THE HIGH SEAS

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Ambition, Power and Greed on the Unclaimed Ocean

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To Rupie
for everything

To George and Millie
for your future

And
In memory of Emma O'Kane
I thought our journey would be longer!

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The Outer Sea

For most, the high seas are a remote realm, far offshore, that we have neither the chance, nor the desire, to visit. Indeed, the view from an aircraft, cruising at 36,000 feet – a height as great as the ocean is deep – is the closest that many of us come to experiencing this forbidding environment. From this vantage, we can almost grasp the ocean's immensity, its unshifting supremacy in the anatomy of our earthly home. The ocean, after all, occupies 70 per cent of the surface of our planet, and two-thirds of this are 'high seas' – unclaimed waters, beyond national borders. Far from land, these waters are on average nearly 4,000 metres deep, and with this depth comes enormous volume; if we're talking about living space on Earth, the high seas are 95 per cent of what's available. By contrast, all the places that you might visit in your lifetime – the forests, mountains, beaches, deserts and ice caps – comprise a mere sliver of what Earth has to offer. From our lofty position above the clouds, the high seas appear flat, motionless – an almost uniform expanse. Beneath the waves, however, is a world infinitely more complex and varied than the solid ground we tread upon. An immense heaving body of fluid, the ocean is constantly in flux, moving through time and space to connect, heat, enrich and enliven our planet. From its sun-speckled surface to its lightless depths, the ocean contains places and life forms we have scarcely imagined, many of which are far from shore, and some of which, no doubt, have yet to be discovered.

When I began writing this book, one friend asked what

I meant by the high seas. Another asked where to find them. Conversations in the schoolyard at pick-up made me realise that many people have never heard of the most iconic places far offshore. Most people know where the Bermuda Triangle is, and many are now aware of the North Atlantic Garbage Patch, but how many know that the world's only shoreless sea, the Sargasso, is in exactly the same spot? The Sargasso is one of the ocean's most vibrant ecosystems, a place eels will travel thousands of kilometres, across entire oceans, to reach, so that their young can feast in its plankton-rich waters. Similarly, when I mention Lost City, of course, people think I'm talking about Atlantis – the legendary island that sank beneath the waves, rather than a real place in the Atlantic Ocean. One of the most extreme environments ever found – with lightless, scorching hot, sulphuric waters that teem with bizarre bacteria – Lost City is an area spanning 500 square metres that is scattered with hydrothermal vents (much like underwater geysers), one reaching nearly 60 metres tall. Biologists believe Lost City may hold clues to the origins of life on Earth, yet most of us are blissfully unaware of its existence. The same holds true of other places offshore – take the Gakkel Ridge, for instance, an underwater mountain range taller than the Alps, that stretches almost 2,000 kilometres from Greenland to Siberia, and is home to the eyeless shrimp. Or what of the Saya de Malha Bank, a submerged plateau that formed 120 million years ago when the ancient supercontinent of Gondwana started to break apart, and split into today's major landmasses? In the heart of the Indian Ocean, the waters of the Saya de Malha Bank are shallow and boast seagrass meadows that span 40,000 square kilometres, making it one of the ocean's largest carbon sinks. Interspersed among these seagrasses are colourful corals and slow-growing encrusting red coralline algae, which attract sea turtles, parrotfish, surgeonfishes and rabbitfishes. Surrounding the bank are deep waters occupied by curious creatures such as the pygmy blue whale and flying fish. Some of the most extraordinary,

most biodiverse parts of our planet are on the high seas. Yet they are unknown to most.

Though few of us venture to the high seas, they have long enthralled us. Metaphorically, the high seas, for many, conjure up images of a lawless frontier, a 'wild west' of our planet that harbours outcasts, rogues and opportunists. To others, the open ocean is a place of danger and mystery, for, despite all of our advances in seafaring, these waters remain as inhospitable as they did when early explorers such as James Cook and Christopher Columbus set sail on arduous voyages in search of new lands. Johann Forster, the chief naturalist on Captain Cook's *Resolution*, which sailed deep into the Antarctic high seas in search of an imagined 'southern continent', described the ferocity of a storm that arose on the night of 30 November 1772: 'The people had not yet been prepared for such weather, and therefore did the rolling of the ship much damage; chairs, glasses dishes, plates, cups, saucers, bottles etc. were broken. The Sea came in one or the other cabin and made all the inside wet. In short, the whole ship was a general scene of confusion and desolation.' So tempestuous was the weather on that voyage that Forster looked to the epic Latin poem *Aeneid* for inspiration in describing the scenes he encountered. 'Then came the cries of the men and the groaning of the rigging. Darkness, like night, settled on the sea and all the elements threatened the crew with death at any moment.' Even now, in popular culture the high seas represent a world of storms, shipwrecks and lives lost.

As land dwellers, we've nurtured a fear of this offshore world. Indeed, one of the earliest known maps of Europe – the *Carta Marina*, published in 1539 – shows waters dominated by oversized, mythical beasts, among them the ziphius, a fierce-looking fish that swashbuckles its way throughout the high seas, cutting open its victims and vessels with its sword-like fin; the sea pig, a prickly monster with the feet of a dragon and eyes on the side of its torso, and the Orm, a 60-metre-long sea serpent. Meanwhile, the *Carta Marina*'s landmasses are decorated with representative

figures of the time: a sledge pulled by reindeer makes its way through Finland's northernmost territories; a woman fishes by the coast of Norway; a soldier marches on horseback through a volcano-pitted Iceland. But to this day, rare landings of the giant oarfish, which reaches up to 15 metres long and resembles a flattened snake, engender reports of 'terrifying sea beasts' and 'creepy sea creatures'. Our knowledge of marine life has, of course, vastly improved in the past few hundred years: using satellites, we've now mapped 100 per cent of the seafloor to a resolution of five kilometres, allowing us to see major underwater features such as ridges and trenches. Admittedly, we've mapped Mars, the Moon and even Venus in much greater detail, at a resolution of around 100 metres. This is a feat we've not yet achieved for planet Earth owing to its watery shroud. We are now, however, venturing to places we've never been before, illuminating secrets of the high seas. Enabled by a new generation of ships, robots and submersibles, the Seabed 2030 project is aiming to map the entire seabed in high resolution by 2030. This will unveil an entirely new layer of detail and with it, the potential to discover previously unknown worlds. Biologists who study the high seas describe them as 'pelagic waters', which means open sea, far from land. Oceanographers simply call them 'open ocean'. The high seas, on the other hand, is a legal definition – one that describes that part of the ocean beyond national ownership, usually starting 200 nautical miles from shore. And while that may, to some, sound like a curious focus, the simple fact that international waters belong to no one is what makes them so important – roughly half of the surface of our planet, and two-thirds of the ocean, is a vast global commons. It is an unclaimed ocean whose resources we are free to pillage or protect.

