section one

WHAT'S UP, DOC?

The Galápagos Islands and Scientific Obstacles to Understanding Climate Change

When we try to pick out anything by itself,
we find it hitched to everything else in the Universe.

—American naturalist and author John Muir,
My First Summer in the Sierra, 1911

chapter one

CARTOONISH BEGINNINGS

ARE YOU A BUGS BUNNY FAN? Come on, you have to admit it. That disarmingly clever bunny, even though a bit of a bully at times, has a certain impish charm. He's one of the most popular and recognizable figures in the world. A classic, down-to-earth trickster, Bugs is refined, old-world cultured, and simultaneously earthy, exuding new-world initiative, willing to defy any rule to achieve his desired results. To many, Bugs would personify the American can-do spirit. A few years back, a piece on National Public Radio made that very claim.[1] Seriously, do you admit to a secret crush on that rascally rabbit?

Believe it or not, this is the initial question I ask first-year college students in my introduction to international relations course. I do this in part to get their attention, jolting them awake to the possibility that they walked in on the wrong class, perhaps a postmodern English course on deconstructing humor—or maybe something a little less stuffy, along the lines of American studies and film or the history of comics and cartoons. Another reason I do this is my deep-seated belief in the power of a well-drawn cartoon. In a spin on the old adage that a picture is worth a thousand words, cartoons can pack quite a punch in a tightly constricted space. I ask my students about Bugs in an effort to achieve the same effect. I draw them a mental image right off the bat, something for them to manipulate with what I say next.

Further, despite the mixed messages sent by Bugs Bunny's gravity-defying Looney Tunes colleagues Road Runner and Wile E. Coyote, cartoons can be highly effective representations of reality. Deftly drawn cartoons, from the silly to the serious, employ humor to great purpose, applying the tried-and-true formula: tragedy plus time equals comedy. Comedy, in turn, like mathematics, is a language that transcends cultures.

I mean, who doesn't like Bugs Bunny with his irrepressible wit, thick New York accent, and flippant catch phrase, "What's up, Doc?" He has his own star on the Hollywood Walk of Fame for gosh sakes.

There are three other reasons I ask a question one might expect more in preschool than in college. They are really important—and, ironically, underscore how preschool programs often understand learning better than higher-education programs.

In part, I ask such an odd, seemingly unrelated question in a course on international relations because I want students to engage in experiential learning. I want them to relate the big ideas we discuss in our academic course to their own individual, nonacademic experiences, even if that means drawing analogies to pop culture consumed many, many years ago.

Another reason I ask this Bugs Bunny question is to set up a follow-up query about a specific Looney Tunes episode. I know you've seen it. It's the one set in 1492, where Bugs Bunny sails the Atlantic, initially as the lucky mascot to Christopher Columbus. When his fortune changes, though, after weeks with no land in sight, he becomes the target of Columbus's increasingly exasperated crew. Our rascally rabbit empties his usual bag of tricks, of course, to successfully hold these sailors at bay while keeping the chuckles coming.

Yet, in this 1951-released short, the indelible image for me is Bugs and Chris, as Bugs calls him, sharing a meal in the captain's mess. I suppose some of my memory revolves around the word association of *mess* and *meal*. After all, we all know children enjoy experiencing mealtime with more than just their sense of taste; they love to test the texture and temperature of their food—all over themselves. Further, as a bit of a disclaimer, I personally love any meal, messy or not. So, right off the bat, there are two good reasons for me to remember it alone.

A third factor, though, is the kicker for me. It's the imagery of how Bugs and Chris eat. There's a long, rectangular table with one wooden bowl that shifts from end to end as rolling waves tip the boat from side to side. I distinctly remember this. I also recall the two having a conversation between each spoonful as the bowl slides from one end of the table to the other. Looking back, I thought they were arguing about the shape of the Earth, but that wasn't exactly right. My memory there seems to have faded a bit over the years, hopefully not a harbinger of things to come.

Their conversation, instead, was about striking land the next day. The argument about the shape of the Earth came earlier. Bugs Bunny, after all, would never be considered a flat-Earth follower. He pops up literally at the beginning of the cartoon, baseball and glove in hand, in defense of Christopher Columbus, attempting to help him prove the Earth is round in his argument with the king of Spain.

