57.5° N, 12.7° W, 175 MILES OFF THE COAST OF SCOTLAND

FEBRUARY 8, 2000

The clock read midnight when the hundred-foot wave hit the ship, rising from the North Atlantic out of the darkness. Among the ocean's terrors a wave this size was the most feared and the least understood, more myth than reality—or so people had thought. This giant was certainly real. As the RRS *Discovery* plunged down into the wave's deep trough, it heeled twenty-eight degrees to port, rolled thirty degrees back to starboard, then recovered to face the incoming seas. What chance did they have, the forty-seven scientists and crew aboard this research cruise gone horribly wrong? A series of storms had trapped them in the black void east of Rockall, a volcanic island nicknamed Waveland for the nastiness of its surrounding waters. More than a thousand wrecked ships lay on the seafloor below.

Captain Keith Avery steered his vessel directly into the onslaught, just as he'd been doing for the past five days. While weather like this was common in the cranky North Atlantic, these giant waves were unlike anything he'd encountered in his thirty years of experience. And worse, they kept rearing up from different directions. Flanking all sides of the 295-foot ship, the crew kept a constant watch to make sure they weren't about to be sucker punched by a wave that was sneaking up from behind, or from the sides. No one wanted to be out here right now, but Avery

knew their only hope was to remain where they were, with their bow pointed into the waves. Turning around was too risky; if one of these waves caught *Discovery* broadside, there would be long odds on survival. It takes thirty tons per square meter of force to dent a ship. A breaking hundred-foot wave packs one hundred tons of force per square meter and can tear a ship in half. Above all, Avery had to position *Discovery* so that it rode over these crests and wasn't crushed beneath them.

He stood barefoot at the helm, the only way he could maintain traction after a refrigerator toppled over, splashing out a slick of milk, juice, and broken glass (no time to clean it up—the waves just kept coming). Up on the bridge everything was amplified, all the night noises and motions, the slamming and the crashing, the elevator-shaft plunges into the troughs, the frantic wind, the swaying and groaning of the ship; and now, as the waves suddenly grew even bigger and meaner and steeper, Avery heard a loud bang coming from *Discovery*'s foredeck. He squinted in the dark to see that the fifty-man lifeboat had partially ripped from its two-inch-thick steel cleats and was pounding against the hull.

Below deck, computers and furniture had been smashed into pieces. The scientists huddled in their cabins nursing bruises, black eyes, and broken ribs. Attempts at rest were pointless. They heard the noises too; they rode the free falls and the sickening barrel rolls; and they worried about the fact that a six-foot-long window next to their lab had already shattered from the twisting. *Discovery* was almost forty years old, and recently she'd undergone major surgery. The ship had been cut in half, lengthened by thirty-three feet, and then welded back together. Would the joints hold? No one really knew. No one had ever been in conditions like these.

One of the two chief scientists, Penny Holliday, watched as a chair skidded out from under her desk, swung into the air, and crashed onto her bunk. Holliday, fine boned, porcelain-doll pretty, and as tough as any man on board the ship, had sent an e-mail to her boyfriend, Craig Harris, earlier in the day. *"This isn't funny anymore,"* she wrote. *"The ocean just*

looks completely out of control." So much white spray was whipping off the waves that she had the strange impression of being in a blizzard. This was Waveland all right, an otherworldly place of constant motion that took you nowhere but up and down; where there was no sleep, no comfort, no connection to land, and where human eyes and stomachs struggled to adapt, and failed.

Ten days ago *Discovery* had left port in Southampton, England, on what Holliday had hoped would be a typical three-week trip to Iceland and back (punctuated by a little seasickness perhaps, but nothing major). Along the way they'd stop and sample the water for salinity, temperature, oxygen, and other nutrients. From these tests the scientists would draw a picture of what was happening out there, how the ocean's basic characteristics were shifting, and why.

These are not small questions on a planet that is 71 percent covered in salt water. As the Earth's climate changes—as the inner atmosphere becomes warmer, as the winds increase, as the oceans heat up—what does all this mean for us? Trouble, most likely, and Holliday and her colleagues were in the business of finding out how much and what kind. It was deeply frustrating for them to be lashed to their bunks rather than out on the deck lowering their instruments. No one was thinking about Iceland anymore.