My own ocean obsession began long ago. From my early childhood, it was there, glimpsed from my bedroom window, if I strained my neck hard enough. The street I grew up on in Dún Laoghaire, a seaside town about 15 kilometres south of Dublin

city centre, ran perpendicular to the harbour and ferry terminal, a location that made it a prime spot for guesthouses, including our own. Ours was a double-windowed, pale green Georgian house with a rose-filled garden. New guests arrived daily, almost always having travelled across seas, with great stories to tell. My most persistent memory, though, is not of their stories or faces but of the bedroom I shared with an elder sister, overlooking the street at the front of our house. Blu-Tacked pictures of rock bands, The Smiths and The Cure, covered its peach-coloured walls, and in their midst was an unsettling image, of two girls looking out to sea, ankle-deep in water, as the ocean rushed in around them, sweeping away their belongings. In the same room, we had a record player and a treasured collection of recorded poems and readings, one of which remains etched in my mind: 'Don't you go too near the sea, for the sea is full of wonder. Don't you go too near the sea, for it's bound to pull you under', boomed the voice, filling my childlike imagination with fear and wonder. Despite years of searching, I've never been able to find evidence of either the image or the recital, as if they too had, somehow, been washed out to sea.

Thus began my fascination with the ocean beyond the horizon. It was a place I longed to visit, to explore and to understand. Eventually, when the time came for university, I chose zoology, with a thesis in marine biology. At weekends, I'd walk to the harbour and watch scuba divers ready themselves before they plunged beneath the waves. I yearned to join them, imagining the subsea world as a place of mystery and beauty, filled with the most extraordinary creatures. Before long, I started to survey local beaches with a non-profit, and was horrified to learn that the waters I'd been paddling in since childhood weren't as pristine as they appeared. Still, it didn't quell my enthusiasm for wading further in. I joined the diving club and saved furiously to buy my first dry suit. I was soon hooked. I spent most of my weekends either on or under water, devoured books about the ocean, and began studying for a PhD in marine ecology,

researching the Irish Sea's overexploited fish stocks, including cod, haddock and whiting. By the time I was twenty-three, I had become obsessed with the idea of venturing offshore to the high seas. A fleet of Spanish vessels was fishing for cod just beyond Canada's territorial waters at the time and I was desperate to join them, strangely enticed by the stories of hardship and horror, one from an observer on a trawler whose captain died of heart failure mid-trip and was stored in the freezer with the catch for two months. There were other stories from a trip to the Southern Ocean, less grim, but still unsettling, of months spent at sea with grossly insufficient food supplies, squabbling shipmates and tsunami-like waves that near toppled the boat. When my opportunity came, I grabbed it.

It was July 2001 when I first set sail for the high seas, joining a crew of nine fishermen on a 30-tonne fishing boat. That Thursday morning, I boarded a freshly painted red and white trawler, the *Agnes na Mara*,* that was to explore a new deep-water fishery for the next three weeks. Our destination was a remote corner of the North Atlantic Ocean, approximately 500 kilometres northwest of Scotland. We departed from Greencastle, a small fishing village in County Donegal. Tucked into the armpit of the Inishowen Peninsula, on Ireland's north coast, Greencastle was like most other Irish fishing ports back then – quiet, aside from the bustle of the pubs; the harbour filled with brightly coloured trawlers and the docks strewn with fishing gear being loaded on and off the boats.

The boat, and its crew, was part of a fleet of forty vessels from Donegal that had previously fished for cod and other whitefish in the Irish Sea, the same stocks that I was investigating for my PhD. As these inshore stocks diminished, the fishers had struggled to make a living. At the time of my trip, however, government subsidies were covering up to 40 per cent of the cost of new vessels to allow them to travel further to explore

*This is a pseudonym. The real name of the vessel has been changed.

and develop an unregulated fishery, one with no quotas, far offshore. There, they targeted unfamiliar species with odd names and even odder appearances: Greenland halibut, orange roughy, grenadier, black scabbard, rabbitfish, and forkbeard (which, in the British Isles, is called Sweaty Betty). Some of the catch made its way to fishmongers and restaurants in the UK and Ireland, but most was destined for Spanish and Greek markets. On board *Agnes na Mara*, the crew's job was to sound out these relatively unexplored, and untapped, resources. Mine was to note the catch, both intentional and accidental, and to report back to the fisheries authorities in Ireland. In our 30-ton trawler, it took around thirty hours to reach the high seas, where fierce squalls lashed at the windows of our little ship. Days passed when the winds blew too hard and the waves were too high for us to do anything other than ride it out. Despite the weather, we caught plenty.

In the twenty years or more since my trip on *Agnes na Mara*, I've returned to sea numerous times, first as a working scientist, and again since becoming a science writer. Although I've worked in all of the world's major ocean basins, I often reflect on that trip on the *Agnes na Mara*. The crew could not have made me feel more welcome, yet the whole enterprise of deep-water fishing was ill-conceived. A bottom trawler, the *Agnes na Mara* had special, heavy equipment that allowed it to fish deep water. On either side of the stern, two wires were attached to a large net held open by steel doors, each weighing around two tons. Once the net was lowered from the vessel's stern, it was dragged along the seafloor, held in place by the heavy doors, stirring up large plumes of sediment and swooshing fish into the net's opening. The bottom of the net on such a trawler is fitted with large rollers, designed to bounce over rocks and rough ground, protecting the net from wear and tear. Typically, the equipment weighs around 8 tons.

