JULIAN CHARRIÈRE

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MIDNIGHT ZONE

Edited by
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MUSEUM TINGUELY
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The Gray Beginnings

Rachel Carson

And the Earth was without form,
and void and Darkness was upon
the face of the Deep.

GENESIS

Beginnings are apt to be shadowy, and so it is with the beginnings of that great mother of life, the sea. Many people have debated how and when the earth got its ocean, and it is not surprising that their explanations do not always agree. For the plain and inescapable truth is that no one was there to see, and in the absence of eyewitness accounts there is bound to be a certain amount of disagreement. So if I tell here the story of how the young planet Earth acquired an ocean, it must be a story pieced together from many sources and containing whole chapters the details of which we can only imagine. The story is founded on the testimony of the earth's most ancient rocks, which were young when the earth was young; on other evidence written on the face of the earth's satellite, the moon; and on hints contained in the history of the sun and the whole universe of star-filled space. For although no man was there to witness this cosmic birth, the stars and moon and the rocks were there, and, indeed, had much to do with the fact that there is an ocean.

The events of which I write must have occurred somewhat more than 2 billion years ago. As nearly as science can tell, that is the approximate age of the earth, and the ocean must be very nearly as old. It is possible now to discover the age of the rocks that compose the crust of the earth by measuring the rate of decay of the radioactive materials they contain. The oldest rocks found anywhere on earth—in Manitoba—are about 2.3 billion years old. Allowing 100 million years or so for the cooling of the earth's materials to form a rocky crust, we arrive at the supposition that the tempestuous and violent events connected with our planet's birth occurred nearly 2½ billion years ago. But this is only a minimum estimate, for rocks indicating an even greater age may be found at any time.

The new earth, freshly torn from its parent sun, was a ball of whirling gases, intensely hot, rushing through the black spaces of the universe on a path and at a speed controlled by immense forces. Gradually the ball of flaming gases cooled. The gases began to liquefy, and Earth became a molten mass. The materials of this mass eventually became sorted out in a definite pattern: the heaviest in the center, the less heavy surrounding them, and the least heavy forming the outer rim. This is the pattern which persists today—a central sphere of molten iron, very nearly as hot as it was 2 billion years ago, an intermediate sphere of semiplastic basalt, and a hard outer shell, relatively quite thin and composed of solid basalt and granite.

The outer shell of the young earth must have been a good many millions of years changing from the liquid to the solid state, and it is believed that, before this change was completed, an event of the greatest importance took place—

the formation of the moon. The next time you stand on a beach at night, watching the moon's bright path across the water, and conscious of the moon-drawn tides, remember that the moon itself may have been born of a great tidal wave of earthly substance, torn off into space. And remember that if the moon was formed in this fashion, the event may have had much to do with shaping the ocean basins and the continents as we know them.

There were tides in the new earth, long before there was an ocean. In response to the pull of the sun the molten liquids of the earth's whole surface rose in tides that rolled unhindered around the globe and only gradually slackened and diminished as the earthly shell cooled, congealed, and hardened. Those who believe that the moon is a child of Earth say that during an early stage of the earth's development something happened that caused this rolling, viscid tide to gather speed and momentum and to rise to unimaginable heights. Apparently the force that created these greatest tides the earth has ever known was the force of resonance, for at this time the period of the solar tides had come to approach, then equal, the period of the free oscillation of the liquid earth. And so every sun tide was given increased momentum by the push of the earth's oscillation, and each of the twice-daily tides was larger than the one before it. Physicists have calculated that, after 500 years of such monstrous, steadily increasing tides, those on the side toward the sun became too high for stability, and a great wave was torn away and hurled into space. But immediately, of course, the newly created satellite became subject to physical laws that sent it spinning in an orbit of its own about the earth. This is what we call the moon.

There are reasons for believing that this event took place after the earth's crust had become slightly hardened, instead of during its partly liquid state. There is to this day a great scar on the surface of the globe. This scar or depression holds the Pacific Ocean. According to some geophysicists, the floor of the Pacific is composed of basalt, the substance of the earth's middle layer, while all other oceans are floored with a thin layer of granite, which makes up most of the earth's outer layer. We immediately wonder what became of the Pacific's granite covering and the most convenient assumption is that it was torn away when the moon was formed. There is supporting evidence. The mean density of the moon is much less than that of the earth (3.3 compared with 5.5), suggesting that the moon took away none of the earth's heavy iron ore, but that it is composed only of the granite and some of the basalt of the outer layers.

The birth of the moon probably helped shape other regions of the world's oceans besides the Pacific. When part of the crust was torn away, strains must have been set up in the remaining granite envelope. Perhaps the granite mass cracked open on the side opposite the moon scar. Perhaps, as the earth spun on its axis and rushed on its orbit through space, the cracks widened and the masses of granite began to drift apart, moving over a tarry, slowly hardening layer of basalt. Gradually the outer portions of the basalt layer became solid and the wandering continents came to rest, frozen into place with oceans between them. In spite of theories to the contrary, the weight of geologic evidence seems to be that the locations of the major ocean basins and the major continental land masses are today much the same as they have been since a very early period of the earth's history.

But this is to anticipate the story, for when the moon was born there was no ocean. The gradually cooling earth was enveloped in heavy layers of cloud, which contained much of the water of the new planet. For a long time its surface was so hot that no moisture could fall without immediately being reconverted to steam. This dense, perpetually renewed cloud covering must have been thick enough that no rays of sunlight could penetrate it. And so the rough outlines of the continents and the empty ocean basins were sculptured out of the surface of the earth in darkness, in a Stygian world of heated rock and swirling clouds and gloom.

As soon as the earth's crust cooled enough, the rains began to fall. Never have there been such rains since that time. They fell continuously, day and night, days passing into months, into years, into centuries. They poured into the waiting ocean basins, or, falling upon the continental masses, drained away to become sea.

Originally published as Rachel Carson, *The Sea Around Us* (1951; repr., New York: Open Road Media, 2011). Stylistic conventions have been adjusted to conform to the publication at hand.

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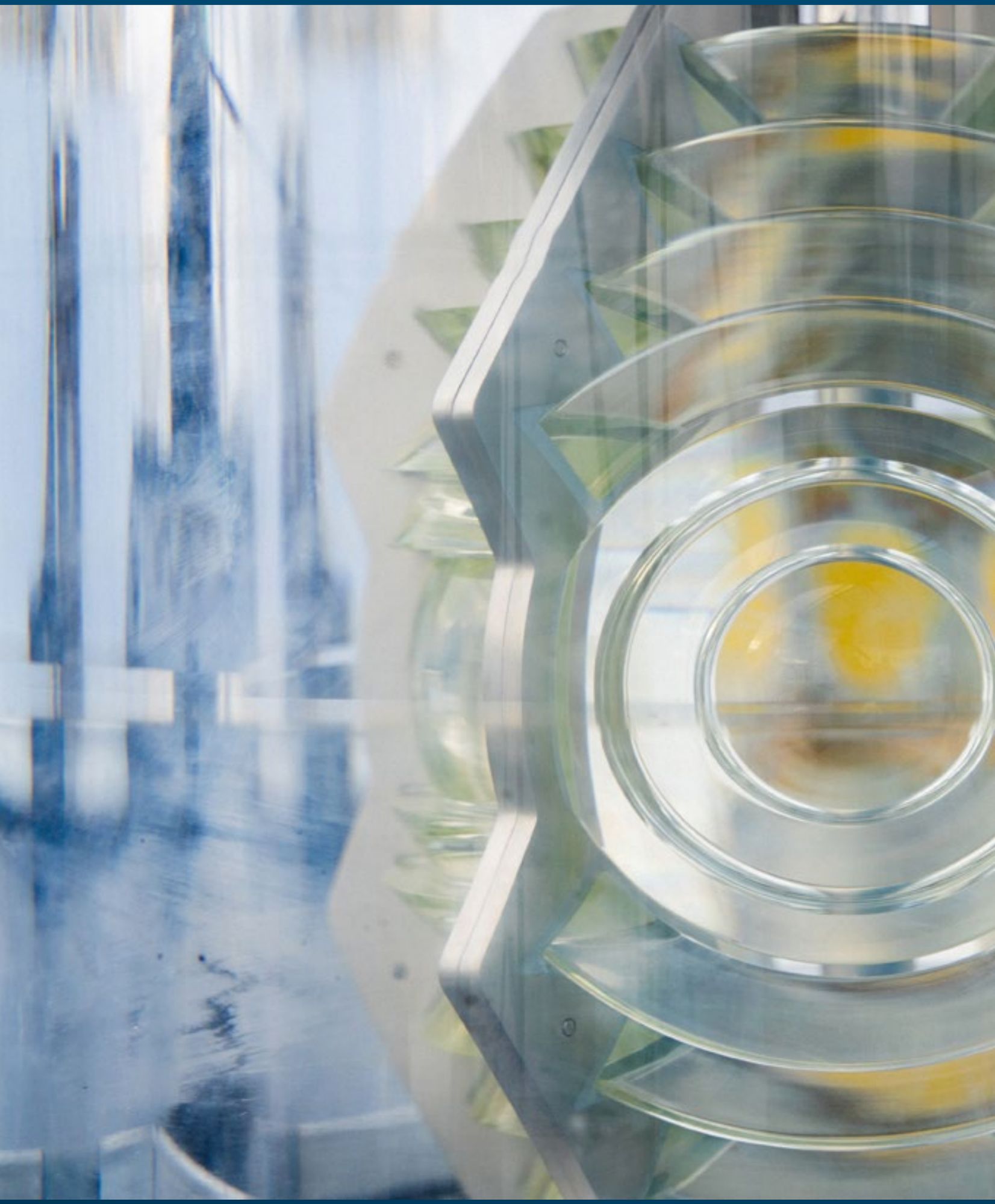
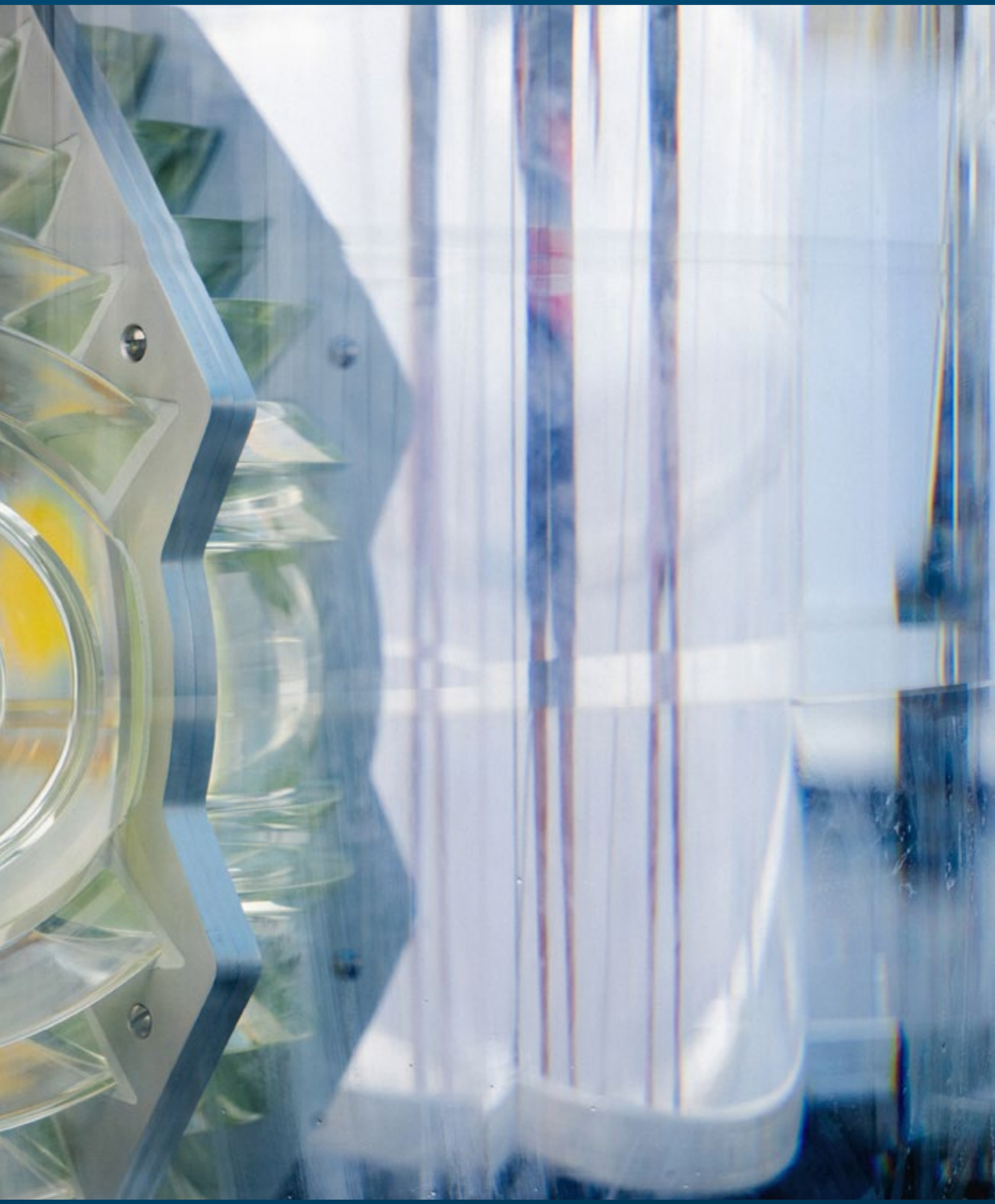




Foreword

In the pitch-black depths of the Pacific, the glistening light of a Fresnel lens, normally used in lighthouses, attracts huge schools of fish. Vast underwater glacier landscapes confuse the senses, making it difficult to tell up from down. In the aquatic caves of Mexico, known as cenotes, divers sink into the darkness as if weightless. The solo exhibition *Midnight Zone* by the French-Swiss artist Julian Charrière presents a fascinating exploration of the mysterious world of water through a diverse and impressive range of works. In addition to photographs, sculptures, and installations, several video pieces created for the exhibition are presented for the first time, inviting viewers to immerse themselves in Julian Charrière's multilayered and fascinating oeuvre.

The exhibition, jointly organized by the Museum Tinguely in Basel and the Kunstmuseum Wolfsburg, highlights not only the sensual and metaphorical levels associated with the element of water and its various aggregate states, but also political references such as human-induced water pollution, the melting of glaciers and polar ice caps, and the exploitation of the seabed through deep-sea mining.

The fact that the two museums are collaborating on the exhibition *Julian Charrière: Midnight Zone* is not least due to their respective topographies. Despite their very different histories and structures, both museums and their host cities are marked by the presence of water and the possibilities it offers: Basel on the Rhine and Wolfsburg on the Midland Canal. Both waterways have long been, and continue to be, of great importance as transport routes for the development of socioeconomic interdependencies in Europe, as well as for the formation of identities in the cultural landscapes through which they flow. So what could be more natural than to join forces with Julian Charrière, one of the most important artists of his generation, to explore artistically the element of water, which is becoming increasingly relevant in ecological, political, economic, and social terms, and to succumb to the fascination of his aesthetic, profound, and in some cases moving images?

The multifaceted texts in this accompanying publication, written by internationally renowned authors from a variety of academic disciplines, provide an opportunity to explore Julian Charrière's artistic work in greater depth and to delve more deeply into the themes it explores.

Our heartfelt thanks go to Julian Charrière, who has been fully committed to our exhibition and publication project from the very beginning, and to the entire studio for their tireless and active cooperation. Our collaboration with the artist and his team has been characterized by a high degree of professionalism and friendly solidarity, which has enabled the project to be realized in the best possible way.

We would also like to express our sincere thanks to the authors of this publication, whose insightful and illuminating essays are well worth reading and contribute to a better understanding of Julian Charrière's work. We thank Patricia Bondesson Kavanagh for her outstanding commitment as Editor at Large of this catalogue and as author of the work texts compiled in this volume. In order to make the essays published here accessible to a broad audience, the German translations of the individual texts can be accessed via a QR code found in the table of contents. We also wish to thank the translators Susanne Bosch-Abele and Gérard Goodrow and the copyeditors Johanne Förster and Dawn Michelle d'Atri. We are grateful to the Verlag der Buchhandlung Walther und Franz König for including the book in their program, to Nicole Rankers for her support on behalf of the publisher, and to Marcus Muraro of Lösch GmbH & Co. KG for his support during the production process.