The trip was far from a loss, however. During the endless trains of massive waves, *Discovery* itself was collecting data that would lead to a chilling revelation. The ship was ringed with instruments; everything that happened out there was being precisely measured, the sea's fury captured in tight graphs and unassailable numbers. Months later, long after Avery had returned everyone safely to the Southampton docks, when Holliday began to analyze these figures, she would discover that the waves they had experienced were the largest ever scientifically recorded in the open ocean. The significant wave height, an average of the largest 33 percent of the waves, was sixty-one feet, with frequent spikes far beyond that. At the same time, none of the state-of-the-art weather forecasts and wave

models—the information upon which all ships, oil rigs, fisheries, and passenger boats rely—had predicted these behemoths. In other words, under this particular set of weather conditions, waves this size should not have existed. And yet they did.

History is full of eyewitness accounts of giant waves, monsters in the hundred-foot range and beyond, but until very recently scientists dismissed them. The problem was this: according to the basic physics of ocean waves, the conditions that would produce a hundred-footer were so far beyond rare as to virtually never happen. Anyone who claimed to have seen one, therefore, was engaging in nautical tall tales or outright lies.

Still, it was hard to discount a report from the polar hero Ernest Shackleton, hardly the type for hysterical exaggeration. On his crossing from Antarctica to South Georgia Island in April 1916, Shackleton noticed odd movements in the night sky. "A moment later, I realized that what I had seen was not a rift in the clouds, but the white crest of an enormous wave," he wrote. "During 26 years experience of the ocean in all its moods I had not encountered a wave so gigantic. It was a mighty upheaval of the ocean, a thing quite apart from the big white-capped seas that had been our tireless enemies for many days." When the wave hit his ship, Shackleton and his crew were "flung forward like a cork," and the boat flooded. Fast bailing and major luck were all that saved them from capsizing. "Earnestly we hoped that never again would we encounter such a wave."

The men on the 850-foot cargo ship *München* would have seconded that, if any of them had survived their rendezvous with a similar wave on December 12, 1978. Considered unsinkable, the *München* was a cutting-edge craft, the flagship of the German Merchant Navy. At 3:25 a.m. fragments of a Morse code Mayday, emanating from 450 miles north of the Azores, signaled that the vessel had suffered grave damage from a wave.

But even after 110 ships and 13 aircraft were deployed—the most comprehensive search in the history of shipping—the ship and its twenty-seven crew were never seen again. A haunting clue was left behind: searchers found one of the *München*'s lifeboats, usually stowed sixty-five feet above the water, floating empty. Its twisted metal fittings indicated that it had been torn away. "Something extraordinary" had destroyed the ship, concluded the official report.

The *München*'s disappearance points to the main problem with proving the existence of a giant wave: if you run into that kind of nightmare, it's likely to be the last one you'll have. The force of waves is hard to overstate. An eighteen-inch wave can topple a wall built to withstand 125-mile-per-hour winds, for instance, and coastal advisories are issued for even five-foot-tall surf, which regularly kills people caught in the wrong places. The number of people who have witnessed a hundred-foot wave at close range and made it back home to describe the experience is a very small one.

Even if a ship does manage to survive a hundred-foot wall of water, there are no underwhelmed survivors. Big fish tales are human nature. Add to that a dose of mortal terror, honest confusion, a fear of being blamed for damage to the ship—if, say, the wave didn't quite measure up to the "something extraordinary" test but managed to poleax the vessel anyway because the captain was below deck playing darts and drinking vodka at the time—and what you've got is less than the scientifically immaculate truth.

But there was a rare occasion in 1933, when a sharp-eyed naval officer aboard the 478-foot oil carrier USS *Ramapo* happened to be up on the bridge as an astonishing wave lurched out of the Pacific and his response, rather than screaming and covering his eyes, was to make a trigonometric calculation using the ship's dimensions relative to the wave's crest and trough. The result was a height estimate that, if not on par with the exactitude of the *Discovery*'s sensors, was at least defensible. And the officer's measurement? The wave was 112 feet high.