It's, therefore, unsurprising that an active trawl fishery, in which hundreds of trawlers are fishing the same grounds, can quickly turn underwater habitats such as corals and seamounts

into vast heaps of rubble. The deep sea targeted by these fisheries is also a quiet environment, inhabited by long-lived, slow-growing and late-to-mature species. One of the targets was orange roughy, a species of fish that can live for up to 150 years, and reaches maturity at age 30. Like the old growth trees in a forest, such individuals are not easily replaced, and their fisheries – with rare exceptions – are unsustainable, often lasting a decade or less. Put simply, we'd moved the problem of overexploitation elsewhere, to a fishery that was less able to recover. Although I didn't realise it at the time, the Irish weren't alone in targeting these high seas stocks. For the Scottish, French, Spanish, Russian, Polish and Faroese vessels all took part in this experimental fishery as part of a much larger global push to discover, and exploit, fishing grounds far offshore. It's now recognised that trawling has caused more severe, widespread and long-term destruction to deep sea habitats than any other fishing practice, and it's unclear whether these environments can ever fully recover. If they do, it will take centuries, perhaps even millennia.

Our early ancestors may have navigated deep stretches of water a million years ago, according to a hominid fossil discovered in 2004 on the tiny island of Flores, east of the Indonesian island of Java. This early human species, separate from *Homo erectus*, and dubbed 'the hobbit', may have travelled from as far as Africa to reach Indonesia. By 1000 AD, Polynesian seafarers were crossing thousands of miles of Pacific Ocean to reach neighbouring islands. But it wasn't until much later in human history – around six centuries ago – that people set sail on the first long-distance, recorded, voyages across the high seas. The first to do so were opportunists. As far back as 1402, Emperor Yongle – an ambitious Chinese leader who reigned during the Ming dynasty – launched a series of seven voyages as far as East Africa and the Persian Gulf under the command of Admiral Zheng He. Each voyage comprised 300 or more 'treasure ships', allegedly nearly

140 metres long, as well as numerous supply ships and warships fitted with canons. In total the crew on each expedition numbered around 28,000. These voyages were intended, in part, to collect treasures from abroad, including foreign spices and jewels as well as strange animals – giraffes, zebras, and ostriches – to impress the royal court. Several decades later, at the end of the fifteenth century, Europe's most powerful empires began their own offshore advance. Their ambition to forge ocean trading routes gave rise to the 'Great Age of Discovery', a period recognised for bringing new resources, wealth and knowledge to the west, and for the grave atrocities enacted on the people whose lands were colonised. Routes were discovered from Europe to India and China, before European navigators made their way across the Pacific and pushed south in search of a mythical southern continent, as well as north towards the Arctic. Before long, the high seas became the world's highway; ships filled with precious wares travelled back and forth along well-defined trading routes. European nations such as the Dutch, the Portuguese and the English formed mega-corporations, such as the Dutch East India Company, tasked with ensuring that their wealthy elites had a constant supply of luxury goods. Textiles, silks, coffee and spices all flowed in abundance from the east. These merchant mariners soon attracted a different breed of opportunist: pirates. At the peak of piracy in the seventeenth century, several thousand individuals were terrorising ships on both sides of the Atlantic, targeting vessels leaden with treasures from the New World on their return leg to Europe, and threatening trade between Europe and the Americas. In the Far East, piracy peaked in the early nineteenth century, at which time 40,000 pirates operated a fleet of around 400 junks on the South China Sea, attacking any merchant ship in sight.

These early offshore adventurers – both the merchants and the buccaneers who assailed them – mostly stuck to well-travelled coastal routes, and paid little attention to the natural world. The first to venture off the beaten path were whalers, in

pursuit of their prey. As the harpooned giants dived hundreds of metres deep, wrestling with the line, these hunters became unwitting naturalists, sensing the depths beneath them. By contrast, the scientist-naturalists who emerged in the early nineteenth century weren't especially concerned with life on the high seas. Lacking access to the deeper ocean, most assumed that life could only be found at the surface, and that the deep sea was 'azoic' or devoid of life. The 'azoic' theory was conceived of by a British naturalist, Edward Forbes, whose own investigations of the Mediterranean's Aegean Sea led him to believe that marine life became gradually less diverse and smaller with depth, petering out entirely below 300 fathoms (500 metres). The first to cast serious doubt on this idea was another British naturalist named Charles Wyville Thomson. In the summer of 1868, he persuaded the Royal Society and the English admiralty to lend him a steam frigate, the HMS *Lightning*, to survey the waters between the Faroe Islands and Shetland. There, Wyville Thomson used a dredge to haul up organic remains from the deep sea, evidence that convinced his benefactors to fund further investigation. During three subsequent expeditions to the Northeast Atlantic and the Mediterranean, Wyville Thomson confirmed that life existed at depth.

But it would take the greatest oceanographic voyage of all time to disprove Forbes' azoic theory once and for all. Dissatisfied with the evidence he'd accrued, Wyville Thomson in 1870 approached the Royal Society of London for further assistance, this time to seek permission to retrofit one of Queen Victoria's ships for a global exploration of the world's oceans. When granted use of a 60-metre-long wooden navy sailing ship, he had all but two of its seventeen guns removed to create space for scientific laboratories and workshops as well as storage for trawls, dredges and samples. Duly refitted, HMS *Challenger* set sail from Portsmouth England in 1872 on the first ever oceanic voyage with scientific enquiry as its primary purpose. The expedition covered an astounding 68,000 nautical miles, travelling as

far as the Great Ice Barrier of Antarctica, visiting Nova Scotia, the Caribbean and South Africa, before pushing on to explore the Pacific and visiting Indonesia, then heading north to Hawaii and then south again before passing back into the Atlantic through South America's narrow Strait of Magellan. Even now, the scale of *Challenger*'s ambitions seems daunting. Its 243 scientists, officers and crew sampled every one of the Earth's ocean basins. At 362 individual locations, spaced at regular intervals across the seafloor, they took physical, biological and chemical measurements. At these stations and others – 400 locations in total – they used a simple rope marked at regular intervals with flags to take soundings, or depth measurements. The details of the physical measurements and biological specimens they recorded filled 50 volumes and 29,500 pages, all bound in reports that took 20 years to complete.