The graphic designer Bijan Dawallu conceived an extremely appealing and imaginative design for this book, and he, too, deserves our warmest thanks, as do the cocurators involved in the exhibition, without whose valuable and judicious collaboration the project could hardly have been realized: Tabea Panizzi for the Museum Tinguely and Dino Steinhof for the Kunstmuseum Wolfsburg.

Roland Wetzel
Director, Museum Tinguely, Basel

Andreas Beitin
Director, Kunstmuseum Wolfsburg

The Call of the Underworld

Susan Casey

We all have dreams that haunt us, lingering into daylight and enduring through the years. Mine have always taken place in the ocean. My subconscious seems to prefer dark brooding waters over crystalline blue waters; night spookiness in aquatic surroundings strikes me as deliciously sublime. In the lightless depths, behind the one-way mirror of the surface, anything might be hidden—but even if it scares me, I want to see it. The yearning to know what's down there has been with me for as long as I can remember. Sea creatures, sunken ships, buried treasures, lost stories—the ocean's obscurities enthrall me. And no realm is more obscure to us than the deep.

From 200 meters beneath the surface to nearly 11,000 meters down—that is the scope of the earth's greatest mystery. Forget space: our planet's autobiography is written on the seafloor. Yet even now, when interactive maps of Jupiter can be viewed on an iPhone, we've mapped only 25 percent of our seafloor in any kind of crisp detail. What's down there in the darkness? Really, we don't know. But in July 2017, I came across a news article that was full of revelations.

The headline was irresistible: "Search for MH370 Unveils a Lost World Deep Beneath the Ocean."[1] Despite 1,046 days spent scouring the remote Southern Indian Ocean—and towing sonar arrays to create high-resolution seabed maps across an area the size of New Zealand—the searchers who set out to locate the vanished Malaysia Airlines Flight MH370 were unsuccessful. They did not find the jet or its 239 passengers and crew. But, as the article reported, they did make a major discovery.

The maps revealed that the Southern Indian Ocean seafloor was spectacularly, eerily beautiful. It was a symphony of extremes, a playlist of geology's greatest hits. It was as if we had discovered Tolkien's Middle-earth, 4 miles underwater. There were mountains taller than Swiss Alps, valleys that dwarfed Yosemite, yawning crevasses, vertical cliffs that plunged into chasms. Volcano fields ran for hundreds of miles. The seabed was slashed with scars left by the supercontinent Gondwana when it broke into pieces, creating Australia, India, and Antarctica.

It was an undersea network of national parks for giants and, until now, no one had known it existed. Reading about this fantastical seafloor, I found it impossible not to wonder: *What else are we missing?* What else is stashed in the abyss—and why aren't we dropping everything to find out? How much lost history is down there? How much knowledge? How many geological marvels? How many undescribed species? What kind of wild rumpus goes on below while we're preoccupied topside with our leveraged buyouts and political bickering and selfie apps?

Nothing would be too unbelievable. The fact that something as large as a Boeing 777 can rest down there, escaping detection for years (and counting), speaks to the deep's immensity and its mystique. It is a realm of eternal night, of such colossal dimen-

1 Ean Higgins, "Search for MH370 Unveils a Lost World Deep Beneath the Ocean," *The Australian*, July 21, 2017.

sions that it dwarfs the mapped, wired, thoroughly trampled continents we live on. The deep ocean covers 65 percent of the earth's surface and occupies 95 percent of the global biosphere.[2]

It isn't merely a part of our planet—it *is* our planet. You'd think we would want to be more familiar with it.

The sum of our knowledge about the ocean has long been concentrated in its uppermost waters, the top 200 meters known as the epipelagic zone. Here, sunlight still reaches, the fish are pretty, there's a jeweled spectrum of blues. This region is what most people think of when they imagine the undersea world, but for all its awesomeness, the epipelagic is merely a ceiling. The real action takes place below.

The mesopelagic zone, more poetically known as the twilight zone, is the next layer down. It's a lively realm, extending from 200 to 1,000 meters, home to a teeming menagerie of animals that twinkle with bioluminescence. This layer of the deep hosts more creatures than all the other regions of the ocean combined. Everything we know about these residents makes it clear that Jules Verne—far from being a fabulist in his descriptions of deep-sea life—wasn't imaginative enough.

You might encounter a vampire squid with its blue cue-ball eyes and webbed arms that encircle its body like a cape. Maybe a 100-foot-long siphonophore will drift by, trailing venomous tentacles, a glimmering chain of cells that is one of the deep's arch-predators. Hatchetfish, dragonfish, viperfish: they're all hanging out in the twilight zone with their needle teeth and pit-trap jaws, like the supporting cast of a nightmare.

Despite their frightful appearances, most of these fish are so tiny they're adorable. What they lack in size, they make up for in quantity. For instance, the bristlemouth—a thumb-size, glow-in-the-dark fish with oversize eyes and teeth—is the earth's most abundant vertebrate. Scientists believe there are hundreds of trillions of bristlemouths in the mesopelagic, outnumbering even the stars in our galaxy.

Each night, a massive wave of these twilight zone dwellers ascends hundreds of meters closer to the surface. Under cover of darkness, these visitors from below are less visible, less vulnerable, as they dine on the sun-nourished phytoplankton at shallower depths. By dawn, they've returned to the deep. This nocturnal commute is the world's largest animal migration—a vertical one that occurs 365 days a year. By eating plankton near the surface and then swimming back down and excreting it, they're shuttling carbon from the atmosphere into the depths, where it remains sequestered for centuries and, in some cases, millennia. These tiny beasts sink a mighty amount of carbon: an estimated 4.4 billion tons each year, the equivalent of America's total annual emissions.

And they do it with such flare! On land, only a handful of creatures can light up—the odd fungus, a few species of earthworms, a smattering of insects—but in the twilight zone, virtually everyone sparkles. They use their bioluminescence for signaling, for mating, for camouflage, for luring prey and frightening predators. Twilight zone creatures have as many different ways to wield light as there are facets on a disco ball.

On June 6, 1930, naturalist William Beebe and engineer Otis Barton became the first humans to witness the twilight zone's light show, plunging 800 feet into the darkness in a steel orb they called a bathysphere. This 5-foot metal sphere, with its two tiny viewports, dangled from a ship on a long steel cable. It's hard to imagine how terrifying that first plunge must have been. Nobody knew if the men would make it back to the surface; there were so many things that could go wrong. Things could break, fail, implode. Any leak might be fatal: under the deep's pressure, water would shoot through a hole with the force of a bullet. What if they ran out of air? What if the viewports caved in?

Despite a heart-stopping hatch leak and an electrical wire erupting with sparks inside the capsule, their first dive was successful. The two men went on to make thirty-three more, venturing as deep as a half mile down. To Beebe's mind, seeing the twilight zone was worth any risk. He wrote about his dives in rapturous terms, sounding more like someone on an acid trip than an empirical scientist. "Adventuring under sea is an unearthly experience," Beebe mused, describing land as "terribly narrow confines."[3]

The sheer novelty of the beings he encountered made him reel in wonder: "Nothing at these depths can be spoken of without superlatives."[4] He reported seeing a quartet of skinny fish—with vermilion heads, yellow bodies, peacock-blue backs, and the attenuated jaws of an alligator—moving through the water upright, as though they were out for a stroll; and a

2 Roberto Danovaro et al., "Towards a Marine Strategy for the Deep Mediterranean Sea: Analysis of Current Ecological Status," *Marine Policy* 112 (February 2020).

3 William Beebe, *Half Mile Down* (New York: Harcourt, Brace, and Co., 1934), pp. 7 and 11.

4 Ibid., p. 206.

creepy-looking dun-colored fish with no tail. On one occasion, he ran into "a thin, endless sea-serpent"; on another, a 6-foot-long fish with mucus dripping from its "numerous fangs."[5]

On every dive, Beebe was rocked by the uncanny quality of the light. At 600 feet down, only the last pinch of the visible spectrum remains, its indigo embers brilliant in their purity. On the brink of utter darkness, those final light waves appear eerily radiant. "We were the first living men to look out at the strange illumination: And it was stranger than any imagination could have conceived," he wrote. "It was of an indefinable translucent blue quite unlike anything I have ever seen in the upper world, and it excited our optic nerves in a most confusing manner." The blue was so piercingly vivid, he felt, that language couldn't describe it. It was more like an emotion than a color, one that "seemed to pass materially through the eye into our very beings."[6]

Below the twilight zone lies the bathypelagic—or midnight zone—reaching from 1,000 to 3,000 meters. It is a vast mid-water kingdom, as spooky as the dark side of the moon. Yet unlike the moon, it's a matrix of strange and wonderful life: creatures that thrive under crushing pressures, in frigid temperatures, in a realm that has never known the sun.

Down here, any light comes from bioluminescence. Some midnight zone dwellers have evolved huge eyes to detect subtle flashes from incoming predators or prey. Others excel at listening, using fine-tuned sensory organs. Food is sparse at these depths. Everyone is looking for a meal, and looking out to make sure they don't become one. In the deep's open waters, there are no rocks to hide behind, no crevices to dart into, no trees to climb, no place to dig a hole. In this environment, the ability to disappear is a handy adaptation. One way to do this is by having red coloration in a place where red light doesn't exist—an act of optical erasure. Some deep-sea fish take this vanishing act to its limit. They're *ultrablack*, their skin packed with a pigment that absorbs 99.5 percent of any light they encounter, making them akin to swimming black holes.

Another survival strategy is to become a giant. Along with legions of the tiny, the midnight zone also harbors behemoths. This is the haunt of the giant squid and the colossal squid, the world's largest invertebrates. Both species have eyes the size of volleyballs—perfect for detecting light trails in the water caused by their nemesis, the sperm whale. Deep-sea sharks slink through the midnight zone, exotic species like the goblin shark (pink, with protruding jaws and what looks like a spear attached to its head), Greenland shark (hefty as a great white, can live for more than four hundred years), megamouth shark (enormous filter feeder with Jagger-esque lips), and the frilled shark (razor-toothed, eel-shaped, could easily star in a horror movie).

1 Sully, a black smoker hydrothermal vent on the Juan de Fuca Ridge, Northeast Pacific Ocean

Descending below 3,000 meters, you'll enter the abyssal zone—the literal abyss. Reaching to 6,000 meters, it covers half the planet's surface. The abyss is the earth's largest ecosystem and we've seen almost none of it. The intersection where these deep waters meet the seafloor is known as the abyssal plain, a rolling, sediment-cloaked flatland that hosts extraordinary and subtle life.

These plains may seem quiet, but they're often interrupted by extreme geological drama. This is where you'll find the mid-ocean ridge, a 40,000-mile-long volcanic seam that encircles the globe like a jagged wound. Here, the tectonic plates are slowly moving apart, the ocean crust is fracturing, and magma oozes from below. It's a place where the earth relentlessly creates itself, a place of constant eruptions, rattling earthquakes, and smoldering hydrothermal vents.

The deep ocean is a Surrealist's dream, but nothing can top hydrothermal vents for sheer weirdness. These geysers of volcanic minerals and gases gush through cracks in the seabed, forming teetering, Gaudi-esque chimneys. Scorching vent fluid billows from their flues like black smoke (fig. 1). From the moment they were first sighted in the 1970s, the vents were hailed as geological marvels. But their biology was the bigger story.

No one had expected to find much life in a lava-choked, pitch-black volcanic gash spewing boiling minerals, but the

5 Ibid., pp. 143 and 172.

6 Ibid., p. 109.

vents are a zoo of wondrous animals: 6-foot-tall tube worms waving blood-red plumes, clams the size of footballs, eyeless shrimp zipping about, albino crabs scuttling across the chimneys. Photosynthesis—the conversion of sunlight to energy that was thought to provide life's only fuel—has no role here. Instead, these creatures rely on chemosynthesis: energy coming from the earth's interior, produced by chemical reactions between fluids and rocks. It's a *Star Wars* bar-scene ecosystem that flouts all of our rules, born of an audacious chemistry experiment that has been underway since the earth has had an ocean. Deep-sea vents, many scientists believe, are where life itself sparked into existence. The abyss is our ancestral home.

This is the bottom of the world, but the descent isn't over yet. Beneath the abyss lies the hadal zone, named after Hades, the Greek god of the underworld (and brother of Poseidon). Hadal waters start at 6,000 meters and pitch down into dozens of ultra-deep trenches—the vast majority of which are located in the Pacific—shaped like the inverted summits of Himalayan peaks. The deepest of them is the Mariana Trench, a 1,500-mile-long, 44-mile-wide cleft in the seabed, near Guam. It is home to the 10,935-meter Challenger Deep, the ocean's absolute nadir. By comparison, Mount Everest is 8,848 meters high.

Like all hadal trenches, it was formed by colliding tectonic plates, one plate driving the other downward into the mantle in a process called subduction. Sinking tectonic plates do not go gently into the night. Rock deforms into mountains and volcanoes, faults appear as the ocean crust fractures, sediment is scraped off as one plate grinds beneath the other, generating undersea landslides. As the stresses of subduction build, the battling plates can abruptly slip, causing violent megathrust earthquakes. And while any seismic spasm can cause damage, megathrust quakes produce devastating tsunamis, like the 2004 nightmare in Indonesia and the 2011 catastrophe in Japan.

2 Cusk eels (*Bassozetus*) at 6,400 meters depth, Pacific Ocean

That's not the only dangerous element in the trenches. Anything that survives at these depths must withstand waters barely above freezing and 16,000 pounds of pressure per square inch. Yet despite Hades' mythical status as a realm of the dead, the ocean's hadal zone—like the rest of the deep—is a trove of magnificent life.

You might spot fiery red prawns doing acrobatics, or crystal-white anemones waving from rocks. Maybe you'll encounter a cusk eel (fig. 2), a burly beast with pinhole eyes and a mouth like a vacuum cleaner. Jellyfish, ascidians, octopuses, brittle stars, mollusks, sea cucumbers, bristle worms, isopods, sponges: all present in Hades. Flitting everywhere are amphipods, spiky crustaceans that range in size from inch-long to foot-long (deep-sea gigantism strikes again). You might spy a hadal snailfish, the world's deepest fish—an angelic-looking, translucent pink creature—eating those amphipods like cocktail peanuts. In the hadal zone you could fly over dunes tinged yellow with sulfur, sporting crinoids like daffodils, or ascend cliffs woven with orange- and hot-pink-colored microbial mats. All dramatic, all beautiful. All vibrantly alive.

It seems logical that we'd drop everything to find out more about this fabulous parallel universe that encompasses our planet, especially since our survival depends on it. Yet humanity has largely ignored the deep. Scientific exploration is chronically underfunded, even as billions are lavished on studying Mars, a barren ball of toxic dust.

It's as if we live in a mansion filled with treasures and artworks and fantastical animals, but haven't bothered to look in most of the rooms. It's a failure of curiosity, to say the least. For a species long on creativity and imagination, we've uncharacteristically limited ourselves in range, our attention fixed outward and upward as if those were the only dimensions that counted. But what if we have it upside down? What if the deeper you go, the more astonishing everything becomes?

The more we've delved downward, the more we've had to revise our ideas about how the earth operates, what we can learn from the distant past, our place in the overall scheme of life—even our definition of life. Now it's apparent that nature runs as a massively interconnected system, with the deep sea as its motherboard. Yet even as we tinker with the machinery, we have only the foggiest notion of how it all works. The deep buffers our excess carbon (at least so far), drives the ocean's circulation (and thus, climate), regulates the earth's geochemistry (important, to put it mildly), and absorbs excess heat (ditto)—to cite just a few of its services. It's a reservoir of genomic

innovation, a sprawling galaxy of microbes. Humming away in obscurity, it's the foundation of the planet.

There has never been a better time to investigate the underworld. Technology has cracked the vault open. Deep-sea robots with artificial intelligence, manned submersibles that can dive safely to full ocean depth (fig. 3), seafloor observatories wired to the Internet, scanners that sequence DNA in the water—a list of the latest marine science tools would stretch for pages. But there's another list to consider, and it's not a pretty one. Even as we're (finally) becoming acquainted with the deep, the threats we're posing to it have never been greater.