It is here that I make my initial political point to the class, my leap to international relations theory. Columbus was not trying to discover America, of course. He had no idea it was there. His goal was to find a quicker, cheaper route to the East Indies—by sailing west. Unlike many in his day, Columbus thought the Earth was round, that he could get to the East by sailing west. His map, his mental model about the shape of world, was different. The Bugs Bunny cartoon "Hare We Go" highlights the power of maps as well as models and theories more generally, calling attention to the fact that they are not merely ideas about how the world works. They are also representations of power itself, establishing parameters for what we debate. Inherently political, models and theories determine what options are available, thus shaping the distribution of resources.

Models are tremendous assets to our society. They make our world more understandable, from the molecular level to global phenomena like climate change. Yet models, by definition, are also oversimplifications of how the world really works. They are imperfect representations complete with their own inherent biases.

Take for example the age old Mercator projection, a map of the world first developed by the Flemish cartographer Gerardus Mercator in 1569. It's an extremely useful map for navigation, accurately displaying direction and distance. On the other hand, this map is also greatly flawed, enlarging the favored Northern Hemisphere to such an extent that Greenland and Africa are shown as essentially the same size, when in reality Africa is roughly fourteen times as big as Greenland. In fact, regions along the equator all appear smaller than they should, especially relative to Europe, and the equator itself does not appear until two-thirds of the way down the map. That means the southern half of the world receives only one-third the space.

Again, recall the context. Constructed by a European in an age of imperialism, its driving purpose was to facilitate efficient navigation, trade, and conquest.

First introduced by Arno Peters in 1974, the Peters projection corrects for these errors, appropriately drawing the equator across the middle of the map and displaying the correct proportion of each landmass. Immediately, this map draws attention to the developed countries of the South where three-quarters of the world's population lives. With that action, though, it greatly distorts the shape and position of each landmass, rendering it virtually useless for navigation.

Herein lies the real peril of making and using models, what we refer to in the field of international relations as theory construction and application. One must always remember that some distortion is inevitable when simplifying the complex, whether within the field of cartography—or computer models of climate change.

Maps, models, and theories, by definition, are imperfect representations of the larger world. They focus on certain components while neglecting others. As world-renowned climatologist and, until he retired in 2013, the leading climate modeler for the National Ocean and Atmospheric Association (NOAA) James Hansen notes, "models are valuable, but only when used with knowledge of their capabilities and limitations."

So while climate models have evolved with remarkable accuracy over the last three decades, keep in mind they remain a work in progress—and always will be. You might say they mimic both their makers and their targets in that respect, continually adapting and adjusting to their surroundings.

Within this margin of error, though, one more crucial point deserves emphasis. Natural causes cannot explain the rate of change underway today. We are the main causal agent. We are the ones driving climate change.

That does not discount additional fascinating forces at work. Over tens of thousands of years, these were important, too, driving past ice ages and interglacial cycles. Indeed, thanks to a Serbian scientist named Milutin Milanković, we have identified the connection between climate and the Earth's orbital motions.[2] In particular, the Earth's orbit changes in three basic respects. The axis spin wobbles slowly, or precesses, through a 26,000-year cycle. The angular tilt of this rotation axis, the obliquity, varies from 22 degrees to about 24.5 over a 41,000-year period. And perhaps most familiar to the majority of us, the shape of the Earth's orbit around the sun is not a circle, but rather an ellipse, which varies roughly every 100,000 years.

None of these, however, can explain the current climate shift underway.

The term *climate change* first appeared in scientific publication in 1956 in the journal *Tellus*,[3] with the term *global warming* following, by most accounts, two decades later.[4] It was not until the summer of 1988, though, in well-publicized hearings before the Senate Energy and Natural Resources Committee, that climate change broke into the public consciousness.[5] Hansen, in particular, drew attention for stating with 99 percent certainty that the documented warming trend was not natural, and a graph accompanying his testimony forecast three possibilities for this continued warming in the twenty-first century.[6]

Back then it was called "global warming" and thought of as a future threat. Today we emphasize not only the future but also the here and now. Like college students with credit card debt compounding with each missed payment, our actions today, or perhaps more accurately our inaction to ending dependence on fossil fuels that drive business as usual, greatly influences the climate threats for tomorrow.