A few months into the expedition, the scientists hauled up a sea lily, a marine invertebrate that resembles a delicate flower, from water around 1,800 metres deep, just offshore from Lisbon. Closely related to starfish and sea urchins, sea lilies have a central stalk topped with numerous feathered and vibrantly coloured arms, used to catch tiny particles of detritus from the water, especially at night. Later that same week, they collected a Venus Flower Basket, a strange and magical creature shaped like a conical tube, with walls made of a delicate tissue that resembles spun glass. The heavy nets that *Challenger* used were often lowered as far as 5,000 metres down, and when lifted from the lightless realms beneath proved beyond doubt that the ocean's depths were swarming with unfamiliar species. Among the catch were spectacular and grotesque deep-water fish, never before seen, as well as great hauls of a small silvery fish called the bristlemouth, now thought to be one of the most abundant vertebrates on Earth.

In addition, the scientists made other discoveries, including the presence of ore-rich rocks on the deep seafloor. One especially insightful moment came on 23 March 1875, more than halfway through the expedition. Since leaving Nares Island in

Papua New Guinea, HMS *Challenger* had been virtually stranded in the Pacific Ocean. Officer Herbert Swire, the navigator on board, had been assigned the job of taking the depth reading at one of the sampling stations, number 225. With no wind to fill its sails, the ship drifted idly for thirteen days, sometimes moving at only half a kilometre an hour. Swire, who kept a detailed journal, noted how the crew's tempers frayed and their faces grew sullen as the days passed with little to occupy them. But on that Tuesday afternoon, as the scientists lowered their sounding rope – a length of simple wire – to the ocean floor, they were astounded. Marked with flags at 25-fathom intervals, their weighted line finally hit the bottom at 4,475 fathoms, or more than 8,000 metres. The incredible gulf below them was by far the deepest point encountered by *Challenger*. Just fifty years earlier, the Encyclopaedia Britannica had included the following entry: 'Through want of instruments, the sea beyond a certain depth has been found unfathomable.' No longer. Originally named Swire Deep, Challenger Deep is now known to be part of the Pacific Ocean's Mariana Trench, which reaches down almost 7 miles, or approximately 11,000 metres, and remains the deepest known place in the ocean. Years later, Swire would recall the discovery as his most treasured memory from *Challenger*. Above all, the *Challenger* expedition upended the view of the open ocean as a uniform watery expanse; by its end, it was clear that the open ocean was both deep and filled with life. By that stage, however, and as early as 1870, the first steam-powered fishing vessels had already left European shores for the high seas. With their capacity to fish deeper and to stay offshore for longer came a turning point in our relationship with the ocean offshore – one of unrelenting exploitation that continues to the present day.

If the high seas are now the wild west of our planet – an unclaimed frontier, open to rampant overuse – one event, in particular, 400 years ago, sealed their fate. It began at 8 a.m. one morning on the 25 February 1603, when the crew of a huge

Portuguese merchant ship, the *Santa Catarina*, were suddenly woken by a loud crash on the deck. Anchored at the entrance to the Singapore Straits, at the southeastern tip of the Malay Peninsula, the 1,500-ton carrack was heavily laden with goods from China and India, including vast quantities of Ming china, of musk for use in perfumes, and 1,200 bales of silk. The gigantic vessel also carried nearly 1,000 passengers, including soldiers, sailors, women, children and Asian captives whom the Portuguese intended to sell as slaves. That night's anchorage had been a final stopover en route to the Portuguese colony of Macau in southern China, where the *Santa Catarina* would collect yet more riches before sailing back to Portugal with its valuable cargo.

Yet, early that Tuesday morning, the *Santa Catarina* found itself under attack by Dutch admiralty sailors who had boarded the carrack on the orders of Captain Jacob van Heemskerck. A merchant seaman, under the employment of the Dutch East India Company, van Heemskerck had spent months at sea looking for a Portuguese prize. At the time, the Portuguese asserted they had rightful ownership of the eastern Atlantic, a position they'd maintained since 1493, when the Roman Catholic Church had been forced to intervene in a growing dispute between Portugal and Spain over trade routes between Europe and Asia. Drawing an imaginary line from the North to the South Pole, the Vatican granted Portugal the eastern Atlantic with exclusive rights to establish trade routes throughout the region, and Spain the western Atlantic. Eventually, the Dutch began to challenge Portugal's monopoly of the eastern spice route. But the Portuguese fought their ground ferociously. As far as they were concerned, they had the right to defend their territory and, as such, they sought to oust the Dutch from Southeast Asia at every opportunity. In the process many Dutch sailors had been killed, as had locals who granted them port access. One particular incident, involving the execution of seventeen Dutch sailors in Macau in November 1601, had enraged Captain

van Heemskerck. Lured ashore by white truce flags, the Dutch had been imprisoned, and then hanged in a Portuguese jail against the wishes of the Chinese authorities. Van Heemskerck had known Admiral Jacob van Neck, the commander executed along with the unfortunate crew, and was devastated by the news of his death. So, when van Heemskerck first laid eyes on the *Santa Catarina*, he saw the ship as a godsend. The attack began at 8 a.m., with van Heemskerck giving his crew orders to fire only at the carrack's mainsails, 'lest we destroy our booty by means of our own cannonades'. With the Portuguese unprepared, the naval battle was fairly one-sided and by six-thirty that evening the *Santa Catarina*'s captain, Sebastian Serraõ, had surrendered, handing over his goods on the condition that the Dutch spare the Portuguese their lives.

The *Santa Catarina*'s capture marked a turning point, in part because her cargo was one of the most valuable seizures on record. When the carrack's wares were later sent to Amsterdam for auction, they fetched the staggering sum of three million guilders, today worth roughly $180 million. News soon spread of the riches to be made from trading with Asia, and in particular with China. But the seizure would also go down in history for an entirely different reason. Although the Dutch and Portuguese were at war when the carrack was captured, it wasn't legal under Dutch law for merchant mariners, such as van Heemskerck, to seize goods by force at sea. So the Dutch found themselves in a legally precarious position. To keep the proceeds, they would therefore have to prove that the attack on the *Santa Catarina* was not an act of piracy. As they weighed their options, public interest heightened. Eventually the Dutch called on a young legal scholar called Hugo Grotius.