Already there are foreboding signs of flux in an ocean that's warming, acidifying, producing less oxygen—*changing*. Deep-sea ecosystems, operating on geological time and far removed from most surface disturbances, are especially vulnerable to abrupt shifts. Global warming, pollution, extraction: in so many ways, we're stressing the deep. Even the hadal trenches are full of industrial poisons, toxic chemicals, microplastics, flame retardants, pesticides, pharmaceuticals, radioactive waste. From the ocean's sunlit waters to its deepest sediments, we have left our mark.

3 Triton 3300/3 submersible on the seafloor at 1,000 meters depth, Bahamas

Sadly, that's not all. Maybe it's inevitable that the fishing industry—having already depleted the upper waters—would set its sights on the deep. The twilight zone is estimated to contain 10 billion tons of fish. Oh, we won't actually eat the bristlemouths, jellies, and krill we haul up. They'll be pulped into fish meal, poultry feed, nutraceutical oils, and crop fertilizer. In the annals of bad ideas, this is one for the hall of fame: messing with the balance of life at these depths will reduce the ocean's ability to remove carbon from the atmosphere, and will disrupt (if not crash) marine food webs. Without the twilight zone's services, it's estimated that the earth's average temperatures would rise by 6 to 11 degrees Fahrenheit (-14 to -11 degrees Celsius).

Elsewhere, vast swaths of the seafloor are slated for destruction from deep-sea mining. To date this hasn't begun, but it appears to be imminent: strip-mining the seabed has long been a gleam in the corporate eye. The abyssal depths are rich in polymetallic nodules: nuggets of manganese, nickel, cobalt, and copper that precipitate from the seawater over eons, aided by microbes in an alchemy that we don't understand. The nodules form a living system in the manner of forests or coral reefs, albeit far more ancient.

Deep-sea mining's boosters are untroubled by the lack of basic knowledge about what they would be destroying. Their first target is the Clarion–Clipperton Zone (CCZ), a vast tract of seafloor stretching from Mexico to Hawaii. Although the miners refer to the CCZ as a "lifeless desert," the researchers rushing to study the area before it's annihilated have found that it is one of the deep's most spectacularly biodiverse regions—a mosaic of unique fauna that lives symbiotically with the nodules. On average, 90 percent of the animals collected in the CCZ are new to science.

These odd little orbs provide a vital habitat, but that's not their only function. New research shows that they play a previously unknown role in the ocean's biogeochemistry. Through an electrochemical reaction on their surfaces, the nodules emit a one-volt charge that splits seawater into hydrogen and oxygen, thus creating what scientists call "dark oxygen."

Another oxygen source on earth? That seems like something we may not want to wreck. No extractive industry is eco-friendly, but deep-sea mining stands alone in its potential for havoc because the damage would be irreversible—and we won't even know what we've ruined. A thousand of the world's top marine scientists have signed a petition demanding a moratorium on all deep-sea mining plans, citing the "risk of large-scale and permanent loss of biodiversity, ecosystems, and ecosystem functions."[7] They're asking for ten to thirty years of further study before it's even considered. But to demand is not necessarily to receive: the first large-scale nodule mining attempts may begin later this year.

You could be forgiven for wondering why, in a world with a mess of problems, the deep ocean should be high on anyone's list of concerns. After all, we've made it this far while mostly ignoring it.

7 "Deep-Sea Mining Science Statement," https://seabedminingsciencestatement.org [all URLs accessed in April 2025].

"It is tempting to try to live without an underworld, without soul, and without concern for the mysterious elements that touch on the spiritual," noted the writer Thomas Moore.[8] This is a mistake, for these "mysterious elements" are more important than we know. Beyond the ordinary lies the extraordinary; beneath the surface lie the depths—how tragic it would be to miss them.

Science provides urgent information, but adding more facts doesn't move us. Bathymetric maps can show us the seafloor rendered in cartoon colors, but no matter how rich the detail, it's still an abstraction. What's missing—what, in some unfathomed way, we yearn for—is an emotional connection to the deep.

Yes, the ocean's underworld is pitch-black and frigid, and yes, it's quite scary, and no, we can't simply drop by for a visit. We can't breathe or smell or see down there; the deep isn't built for us. It defies our easy acquaintance, but that's exactly the reason for its allure. The deep's *otherness* is the essence of its enchantment, and it deserves to be appreciated on its own terms. "To sense this world of water known to the creatures of the sea we must shed our human perceptions of length and breadth and time and place . . . ," the marine biologist and author Rachel Carson advised, with her usual poetic clarity.[9] It would also be helpful if we could set aside our terrestrial bias, the mistaken belief that everything significant happens aboveground, because that's where we live.

Those anthropocentric blinders keep us stuck—as William Beebe pointed out—in "terribly narrow confines." To transcend that limitation is to descend into a realm that most will never experience firsthand. It's a place beyond mind where egos can't go, money won't help, and humility is the price of admission. Short of a seat on a deep-sea submersible, what can take us there is art.

Stories, images, sounds, vibrations: these are the catalysts of a sensory immersion. In his sublime exhibition *Midnight Zone*, Julian Charrière translates the slow rhythms of hydrothermal vents into music, the bioluminescent codes of deep-sea creatures into movement, the gravitas of the abyss into a feeling in the solar plexus. Charrière has delved far beneath the surface, and returned to share new perceptions. If science reveals the underworld, art lets us feel it.

Consider any creature, any landscape, any aspect of the deep: its story is our story. On a different time scale, in a different element, sure, but our fate and the ocean's fate are one and the same. Only a heartfelt bond will stir us to understand the deep before its changes overwhelm us; to explore it before it's exploited beyond recognition. To protect it, and ourselves, in a time of unsettling change—and in doing so, to know, at last, the majesty of our own home.

This essay has been adapted from the following book: Susan Casey, *The Underworld: Journeys to the Depths of the Ocean* (New York: Doubleday, 2023). Stylistic conventions have been adjusted to conform to the publication at hand. © Susan Casey.

8 Thomas Moore, *Care of the Soul: A Guide for Cultivating Depth and Sacredness in Everyday Life* (New York: Harper Perennial, 1992), p. 43.

9 Rachel L. Carson, "Undersea," *The Atlantic*, September 1937, https://www.theatlantic.com/magazine/archive/1937/09/undersea/652922/.

Silent World – Saratoga, 2018

Silent World – Saratoga is a color photograph capturing the sunken kitchen of the eponymous U.S. Navy aircraft carrier, now resting at the bottom of Bikini Atoll's lagoon. Once a symbol of military might, the vessel was scuttled during Operation Crossroads, a series of atomic tests conducted in 1946 to study the effects of nuclear explosions on warships. Since its descent into the depths, the ship's carcass has been slowly transforming, its steel hull becoming a new substrate for marine life, an artificial reef where nature quietly reclaims the remnants of human ambition. Taken as part of *First Light* (2016), a photographic series created over a month and a half of fieldwork at Bikini Atoll, this image documents Charrière's extensive dives into the wreckage left by the U.S. Navy. The photograph *Silent World – Saratoga* presents an eerily familiar yet estranged scene: plates left behind in the ship's galley, frozen in time as if awaiting a meal that will never come. It is a moment of domesticity suspended in the abyss, a quiet echo of the lives once sustained aboard a vessel now submerged in history.

Beyond its immediate stillness, *Silent World – Saratoga* engages with broader themes of environmental change and cultural memory. The wreck, partially entombed by rising seas, serves as both artifact and living ecosystem—an object oscillating between ruin and renewal, history and biology. The photograph challenges the inherited romantic dichotomy between nature and culture, presenting a world where the two are no longer distinct. Instead, the scene dissolves into a continuum where human traces merge with marine life, where the detritus of war becomes a site of regeneration, and where the ocean holds, in its depths, the future memories of the Anthropocene.

Calypso, 2019

Exploring the tension between human ambition and the fragility of the body, *Calypso* reflects on how modernity has both expanded our physiognomic capabilities and imposed new limitations upon it. While our collusion with technological progress initially promised infinite speed and clarity, the consequences of such advancements have also forced us to confront unexpected instabilities and the boundaries of our physical and mental endurance. *Calypso* uses the paradox of oxygen—which, though essential for life, is toxic and disorientating in its pure form—to investigate relationships that are both beneficial and destructive, be they technological, socioeconomic, or ecological. In *Calypso*, this question of uncertain support systems, marked by control and surrender, is embodied by a diver's mask, the chromed surface of which reflects the wearer's gaze inward, transforming it into a mirror for self-reflection. This introspective design invites viewers to consider their place in a world driven by relentless technoscientific progress. Paired with Le Corbusier's LC4 chaise longue—an icon of modern design—this juxtaposition of comfort and stillness symbolizes a moment of pause within the frantic race toward mastery. Yet even in repose, the viewer is reminded of their own limitations, tethered to the confines of perception.

Calypso invites the audience to navigate the liminal space between the familiar and the unknown, diving into the uncharted depths of their subconscious in search of an elusive sense of connection, often described as the "oceanic feeling." Rather than striving to conquer the unknown, the work challenges us to embrace it as an ongoing, infinite process—an ever-receding horizon that shapes understanding while remaining just beyond reach.

A Thousand Worlds, 2025

Julian Charrière, with his minimalist artwork *A Thousand Worlds,* presents a small single mirror floating on the wall. Made using a classical mirroring technique, where a layer of silver is deposited on the back surface of the glass, it forms a highly reflective patina. Not immediately evident to the viewer, the silver used for this artwork has been extracted from thousands of black-and-white photographs, which accumulated the metal in the paper during their production process. This photographic method, known as the gelatin silver process, relies on silver halide crystals in a gelatin emulsion reacting to light, forming latent images. Through a laborious process of extraction and transformation, Charrière reclaims this silver, revealing a hidden economy of image-making, and by extension, a reflection on anthropogenic resource exploitation—a system where vast amounts of mineral, metal, and organic material are continually extracted, destroyed, and remade to serve human needs.

Yet *A Thousand Worlds* is also an intimate meditation on the relationship between the self and the act of image production. Drawing on psychology, the mirror emerges not only as a reflective surface, but as a symbolic space where identity is mined, questioned, and reframed. Assembled from the dissolved remnants of countless photographs, the work becomes a collective mirror—a liquid space where individual memories and captured moments, once entangled and singular, are melted down and reconstituted into a unified, ambiguous reflection. It offers an eternal return in which personal histories are both obliterated and preserved, reappearing as something other—a sea of something shared.

Midnight Zone

Midnight Zone, 2024

Midnight Zone is one of the latest major video productions by Julian Charrière, guided by the light of a wayward Fresnel lighthouse lens sinking down the water column above the Clarion–Clipperton Zone (CCZ). Stretching between Hawaii and Mexico, this vast abyssal plain in the central Pacific Ocean is home to one of the most mineral-rich deep-sea regions on Earth. The presence of these dense deposits of polymetallic nodules has made it an intense point of economic interest in recent decades, since it contains valuable metals such as nickel, cobalt, copper, and manganese—key materials for batteries and renewable energy technologies.

Still, the CCZ remains a largely unexplored frontier, home to fragile ecosystems dense with bioluminescent anglerfish, grideye fish, elusive sleeper sharks, and the giant sixgill sharks, as well as slow-growing corals, sponges, and unique, often undiscovered species adapted to extreme conditions. The growing push for deep-sea mining in this region raises serious concerns about irreversible habitat destruction, biodiversity loss, and the disruption of carbon-cycling processes in one of the planet's last untouched biomes.

The presence of the lighthouse lens, unbound from the terrestrial tower and wheeling through water shimmering with life, seeks to challenge our conception of these deep, submerged regions as largely lifeless.

The video stages an ambiguous investigation into the extractivist threats the area faces—by illuminating not the desirous seafloor, but the scintillating life-forms which occupy the waters above it. With a custom-built Fresnel lens, Charrière ignites an abyssal campfire, attracting a menagerie of oceanic creatures whose fate would be inevitably disrupted by underwater mining operations. Rejecting the fixed vantage point recognizable from classic nature documentaries, the camera, reeling and untethered, orbits the suspended lantern. As underwater species gather and disperse around the drifting light, the video acquires an anti-gravitational quality, dissolving any clear sense of orientation. No longer are we positioned as detached observers; now we seem to drift into the scene itself, moving with the beacon rather than statically imposing meaning upon it. The result is a destabilizing choreography where light, life, and viewer become entangled in shared suspension.

Submerged Light

A Reflexive Aesthetic for Anthropocene Beings

Stacy Alaimo

Jeff VanderMeer's science-fiction novel *Annihilation* opens with a biologist on an expedition to "Area X," a site of environmental devastation crawling with weirdly evolved creatures. Strangely, the biologist perceives a structure that "tunneled into the ground" as being a tower. She associates this inverted "tower" with a nearby lighthouse on the coast. As she descends into the tower, she watches words form on the walls, sprouting from mysterious fungi. She realizes that the tower is breathing, that it is a "living creature of some sort," and that they are "*descending into an organism*."[1] Later, the words become bioluminescent and the scientist melts into her surroundings, as she can no longer "remain *separate from, apart from*" what she is supposed to be analyzing, as entwining, vibrant agencies of this place render conventional scientific objectivity a "foreign land."[2]

Although *Annihilation* takes place on land, it not only includes references to deep-sea life, bioluminescence, and unknown species, but also dramatizes how submergence—the descent into mysterious, biologically surprising zones—dissolves dominant onto-epistemological orientations that aim to distance, categorize, and objectify other living creatures. As the tower is experienced as a living, breathing creature that hosts communicative forms of life, it warps extractivist presumptions, because there is no dead matter here, nothing that is merely a "resource" for human use. The magnitude of the world's liveliness and intelligence cannot be confined or defined in advance. This profound sense of an animated world emanates from the practices and philosophies of many Indigenous cultures. While reverence for living beings who inhabit an animated world is indebted to Indigenous thought, the weird creatures and unexpected agencies of Area X epitomize a postnatural Anthropocene, since they may have been caused by "experimental military research."[3] This is not an Anthropocene that can be viewed from high above the wreckage, however, but a zone of immersion in which the human dissolves into interconnected networks of beings and places. Noting that the protagonist of the novel is "'empathic more toward environments than people,'" the science-fiction theorist Sherryl Vint argues that this "reorients how we understand life from a focus on organisms to one on entanglements."[4] It is fitting that the last two chapters of *Annihilation* are titled "Immersion" and "Dissolution," as the scientist inhales spores and begins to merge with this evolving, cryptic place. Experiences of submersion—descending, rather than transcending—implicitly critique the function of a lighthouse: to illuminate, guide, and delineate the boundaries between land and sea. The biologist's vertiginous experience of submergence into postnatural realms raises questions about how to perceive, encounter, and become transformed by radically altered yet still lively beings-in-environments. Can submergence signal less exploitative modes of onto-epistemologies, ways of being and knowing, that could cultivate concern for the beings within Anthropocene seas?

1 Jeff VanderMeer, *Annihilation* (New York: Farrer, Strauss and Giroux, 2014), pp. 6 and 41 [italics in the original].

2 Ibid., p. 173 [italics in the original].

3 Ibid., p. 94.

4 Sherryl Vint, *Biopolitical Futures in Twenty-First-Century Speculative Fiction* (Cambridge: Cambridge University Press, 2021), p. 193.