Another key item to note here is one of semantics. While some in the popular media continue to use the term "global warming" regardless of their political persuasion, that phrasing is also a favorite whipping boy of those predisposed to ignore the advancing scientific research, especially when winter storms such as those in 2014–2015 continually dropped more than a foot of snow on the Northeast, one even topping three feet in some locations. Climatologists, on the other hand, have come to prefer the term "climate change" to "global warming," particularly because it shifts our attention to how temperature changes affect water vapor in the atmosphere and the resulting precipitation patterns over long periods of time.

Indeed, we now know that, over a period of decades instead of mere months or years, climate change in the twenty-first century does mean a warmer world overall. This will continue to initiate the melting of ice, from the tropics (in glaciers at high elevations) to the poles and, thus, higher sea levels across the globe, particularly as Antarctica and Greenland melt more each year. In fact, sea level is now rising more than three centimeters a decade worldwide, double the rate of the twentieth century. Further, in this warmer world, climate change also means much more powerful storms, increasingly violent weather regardless of the season (which, by the way, is another issue, as seasons become progressively less defined).

Perhaps one of the least-known aspects of climate change among the general public, this timing of the seasons is visibly shifting. Since World War II, for example, butterfly territories have moved northward in Europe by thirty to sixty miles, according to scientists Camille Parmesan and Gary Yohe. Ruling out habitat destruction, these scientists find a shift toward the pole of approximately four miles per decade, with spring events such as egg laying and tree flowering shifting to 2.3 days earlier per decade.[7] Over time, the consequences of this shift will be felt more and more.

Nothing illustrates this better than the Intergovernmental Panel on Climate Change (IPCC). Created in 1988 by the World Meteorological Organization and the United Nations Environment Program, the IPCC consists of around two thousand scientists from over a hundred countries. Cowinner of the Nobel Peace Prize in 2007 along with former Vice President Al Gore, it is the largest, most rigorous peer-reviewed scientific collaboration in history. Noted climatologist Michael Mann sums up their status simply as "the gold standard for evaluating scientific understanding of climate change."[8] Every five to seven years, since 1990, the IPCC publishes a three-volume work on climate change. The first volume, known as Working Group 1, focuses on the science of climate change. The second, Working Group 2, concentrates on projected impacts. The third, Working Group 3, addresses the potential for mitigation.

Roughly a dozen scientific experts in their respective subdisciplines serve as the lead authors for each chapter in a report, with fifty or more additional contributing authors. Each working group also develops a summary for policymakers of findings accessible to a general audience. This is what most people see referenced in the mainstream media, the exact wording determined after extensive discussion in a final plenary meeting; for example, the synthesis report of the Fifth Assessment Report (AR5) was released from Copenhagen in October 2014.[9]

Following the watershed year of 1988, with the establishment of the IPCC and the aforementioned congressional hearings in the United States, one might argue that the next major political climate-change landmark came in 1995 when the IPCC, in the decidedly conservative language of science, stated that a "discernible human influence" on our climate exists. This is not to say the years between 1988 and 1995 were devoid of politics surrounding climate change. Far from it. Climatologists became more and more convinced of warming trends during these years, and fossil-fuel interests shifted their

attention from merely suppressing the release of scientific studies to outright attacks on the messengers that delivered them. After 1995, furthermore, these tactics morphed into full-fledged strategies, as addressed later in this book in the fifth set of chapters on Antarctica and the politics of climate change.

Perhaps not by coincidence, my own work in the field of environmental politics began at roughly that time two decades ago, although I did not focus on climate change till late summer of 2004. As I put the finishing touches on my first book on environmental groups and their species-protection efforts, I was hunting for a new project. Research projects tend to develop more slowly when teaching at a liberal arts college. Time is devoted first and foremost to interactions with students and continual class preparation. Despite that handicap of sorts, you might also argue there are more opportunities to experiment outside our standard academic disciplinary silos than at a typical research institution. Professors at smaller schools, provided they have the time, are more likely to refresh and revise their research agenda periodically as a result, particularly if it relates to the classroom.