Grotius was then just twenty-one years old. Drafted in to write the Dutch defence, Grotius marshalled his arguments in a document called *Mare Liberum*, meaning 'the free seas', which was published in 1609. In *Mare Liberum*, Grotius argued that the sea is international territory and that all nations should be

free to use it, not just those with existing trade monopolies. In making his case against the Portuguese, Grotius took the moral high ground, arguing that the 1601 murder of Dutch sailors in Macau was not an isolated incident, but one of many barbaric and unprovoked attacks by Portuguese naval powers. In consequence, the Dutch were fully entitled to protect themselves and the *Santa Catarina*'s seizure was a pre-emptive act of self-defence. To bolster his case, Grotius contended that, 'Every nation is free to travel to every other nation and to trade with it.' As he wrote:

> The question at issue is the OUTER SEA, the OCEAN, that expanse of water which antiquity describes as the immense, the infinite, bounded only by the heavens, parent of all things; the ocean which the ancients believed was perpetually supplied with water not only by fountains, rivers, and seas, but by the clouds, and by the very stars of heaven themselves; the ocean which, although surrounding this earth, the home of the human race, with the ebb and flow of its tides, can be neither seized nor inclosed; nay, which rather possesses the earth than is by it possessed.

Grotius framed *Mare Liberum* as a broader statement of the right to freedom and navigation, sparking an enduring controversy. The ocean was so vast, he contended, that no single nation could appropriate it and secondly, its resources were effectively limitless and therefore inexhaustible. In the long term, the publication of *Mare Liberum* earned Hugo Grotius international renown as a champion of the free seas, and while the idea has faced some stiff challenges, it still forms the basis of how we govern the high seas. In winning his argument, Grotius changed the course of history. For over 400 years, roughly half of our planet has been a vast global commons owned by no one.

Grotius was born in the Dutch city of Delft in 1583, the eldest son of a wealthy family. Grotius was regarded as a child

prodigy, and books became the staple of his life from a young age. By the age of eight, he was writing Latin poetry; age eleven, he was accepted to study at Leiden University and by the time he was a young teen, he was amending religious texts. Today, Grotius' face adorns the walls of some of world's most prestigious buildings, including the US Capitol, where it sits alongside twenty-two other relief portraits, all depicting the men whose intellectual contributions formed the foundations of modern law. These flattened busts include Thomas Jefferson, who wrote the Declaration of Independence, and Hammurabi, a Babylonian King who crafted one of the earliest surviving legal codes.

London's National Portrait Gallery lists thirteen line drawings of Grotius, created from sittings throughout his life. A painting of Grotius, age forty-eight, adorns a wall in the Rijksmuseum in Amsterdam; another portrait, of him aged just sixteen, can be found in Paris' Frits Lugt Collection, just a stone's throw from the Musée d'Orsay. Arguably the most famous representation, however, is an oversized statue that stands in 'Markt square' in Grotius' home town of Delft, and which these days is greeted partly with irritation by busy motorists and market-goers.

In addition to these illustrative homages, hundreds of titles detail Grotius' life and works, including at least 350 written during his lifetime. For the most part, accounts of Grotius portray him as a lifelong advocate of peace and of human rights, who was willing to defend his beliefs at almost any cost. Defending the capture of the *Santa Catarina* was just the start of Grotius' career and fame. Sixteen years after the publication of *Mare Liberum*, Grotius wrote O*n the Law of War and Peace*, a substantial work in which he set out many of the ideas that form the basis of the laws we use today. Now regarded as the founder of modern international law, he became one of the first scholars to make the case for clemency in conflict. He saw altruism and charity as essential traits of civilised nations, argued emphatically for restraint, and set the tone for how emerging sovereign

states should relate to one another. But Grotius' impact on how we manage the high seas has been just as enduring. Who would have thought that a single argument, intended to justify the ransacking of a Portuguese carrack, could – 400 years later – have such a decisive impact on the health of the global ocean? Had Grotius not stepped in to defend the Dutch, would the open ocean have eventually been carved up between nations? And would any nation, over time, have come to protect marine life, to manage fisheries, or to create sanctuaries on the high seas? It is, of course, impossible to say.

At times a great promoter of peace, Grotius was a complicated, conflicted character: he had the propensity to be quite self-serving, even Machiavellian. When Grotius defended the Dutch he was also defending the Dutch East India Company, a conglomerate so aligned with the Dutch state that they were, for all intents and purposes, one and the same. He's been described by one historian as a 'polemic publicist' and an 'itinerant ideologue of empire' whose attachment to the Dutch East India Company was a means to further his own career and that of his family, while also protecting the nation's interests. In the early days, when *Mare Liberum* was being used for the Dutch defence, Grotius was also acting as a political lobbyist and an advocate for the company.

So it would seem that the 'free seas' concept was a smart way of Grotius advancing his own interests, rather than pure altruism. Not long after the publication of *Mare Liberum* – in which Grotius made a passionate plea for the freedom of the seas – he successfully petitioned, lobbied and even threatened the French and English against venturing east to trade in spices and other commodities and was handsomely rewarded with 400 Dutch guilders' worth of gold coins by the company directors.

For the Portuguese and Spanish authorities, the concept of the free seas proved so controversial that they banned *Mare Liberum* in 1612. The British, too, took issue with *Mare Liberum* and, before long, came up with a rebuttal. Their grievance

related to the fact that Dutch vessels were fishing English waters, mostly for herring, and doing so rather more successfully than the English fleet. Throughout the eighteenth century, more nations began to assert their naval powers, leading to conflicting claims on the ocean. To resolve these disputes, in 1702 a 'three-mile limit' was introduced; this gave nations the right to govern waters they could protect within the supposed range of a cannon. For the next 250 years and more, most nations respected what came to be known as the 'cannonshot rule'. But the peace didn't last. In the 1870s, the first steam-powered fishing vessels were introduced to Europe, allowing fishers to stay at sea for longer, taking more hauls, or to travel further in search of lucrative or untapped fisheries. In the years leading up to the First World War, steam-powered vessels became the norm, and Europe's fishing fleets grew in size and power. This put huge pressure on inshore fish populations, such as North Sea herring and cod, whose stocks started to decline.