The speculative, futuristic Area X in VanderMeer's *Southern Reach* series was inspired by St. Marks National Wildlife Refuge in Florida, which includes a lighthouse completed in 1830, intended to prevent ships from running aground (fig. 1). The commerce the lighthouse was built to protect depended on the labor of enslaved Africans, as well as the killing and violent "removal" of Indigenous peoples. Indeed, just five years after the lighthouse was completed, the second Seminole "Indian War" commenced, which included attacks on lighthouses in the region.[5] Lighthouses, radiating the promise of visibility as a means of safety for some, the domination of others, and control over natural forces, stand as testaments to the entangled histories of colonialism, settler colonialism, and environmental devastation. Lighthouses, as they illuminate the surface of the seas, also signify how capitalist enterprises have flattened the ocean's volumetric expanses and ignored the life worlds below the surface by producing narrowly utilitarian views of the ocean as a horizontal plane for transportation.[6] Iconic paintings of the sea, such as those by the nineteenth-century English artist J. M. W. Turner, also represent the surface of the ocean, with ships being tossed about by tremendous winds and waves, dramatizing powerful elemental forces rather than depicting marine life in sympathetic modes. Rising up, providing clear views of distant surfaces of sea and seashore, the lighthouse symbolizes the vertical structure of Western epistemologies that value distancing as the path to objectivity, as well as "commonsensical" ideologies in which what is high is imbued with power, spirit, and transcendence, while what is low is sunk into the mud, degraded, dark, and murky. Such vertical ideologies are so pervasive as to be the water that white Western settler colonialists swim within but rarely notice. Donna J. Haraway critiques the "god trick of seeing everything from nowhere," arguing instead for a "feminist objectivity" of "limited location and situated knowledge" that does not split "subject from object" and "allows us to become answerable for what we learn how to see."[7] Similarly, Macarena Gómez-Barris, in *The Extractive Zone: Social Ecologies and Decolonial Perspectives,* describes vertical visions as an "extractive view" that underwrites violence toward human and more-than-human beings: "colonial visual regimes normalized an extractive planetary view that continues to facilitate capitalist expansion, especially upon resource-rich Indigenous territories." In short, "vertical seeing normalized violent removal."[8] Horizontal perspectives, such as those within conventional landscape paintings, can also train a colonizing eye, with their expansive geographic scenes that visually open up territories for exploration. The pelagic realm of the ocean, however, which lacks landmarks, and which does not lend itself to representations that suggest a three-dimensional breadth or depth, provides viewers with a flat, limited field of visibility, an intimate immediacy that is, paradoxically, also speculatively imbued with the astounding scale of the seas.

1 Oldest known image of the St. Marks Lighthouse, ca. 1854, United States National Archives

Julian Charrière's video *Midnight Zone* (2024) takes the viewer from the surface of the sea, down through blue waters that darken into black as the camera descends. Viewers glimpse rays of revolving light, accompanied by hypnotic sounds. As the light turns, it illuminates tiny organisms and particles that hover in the water, the material richness of this environment, a mélange of organisms hovering beside unidentified, perhaps anthropogenic substances such as microplastics. The glints of light, reflecting on this sea of particles, also suggest an aquatic cosmos of stellar constellations. Tangible, intimate immediacy shifts into contemplations of scale and the vastness of oceanic worlds. Such scale shifting, a speculative practice of alternating between limited locations and immense temporal and geographical expanses, be they on land or at sea, is a prelude for practicing an ethics and politics responsive to the invisible networks of techno-capitalism that entangle a multitude of creatures and their biomes.

In the *Midnight Zone*, gorgeous fish swim in and out of view—fortunate, momentary sightings of creatures who are sometimes luminous, sometimes barely discernible. When the lighthouse lamp enters the scene, its beams are harsh and glaring. It seems out of place, and yet the fish do not flee; instead, they begin to swim around it. Conventional nature documentaries, such as BBC's *The Blue Planet* series, usually erase the presence of human technologies that enable the filming, thereby constructing an invisible yet impermeable barrier between oceanic nature and human culture, reveling in anachronistic visions of discovery which imply that oceanic realms

5 Note that the term "Indian War," used by the source of this information, seems to blame Indigenous tribes for attacking the United States, as if the US had not been the aggressor. "St. Marks National Wildlife Refuge," U.S. Fish and Wildlife Service, https://www.fws.gov/refuge/st-marks/historic-st-marks-lighthouse [accessed in February 2025].

6 Phil Steinberg, *The Social Construction of the Ocean* (Cambridge: Cambridge University Press, 2001).

7 Donna J. Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14, no. 3 (Autumn 1988), pp. 575–99, esp. pp. 581 and 583.

8 Macarena Gómez-Barris, *The Extractive Zone: Social Ecologies and Decolonial Perspectives* (Durham, NC: Duke University Press, 2017), p. 6.

remain safe from human harm. Margaret Cohen, in *The Underwater Eye*, notes that *Blue Planet II* depicts the ocean as "pristine nature" and "untouched wilderness."[9] The lighting and resolution at the start of the episode "The Deep," from *Blue Planet II*,[10] is dazzling, presenting hyperreal, extraordinarily crisp and colorful shots of deep-sea creatures. Touching on a *National Geographic* volume on space, Donna J. Haraway critiques "this ideology of direct, devouring, generative, and unrestricted vision, whose technological mediations are simultaneously celebrated and presented as utterly transparent."[11] While this aesthetic may be instantly appealing, it reiterates a model of representation that "lifts the veil" on nature, by illuminating unknown creatures and erasing the traces of mediation. This sort of pristine aesthetic fails to lure the viewer into ethically engaged relations with what is seen, as the living creatures become mere marvels for a virtual cabinet of curiosities, rather than beings in anthropogenically diminished worlds.

By featuring the lighthouse lamp within the video, Charrière enacts a reflexive aesthetic that is appropriate for the Anthropocene, in which viewers experience themselves seeing a scene that has been constructed for them. Such contemplations evoke John Berger's simple yet incisive question "Why Look at Animals?" and Berger provocatively contends: "Everywhere animals disappear. In zoos they constitute the living monument to their own disappearance."[12] In the *Midnight Zone*, by contrast, the fish are not enclosed in an aquarium, nor are they confined within the frame of the shot or corralled by the beams of light. They swim freely around, in and out of sight. And yet, in an era when ocean ecologies face multiple threats, and a multitude of species are being rendered extinct, a reflexive mode of seeing the ocean creatures steeps the video with Anthropocenic reverberations, especially as the beams of light from the lighthouse lamp suggest long histories of exploration, colonization, and anthropogenic harm. Both scientific and artistic forays into the midnight zone entail human disruptions of the biome. The glaring light of the lamp, spinning with several beams of light, may lure viewers into considering how marine life in the global seas has been affected by many human incursions, such as industrialized overfishing; mining; chemical, radioactive, plastic, and other pollution; and the warming, acidified waters of climate change. While popular media stories of deep-sea exploration revel in the romance of the depths as unexplored, "virgin territory," as yet to be conquered, the ocean has already been saturated with the effects of human exploits. As the lighthouse lamp revolves, it illuminates the vibrant life in the seas, but it also intermittently blinds the viewer with its glaring intensity. The video generates curiosity and aesthetic pleasure, and at the same time, it momentarily suggests the necessity of recognizing persistent, ordinary modes of violence and culpability. Light seems innocent, and yet it has long infused epistemologies that distance and objectify.

As we watch the lighthouse lamp revolving in the depths, we might wonder how the lamp ended up there? Momentarily bracketing our knowledge of the artistic practice that built the light for this video, we could imagine a speculative fable. Perhaps the lighthouse has collapsed into the sea, toppling from its solid rocky outcropping and becoming submerged in the very waters it was designed to tower above and demarcate. Lighthouses are constructed to prevent shipwrecks; here, ironically, the lighthouse has failed to keep itself afloat, failed to keep itself from sinking into the depths, thus becoming a sort of shipwreck itself. This is a classic Anthropocene tale—the "nature" that certain humans have attempted to master ricochets back, entangling planetary beings within environments of accelerating risks and devastation. Technological, industrial, biological, and chemical transformations result in such things as climate change, ocean acidification, drought, wildfires, and death from carcinogens. When the lighthouse topples into the sea, it evokes "wet narratives," as described by Steve Mentz in *Shipwreck Modernity*, which "emphasize disorder, disorientation, and rupture."[13] Disorder complicates the established routes of global extractivism, while disorientation provokes more murky visions, where the "Human" is no longer hovering above an externalized entity that used to be called nature. Predominant visions of the Anthropocene—a proposed geological epoch which

2 Else Bostelmann, title unknown [Pallid sailfin, *Bathyembryx istiophasma*], ca. 1930–34

9 Margaret Cohen, *The Underwater Eye: How the Movie Camera Opened the Depths and Unleashed New Forms of Fantasy* (Princeton, NJ: Princeton University Press, 2022), pp. 237 and 239.

10 *Blue Planet II* (BBC Earth, 2018).

11 Haraway 1988 (see note 7), p. 582.

12 John Berger, *About Looking* (London: Bloomsbury, 2015), p. 26.

13 Steve Mentz, *Shipwreck Modernity: Ecologies of Globalization, 1550–1719* (Minneapolis: University of Minnesota Press, 2015), p. 11.

marks the massive scale of industrial, colonialist, and capitalist assaults on the biosphere—scale up, depicting scenes of factories, highways, feedlots, and cities as seen from an ethereal realm, far above the Earth.[14] By contrast, the lighthouse lamp sinks down into the midnight zone. As viewers hover within the midnight zone—with no horizon and no exit in sight—the encounter with an entirely different biosphere underscores an expansive sense of life itself, which seems immediate yet not confined, intimate but not domesticated. Sherryl Vint argues that we "need to find a way to theorize life that does not abstract living beings from their entanglements with and dependencies upon other matter, including the inorganic."[15] As the fish swim, curve, and swirl, dynamically moving with and through their material environs, surrounded by glints of light reflecting off of tiny creatures and particles, they enact the theory of life that Vint proposes, as they live their creaturely lives as part of zones best encountered with the help of a lamp that has toppled.

Submerged Visions and the Limitations of Light

Scientists, artists, and filmmakers have long grappled with the question of how to represent ocean species who live at depths that sunlight does not reach. In my book *The Abyss Stares Back: Encounters with Deep-Sea Life*, I analyze nearly a century of science, literature, art, film, and activist videos, in which deep-sea life circulates in extraordinarily aesthetic modes.[16] While capturing specimens is integral to the long colonial practices of naturalism as well as current practices of marine biology, scientists such as William Beebe, in the early twentieth century, recognized the cruelty of rendering living creatures into dead specimens. He also insisted that science would not be harmed by beauty, emotion, literature, and art. In his popular rather than strictly scientific writing, he sometimes animated his dead specimens, dramatizing their lives and perspectives in speculative narratives. Beebe also hired a team of illustrators to draw and paint the species of marine life that he collected or glimpsed. The talented scientific illustrator and artist Else Bostelmann shifted from painting deep-sea fish on white backgrounds to painting them on black backgrounds, even when the fish were themselves black, tracing their outlines in glimmering light. She also added a spark of white light to the colorful eyes of the fish she painted, gesturing toward their consciousness and perspectives. When William Beebe and Otis Barton descended a half mile down into the Atlantic in their bathysphere in the 1930s, Beebe was mesmerized by the color spectrum of the depths. He was entranced by the shifting color of the water as the sunlight disappeared during the descents. As Beebe pointed his handheld light out the bathysphere window, attempting to discover new species and chart which species lived at which depths, the beam of the flashlight was modest and limited. One painting by Else Bostelmann, which Beebe included in his book *Half Mile Down*, presents a geometric, modernist vision of the bathysphere dives, which features a rectangle of light cutting across the top third of the painting on the diagonal, with portions of the fish illuminated as they swim through the beam, accompanied by other fish that swim away from Beebe's range of vision and are barely discernible to the viewer (fig. 2). The linear geometric rectangle of light clashes with this creaturely world of curving mouths, eyes, and bodies. Moreover, the viewer of the painting is positioned below, in the dark waters, with the nearly undiscernible fish. Beebe is not portrayed, but presumably he holds the light, beaming it out of the bathysphere window. Viewing the scene from below the technologies of light dramatizes the impossibility of the viewer's perspective. We hover in an uninhabitable zone, speculatively encountering the vaguely depicted fish that still, nearly a century later, remain unidentified. The beam of light, illuminating some fish in a merely fragmentary way and missing others entirely, is not unlike that within the *Midnight Zone*. In Bostelmann's painting and Charrière's video, the beam of light is restricted, but the fish swim about. There is no promise of perfect, unobstructed, transparent, and totalizing vision, but instead a more modest and ethical illumination that respects these distinctive beings and their world.

3 Else Bostelmann, *Bathysphaera intacta and bathysphere*, 1934, Wildlife Conservation Society

Another, more well-known painting by Bostelmann dramatizes the limitations of light in the

14 Stacy Alaimo, "Your Shell on Acid," in *Exposed: Environmental Politics and Pleasure in Posthuman Times* (Minneapolis: University of Minnesota Press, 2016).

15 Vint 2021 (see note 4), p. 184.

16 Stacy Alaimo, *The Abyss Stares Back: Encounters with Deep-Sea Life* (Minneapolis: University of Minnesota Press, 2025).

depths. In her 1934 painting *Bathysphaera intacta and bathysphere* (fig. 3), she depicts the bathysphere in dark waters, with a face visible within one of the small portals and a triangular beam of light emanating from another. The bathysphere is dwarfed by two enormous "untouchable bathysphere fish" that swim around it. The light beaming out of the window does not illuminate the entirety of the huge fish surrounding it, failing to give Beebe and Barton an encompassing view. The speculative scenario allows the viewer to see what Beebe and Barton cannot discern. Yet in making the invisible visible to the viewer, the painting does not reveal all, but instead dramatizes how much cannot be illuminated, experienced, or understood, thereby granting the depths their own resistant integrity and dominion. The submerged visions in the *Midnight Zone* and in Bostelmann's paintings depict light as limited in the depths, providing only partial visions and fragile, momentary disclosures, thereby extending curiosity and respect to the creatures of the midnight zone. While respecting the midnight zone's mystery can be an ethical provocation, the precise articulation of what it means for the abyss to be unknowable does matter, as magical thinking poses the depths as a separate realm where human harms dissolve into invisibility. Astrida Neimanis warns, writing about chemical waste in Sweden's Gotland Deep in the Baltic Sea, that conceptualizing the ocean as "universal solvent" and "pure alterity" enables us to ignore responsibility for anthropogenic harms: "Those matters swallowed up by the sea become part of its unknowable abyss—not only forgotten but rendered unintelligible."[17] While anthropogenic harms to ocean ecologies need to be scientifically captured, understood, halted, and remedied, the incomprehensible being of oceanic life can circulate in aesthetic modes that spark a sense of wonder that cannot be reduced to something knowable. Similarly, Michael Marder proposes that we "allow plants to flourish on the edge or at the limit of phenomenality, of visibility, and, in some sense, of 'the world.'"[18]

Radiant Beings Singing of Themselves

J. M. Ledgard, in the novel *Submergence*, provocatively asks: "Did the abyss sing of itself?"[19] This aesthetic koan prompts readers to contemplate what it would mean for ocean life to create and experience its own aesthetic modes. One way the abyss sings of itself is through the submerged light of bioluminescence. Ledgard, representing the thoughts of a scientist descending into the sea, writes: "The water was alive with bioluminescent fish and eels. . . . Down there everything spoke in light: it was the most common form of communication on the planet."[20] Ledgard's scientist echoes marine biologist Edith Widder's enthusiasm for bioluminescence. In *Below the Edge of Darkness*, Widder contends that human survival depends on "fostering a greater sense of connection to the living world" through "wonderment" and that "bioluminescence provides a means to reveal the wonder in this unseen world to a public that is alarmingly unaware." She argues that wonder sparks the imagination and thus provides a "beacon of hope for the future of life on Earth."[21] While I join Widder in her exuberant marveling at bioluminescent marine life, the framing of this argument is surprisingly anthropocentric. In an era of massive species extinction and multiple, accelerating threats to ocean ecologies, concern for the survival of nonhuman marine life need not be subordinated to the specter of human extinction. Moreover, while public support for ocean conservation can certainly be inspired by images, videos, scientific illustrations, and art depicting marvelous marine life, I also think it is imperative to develop reflexive Anthropocene aesthetics that expose conventional epistemologies of objectification and distancing that obscure global networks of colossal, albeit ordinary harm. Oscillating between the seductive image of a marvelous marine creature and the sense of seeing that creature be seen encourages viewers to consider the long networks of culpability and responsibility within global capitalism, extractivism, and carbon-based economies. A reflexive aesthetic does not erase the human presence in the sea, but instead calls for a recognition of the radiant beings in their own worlds, while also highlighting the anthropogenic alterations of those worlds. While Beebe unofficially named the fish that he had glimpsed through the bathysphere portal in the 1930s "untouchable bathysphere fish," nearly a century later the concept of the Anthropocene insists that the oceans have already been touched by human activities, if not by human hands. Radiating beams of light in Julian Charrière's video *Midnight Zone*, the lighthouse lamp—fallen, submerged, and out of place—offers glimpses of vibrant marine life that may inspire speculative yet passionate connections to ocean creatures. Simultaneously, that fallen light suggests that the aesthetic pleasures of encountering pelagic and abyssal creatures are always already submerged within long histories and ongoing practices of exploitation, devastation, and harm. The abyss may sing of itself, may radiate its own brilliant aesthetic, but the radiant beings will not survive unless the most privileged and powerful groups of terrestrial humans witness and contemplate both the beauty of these creatures and their precarious existence in Anthropocene seas.

