantic ones? What are the three forces making declines worse? (192)

What are numerical trends on Leatherback numbers on Costa Rica's Pacific side most key beach for 1990 to 2000?

What are trends for Mexico's Pacific Leatherbacks, 1990-2005?

List four key reasons for decline in Pacific and Indian Ocean sea turtle populations.

Study Questions for pages 248-253

What are listed causes of the Hawksbill turtle population declines on the Mexican Pacific Coast? What is the role of Japan and *bekko*?

Describe the analogy the author makes between Japan and the United States.

What are the geographic origins of the "bad" shrimp fishermen, according to Alberto Abreu? Related to this, what does he believe the ultimate key to turtle conservation is, for the Pacific Coast region of Mexico?

What does Laura believe the main cause of the Leatherback declines on the Mexican Pacific Coast is? Explain. What are other hypotheses listed? (note that Laura is a Mexican biologist who has for years trained local biologist to count Leatherback nests from the aerial flyovers, and who has participated in thousands of miles of such aerial censuses)

Why will some egg poachers kill female turtles? What are the long-term implications of this strategy, for a) the turtles, and b) the poachers livelihood?

<http://www.youtube.com/watch?v=HTKc-6hfPvw&feature=related> Pacific loggerhead turtles, in whose hands?

<http://www.youtube.com/watch?v=3NT5ltBVd6E> saving the leatherback people