By the 1920s, British trawlers started to venture further north to rich fishing grounds around Iceland and the Barents Sea. Soon trawlers from Germany, France, Portugal, the Netherlands and the USSR joined them in fishing the stocks of the far north. Within a few decades, Icelandic fish stocks were also in decline. With Britain and Germany still fishing them hard, in 1958 Iceland called time on foreign fleets and extended their territorial waters to 12 nautical miles from shore. This decision marked the start of the so-called Cod Wars between Britain and Iceland, a bitter dispute that would take almost twenty years to resolve. The British initially ignored Iceland's 12-mile limit, protecting their trawlers with naval frigates, but they conceded in 1961. Then in 1972, Iceland extended its territorial claim again, this time to 50 nautical miles, guarding their waters with patrol boats, and even employing force when deemed necessary.

Eventually, the UN stepped in, and work began to formulate the United Nations Law of the Sea (UNCLOS) at a New York conference in 1973. From the outset, it was clear

that many nations wanted a 100-mile coastal zone in which they would have exclusive rights over resources. In May 1975, Iceland declared a 200-mile limit. When others followed, the 200-mile limit was written into the Law of the Sea. The treaty was eventually agreed in 1982, came into force in 1994 and has since been ratified by 150 states and the European Union. It allowed states to claim territorial waters or 'closed seas' up to 12 nautical miles from land, and an Exclusive Economic Zone (EEZ), which stretched out to 200 nautical miles, and within which nations had first rights on mineral and fishery resources. Nations could also use these waters to develop wind and wave energy, or to exploit oil and gas, but they remained free for other nations to navigate. There were, however, nuances and exceptions: in certain regions, such as the Mediterranean, EEZs – and, in some cases even territorial seas – clearly overlapped, forcing neighbouring nations to forgo these claims or to negotiate their maritime boundaries.

In fighting for a large Exclusive Economic Zone, nations weren't just interested in fishing rights. Within their EEZ, they also gained first rights to mineral resources – oil, gas and metals – across an area known as the 'continental shelf', which is the submerged portion of a landmass and which, on average, extends out 200 nautical miles from shore. Formed over millions of years, from accumulated layers of organic matter, such as the remains of plants and animals, and inorganic matter, such as sediment from rivers, continental shelves contain around 20 per cent of global oil and 30 per cent of global natural gas reserves, making this submerged territory especially valuable. Some nations, however, have vastly larger continental shelves than others. Along Russia's northern Siberian coast, for instance, the continental shelf stretches almost 14,000 kilometres from land. Recognising the commercial potential of this subsea real estate, nations were, under UNCLOS, allowed to claim an extension of the 200-nautical-mile allocation, up to a maximum distance of 350 nautical miles from land. First though, they have to prove

their rightful ownership using detailed scientific surveys to gather the required data. Predictably, coastal states have jumped at this opportunity, and have collectively, since 2001, asserted their rights to a portion of the subsea twice the size of Russia. The process of deciding who, exactly, owns what is still ongoing.

It took almost a decade to agree the Law of the Sea, a feat that is regarded as one of the greatest ever triumphs in international diplomacy. By the time the deal was done, in 1982, the entire ocean had been carved up into new zones, with fresh rules on ownership and governance. An expanse covering half of our planet was left as a global commons; in a quirk of the diplomacy needed to secure the treaty, the ocean beyond national borders remained the free seas, its resources owned by no one, but the international seabed became a shared commons. Known in legalese as 'the Area', the international seabed is governed, in theory, for the good of humanity, and the profits from its exploitation are shared among nations. But in practice, it's not that clear-cut: the offshore ocean in general is still a frontier, and its unclaimed resources a potential gold mine – whether they are fish from the ocean, minerals from the seabed, or oil and gas reserves from deep beneath the seafloor. Colloquially, experts now refer to all ocean space beyond national jurisdiction as the 'high seas'. In recent years, as scientists, conservationists, lawyers and politicians have wrangled with how to protect the unclaimed ocean, the term 'the high seas' has escaped the confines of the UN, and has entered common parlance. It's with this broader understanding that I use the term throughout this book.

The Law of the Sea has now been ratified by nearly every state on Earth. Even the US, which refused to sign, abides by its rules. There are huge and undeniable gains that have come from the freedoms it enshrines: it allows us to navigate international waters and the airspace above them safely, it allows nations the freedom to fish and to engage in other activities such as laying cables and constructing artificial islands – if they so wish – offshore. Perhaps above all, it has allowed us to research, explore,

understand and benefit from the global ocean. In a world marred by territorial disputes, none of these privileges can be ignored. But in practice, the freedom of the seas has left half of our planet as a free-for-all. That's not, however, to say the high seas are ungoverned: a menagerie of organisations, bodies and codes of conduct oversee specific activities from mining to shipping. No less than seventeen regional fisheries management organisations, for instance, oversee fishing on the high seas, but their mandate is severely limited, covering a tiny number of commercial fish species or certain areas. Vast swaths of the offshore ocean are unregulated for fishing. The International Seabed Authority governs the emerging industry of deep-sea mining, but as we'll see later, part of its mandate is to facilitate exploitation. As a general rule, the high seas have, throughout human history, been managed for commercial gain; preserving the environment offshore has been an afterthought. We have long cultivated an 'out of sight, out of mind' relationship with this half of our planet. And while conservationists have made some recent, serious gains on protecting the high seas, even now industry and economic progress rule the waves. Lax enforcement and apathy remain the status quo. For all intents and purposes, the high seas are still the wild west, a blue frontier.

The offshore world has long attracted those seeking fame and fortune. The difference now is that humanity's relationship with the ocean has entered a new phase, marked by the need for new resources. Today's unclaimed ocean is under siege. Far offshore in the Pacific Ocean, for instance, mining companies are exploring the deep seabed for rare metals. As regulators scramble to finalise a rulebook that will green light this industry, conservationists, scientists and even governments are calling for a ban on bringing mining, a notoriously destructive practice, to the deep sea. Meanwhile, Norway, one of the world's most successful maritime economies, is positioning itself to begin harvesting the fish of the ocean's 'twilight zone', a gloomy

mid-water layer between 100 and 1,000 metres that is believed to contain the largest global supply of untapped fishery resources on Earth. Mostly in international waters, the fish stocks they are targeting are unregulated, free for anyone to exploit. Yet the twilight zone also happens to be the ocean's most vital pathway for bringing carbon to the deep sea, where it stays locked up for hundreds if not thousands of years, softening the blow of greenhouse gas pollution.