In any case, I jumped quickly late that summer of 2004 when our energetic dean presented a unique opportunity to visit the Galápagos Islands after the upcoming academic year. In preparation, beginning in January 2005, my colleagues and I went back to school that spring semester as not only professors but also students, taking turns leading weekly seminars for each other about the Galápagos Islands and Ecuador, all tailored to the grand finale of the trip itself in May.

Departure day started smoothly enough. Meeting in a campus parking lot early that morning, sixteen of us drove a rental van from Winter Park to Miami International Airport, saving a bit on the airfare as academic cheapskates everywhere are wont to do. The four extra hours actually went by surprisingly quickly and served an added benefit of allowing the group to coalesce in ways only tightly constricted seating arrangements can encourage. In short, picture your typical summer family vacation drive with all the anticipation of the final destination, and then add to that a group of individuals who love to really, really talk.

That all changed when we boarded our flight to Guayaquil and fatigue started to set in. The first rule of travel, at least in my book, is to have fun. I guess it's my version of carpe diem. Seize the day. Live life for each precious moment. But even as you do that, always remember there will

be complications. That's where my second rule of travel enters the fray. Expect the unexpected. Nothing will ever go precisely as planned. Eventually, no matter how meticulous your plans, you will need to improvise . . . or simply wait.

The latter is what was in store for us. As our bags were loaded onto the plane, the tow rig damaged our plane's landing gear. For the next hour, airport personnel attempted to fix the damage, but eventually we were instructed to change planes. It turned out that was problematic too as we boarded before our baggage and then, with shift changes and tight departure schedules, we literally could not find anyone to load our baggage. After another four hours waiting on the tarmac, our flight finally departed. Arriving in the port city of Guayaquil at 3:30 A.M. the next day, hours behind schedule, we did not actually check into our lodging for that night, the simple but efficient Hotel Doral, until the painfully late hour of 5 A.M.

We'd adjusted our schedule smartly to see the high-elevation capital city of Quito at 9,350 feet above sea level[10] (particularly in comparison to our near-sea-level start in Florida) on our return trip, thus postponing potential altitude sickness until then, but no one could have foreseen the extensive five-hour-plus airplane delay. In an ironic twist of my initial argument in this chapter that art imitates life, with cartoons representing reality, at least to some degree, you might say my adventure to the Galápagos was off to its own cartoonish start.

Expect the unexpected.

The following day was devoted to sightseeing, including an evening on the Malecon, a lovely mile-and-a-half boardwalk along the western shore of the Guayas River populated with historical monuments, museums, gardens, fountains, restaurants, and bars. Kurt Vonnegut's novel *Galápagos* starts here as the main characters gather for the "Nature Cruise of the Century" amid a global economic crisis, and I resisted the brief urge to draw analogies to my own voyage the next morning, that life would not imitate art once again on this trip.[11]

Actually it did, but not in the apocalyptic manner that Vonnegut relays. Natural selection, as in Vonnegut's page-turning work, would take center stage. My photographs and mental images would last a lifetime, and hopefully they now take larger form here. That said, unlike with Vonnegut's characters, my own trip from mainland Ecuador to the Galápagos Islands, what *National Geographic* labels as one of the top ten wildest places on Earth, went largely as scheduled.

1.1 The Galápagos Islands.
Source: Wikimedia Commons via 2002 NASA satellite photo.

1.2 Ecuador and South America. Source: Wikimedia Commons.

The Galápagos Islands, as noted in Figures 1.1 and 1.2, are a group of thirteen major islands (those larger than four square miles) plus six smaller ones, and more than a hundred islets. Over the next eight days we'd land on nine of the islands and snorkel offshore on a tenth. I'd be practicing what I preached in my classroom back in Florida, living and breathing experiential learning. And I'd be doing it in one of the most ideal environmental settings one could imagine, the "origin of all my views" according to the one of the most famous names on the planet and originator of the theory of natural selection, Charles Darwin.[12] Heck, even a gaggle of academic tourists like ourselves would feel like biologists in that context, and we had the added bonus of actually having one in our midst.