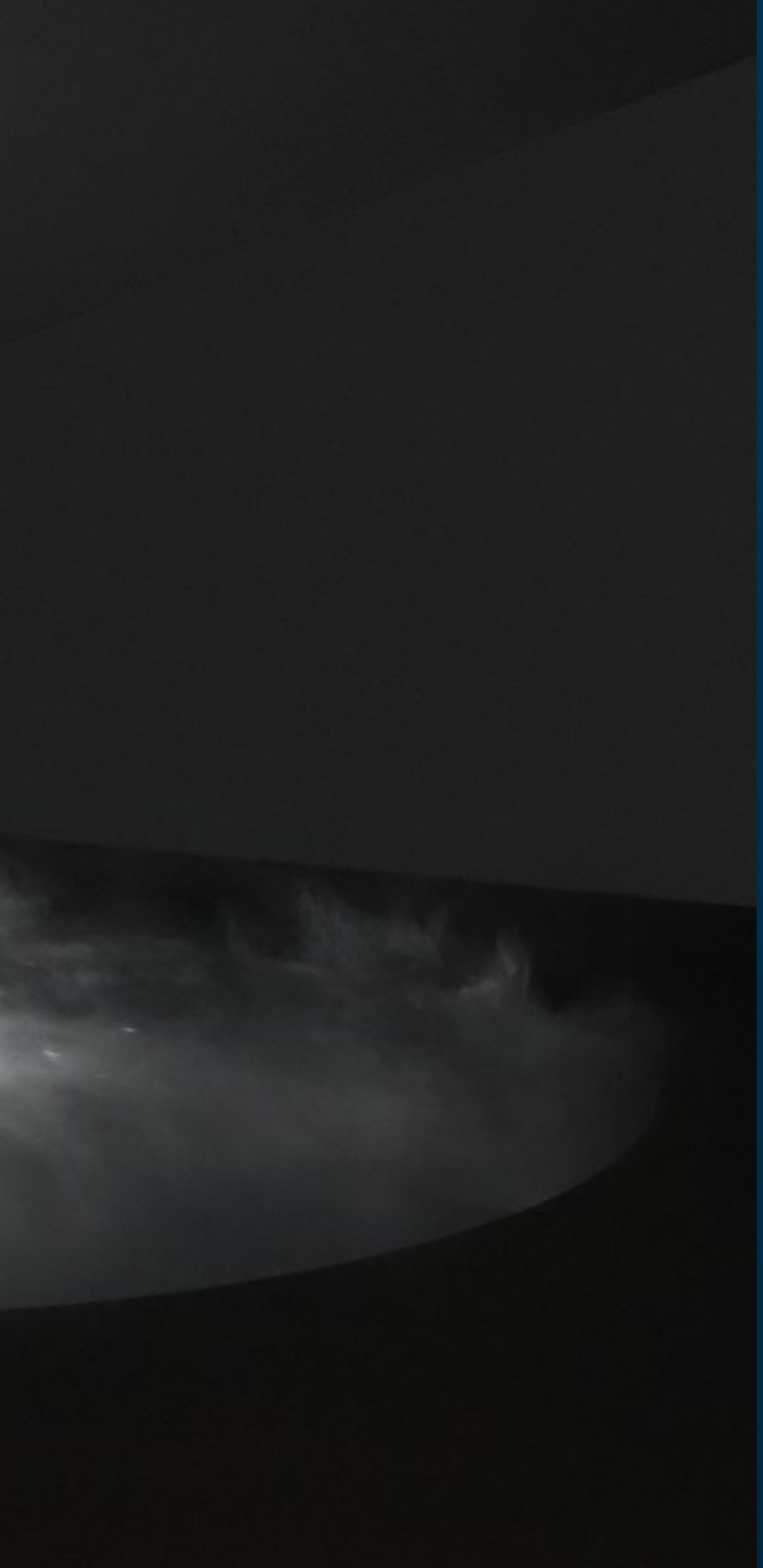
17 Astrida Neimanis, "Held in Suspense: Mustard Gas Legalities in the Gotland Deep," in *Blue Legalities: The Life and Laws of the Sea*, ed. Irus Braverman and Elizabeth R. Johnson (Durham, NC: Duke University Press, 2020), pp. 45–46.

18 Michael Marder, *Plant-Thinking: A Philosophy of Vegetal Life* (New York: Columbia University Press, 2013), p. 9.

19 J. M. Ledgard, *Submergence* (Minneapolis: Coffee House Press, 2013), p. 208.

20 Ibid., p. 196.

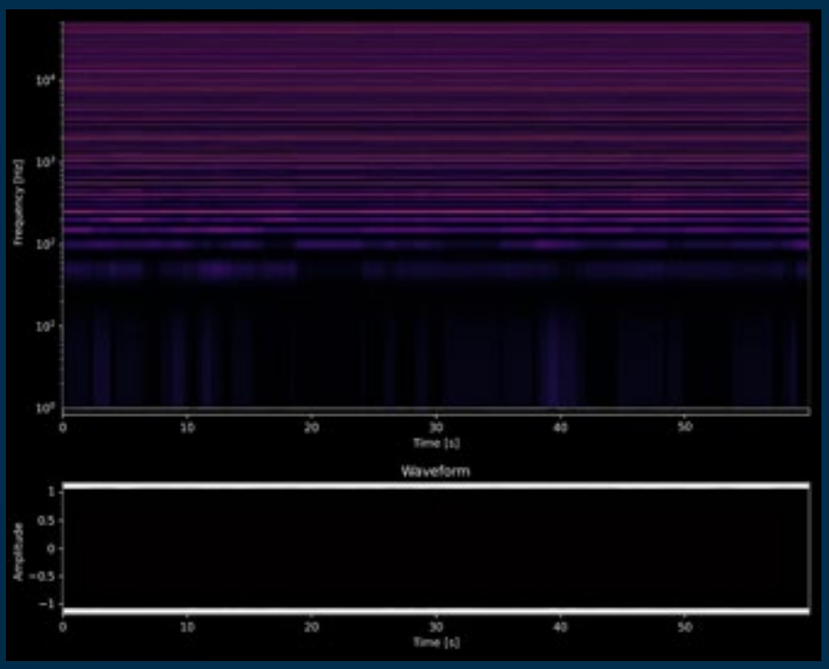
21 Edith Widder, *Below the Edge of Darkness: A Memoir of Exploring Light and Life in the Deep Seas* (New York: Random House, 2021), p. xx.



Silent World, 2019

Silent World is an immersive spatial installation binding together the cosmic presence of the sun with water vapor. It consists of a circular steamy pond embedded within the floor of the museum, upon which a video projector beams visuals of the sun. The footage of solar rays is shot from underwater, yet the visitor gazes down at this mist-laden imagery from above. In terms of spatial orientation, the installation proposes an inverse scenario—with the sun occupying a submerged position, shining up from the deep. The conceptual gravity of the gesture is heightened by this reversal. As well as turning down into up, and up into down, fire appears to be present in water. Everything has undergone a sea change. The work borrows its title from an early underwater film by Jacques Cousteau, the first of its kind to bring moving images from the ocean depths to screen.

Though his earliest dives were largely funded by oil companies, eager to develop underwater exploration technologies for resource extraction, Cousteau's footage would ultimately do more than serve corporate interests—transforming humanity's perception of the ocean, revealing its beauty, fragility, and complexity. His films and documentaries sparked a shift from seeing the sea as merely a reservoir of wealth to recognizing it as a world worth protecting. This paradox highlights a deeper truth: our earliest visual culture of the deep sea, which now inspires conservation, was born from the very forces that threaten it. And while that sudden access to images of the deep, consolidated by the high-definition documentaries of today, might tempt us to believe we know this place, *Silent World* instead concedes to the ocean as unfathomable.



Black Smoker, 2025

The exhibition *Midnight Zone* is a sensory passage through regions of the sea that appear opaque or impenetrable to the human animal, a reality seemingly unknowable. *Black Smoker* invites the audience to enter this previously unenterable realm—laying bare the energetic forces which govern it. In a murky room, where the human eye struggles to adjust, the installation brings together the primordial presence of underwater volcanoes, hydrothermal vents, deep-sea landslides, and the magmatic currents which surge beneath the seafloor once believed to be barren. An auditory and bodily katabasis, this work plunges the visitor into the geological world of the deep, from the unfathomable ranges of the Monterey Submarine Canyons in California to the Axial Seamount volcano, towering on the seafloor off the Oregon coast-line. It stages an encounter not only with the tectonic plates whose drift and violent confrontations shape our planet's foundation, but with acoustic phenomena conventionally restricted to an abyss beyond our reach. By listening in to a number of deluged voices, from the abyssal plains of the Oahu coast to Italian hydrothermal vent systems in Panarea and beyond, *Black Smoker* brings these low, often imperceivable frequencies to the surface, made perceptible by the artist through the conception of a multidimensional and haptic sound system.

To compose this experience of a world inundated by immense pressure, searing heat, and shadow, Julian Charrière uses field recordings from deep-sea hydrophones, as well as material from seismic monitoring stations and scientific archives. From crackling exhalations of subterranean gasses to the guttural eruption of rocks and magma from abyssal calde-ras, *Black Smoker* represents a spatial anomaly, a chamber of submarine resonance, where human timescales give way to the temporality of the Earth itself, forming a parliament of ancient voices that speak to the molten power that still courses through our planet's stone-set veins. By amplifying this dialogue and com-bining it with the sonification of live data feeds from deep-sea monitoring stations, it bridges the philosophical trench that divides the surface world from the submerged, unearthing rhythm sustained for millennia by deep, unseen and unheard currents flowing beyond human perception.

Ocean as Mirror

Helen M. Rozwadowski

A historian viewing Julian Charrière's *Midnight Zone* (2024) sees two things at first glance. For a maritime historian, the first is the Fresnel lens, a marvel of engineering and craft that concentrates and broadcasts light—normally from atop a lighthouse tower, but here, instead, in the ocean's depths. Charrière's work reflects the divide between traditional maritime history, on the one hand, and history that attends to relationships between people and the volumetric oceans, on the other. Rather than focusing, as maritime history usually does, on the sea's surface and on the connectivity or separation between places or groups of people created by ocean basins, Charrière's latest major video works, *Midnight Zone* and *Albedo* (2025), explore the undersea. Yet, in contrast to many nature documentaries, people, including their past, contemporary, and future interactions with the oceans, are present in these works.

A historian of oceans could also not possibly ignore the echoes of the pioneers of undersea filming, most especially Jacques Cousteau. Cousteau's invention of the Aqua-Lung and development of equipment to film in color underwater touched off a new industry and art form. The award-winning 1956 film *The Silent World* set Cousteau's course toward cinematographic fame and promoted sales of his diving gear as well. His 1964 film *World Without Sun* documented the Continental Shelf Station, or Conshelf II, the experiment of a "village" of humans living and working on the seafloor in the Red Sea, including a habitat for six aquanauts at 10 meters depth, a "diving saucer" and its underwater hangar, and a small outpost habitat for two divers at 30 meters depth. The subsequent 1965 Conshelf III project, partly funded by the oil industry, featured a closed-circuit television demonstration of workers operating a mock wellhead for industry viewing.[1] Conshelf reflected a starkly different vision of a human-ocean relationship than did Cousteau's later environmentalist television shows.[2] Charrière's *Midnight Zone* and *Albedo* respectively engage with the prospect of deep-sea mining and the reality of present and future climate-change effects on oceans, critiquing our continued extractivist posture toward the sea.

The optical constraints of filming in dark depths, whether in 10 meters at night or in the darkness of the midnight zone, creates echoes between Charrière's work and Cousteau's. Both needed to bring light underwater to enable filming. Light renders visible what is otherwise invisible to the human eye, while the camera allows human eyes not present in the depths to see this inaccessible realm. In their work, both of these filmmakers play with light to illuminate oceanic creatures and formations, but both also do so to reveal or imply human presence and influence. In *World Without Sun*, Cousteau switches between filming from within the diving saucer, thereby showing the window and controls in the frame of the image that otherwise looks out into the sea, to having divers film from outside the vehicle entirely. In his film, the saucer itself is often as much the subject as is the ocean world. He pans from the dinner-and-work table in the habitat where aquanauts sit, talk, and eat following a diving session, moving out the window and receding into the dark sea until the window is a tiny spot of light alongside other small lights in the compound. In other scenes, aquanauts use light to "hunt" for fish or to explore an undersea tunnel. These uses of light assert the potential for the undersea to be transformed into a human environment.

Julian Charrière's work, by contrast, deploys light underwater to warn of harmful consequences of historical uses of the sea, and of possible future exploitation that would further damage them. *Midnight Zone* depicts the vertical movement of a lighted Fresnel lens into the depths, home to creatures that

1 Jon Crylen, "Living in a World without Sun: Jacques Cousteau, *Homo aquaticus*, and the Dream of Dwelling Undersea," *JCMS: Journal of Cinema and Media Studies* 58, no. 1 (Fall 2018), pp. 1–23, esp. p. 12.

2 Helen M. Rozwadowski, *Vast Expanses: A History of the Oceans* (London: Reaktion Books, 2018); Crylen, "Living in a World without Sun."

interact with the light as it sinks. Sweeping beams of light produced by the rotating lens illuminate fish. The viewer sees passing sharks and fish backlit against the light; they are sometimes seemingly indifferent to the light but other times interacting with it. A sequence filmed vertiginously from below the descending lens shows fish schooling in circles around the lens, very much like fish in a cylindrical aquarium tank swim. On one level, *Midnight Zone* provides a glimpse into what Charrière calls "a vast and non-human unknown."[3] On another level, the attraction of fish to the light reminds us of the traditional practice of deploying light to attract and hunt them. The descent of the lens toward the Clarion–Clipperton Zone, where polymetallic nodules and the ecosystems that form around them attract commercial ambition, amplifies the scale and scope of the extractive posture of fishing with light. The light, then, represents an urgent warning. A ship approaching a lighthouse too closely would understand the message to turn away from a danger to navigation. This light advises us of the perils it marks—that is, the endangerment to oceans and to ourselves as well—if we proceed in extending industrial and colonial relationships to the deep-sea floor.

Yet, the kaleidoscopic beams in the *Midnight Zone* also point to the lighthouse as a more ambiguous object, representing the aforementioned danger as well as harbor and civilization. Indicative of life, it challenges our historic presupposition of the deep sea as largely lifeless, something which becomes evident when multitudes of silvery life-forms emerge from the seemingly impenetrable darkness of the water column as if conjured by the lens. Like a submerged sun, the light spatializes an environ otherwise difficult for the human senses to comprehend, but which urgently requires our understanding. In turn, the video *Albedo* invites viewers into a melting architecture of ice, flipping our perspective on the icebergs and ice sheets that help to stabilize the earth systems. It too relies on light both to enable filming the dark waters under polar ice and to explore existing and future human-ocean connections. The video sequences invert the underwater vista, with the deep sea above and the mirror of the ice surface below "questioning the all too hominid lens with which we see the sea and orient its meaning," as Charrière explains.[4] This device disorients the viewer and projects an alien, unearthly atmosphere that reminds us of how often we think about the oceans' depths in the context of outer space. But this distant and extreme environment is far from untouched by human activities. Rather, polar seas are among the places most affected by human-caused climate change. Melting ice will raise sea levels and reduce the planet's ability to reflect back heat from the sun. Marine life in polar seas is also under threat, while the soon-to-be open polar seas offer prospects for newly accessible fisheries and fossil-fuel exploitation.

Charrière's work, then, highlights many dimensions of human relationships with oceans, encompassing parts of the sea that we often don't consider tightly linked to our activities: the great depths and the poles. The arts and the humanities provide a mooring for considering not only the history and present status of oceans but their future as well. The exhibition *Midnight Zone* at the Museum Tinguely and the Kunstmuseum Wolfsburg reflects a broad shift in the humanities to encompass the "blue," that is, inquiry into relationships between people and oceans and the expansion of thinking and creating beyond the bounds of the terrestrial to encompass the oceanic.[5] Within the field of history, oceans had until recently been sequestered into the specialized area of maritime history, and mostly treated as flat stages or backdrops for maritime activities. The oceanic turn in history has prompted some histories to attend to the undersea in addition to the surface. We are beginning to pay serious attention to interrelationships between people and volumetric oceans. As a consequence, frameworks of thinking about oceans that sufficed for maritime history need to be reconsidered. Revised historical frameworks can, in turn, inform our understanding of works of art like Julian Charrière's.