The overexploitation of coastal fisheries has made a frontier of the high seas, as fleets now need to travel further and to fish for longer in search of ever-dwindling resources. Reaching these rich fishing grounds requires large vessels, plentiful fuel and supplies. As costs are high and it's hard to make a profit, fishers have been known to use unscrupulous means – misreporting the type or the size of their catch, targeting waters where no quotas have been set, or poaching directly from protected areas. Known collectively as 'illegal, unreported and unregulated' (IUU) fishing, these fishing-related offences decimate wild stocks and cost the global economy, through lost taxes, up to $50 billion a year. Throughout the open ocean, environmental transgressions such as poaching are now also associated with more serious crimes such as tax evasion, money laundering, murder, slavery, drugs and human trafficking, as the distant-water fishing industry has become a convenient front for transnational, highly organised criminal gangs. While ferrying drugs from one port to another, for instance, criminals think little of filling their holds with endangered species such as sharks. For the most part, criminals target international waters, outside any nation's jurisdiction, where their violations largely go unpunished. The criminality that now pervades the open ocean is both a symptom and a cause of its overexploitation.

Fresh battles are also emerging offshore, as climate change takes hold. As the Arctic's permanent ice cover melts, China, for example, is planning a shipping route through the newly

navigable Central Arctic Ocean, which could eventually become the main passageway between Asia and Europe, supplanting existing sea routes. And the Arctic seabed – currently out of bounds, due to perennial ice cover – could hold up to 13 per cent of the world's undiscovered oil and as much as 30 per cent of the world's undiscovered natural gas. Unsurprisingly, states such as Russia and Canada are now staking claims to the Arctic seafloor, in the hope of extracting these lucrative resources. At the other end of the world, the ongoing conflict between those looking to exploit and protect the high seas is making a political flashpoint of Antarctica's Southern Ocean. Here, shrinking sea ice is squeezing the living space for krill, a tiny briny shrimp that survives by feeding on algae on the underside of ice floes. These partly ice-dependent krill are prey for penguins, fish and whales, and the base of Antarctica's entire food web; they also happen to fuel a billion-dollar industry for nutraceuticals, making them a prime target for the fishing industry.

One could point to the high seas as a modern-day tragedy of the commons, in which the resources of the unclaimed ocean are being exhausted by a few at the expense of all. Take the Pacific Bluefin Tuna, for instance, a stock that is at around 10 per cent of its pre-fished level, but which saw an increase in its catch quota in 2022, contravening scientific advice. In 2022, the quota for tuna over 30 kilograms was increased by 15 per cent in the Western and Central Pacific, compared to 2021. The regional authorities also introduced a new rule, allowing a much larger proportion – 17 per cent – of the previous year's quota to be carried over, compared to 5 per cent originally. And yet this is a stock that is allegedly managed by a sanctioned organisation. For fisheries such as squid, with no catch quotas in international waters, the outcome is worse still: throughout the high seas, squid fisheries are now booming in a regulatory vacuum, leaving experts concerned about the health of the stocks and the larger ocean ecosystem. In the Northwest Indian Ocean, for instance, the presence of squid fishers in one unmanaged area

grew by 830 per cent in just five years between 2015 and 2019, threatening the entire local food web.

Added to all this is the problem of pollution. We permit the high seas – our largest earthly commons – to be used as a dumping ground. Space agencies can't dispose of a decommissioned space station or a spent rocket on land or along the coast, but they can do so on the high seas. Farming waste, in the form of excessive nutrients, routinely ends up in rivers and coastal waters, making its way from the coast to the open ocean, where it has helped to create dead zones – vast areas devoid of oxygen and life – throughout the seas. From 2008 to 2019, the number of dead zones in the ocean increased from 400 to 700, in part a response to nutrient runoff, but also to climate change. Ocean warming is just one manifestation of fossil-fuel pollution; about 30 per cent of our carbon emissions end up in the ocean, changing the temperature, but also altering large-scale circulation and increasing ocean acidity, which has risen 30 per cent since fossil-fuel use began. What's more, so much plastic is now entering the ocean that by 2025, it is expected to weigh 150 million tons.

A general truism of any mistreated commons is that those causing the damage never bear the full cost – hence, their apathy over changing tack. Why would they rejig a system from which they benefit and are rarely held accountable for the damage caused? This is undeniably true of the unclaimed ocean. Flotillas of vessels – armadas even – patrol the high seas squeezing what they can from every inch of unregulated space. Only a handful of nations benefit, but the rest of us suffer the consequences of an ocean that has fewer oxygen-emitting plankton, that soaks up less CO_2 and that provides us with less food for a growing global population. Similarly, those few with an interest in seabed mining stand to profit from this nascent industry, but the damage to the deep sea will be borne by us all.

There are, of course, benefits to our offshore expansion. Since the 1950s, researchers have discovered almost 34,000

marine compounds with commercial potential for a wide variety of uses. An anti-freeze protein from a cold-water fish has been used to improve the texture of ice cream, for instance, and an enzyme extracted from a marine microbe is being used to develop a biofuel. So far companies have successfully developed more than a dozen drugs from marine organisms found within national waters. Some have helped solved public health crises and have been worth billions of dollars to the pharmaceutical industry. These include Remdesivir, the first treatment approved for Covid, AZT, the first approved treatment for HIV, and Halaven, a blockbuster anti-cancer drug with annual sales of more than $300 million, all of which have been developed from ocean creatures. Scientists in countries with advanced research programmes are now looking to the unexplored genomes of high-seas organisms for new leads for the marine biotechnology industry, which is projected to be worth $6.4 billion by 2025.