The Galápagos Islands, officially named the Archipelago de Colón since 1892, rest on a geological conveyor belt, gradually moving southeast one to two inches a year. Beginning with volcanic eruptions some twenty million years ago on the western edge of the Nazca plate, lava flows finally broke the surface of the Pacific Ocean about three to five million years ago to form the Galápagos Islands.

The islands on the east side are older, with the younger ones to the west. Isabela, the largest island, straddles the equator with a seahorse shape, the result of six volcanoes merging together approximately one million years ago, making it a relative teenager in geologic time. Five of the six volcanoes on Isabela are still active, adding to the teenager analogy as one of the most volcanically active places on earth.

Interestingly, despite its equatorial location, the Humboldt current brings cold ocean waters to the islands, and it is these cold waters, which are richer in oxygen and plankton, that foster the diversity of life here, particularly the famous marine and bird diversity. The currents of the Galápagos, which rotate clockwise in the warmer north and counterclockwise in the cooler south, also add an air of mystery to accompany the intriguing diversity of the islands. For part of the year, they are enshrouded in a cloak of mist, which helps explain why Spanish explorers first referred to them as Las Islas Encantadas, the bewitched or enchanted islands.

The Galápagos Islands are famed as a living laboratory of unusual species, which exist nowhere else on Earth, and whose origin most likely stems from ancestors on the mainland six hundred miles to the east. Swept out to sea millions of years ago, perhaps during a flash flood, the hardiest

among them survived on rafts of vegetation before striking this volcanic patch of land.[13] Most introductions to the Galápagos highlight the first historical account of March 10, 1535, when stormy weather blew a Roman Catholic bishop off course during his voyage from Panama to Peru. Fewer recite Tomás de Berlanga's succinct one-line quote about his surroundings in a letter back to his Spanish king, "It looked like God had caused it to rain stones."

That sentiment, though, summed up the prevailing attitude about the Galápagos for many years to come. The Spanish government never attempted to colonize the islands, and failed to even investigate them for nearly two centuries, mindful that the single biggest limitation of the entire chain was its lack of fresh water. Such limitations, of course, provided unique opportunities for a number of other creatures, many of which, like the marine iguana, are found nowhere else on earth. As seen in Figure 1.3, though, this harsh and unforgiving environment can take its toll.

Despite that history, the Galápagos owe their popular name to the Spanish, which they received in the early 1570s. Another noted Flemish cartographer, Abraham Ortelius, first published maps in Europe identifying the islands by this name based on the Castilian term for the distinguishing characteristic of their giant tortoises, their carapace or shell, which resembled the front piece of a riding saddle.

Averaging over a hundred years in lifespan, Galápagos tortoises are the longest-lived of all vertebrates, with one in captivity once lasting 152 years. Still, when first viewed, it is their size that garners your immediate attention. Along with the giants of Seychelles, they are the world's largest tortoises, with some impressive specimens registering five feet in length. Males can reach 550 pounds, and females average 250. The Galápagos tortoise underscores that, while

1.3 Marine iguana skeleton on Santiago.

mammals tend toward dwarfism on islands, reptiles decidedly favor the opposite, gigantism.

Don't pinch yourself if the face in Figure 1.4 looks oddly familiar. Legend has it one Galápagos tortoise, Winston from the San Diego zoo, served as inspiration and face model for the main character in Steven Spielberg's 1982 classic, *E.T.* A zoo volunteer even claims that Winston still receives gratitude packages from Spielberg on occasion.

The next set of characters to influence the Galápagos were a motley crew of buccaneers, a legacy manifested in several respects, including endangering of the islands' namesake tortoises and leading to a noted 1729 map of the archipelago in which islands were named for British nobles as well as officials who favored these pirates. Intriguingly, these swashbucklers had a continually shifting status, sometimes considered to be admired adventurers and at other times notorious thieves, depending on their usefulness to the powers that be.