Traditional maritime history sees oceans as spaces that join or separate groups of people. In 1975, Benjamin Labaree pointed to what he called "the Atlantic paradox," the simultaneous function of the North Atlantic ocean as a bridge and a moat for European settlers of colonial North America and citizens of the early United States.[6] Until the Columbian Exchange, when Europeans initiated an uneven biological exchange of people, plants, animals, and pathogens, the Atlantic separated the Old and New Worlds. European desire to reach China to access its spices and silks inspired Atlantic crossings, but

3 Julian Charrière in conversation with the author, January 2025.

4 Ibid.

5 John R. Gillis, "The Blue Humanities," *Humanities* 34, no. 3 (May–June 2013), https://www.neh.gov/humanities/2013/mayjune/feature/the-blue-humanities [all URLs accessed in January 2025]; Steve Mentz, *An Introduction to the Blue Humanities* (New York: Routledge, 2023).

6 Benjamin W. Labaree, "The Atlantic Paradox," in *The Atlantic World of Robert G. Albion*, ed. Benjamin W. Labaree (Middletown, CT: Wesleyan University Press, 1975), pp. 195–217.

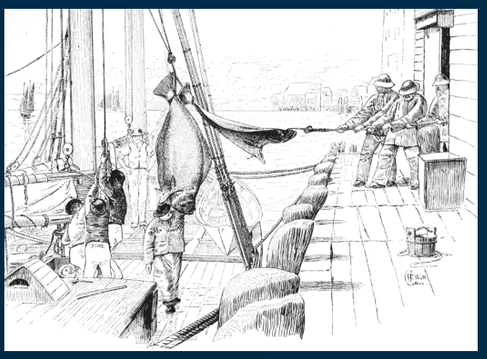
bridging the ocean also happened because of "islands of the mind." As the cultural historian John Gillis argues, actual islands, and also mid-ocean imagined ones such as HyBrasil and St. Brendan's Isle, divided the vast and hostile ocean into manageable, and imaginable, sections to cross.[7] English Puritans felt that the remoteness of New England offered them sanctuary. Subsequent generations of immigrants, both voluntary and involuntary, endured a lengthy, uncomfortable, and at times deadly voyage to reach American shores. Labaree argues that this experience shaped Americans' sense of their national history as unique and distinct from that of Europe.

The bridge–moat paradox, in turn, has provided an enduring touchstone for maritime history. As mentioned above, seas provided linkages and separations between people and places around the globe and through time, both along coasts and across ocean basins. Archaeologists now understand that the Americas were almost certainly settled by people who moved coastwise in boats from west to north to east around the North Pacific rim. Kelp forests spanned virtually the entire route, and their plentiful and familiar marine resources would have augmented land resources for the migrants.[8] Ships plying ocean routes have enabled trade, migration, and the exploitation of distant resources. Starting in the nineteenth century, telegraph cables laid across the seafloor bridged continents. Today, though people now fly over oceans, 90 percent of consumer goods move by ship. Yet to many, the global shipping industry remains invisible until disaster strikes, as when the container ship *Dali* destroyed the Francis Scott Key Bridge in Maryland or when the global supply chain was suddenly disrupted after the *Ever Given* got stuck in the Suez Canal. Yet, despite the sophisticated tracings of peoples, cultures, and markets that we see in maritime history, its oceans are horizontal surfaces, not complex and volumetric environments.

Histories of the vast, three-dimensional oceans require further paradox pairings beyond the surface-oriented bridge–moat paradox: repository–mirror and destination–home. Each of these three paradoxes conveys rich but productive tension. Together they reflect the broad spectrum of interconnections between people and oceans, including over deep time and around the globe. Both the repository–mirror and destination–home paradoxes account for the broad range of actual uses of the seas and for imaginative engagement with them, as surfaces *and* depths.[9]

Oceans have long served as repositories, that is, as places where people could turn for needed or desired resources. Shell middens and other archaeological evidence testify that early Homo sapiens and their hominid ancestors used aquatic resources whenever they were available. Sustenance fishing remains important in places around the globe today. Commercial fisheries, for shellfish, herring, tuna, cod, and whales, began hundreds of years ago. Fisheries motivated exploration of distant waters and affected fish populations, sometimes dramatically, even before mechanization and industrialization (fig. 1).[10] People have not only viewed oceans as storehouses for raw materials or commodities; they have also used them as a place to dispose of wastes. The ocean's vastness, along with the expanding capacity to reach distant seas tied to capitalist expansion starting in the early modern period, encouraged a vision of the oceans as a source of essentially limitless resources and as a sink of endless capacity (fig. 2). For many, this perception lingers, as reflected in offshore oil and gas drilling, bioprospecting for new drugs, renewed enthusiasm for seafloor mining of polymetallic nodules, and the continued disposal of plastic and carbon into oceans.

Repositories contain knowable, enumerable things. But we also know the oceans imaginatively. The oceans' opacity guarantees that we see reflected back from their surface what we bring to it: our ambitions, preconceptions, fears, and desires. That is, our understandings of oceans depend as much (or more at times) on our assumptions, beliefs, and hopes as they depend on our actual experiences with ocean waters and their nonhuman inhabitants. Because oceans mirror, different cultures forge distinctive relationships with their seas. European immigrants to the Americas viewed oceans as a terrifying wilderness, outside the bounds of society and religion.[11] By contrast, people in Oceania consider the same element as home.



1 The mid-nineteenth century US halibut fishery illustrates that overfishing could happen even in the absence of mechanization of the fishery.

7 John R. Gillis, *Islands of the Mind: How the Human Imagination Created the Atlantic World* (2004; repr., New York: Palgrave Macmillan, 2009).

8 Jon M. Erlandson et al., "The Kelp Highway Hypothesis: Marine Ecology, the Coastal Migration Theory, and the Peopling of the Americas," *The Journal of Island and Coastal Archaeology* 2, no. 2 (2007), pp. 161–74.

9 The three ocean paradoxes were first presented in a virtual exhibition: Helen M. Rozwadowski, "Oceans in Three Paradoxes: Knowing the Blue through the Humanities," *Virtual Exhibitions 2021,* no. 2, *Environment & Society Portal,* http://www.environmentandsociety.org/exhibitions/oceans-three-paradoxes.

10 Torben C. Rick and Jon M. Erlandson, eds., *Human Impacts on Ancient Marine Ecosystems: A Global Perspective* (Berkeley: University of California Press, 2008); W. Jeffrey Bolster, *The Mortal Sea: Fishing the Atlantic in the Age of Sail* (Cambridge, MA: Belknap Press, 2012).

11 Jason W. Smith, *To Master the Boundless Sea: The U.S. Navy, the Marine Environment, and the Cartography of Empire* (Chapel Hill, NC: University of North Carolina Press, 2018).

2 The 1969 blowout of an oil rig off Santa Barbara, California, dramatically drew public attention to the deleterious effects of oil spills at sea. Despite continuing worry about coastal oil spills and fear over radioactive waste disposal at sea, most marine scientists for decades after the spill adhered to the traditional dictum that the solution to pollution is dilution, continuing to view the open ocean as an appropriate repository for waste.

As the anthropologist Epeli Hau'ofa explains, where European explorers of the Pacific saw vast swaths of ocean that dwarfed tiny specks of land, those islanders perceived instead seas of islands.[12] For them, and for others such as West Africans, oceans form part of their social and cultural space.[13]

Metaphors signal how culture powerfully shapes understandings of the opaque oceans, as with the howling ocean wilderness of New England's settlers. Another metaphor, that of the ocean as "frontier," akin to the nineteenth-century United States western lands and the opportunity they represented, forged an image of oceans as a resilient cornucopia. The post–World War II embrace of this metaphor fueled existing ideas about the limitlessness of oceanic resources in the face of evidence of declining great whale populations and certain fisheries. Combined with techno-optimism, ocean frontiers, alongside space frontiers, promised to provide anything humans could need or want: gear to catch previously uncatchable fish, new species to pursue in distant waters, and offshore oil, among other things (fig. 3). Such frontiers also looked to a near future where human control of these places was expected.[14]

3 Illustration of undersea oil industry created by Reynolds Metals, reflecting the 1960s view of the ocean as a frontier full of potential wealth and available for human use.

Like metaphors, images also contribute to perceptions that we bring to oceans and find mirrored back. Representations of the oceans' depths proliferated in the mid-nineteenth century, reflecting new cultural interest in the undersea associated with the advent of submarine telegraphy, the popularity of aquariums, and government funding of sciences related to oceans.[15] The oceans also gave Western culture a framework with which to imagine geological time. Ideas of rising or falling seas, whether marked by floods, earthquakes, or coral islands, shaped understanding of both secular and sacred geohistory. Colorful and strange life-forms associated with tropical seas or ocean depths became a part of the aesthetics of modernism.[16] Public aquariums prospered in the twentieth century, alongside marine parks. Marine Studios in Florida enabled underwater filming, which was further promoted with the invention of easy-to-use diving gear and underwater cameras.[17] The film work of pioneers such as Hans Hass and Jacques Cousteau was followed by a flood of movies, documentaries, shorts, commercials, and television shows with underwater scenes. In the post–World War II era, these media reinforced the ocean frontier metaphor. By the 1970s, media representations contributed to new views of oceans: endangered great whales, friendly gray whales, and intelligent dolphins, as well as coasts endangered by massive oil spills.[18] More recent media show us plastics in the sea, stranded whales, and bleached coral. Such images are actively reshaping perceptions of the human relationship with oceans.

The repository–mirror paradox explains the existence of multiple, coexisting perceptions of oceans, both within a culture and certainly between cultures. The ocean as mirror helps explain how apparently contrasting uses, such as bridge or moat, can exist simultaneously. The mirror of the ocean surface, inverted and viewed from beneath, or rather from within the water, in Charrière's video *Albedo*, becomes a meditation on the surface as a boundary zone—refracting differently depending on

12 Epeli Hau'ofa, "Our Sea of Islands," in *A New Oceania: Rediscovering Our Sea of Islands*, ed. Eric Waddell, Vijay Naidu, and Epeli Hau'ofa (Suva, Fiji: The University of the South Pacific in association with Beake House, 1993), pp. 2–16.

13 Kevin Dawson, *Undercurrents of Power: Aquatic Culture in the African Diaspora* (Philadelphia: University of Pennsylvania Press, 2018); Philip E. Steinberg, *The Social Construction of the Ocean* (Cambridge: Cambridge University Press, 2001).

14 Helen M. Rozwadowski, "Arthur C. Clarke and the Limitations of the Ocean as a Frontier," *Environmental History* 17, no. 3 (July 2012), pp. 578–602.

15 Helen M. Rozwadowski, *Fathoming the Ocean: The Discovery and Exploration of the Deep Sea* (Cambridge, MA: Belknap Press, 2005).

16 Katharine Anderson, "Coral Jewellery / Victorian Things: A Forum on Material Objects," *Victorian Review: An Interdisciplinary Journal of Victorian Studies* 34, no. 1 (Spring 2008), pp. 47–52.

17 Gregg Mitman, *Reel Nature: America's Romance with Wildlife on Film* (Seattle: University of Washington Press, 2009).

18 Frank Zelko, *Make It a Green Peace! The Rise of Countercultural Environmentalism* (Oxford: Oxford University Press, 2013); Anna Guasco, "From Devil-Fish to Friendly Whale? Encountering Gray Whales on the California Coast," *Environment and History* 30, no. 3 (August 2024).

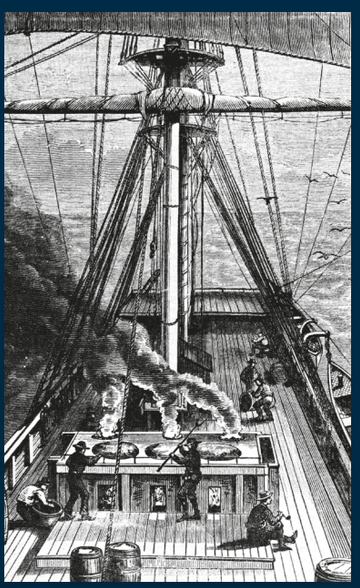
who gazes upon it, whether dictated by phantasmagorical wonder or material greed. If icebergs are Earth's mirror facing outer space, reflecting solar radiation away from the planet through the Albedo effect, then the polar sea ice operates similarly in the opposite direction. In *Albedo*, the beautiful curves and haunting shapes of the sea ice facing the polar oceans and their seafloors mirror, to some, desire for thus-far-hidden resources and, to others, fear of what melting ice will bring.

The mirror effect also bears on perhaps the most puzzling ocean paradox, that of destination–home. For most of human history, the ocean has been a place for people to visit for resource use or to travel across. The open ocean has not itself been a destination for people, not in the sense that it is for European eels seeking their spawning grounds in the Sargasso Sea or for young salmon swimming far out to sea to eat and grow to maturity. Whalers seem to have been the first people to dwell on the high seas, not to hurry across as quickly as possible. Basques began commercial whaling by the eleventh century, but when their quarry grew scarce along the coasts by the sixteenth century, they left the Bay of Biscay for the North Atlantic. Early in the nineteenth century, whalers installed tryworks to render whale blubber on board their ships (fig. 4). Severing ties to land-based processing of dead whales enabled them to spend years hunting their prey at sea, making only brief port stops for water and supplies. Whaling contributed significantly to the mid-nineteenth-century discovery of the oceans' depths, a simultaneous scientific and cultural project that also involved naval hydrographers, middle-class marine naturalists, submarine telegraph engineers, and yachtsmen and -women, as well as readers, aquarium-keepers, and beachgoers.[19] The confluence of interest in the depths helped to redefine the oceans, as both destination and highway. Today's oceans attract spear-fishers, divers, or underwater photographers as a site of recreation; cruise ship passengers as a site of pleasure; circumnavigators as a personal challenge; and merchant mariners, for some, as an enforced home when they are not permitted ashore at brief stops in industrial ports.

Oceans, however, are not generally understood as a home for people, whose naked bodies do not allow for lengthy or deep submersion. Yet the historic and contemporary activity of free diving testifies to people's interest in trying to move into the oceans. In Julian Charrière's photographic series *Where Waters Meet* (2019), this physical preoccupation becomes metaphysical. It depicts naked free divers suspended in the abyss of aquatic caves in Mexico. Floating above a chemocline, an obscure and uncanny layer of sulfurous bacteria, the divers appear to sink not only toward the bottom of the sea but also toward their psyches. It speaks to a sense of oneness, that which Sigmund Freud referred to as "oceanic feeling," which could be used to infer the gravitational pull the deep has on us as a species, drawing us both downward and inward at once, and reflecting our consciousness of our evolutionary origins in the sea.[20]

Shipwrecks, ancient and contemporary, attest to the undersea as a place humans cannot (at least not yet) call home, although wrecks store traces of people's interactions with the sea. Many cultures, though, have forged partial lives undersea. Groups of people in Indonesia, Thailand, China, and the Philippine islands depend on marine resources gathered by diving, live on boats, and in some cases appear to have physiological adaptations for breath-holding that enables long and deep dives. As Cousteau's Conshelf II program demonstrates, dreams of technology allowing people to live and work underwater flourished in the post–World War II period. Although undersea suburbs haven't materialized, nuclear submarines carry and house sailors of half a dozen navies, while the offshore oil and gas industry has the capacity to operate in ever-deeper waters. Work brings a small number of people to live beneath or on oceans, but recreation attracts many more to spend shorter moments at or in the sea. The recent increase in shark attacks provides a stark reminder that such people trespass in an ocean environment that is home for innumerable nonhuman species.