If a 112-foot wave isn't freakish enough, consider that this one had leaped out of 45-foot seas. Thus it was more than twice the average size of anything else in the *Ramapo*'s path, which matches the scientific definition for a freak (or rogue) wave. For centuries mariners had spoken of the "hole in the ocean," a cavernous trough at the base of an abnormally large wave, and the "three sisters," a series of freaks in rapid succession. To scientists this kind of folklore was a hard sell. The numbers didn't add up. Maybe, just maybe, a once-in-an-aeon wave triple the size of its surrounding seas might exist—but there was no way traditional oceanography could accept this as a typical occurrence. As for the notion of mutant walls of water showing up in sets, that was not even worth discussing. Then something happened that no one could ignore.

On January 1, 1995, the North Sea was feisty due to a pair of storms, a brutish one crawling northward and a smaller one moving southward to meet it. Statoil's Draupner oil-drilling platform sat somewhere between them, about one hundred miles off the tip of Norway. For the crew who lived on the rig it was a New Year's Day of thirty-eight-foot seas rolling by, as measured by the laser wave recorder on the platform's underside. Unpleasant, perhaps, but not especially dramatic—until three o'clock in the afternoon, when an eighty-five-foot wave came careening over the horizon and walloped the rig at forty-five miles per hour. While the Draupner sustained only moderate damage, the proof was there. This wasn't a case of laser malfunction or too many aquavit toasts the night before. It was the first confirmed measurement of a freak wave, more than twice as tall and steep as its neighbors, a teetering maniac ripping across the North Sea.

They were out there all right. You could call them whatever you wanted—rogues, freaks, giants—but the bottom line was that no one had accounted for them. The engineers who'd built the Draupner rig had calculated that once every ten thousand years the North Sea might throw them a sixty-four-foot curveball in thirty-eight-foot seas. That would be the maximum. Eighty-five-foot waves were not part of the equation, not

in this universe anyway. But the rules had changed. Now scientists had a set of numbers that pointed to an unsettling truth: some of these waves make their own rules. Suddenly the emphasis shifted from explaining why giant waves couldn't simply leap out of the ocean to figuring out how it was that they did.

This was a matter of much brow sweat for the oil industry, which would prefer that its multimillion-dollar rigs not be swept away. It had happened before. In 1982 the Ocean Ranger, a 400-foot-long, 337-foot-high oil platform located 170 miles off the coast of Newfoundland, was struck by an outsize wave in heavy weather. We'll never know how big the wave was exactly, for there were no survivors. Approved for "unrestricted ocean operations," built to withstand 110-foot seas and 115-mile-per-hour winds, considered "indestructible" by its engineers, the Ocean Ranger had capsized and sank close to instantly, killing all eighty-four people on board.

In the nautical world things were even more troubling. Across the global seas ships were meeting these waves, from megaton vessels like the *München*—oceangoing freighters and tankers and bulk carriers—down to recreational sailboats. At best, the encounters resulted in damage; at worst, the boat vanished, taking all hands with it. "Two large ships sink every week on average [worldwide], but the cause is never studied to the same detail as an air crash. It simply gets put down to 'bad weather,' " said Dr. Wolfgang Rosenthal, senior scientist for the MaxWave Project, a consortium of European scientists that convened in 2000 to investigate the disappearing ships.

While Rosenthal's numbers may be high, his point is well taken. Given the lack of survivors or evidence, exact statistics of ships scuttled by giant waves are impossible to come by; but it is clear that every year, on average, more than two dozen large ships sink or otherwise go missing, taking their crews along with them. (If you also consider smaller vessels, the numbers are vastly higher.) In particular, a type of ship known as a bulk carrier is vulnerable: on one infamous occasion in March 1973, two

bulk carriers were lost within an hour of each other in the same area of the North Atlantic.