Their presence grew more commonplace when Spain conquered first Mexico in 1519 and then Peru in 1532. An enormous amount of gold and silver was extracted from the fallen Incan empire in the aftermath. By the seventeenth century, English, French and Dutch pirates were essentially waging a war against Spain, periodically raiding Spanish galleons along the coast. France and England, furthermore, engaged in heated competition as maritime powers at the time, targeted precious metals from the Americas, and buccaneers were handy assistants, often literally working with official commissions.

1.4 Galápagos tortoise at Charles Darwin Research Station.

Much of this activity centered in the Caribbean, of

course, but as competition grew, some pirates moved closer to the sources of booty in the Pacific. The Galápagos and harbors such as James Bay in Santiago became a convenient hideaway and restocking point. Giant tortoises were a prime target for this restocking, because they have slow metabolisms and vast internal water storage in their bladders, enabling them to survive as long as a year without eating or drinking—and thus providing a valuable source of fresh meat for the pirates and other seafarers.

By the early nineteenth century, whaling replaced pirating as the leading human influence in the Galápagos—and tortoise fortunes took an even worse turn. With its confluence of ocean currents, the Galápagos waters were, and remain, an ideal feeding and breeding ground for large baleen whales such as fins, sperms, and humpbacks. Seeking valuable oil fuel extracted by cooking fresh blubber, an array of Europeans found their way to the Galápagos as well. The oil rush continued for fifty years, essentially until discovery of commercial quantities of petroleum.

During this period, like their brethren from the sea, the Galápagos giant tortoises faced slaughter of unprecedented proportions. Whaling crews remained at sea for months, sometimes years, with no refrigeration to preserve fresh meat or produce. Tortoise meat was a welcome alternative to salt pork and biscuits. While some 100,000 prospered among the islands at the beginning of the whaling era in 1780, only about 15,000 to 20,000 exist today.

Ecuador took possession of the Galápagos as this oil rush was still underway in 1832, but the first time people stayed on the islands for a substantial time was nearly a century later, although Darwin witnessed a small penal colony on Floreana in 1835.

World War II forever changed this equation. Just four days after the Japanese bombed Pearl Harbor, U.S. troops occupied the islands in an effort to protect the Panama Canal. By most accounts, Ecuador begrudgingly rented the islands situated just above Santa Cruz to the U.S. military, which subsequently began constructing an air force base on the island of Baltra in February 1942. The Americans eventually stationed one thousand personnel on the island, dynamited a mile-long landing strip, and constructed some two hundred wooden buildings, including a beer garden, chapel, cinema, mess hall, and bowling alley. As substantial as this impact was, though, the events it set in motion were even more significant.

The American presence created a new source of income for settlers on Santa Cruz, and its population expanded with this newfound opportunity. Today, as tourism continues to grow, according to the Ecuadorian National Census of 2010, the residential population in the Galápagos totals over 25,000 across five islands, although people are officially restricted to 3 percent of the total land area of the islands.[14]

As we shall elaborate later, more in this case is decidedly not better, and these increasing numbers of people fundamentally threaten the islands with the clearing of primordial forests, uncontrolled hunting, and the introduction of domesticated animals as well as invasive species. In recognition of this detrimental growth, in a desperate attempt to curtail populations doubling every decade or so, the 1998 Special Law for Galápagos includes an amendment to Ecuador's national constitution authorizing restrictions on domestic immigration to the islands. Permanent residency was restricted to three categories: those born in the Galápagos, those who lived there five or more years before the law, and the spouses or children of residents. Other features of the Special Law were limits on local fishing, widening of protection boundaries, establishing quarantine systems for nonindigenous species, and general education of islanders about conservation of resources.

Mainlanders come to the islands largely for one reason: money can be made from tourists. Tourism, then, is driving population increases. It is part of the problem. In a refrain that will be often repeated in my travels, ecotourism, by definition, brings its own set of special challenges.

Following World War II, tourism in the Galápagos slowly picked up where the American GIs had left off, bringing not only more damage from the tourists themselves but inspiring Ecuadorians to relocate to the Galápagos to profit off those tourists, requiring additional infrastructure for both tourists and domestic immigrants. The first large tourist boat arrived in the mid-1960s, and the industry has been growing ever since. Now more than eighty vessels from a range of travel companies regularly ply its waters, with peak season from mid-November to January and roughly 180,000 tourists spending $120 million a year.