Ocean environmentalism emerged tardily in the twenty-first century. The terrestrial environmental movement focused mainly on clean air, land, and fresh water. Other than movements to save great whales and protest coastal oil spills, environmentalists mostly overlooked ocean issues such as overfishing. With the exception of dumping nuclear materials, which became the subject of an internationally agreed-upon ban in 1970, waste disposal in open oceans remained acceptable for a long time, following the mantra that the solution to pollution is dilution.[21] The shocking crash of the northwestern cod stocks in the late twentieth century transformed an economic disaster into an ecological



4 Engraving of whaling vessel with tryworks on deck, used to render blubber to recover oil while ships remained at sea. Whaleships with tryworks made the open ocean into a destination for whalers, while the ships themselves served for long periods as a home for these men and for the small number of women who voyaged with them.

19 Rozwadowski 2005 (see note 15).

20 Helen M. Rozwadowski, "'Bringing Humanity Full Circle Back into the Sea': *Homo aquaticus*, Evolution, and the Ocean," *Environmental Humanities* 14, no. 1 (2022), pp. 1–28.

21 Simone Müller and David Stradling, "Water as the Ultimate Sink: Linking Fresh and Saltwater History," *International Review of Environmental History* 5, no. 1 (May 2019), pp. 23–41; Jacob Darwin Hamblin, *Poison in the Well: Radioactive Waste in the Oceans at the Dawn of the Nuclear Age* (Piscataway, NJ: Rutgers University Press, 2008); Helen M. Rozwadowski, *The Sea Knows No Boundaries: A Century of Marine Science under ICES* (Seattle and London: University of Washington Press and International Council for the Exploration of the Sea, 2002).

one when the population did not rebound with the closure of the fishery. Not only had people fished out a fabled resource that had sustained half a century of exploitation, but we have since discovered that fishing has permanently changed the ecosystem. Today we understand the scale and extent of overfishing, plastic pollution, and other harms to the oceans from human activities. Thanks to historical scholarship, we are growing more aware of the unequal effects of this damage as a postcolonial legacy. Our actions endanger home for many marine creatures but, ironically, also threaten the planet that we depend on and share with other forms of life. Ecologists believe that, without us, reefs and other oceanic spots would recover—a reminder that we need the oceans more than they need us.[22]

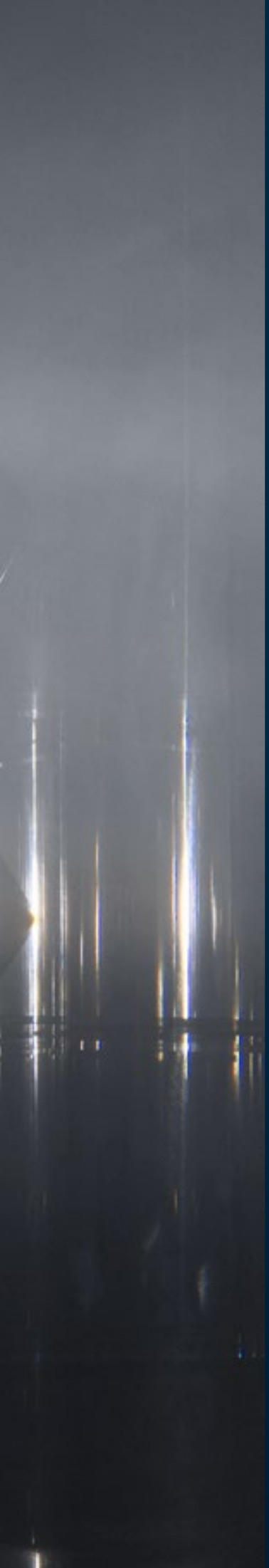
How do these three ocean paradoxes—bridge–moat, repository–mirror, and destination–home—help us meditate on the *Midnight Zone* exhibition's messages about the undersea? The first two pairings reveal that different cultures have forged distinct relationships with oceans over time. Oceans, including the undersea realm, are meaningful parts of society and culture for many coastal and island peoples. Starting in the early modern period in Europe, a posture of extractivism emerged, accompanied by a sense of the oceans as separate from human society. Imperial and capitalist expansion spread attitudes and practices of treating oceans as repositories, setting in motion patterns of overfishing, waste disposal, and climate change that profoundly shape today's oceans.

5 Manganese nodules, which accrete valuable metals such as iron, nickel, copper, and cobalt in addition to manganese, inspired hopes in the 1960s for easy exploitation because they rest on top of the seafloor sediments. Now called polymetallic nodules, these deep-ocean resources have once again attracted the attention of would-be miners.

While actual interactions with oceans, through both work and play, represented an important way that people came to know oceans, imagination proved equally important. The vast size, inaccessibility, and opacity of oceans invited those viewing or thinking about them to bring to them their preconceptions and ambitions. The mirror function of oceans invites a future orientation: people have always dreamed about what they hope to draw from oceans. Sustenance fishers expected to feed their communities by diving and fishing. Early modern salvagers hoped to extract sunken treasure from wrecked Spanish ships returning from the New World. Commercial whalers and fishers aimed to transform the creatures they hunted into commodities and thereby into profit. Post–World War II ocean scientists, engineers, and entrepreneurs intended to mine manganese nodules from the deep-sea floor (fig. 5). While the latter has not yet happened, it's a dream deferred, which only demonstrates more clearly this future orientation.

What we do next, in response to today's ocean challenges, will tell us the future of the destination–home paradox. *Albedo* shows the underside of sea ice, reflecting into the sea our fears of the causes and consequences of melting poles. The top of that same ice touches the atmosphere and reflects—and connects to—outer space, demonstrating the vertical links tying together deep space, the atmosphere, and the volumetric oceans. This two-way mirroring should remind us of the scale and yet the singularity of our ocean planet home. While Julian Charrière views the Fresnel lens lowered into the deep Pacific as an emergency beacon, signaling impending disaster if we proceed with the style and extent of extraction characteristic of our history, there is another, hopeful, possibility. Such lights atop lighthouses most days guide ships safely in and out of harbors. Perhaps viewers of *Midnight Zone* might recognize the submerged light as a navigational aid, to guide our future voyages toward healthier oceans whose resources are used in more just ways.

22 Alan Weisman, "The Sea Cradle," in *The World Without Us* (New York: Picador, 2007), pp. 328–44.



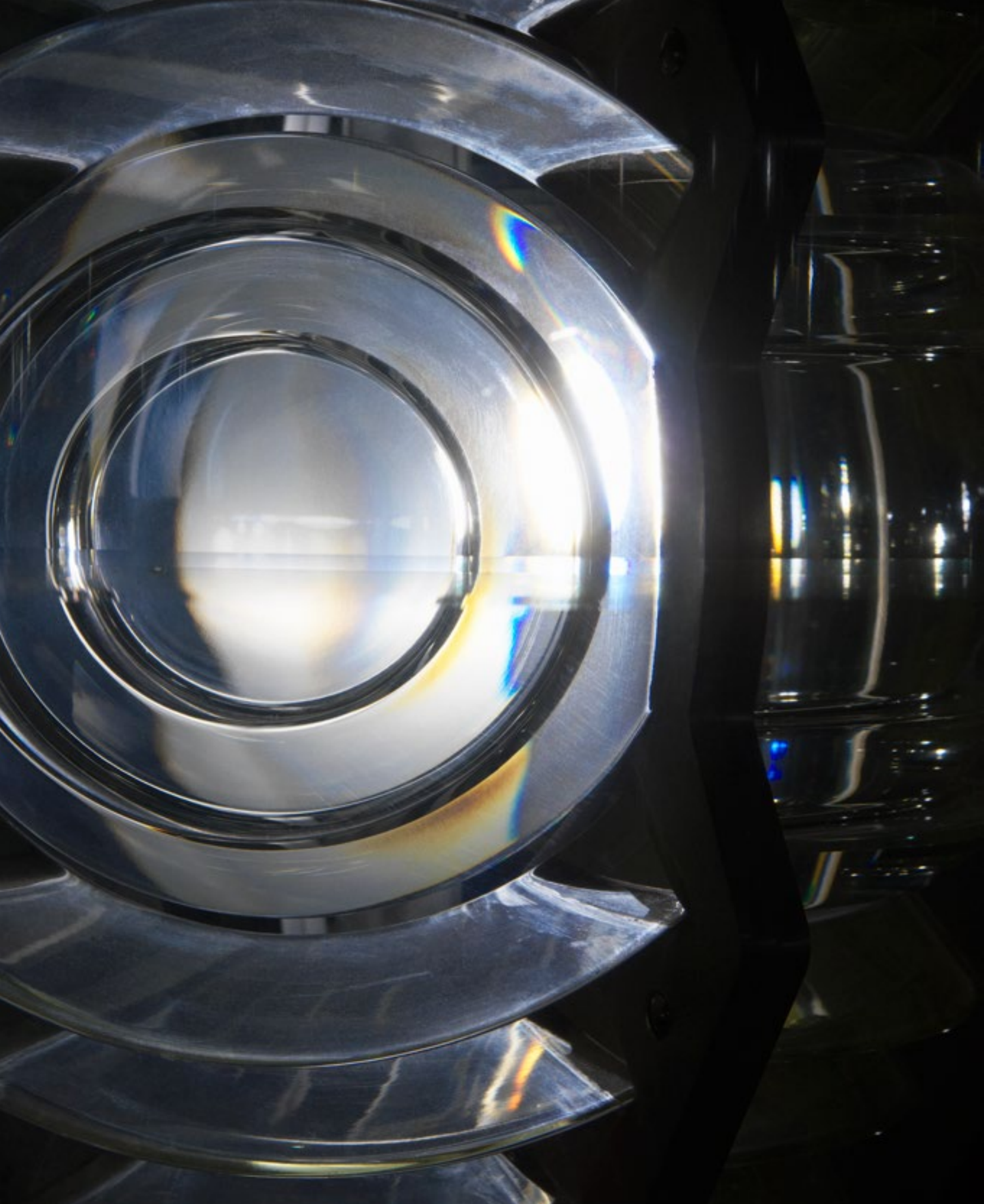
Midnight Zone, 2025

An architecture for the boundary zone between land and sea, the figure of the lighthouse has historically been both a portent of danger as well as a promise of safe harbor. Standing on the last terrestrial vestige before giving way to the unknown of the ocean, it uses compact composite lenses to cast messages silently and across vast distances. A watchtower of what the marine historian Helen M. Rozwadowski calls the bridge–moat paradox, it projects our presence across waters which both divide and unify us, separating land masses while also sinewing them together as a whole. Rejecting our species' preoccupation with the surface of the Earth's oceans, Julian Charrière's *Midnight Zone* slips beneath this barrier, sinking a Fresnel lens down 1,000 meters into the aquatic biome of the Clarion–Clipperton Zone (see the essay by Helen M. Rozwadowski in the present volume, pp. 62–67).

Resurfaced, the installation *Midnight Zone* features this same lens as the eponymous video. Suspended in the museum, the lantern casts a revolving beam of light across the walls clad in undulating reflective foil—fracturing and extending the beam infinitely. Set in a fine haze, it recalls the spectral glow of a lighthouse piercing mist-laden seas, yet the mirrored structure refuses stillness.

Fluctuating from harmonic to chaotic, the disturbances influence both the glow and spin of the lighthouse lens as well as vibrations in the architecture, triggered by a composition crafted from deep-sea anthropogenic sound pollution recordings. The low-frequency hum of container ships, the seismic blasts of air-pressure cannons searching for fossil fuels, the grinding reverberations of seabed mineral extraction, sonar pulses, and the industrial drone of offshore wind farms—all sounds that disrupt marine ecosystems—are translated into physical vibrations. Just as deep-sea creatures, dependent on sound for navigation and survival, are disoriented by these intrusions, the reflections in *Midnight Zone* disorientate and confuse, mirroring the unseen turmoil beneath the ocean's surface.

By rendering the imperceptible visible, *Midnight Zone* immerses visitors in the fragile soundscape of the deep sea. It translates sound into image, noise into light, creating a visceral parallel between disruption and reflection. The installation transforms the gallery into a space of contemplation, urging us to reconsider our impact on the ocean's hidden realms—worlds we rarely see, yet irrevocably shape.



A Lens in Water

Peter Godfrey-Smith

Julian Charrière lowers a lighthouse lens deep into the sea. With the beam of its electric light pulsing outward, the lens descends through 1,000 meters, a depth at which all sunlight is gone.

The lens was invented by the French physicist Augustin-Jean Fresnel around 1819 (a history described with care in Theresa Levitt's book *A Short Bright Flash*).[1] Fresnel was an early defender of the wave theory of light. The dashing physicist François Arago, a friend and champion who shared Fresnel's undulationist commitments, had taken charge of Napoleon's Commission des Phares, dedicated to improving and extending France's lighthouse system. Arago enlisted Fresnel, who quickly realized why previous lighthouse designs were so imperfect. Based on collections of mirrors reflecting lamplight, they lost too much in their attempt to direct the beam. A system based on lenses, which refract (bend) the light, would be far superior (especially with added reflectors, above and below, to catch the most wayward scraps).

The first lighthouse system with a functioning Fresnel lens, the Cordouan light, was lit in 1823, at the mouth of the Gironde estuary in France. In this first version, the system of lens plus mirrors looked like a slowly exploding beehive. How far did its light visibly extend? It was hard to say, because the beam was sent off into space by the curvature of the Earth before it faded. Sailors in the rigging of ships could see the beam 33 nautical miles away.

Fresnel-lens lighthouses, like many of their predecessors, were originally powered by oil-burning lamps. (Other lighthouses simply had piles of burning coal.) With the aid of Fresnel's invention, a small flame could be used to send beams over many miles.[2] The lens makes this possible by organizing energy—organizing light. The light from a lamp will normally spread in all directions. The Fresnel lens concentrates, manipulates, directs (fig. 1).

1 The first-order Fresnel lens in the Point Perpendicular lighthouse at Jervis Bay, Australia. The lens was manufactured by Chance Brothers and was first lit in 1899.

After his first successes, Fresnel, searching for "total refraction," altered his design. The mirrors that had augmented the main lenses, at the top and

1 Theresa Levitt, *A Short Bright Flash: Augustin Fresnel and the Birth of the Modern Lighthouse* (New York: W. W. Norton, 2013). The polymath Georges-Louis Leclerc, Comte de Buffon, had sketched a simpler version of the lens design some decades before. Buffon's interest had been in focusing heat, rather than illumination.

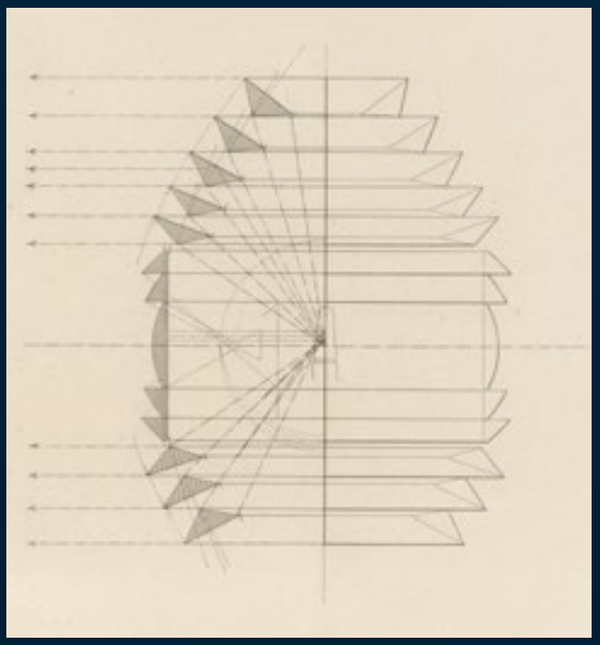
2 The oil-burning lamps inside Fresnel's lighthouses were also somewhat special, as they had five concentrically organized wicks. This was another of his innovations, modifying the Argand lamp. On this, see Levitt 2013 (see note 1).

bottom of the structure, were replaced with prisms. Unlike mirrored surfaces, these prisms reflected light with almost no loss. In this more compact and efficient "catadioptric" design (fig. 2), the organizing and directing of light occurs entirely inside the lens. The lens lowered into the sea for Charrière's work *Midnight Zone* (2024) is a catadioptric lens.

A lighthouse lens is one kind of organization of energy, channeling light from a source that would otherwise radiate ubiquitously, forming it into a beam. Life itself is like that—a matter of the organization of energy, especially the energy in light from the sun.

This was probably not life's first source of energy, but now it is by far the most important. Sunlight comes in, bathing the Earth. Most of the energy radiates away as heat. But some of the sun's energy can be retained and put to work, used to build living material and fuel living activity.