In January 2020, a group of researchers from the Stockholm Resilience Centre in Sweden described a new phenomenon, which they named 'The Blue Acceleration'. 'Claiming marine resources and spaces is not new to humanity, but the extent, intensity and diversity of today's aspirations are unprecedented', wrote the authors. 'The Blue Acceleration' is the race between these diverse, growing and often competing interests. The term itself was a nod to the larger phenomenon, known as 'The Great Acceleration', in which our growing consumerism has begun to negatively impact Earth. Since 1950, the human population has trebled in size and has started to use more of the Earth's finite resources, including fish, fossil fuels, wood and water. Since then, we've also physically altered the Earth's surface on an unprecedented scale – by opening mines, building dams and cities, and replacing forests with farms. The changes to our lifestyles have now mapped on to measurable changes in the physical environment. From 1950, there's been an uptick in greenhouse gas levels, global air temperature, ocean

acidification, loss of habitat and loss of wildlife, both on land and in the sea.

There are two main reasons for the Great Acceleration's offshore advance. The first is that we're running out of resources on land and so costly endeavours such as seabed mining, once deemed foolhardy, now seem imminent. The second is that technology has advanced to the point where it's now feasible for us to find solutions to complex problems – such as antibiotic resistance – in remote deep-sea environments. As the Blue Acceleration gets underway, the unclaimed ocean is becoming crowded and impacted. Most of the ocean – 59 per cent – is now subjected to cumulative impacts that are becoming increasingly layered. Fishing takes place alongside shipping, military exercises, scientific research, and oil and gas exploration, in seas already awash with plastic and which may eventually be subjected to new pressures such as deep-sea mining. More pernicious still are the warming and ocean acidity that threaten to destabilise the polar ecosystems of the Arctic and Antarctica. The once common view of the ocean – a place of inexhaustible resources, too large to be affected by our actions – has been replaced by a new reality. As the Anthropocene advances, our presence is being felt in parts of the planet that have previously seemed as remote and unknown as other planets.

Faced with a new wave of exploitation, unparalleled in its breadth and potential impact, the story of deep-sea bottom trawling serves as a reminder that our actions have unknown outcomes, some of which may be negative and irreversible. But what if we were to take a different approach, allowing our decisions to be informed by science, and using our global commons in ways that benefit the majority? In writing this book, my aim was to ask whether that is possible. My efforts to explore this question took me to the far corners of the Earth, from the Arctic to Antarctica, and to cities ranging from London to Panama City to Copenhagen. During the course of this journey, I came into contact with conservationists fighting to protect

these waters as well as with those looking to exploit the ocean's untapped resources. Above all, I came closer to the huge scientific effort underway to better understand our open ocean, and how we could use this unclaimed space. We might not all agree on the answers. But if half of our planet is a free-for-all, beset by opportunists, who chooses how we use it? And what does that mean for the rest of us?

These decisions are unfolding at a unique point in human history, in which atmospheric greenhouse gas concentrations have reached levels not seen on Earth for 3 million years. Each year, the ocean soaks up roughly a quarter of the emissions that we pump into the air. It's also absorbed 90 per cent of the extra heat we've generated in the past fifty years. To put that in perspective, if all that heat had entered the atmosphere, the global average temperature would now – according to one estimate – be roughly 55°C higher, rendering the Earth uninhabitable. The deep sea, in particular, is our greatest buffer against climate change. The ocean also produces half of the oxygen on Earth, most of which is used to sustain ocean life. But the ocean can only continue as our ally if it remains healthy. A warmer ocean absorbs less carbon, and loses oxygen more rapidly. A stressed ocean, polluted by plastics and overexploited, struggles to support life. To avoid a further collapse of global fisheries and stem the loss of marine biodiversity, scientists say that we need to set aside at least 30 per cent of ocean space in sanctuaries, and manage the rest in a way that is fair and sustainable. As it stands, most marine protected areas are ineffective, blighted by a lack of regulation and poor oversight. Just 1 per cent of the high seas is fully protected.

Yet, there are reasons to be hopeful. We are entering an era of unrivalled political will to protect the high seas. In March 2023, UN member states secured an historic deal that could allow large swaths of the high seas to be set aside as marine protected areas, and that could slow our offshore advance. It's now conceivable that places such as Lost City or Gakkel Ridge

or the Sargasso Sea will be safeguarded for future generations. What's more, we are witnessing an era of rapidly evolving ocean surveillance technology, bringing visibility to the offshore world and accountability to the industries that operate there. Our scientific understanding of the ocean has never been greater. Yet despite these wins, even now, the offshore world remains an untamed frontier. To redress our 'out of sight, out of mind' relationship with the unclaimed ocean, and to use our ocean commons in ways that benefit the majority, we need to go further. In the years that I've been writing about this topic, we've slowly come to accept that if we don't change tack, we risk doing irreversible harm. My hope, in writing this book, is that everyone, and not just ocean obsessives like me, will understand what's at stake.

2

Enter the Twilight Zone

On 21 September 2021, an enormous, odd-looking creature was projected in purple onto the northern façade of the UN building in New York City. Some thirty storeys tall, the image was the creation of 'Superflex', a Danish art collective, and the animal they featured was a siphonophore. Dancing 150 metres above the ground, its wiry tentacles stretching out in every direction, the siphonophore was there to remind passers-by of the unsung creatures of the ocean's twilight zone, of which it is one. A year earlier, scientists in Australia had discovered a siphonophore almost 120 metres long, believed to be the longest existing animal on Earth. A relative of the jellyfish, a siphonophore is actually a colony of gelatinous animals called 'zooids' which, attached together, form long transparent floaters that drift with the currents. They inhabit a mid-layer of the ocean, where temperatures drop as low as 4°C, visibility is poor, and much of the available food rains down from the sunlit waters above.

If ever there was a hang-out for weird creatures, it's here, in the twilight zone. Mostly far offshore, this ocean mid-layer starts where photosynthesis stops, at around 100 metres deep and ends where the ocean becomes truly devoid of light, at roughly 1,000 metres. Though bizarre, the siphonophore is by no means the oddest of the twilight zone's inhabitants: competitors for that title could be the Sloane's viperfish, an agile swimmer no bigger than a human hand. With fangs too large to fit inside its mouth, the Sloane's viperfish impales its victims in high-speed attacks, which are so forceful that it has adapted its