National and international environmental interests foresaw this rise and scrambled to prepare for the onslaught. In 1959, on the hundredth anniversary of the publication of Charles Darwin's seminal *The Origin of Species*, and

with funding from the United Nations Educational, Scientific and Cultural Organization (UNESCO), World Wildlife Fund (WWF), the New York Zoological Society, and the United States government, 97 percent of the Galápagos was declared a national park. Only the land was protected at this point, though, and even with that so-called protection, invasive species ran roughshod, figuratively if not literally, throughout.[15]

With their destruction of natural habitat, feral goats, descendants of earlier generations left behind by sailors and fishermen to hunt for replenishing supplies, pose arguably the greatest threat to the islands. Other invasive species are problematic too, but the goat quickly became a prime target for conservationists. Native flora expert Duncan Porter sums up the general sentiment with the stern assessment that, "The only good goat on Galápagos, is a dead goat."[16] More on that in a bit.

In 1978, UNESCO proclaimed the Galápagos a World Heritage Site, and, by 1986, Ecuador was ready to expand the Galápagos protection efforts to declare a marine reserve within its perimeter out to five miles offshore. Like paper parks throughout Latin America, though, enforcement was lacking as fishermen continued extracting everything they could get their hands on.

A surprisingly inconspicuous species arose as a major galvanizing force at this point. Sea cucumbers cover the ocean floor by the millions in the Galápagos, living in relatively shallow waters and inching harmlessly along the ocean floor. Most closely related to starfish and sea urchins, they belong to a group of animals called *echinoderms.* These headless, tubular slugs don't just look like oversized worms, they act like them too. Sucking up muck and spreading nutrients like an earthworm aerating soil, sea cucumbers perform a valuable function for many other ocean species.

It turns out that people value the sea cucumber too. Bedrooms from Tokyo to Beijing and beyond treasure them as an aphrodisiac, and that lucrative market offers premium prices. In the late 1980s, decreasing supplies along South America's west coast combined with increasing demand among a number of Asian societies to push the price of these dog poop–sized creatures still higher and higher. Discovery of commercial quantities[17] in the Galápagos in the early 1990s set off a new round of conflicts as this decided economic incentive quickly divided local settler interests from international conservationists even further.

It should also be noted that removing the sea cucumbers themselves was not the only negative aspect of these fishermen's transgressions. How they did it mattered. Freshly picked sea cucumbers must be processed with large pots of boiling water. To fuel those cooking fires, fishermen chopped down mangrove after mangrove, and then left behind their trash and human waste when they were ready to move on.

Following the park service bust of an illegal fishermen camp on Fernandina in which an amazing thirty million sea cucumbers were confiscated, President Rodrigo Borja Cervallos announced a total ban on their harvesting in June 1992. Fishermen were forced underground, and pirate camps, particularly on Isabela, continued to plunder the species. Antagonism between park officials and fishermen grew so great that several dozen *pepineros*, as the sea cucumber fishermen are called, even blockaded the entrance to the Charles Darwin Research station in early January 1995. That scary, three-day standoff highlighted their demand to reopen the fisheries after a failed three-month experimental permit season beginning in June 1994 was cut short.

Finally, in 1997 fishermen, tourist, and protection interests all sat down to discuss proposed enlargements to the boundaries up to ninety miles. These negotiations appeared doomed to failure until a compromise of forty miles emerged after extensive pressure from UNESCO on the Ecuadorian government. Today only tourism and local fisheries are allowed in this area, and the Galápagos are the second-largest marine reserve in the world, second only to the second stop on our itinerary, Australia's Great Barrier Reef.

Enforcement is by no means perfect, but it is greatly improved over the last twenty years. An array of actors found common ground thanks to the fundamental ecological principle of interdependence. This is not just a lesson for the Galápagos Islands. It's one we must apply to global climate change as well. Our world is intricately hitched together, as noted American naturalist and author John Muir famously articulated. It's a concept now deeply ingrained within environmentalism. We do not act in a vacuum. Our actions today shape our options tomorrow. Everything is connected.