When I first read about the missing ships, I was astonished. In the high-tech marine world of radar, EPIRB, GPS, and satellite surveillance, how could hundreds of enormous vessels just get swallowed up by the sea? And furthermore, how could this be happening without much media notice? Imagine the headlines if even a single 747 slipped off the map with all its passengers and was never heard from again.

Clearly, there *was* something extraordinary going on out there. After the Draupner incident, it became undeniable: no one really had a clue as to how waves behaved in their most extreme forms. Yet lives depended on this information. As the scientists scrambled and the oil companies mobilized and the naval architects double-checked their calculations and ship captains worried the horizon, I imagine they thought to themselves: *So the old stories were true after all*.

The first time I saw a truly big wave was in December 1989. I happened to be in Hawaii and my trip coincided with the Triple Crown of Surfing, a series of three competitions held on Oahu's north shore. In order to have the events, though, first you must have the waves. Sometimes the surfers had to wait weeks or even months for the right conditions to materialize, and so it was lucky and unusual that a good-size swell arrived during my visit. On the day the big-wave contest was called at Sunset Beach, I drove my rental car across the island and landed on that stretch of sand, along with about a thousand other people.

The spectator scene was a riot of color, of neon pink bikinis and canary yellow surfboards and lime green banners and all the glimmering blues of the Pacific Ocean. It was a convention of gear-laden trucks, a bazaar of beach hair, from sun-bleached white to drip-dry dreadlocks. The nearest closed-toe shoe was at least twenty miles away. The sky was cloudless but a veil of mist hung in the air from the force of the waves

slamming down. At first I found that startling because the Sunset wave itself—the face the surfers would be riding—broke more than a half mile offshore. But then a set rolled in, a pulse of energy that caused several waves to jump up in size. I watched through binoculars as the waves began to build, ominous lumps in the ocean. The water rose and rose until a tiny rider appeared at the top and dropped onto the face as it exploded into a thirty-foot moving cliff. Whenever a wave broke, the beach shook with a little hum of violence.

Standing on shore, I was scared. I'd witnessed avalanches, explosions, tornadoes, wildfires, and monsoons, and I'd never seen anything as intimidating as those waves. For all the gentle images evoked by the name Sunset Beach, in reality this was a different beast. One surf expert described this break as "the entire Pacific Ocean rearing up to unload on your head." On big days at Sunset, people were often swept away by ferocious currents and surges. Watching, I could easily imagine this. What I couldn't imagine was why anyone would willingly insert himself into these elements.

It felt strange to be terrified of the water. After decades of competitive swimming I'm usually more at home in aquatic environments than I am on land. Over the years I'd done assorted damage to myself on solid ground—bruises, bumps, tears, a knee pieced together by titanium screws—but nothing bad had ever happened to me in the water. Then again, I'd never experienced the water in this particular mood. As I watched the surfers launch themselves into the churning ocean and paddle toward the break, I worried for each of them. Their sport seemed more gladiatorial than athletic, like showing up for work each day to grapple with bull elephants.

Which is why, a few years later, I was stunned to see a photograph of a man riding a wave more than twice the size of Sunset, somewhere in the sixty-foot range. The surfer was Laird Hamilton, a six-foot-three, 215-pound twenty-eight-year-old from Hawaii who looked completely at ease inside a barrel as tall as an office building. His blond hair whipped

back in the spray; his muscular arms were spread wide for balance as he plummeted down the wave on a tiny board. He had classically handsome features, chiseled and intense, but no fear showed on his face, only rapt focus. Looking at the picture, I didn't understand how any of this was possible.

Since surfing became popular in the mid-twentieth century, faces in the forty-foot range have represented the outer limits of human paddling abilities. Anything bigger is simply moving too fast; trying to catch a sixty-foot wave by windmilling away on your stomach is like trying to catch the subway by crawling. Never mind, though, because even if you could catch it, there would be no way to ride it. Too much water rushes back up the face of a giant wave as it crests, sucking you, the hapless human (not enough momentum), and your board (too much friction) over the falls. So while the most popular surf spots quickly became so overrun that fistfights erupted in the water, all over the world the most impressive waves were going to waste. To Hamilton and his friends, this was unacceptable. The rules had to change, and a new system invented. So they came up with a technique called tow surfing.

Borrowing ideas from windsurfing and snowboarding, they created shorter, heavier surfboards with foot straps, and thinner, stronger fins that sliced through the water like knives. Then they added Jet Skis and water-ski ropes to the mix, using them to tow one another into perfect position at thirty miles per hour. In the optimal spot, just as the wave began to peak, the rider would drop the tow rope and rocket onto the face. The driver, meanwhile, would exit off the back. Using this method, with its increased horsepower and redesigned gear, a surfer could theoretically catch the biggest waves out there. Riding them—and surviving if you fell—was another story.

Hamilton was the test pilot, followed immediately by other surfers and windsurfers in his circle: Darrick Doerner, Brett Lickle, Dave Kalama, Buzzy Kerbox, Rush Randle, Mark Angulo, and Mike Waltze. Nicknamed

the Strapped Crew, they experimented on the outer reefs of Oahu and Maui, far beyond the crowds. "No one was there," Hamilton said. "No one had ridden waves this size. It was the unknown. It was like outer space or the deep sea. We didn't know if we were going to come back."

Anything involving giant waves qualifies as a risky pursuit, but tow surfing seemed to invite disaster. The sport's learning curve was a series of hard lessons, and the price of falling was high. It included dislocated shoulders, shattered elbows, and burst eardrums; broken femurs, snapped ankles, and cracked necks; lacerated scalps, punctured lungs, and fractured arches; hold-downs that Brett Lickle described as "sprinting four hundred yards holding your breath while being beaten on by five Mike Tysons." As for stitches, Hamilton "stopped counting at 1,000."

Regardless of its dangers (or maybe because of them), tow surfing's popularity and visibility grew throughout the 1990s, the surfers venturing onto more treacherous waves every year. They tinkered with equipment. They refined their techniques. Working in teams of two—a driver and a rider—they figured out how to rescue each other in behemoth surf. As the stakes got higher and the margin for error got slimmer, a kind of natural selection occurred. Riders who'd glimpsed their own mortality a little too closely drifted to the sidelines. At the other end of that spectrum was Hamilton. Watching him, you got the feeling that no wave was out of reach. The more intimidating the conditions, the more he seemed to thrive in them.

Then in July 2001 a surf impresario named Bill Sharp issued a challenge. "For 2700 years," his press release read, "the Homerian [*sic*] epic known as the *Odyssey* has been associated with beautiful-but-deadly temptresses, forgetful lotus-eaters, and scary, one-eyed monsters. But now thanks to surf wear giant Billabong, it's associated with an even scarier monster: the elusive 100-foot wave." The company, the press release continued, would offer a prize of $500,000 to any man who rode one. This payday was exponentially larger than anything surfing had

seen; millions more would come from sponsors in the wake of the triumph. A select group of tow teams would be invited to participate, a crew Sharp referred to as "the Delta Force of surfing."

It was a sexy frontier, defined by a nice round number. Marketing that number was Sharp's intention; he noted that he'd sold the hundred-foot-wave Odyssey contest, originally named Project Sea Monster, to Billabong in less than fifteen minutes. Prone to flourishes of hype, Sharp delivered vivid sound bites: "The Odyssey is Jacques Cousteau meets Evel Knievel meets *Crocodile Hunter* meets *Jackass*," he said. And almost overnight the idea of the hundred-foot wave became the media grail, tow surfing's equivalent of a moon landing.

There were a couple of snags. First, was it physically possible? No one knew how riding a hundred-foot wave might differ from, say, riding a seventy-five-foot wave. As they grow in size, waves increase dramatically in speed and energy. At what point would the forces overwhelm the equipment, or the surfers? "The 100-foot wave would probably kill anyone who fell off it," *Time* magazine wrote. Honolulu's then–ocean safety chief, Captain Edmund Pestana, agreed: "It's a deadly scenario for everyone involved." The trade journal *TransWorld SURF Business* was blunt: "You're asking these surfers to take huge risks for our titillation."

Next, even if a surfer wanted to take his chances, finding the wave was a problem. Although they were no longer considered imaginary, hundred-foot waves were not exactly kicking around within Jet Ski range. Further complicating things, for tow surfing's purposes not just any hundred-foot wave would do. The enormous seas the *Discovery* encountered; the huge freaks that pop up to batter oil rigs—these are unsuitable, despite their great height. Waves that exist in the center of a storm are avalanches of water, waves mashed on top of other waves, all of them rushing forward in a chaotic jumble.

Surfers need giant waves with a more exclusive pedigree. In their ideal scenario, a hundred-foot wave would be born in a blast of storm energy, travel across the ocean for a long distance while being strength-

ened by winds, then peel off from the storm and settle into a swell, a steamrolling lump of power. That swell would eventually collide with a reef, a shoaling bottom, or some other underwater obstacle, forcing its energy upward and sideways until it exploded into breaking waves. And that's where the ride would begin—far enough from the storm's center to be less roiled and choppy, but not so far that its power was too diminished. This was a pretty tall order. If the ocean was a slot machine, rideable sixty- or seventy-foot waves came along about as often as a solid row of cherries. And the perfect hundred-foot wave? Hit that one and the sirens would go off as everyone in the casino stopped what they were doing to gawk, and the staff rolled in palettes to help you haul away your money.

A surfer who intended to participate in the Odyssey, therefore, would be signing up for a global scavenger hunt. Not only would he have to ride the wave, he'd have to scour the oceans to find it, monitoring the weather's every nuance like a meteorologist, and then show up at precisely the right moment toting Jet Skis, safety equipment, surf gear, and photographers along with him—not to mention a highly skilled partner who didn't mind risking his life when called upon to do so. This was a surfing competition the way the Space Shuttle was a plane. "The Odyssey makes climbing Everest look easy," one British journalist wrote. Regardless, Sharp was undeterred. "I think everybody's ready," he said. "Now, on the giant days, there's no wave that anyone's backing down from."

Millions of years before there was water on the earth, before steam turned into rain turned into oceans, there were giant waves. There were electromagnetic waves and plasma waves and sound waves. There were shock waves from the many explosions and collisions that made our planet's earliest days so lively. Asteroids smacked into it and sent up waves of molten rock, thousands of feet tall. At one time scientists even believed that an enormous wave of this magma, created by intense solar tides, had swung off into space and become the moon.

Although that particular theory is no longer considered true, it points to something that is: waves are the original primordial force. Anywhere there's energy in motion there are waves, from the farthest corners of the universe down to the cells in your eyeball. I wondered if this was why, after eighteen years, I couldn't stop thinking about that day at Sunset Beach. Far from being an abstraction in the ether—like electrical waves, X-ray waves, or radio waves—those thirty-foot ocean waves were a majestic demonstration of the unseen force that powers everything. Catching a glimpse of something that elemental, that beautiful, and that powerful created one inevitable result: the desire to see it again.

The more I read about the mysteries of freak waves, the more jaw-dropping tow-surfing images I saw (and the more inevitable it became that someone *would* ride a hundred-foot wave), the more fascinated I became. New technologies began to reveal startling information. "Ship-Devouring Waves, Once Legendary, Common Sight on Satellite," read the *USA Today* headline on July 23, 2004, describing how radar was now able to measure waves from space: " . . . a new study based on satellite data reveals the rogues are fairly common." "Rogue Giants at Sea: Huge, Freakish, but Real, Waves Draw New Study," the *New York Times* reported in July 2006. "Scientists are now finding that these giants of the sea are far more common and destructive than once imagined, prompting a rush of new studies and research projects."

From a science and technology standpoint, we humans like to think we're quite smart. Over in Switzerland, for instance, physicists are chasing the Higgs boson, a subatomic speck so esoteric that it's referred to as the "God particle." If we're closing in on *this*, how is it possible that only fifteen years ago a force that regularly demolishes 850-foot-long ships was deemed not to exist?

Quite simply: the ocean doesn't subscribe to the orderly explanations that we would like it to. It's a mosh pit of variables, some of which science has considered and others of which it hasn't—because we don't even know what they are. Though we're more informed about the sea

now than we were several hundred years ago when mermaids were listed along with sea turtles in Pliny's *Historia Naturalis*, the depths still hold more secrets than anyone can count. And this lack of knowledge affects far more than ships at sea.

Anyone who lives on this planet is utterly dependent on its oceans. Their temperatures and movements control the weather; their destructive—and life-giving—ability dwarfs anything on land. Now that climate change is an accepted fact with unknown consequences, our vulnerability is sinking in. The earth's mean surface temperature (land and oceans combined) is warmer now than at any other time during the past four hundred years, and it continues to rise. In its 2007 report the Intergovernmental Panel on Climate Change (IPCC) concluded that "the ocean has been absorbing more than 80 percent of the heat added to the climate system." As the waters heat up, wind velocity increases; storm tracks become more volatile; polar ice and glaciers melt, causing sea levels to rise. How far will they rise? All we have is a best guess, continually adjusted upward as new (and discouraging) data arrives. In 2007 the sea levels were predicted to rise about 23.5 inches by 2100. In 2009 that number was raised to 39 inches, a level that would displace some 600 million people in coastal areas. (Other scenarios, like the collapse of the Greenland ice sheet, should they occur, would raise the sea level as much as twenty-three feet. For perspective, that would drown most of Florida.) As a result of all of the above and, likely, other factors no one's aware of yet, average wave heights have also been rising steadily, by more than 25 percent between the 1960s and the 1990s. Planetary waves, massive subsurface ocean waves that play a key role in creating the climate, are speeding up as well. The details about what a warmer planet will look like are still coming into focus, but there is one thing our environmental future will clearly hold: a lot of restless water.

If anyone needed a stark preview of the kinds of situations that a stormier, more liquid world might bring, it came on August 29, 2005, when a twenty-eight-foot storm surge from Hurricane Katrina over-

whelmed the levees surrounding New Orleans, submerging 80 percent of the city and killing almost two thousand people. (A record-breaking twenty-seven tropical storms formed in the Caribbean that year.) Intense storms are destructive enough on their own, but when the waves hit land the potential for damage goes off the charts: more than 60 percent of the global population lives within thirty miles of a coastline. Then, of course, there are tsunamis, extraordinarily powerful waves caused by underwater earthquakes and landslides. Six years ago the world watched in horror as an estimated hundred-foot tsunami wave erased the Indonesian city of Banda Aceh, home to 250,000 people, in a matter of minutes. Japan, perhaps the most vulnerable nation, has lost entire coastal populations to the waves. In the geological time frame these sudden inundations are hardly isolated events. Over the course of history volatile seas have wiped cities, islands, and even civilizations from the map.

In Waveland, it was as though the scientists aboard the RSS *Discovery* had dropped through a secret trapdoor in a surly but typical North Atlantic storm and into the darkest heart of the ocean: a place where giant waves not only exist but flourish, a place so obscure to us that we're more familiar with the workings of subatomic particles. What *is* out there? What happens in that place? That's what Dr. Penny Holliday and her team wanted to learn. And so did I.

Five years ago I set out to understand giant waves through the eyes of the people who knew them most intimately: the mariners, for whom Shackleton's "massive upheaval of the ocean" is a present and serious threat; the scientists, who are in a race against time to understand the intricate complexities of the sea in a rapidly changing world; and of course, the tow surfers. The members of this rarefied tribe—maybe fifty highly skilled riders across the globe—don't just stumble across giant waves or steer their ships clear of them or consider them as equations on a computer screen, they seek them out. While everyone else goes to great lengths to avoid encountering a hundred-foot wave, these men want nothing more than to find one.

What kind of person drops in on Mother Nature's biggest tantrums for fun? What drives him? And since he has gone into that dark heart of the ocean and felt its beat in a way that sets him apart, what does he know about this place that the rest of us don't? My questions went on, but I knew one thing for sure: if you followed the wave experts into the waves, you would have an interesting—and turbulent—time.