Life itself probably began in the sea—in an aquatic environment, anyway. Life could not arise



2 Meridian section of a fourth-order catadioptric lens by Augustin Fresnel

from scratch on dry land. Our bodies and cells today contain not just water, but salt water, which is water with dissolved ions. These electrically charged particles, some positive, some negative, play essential roles in organizing the spontaneous, storm-like interactions between larger molecules immersed in water. As James Lovelock (of the "Gaia hypothesis") put it, ions cluster around the active parts of larger molecules and modulate their interactions, enabling them to "position themselves with due deliberation and a high degree of precision."[3]

Influential recent models of the origin of life have looked to warm deep-sea vents.[4] Here, the source of energy is not sunlight, but chemical compounds coming up from beneath the Earth. Whichever kind of energy is harnessed to enable life, this activity requires a sequestering, a formation of borders with traffic across them. Something must confine the unusual reactions characteristic of life so that the unusual chemistry that enables it does not diffuse away into the surrounding chaos. A form of *selfhood* is required in the most basic forms of life.

Life driven by light, through photosynthesis, probably came somewhat later. There are several kinds of photosynthesis. The most important kind, the kind seen in plants and algae today, works by splitting molecules of water and releasing oxygen gas as a by-product. This might sound simple enough, but apparently that splitting of water is a "difficult" chemical step. In all forms of photosynthesis, the energy from incoming photons (the particles of light, a concept Fresnel would have rejected) is absorbed by a molecule held out, like a collector, for that purpose. Energy from the photons dislodges an electron in this "light-harvesting" mechanism, and the electron is transferred from molecule to molecule in a series of steps, eventually powering the formation of living material.

The electron that wanders off down this path has to be replaced. In some bacteria, the whole process works in a cycle, but in most forms of photosynthesis, the source of electrons is some particular chemical. This need for a fuel often confines the organism to unusual environments. But one kind of photosynthesizer found a way to use water itself as the electron source. This innovation, perhaps 3 billion years ago, required the cell to bring together two distinct machineries for photosynthesis, and connect them. These two systems probably arose from a single ancestor, were separated in diverging evolutionary lineages, and then came back together to work in combination.

The invention of this water-driven form of photosynthesis, in the group of organisms called *cyanobacteria*, was a tiny but momentous event. The Harvard geobiologist Andrew H. Knoll has described the reuniting of those two machineries for photosynthesis as, from an ecological perspective, "the central event in the history of life."[5] Because water is so common, it freed life from rare and marginal places. It made possible *more* life, and more evolution; life went from fringe-dweller to Earth-changer.

Through a series of symbiotic events, the new water-splitting photosynthesizers became part of algae, corals, and plants. And this form of photosynthesis had its impact not only because of how life could now spread, but because of a by-product. The more complicated, water-consuming form of photosynthesis is also *oxygenic* photosynthesis; its by-product is the oxygen gas that makes animal life possible.

3 James Lovelock, *Gaia: A New Look at Life on Earth* (Oxford: Oxford University Press, 1979), p. 84.

4 See, for example, Eugene Koonin and William Martin, "On the Origin of Genomes and Cells within Inorganic Compartments," *Trends in Genetics* 21, no. 12 (2005), pp. 647–54.

5 Andrew H. Knoll, "The Geological Consequences of Evolution," *Geobiology* 1, no. 1 (2003), pp. 3–14: "From an ecological perspective, this concatenation might well be regarded as the central event in the history of life, because it liberated biology from hydrothermal vents and other environments where locally strong redox gradients could support chemosynthetic life, allowing organisms to spread across the planet. . . . And it only happened once" (pp. 4–5).

Animal life, which also arose in the sea, is one of several experiments in collective living on the part of those first selves—cells. Cells that initially lived in loose collaborations and clumps became more integrated, forming coherent units at a new spatial scale.

The animal form of life specializes now in action, in controlled movement. This probably took a while to evolve. Some early animal forms seemed to have lived quietly on the seafloor (though perhaps with more active jellyfish-like relatives in the water column). The nervous system, which emerged quite early in animal life, was the key to making this more active form of life possible.

The invention of the nervous system was the invention of further ways of organizing energy—energy ultimately deriving from the sun. Nervous activity is based on the "excitable" cell; some cells can undergo a tiny electrical fit (the *action potential*) that envelops one cell and may be passed to another. Excitable cells existed before animals in various single-celled forms of life. Nervous systems organized these electrical spasms in a new way, forming networks in which excitation in one cell triggers excitation in others.

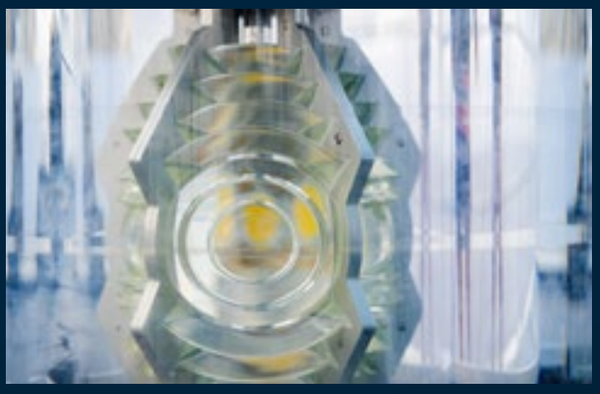
Many other pivotal stages in the evolution of the mind occurred before any animals had left the sea. The sea is where eyes were invented—invented many times, in fact. Light-sensing machinery is widespread across organisms, and even some of the tiny cyanobacteria we have to thank for our oxygen-filled atmosphere have made a transition from using light purely as a source of energy to using it also as a source of information; they can sense the position of a light source and move toward it. They do this by focusing light on the interior surface of the cell itself—using the inner edge of their body as if it were a retina.[6]

Within animals, animal eyes that could form definite images of the environment—of objects around the seer—evolved in several forms around half a billion years ago during the Cambrian Period. Along with seeing and other sensing, much else about the mind evolved in the sea. This is where learning and memory evolved, and where the movement, on the scale of animal bodies, became coherent, rapid, and elegant.

All the basic animal body plans were laid down in the sea, including our vertebrate form. Initially, that was the form of a fish. This body form was an unlikely one, in the light of what we went on to do. In the early stages of the more active part of animal evolution (again, the Cambrian Period), the animals that seemed to have a kind of behavioral dominance were arthropods, the group that now includes insects and crustaceans. Vertebrates, early fish, were nondescript slivers. Their bodies seem to have been built for pure mobility, with an emphasis, perhaps, on escape from the arthropods around them. But the fish body plan turned out to have surprising potential. From the invention of jaws, fishes began to dominate the oceans, while arthropods shrank and receded to crevices.

Some descendants of early fish came onto land. This is a harder place to function as a living organism, but one allowing new scope for action, especially for manipulation, building, and technology. Eventually we reach the fragile body and mental lucidity of Augustin-Jean Fresnel, who died of tuberculosis at thirty-nine, reflecting on what more he might have done for science with a few additional years.

The pressure at 1,000 meters is extraordinary. The *Midnight Zone* system has an airspace between the lens and the exterior wall. If that air felt the pressure of 1,000 meters depth, its volume would be reduced by around 99 percent. This is roughly the depth at which William Beebe and Otis Barton did an



3 Close-up of a Fresnel lens from the installation *Midnight Zone*, 2025

unmanned test of their deep-sea exploration vehicle, the bathysphere, in 1932.[7] They wanted to see if the windows and other seals would hold at those depths. When the bathysphere was brought to the surface after that trial, it had largely filled with water. Beebe wrote in 1934:

> I began to unscrew the giant wing-bolt in the center of the door and after the first few turns, a strange, high singing came forth, then a fine mist, steam-like in consistency, shot out, a needle of steam, then another and another. This warned me of what I should have sensed when I looked through the window, that the contents of the bathysphere were under terrific pressure.

Beebe and Barton stood back, and continued slowly turning.

> Suddenly, without the slightest warning, the bolt was torn from our hands, and the mass of heavy metal shot across the deck like a shell from a gun. The trajectory was almost straight, and the brass bolt hurtled into the steel winch thirty feet away across the deck and sheared a half-inch notch gouged out by the harder metal.

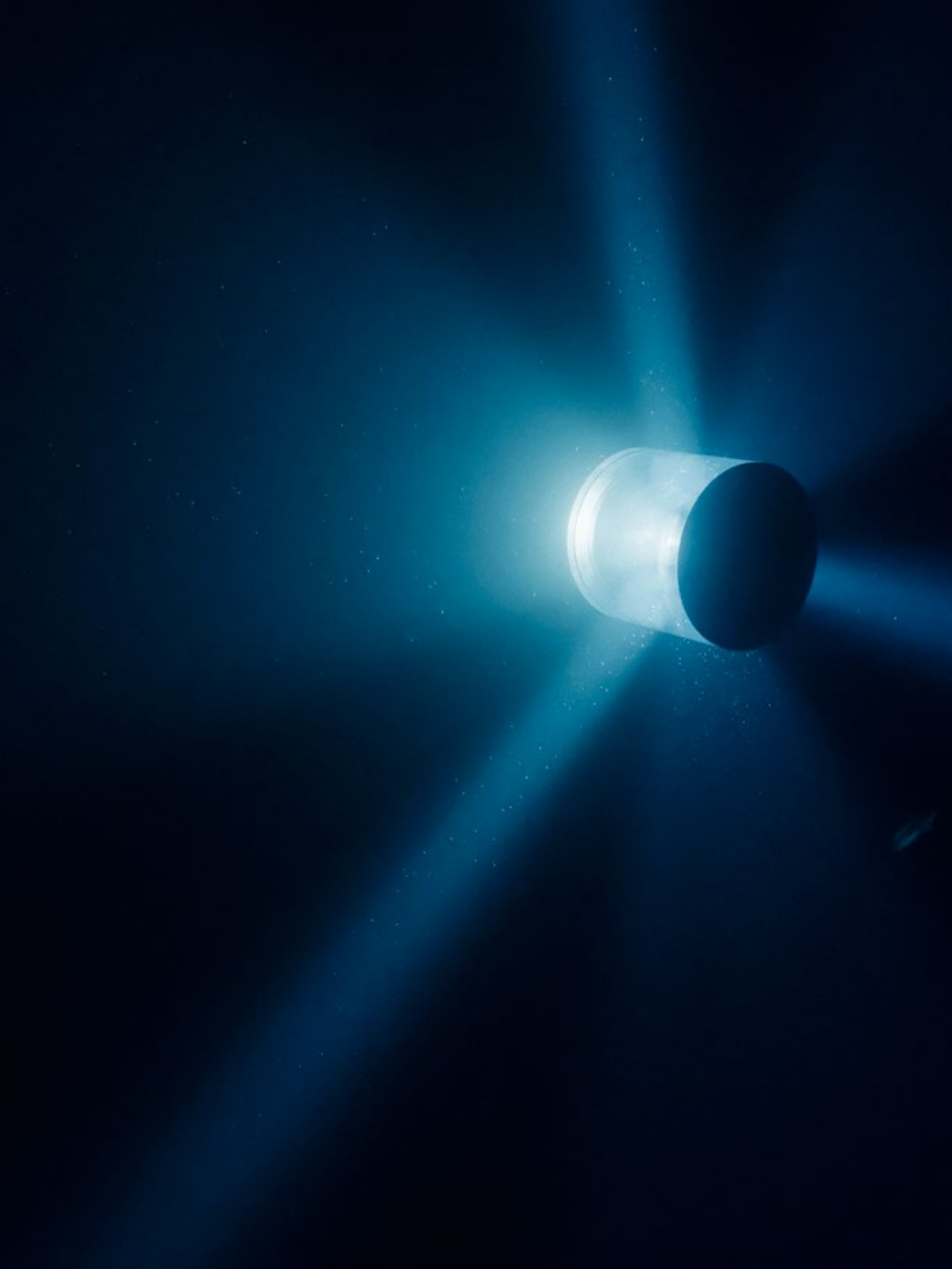
6 Nils Schuergers et al., "Cyanobacteria Use Micro-Optics to Sense Light Direction," *eLife* 5 (2016), e12620, https://d-nb.info/1256590541/34 [accessed in February 2025]: "*Synechocystis* cells act as spherical micro-lenses, allowing the cell to see a light source and move towards it. A high-resolution image of the light source is focused on the edge of the cell opposite to the source, triggering movement away from the focused spot. Spherical cyanobacteria are probably the world's smallest and oldest example of a camera eye."

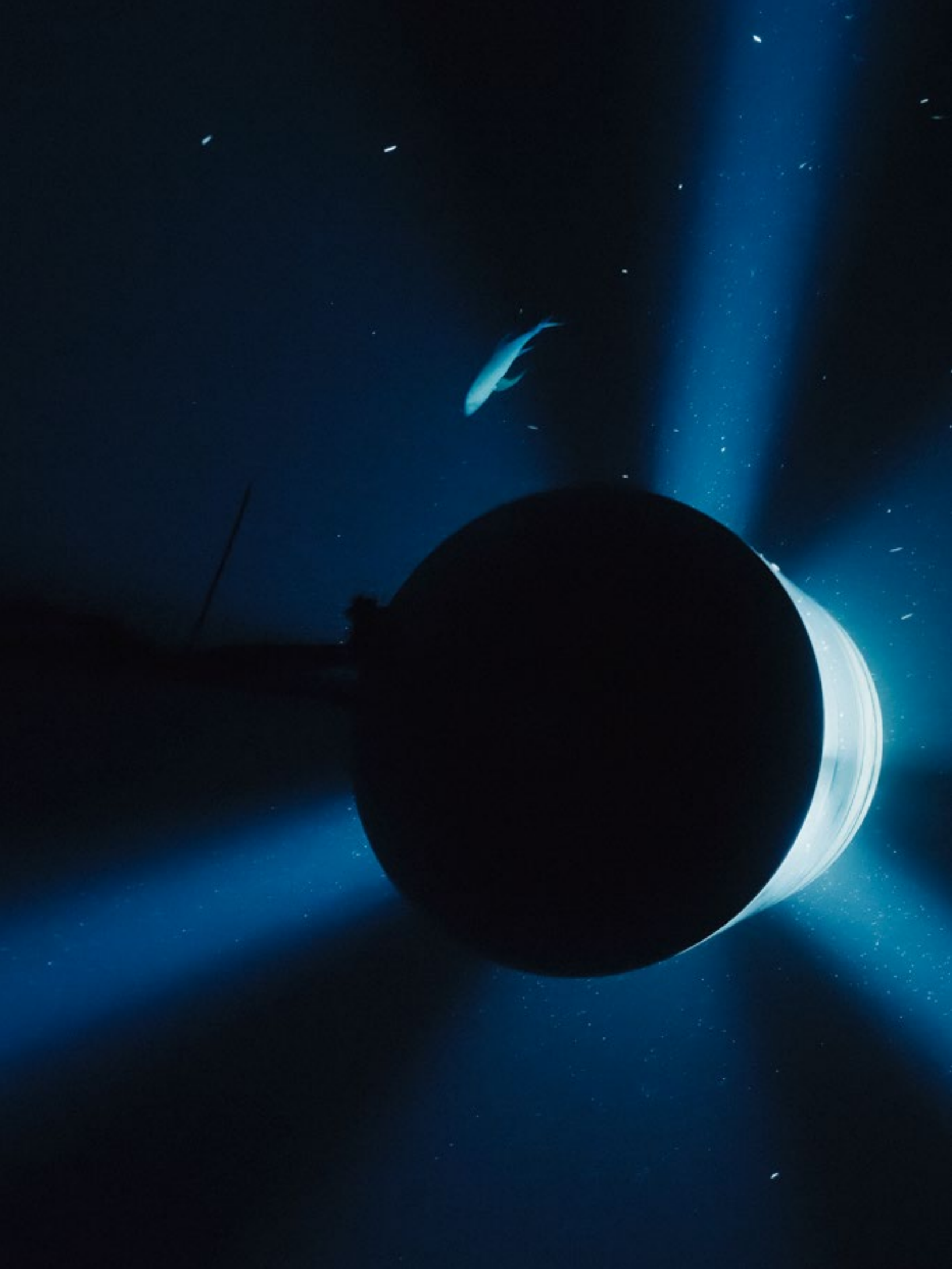
7 This test, to 3,000 feet (914 meters), is described in William Beebe, *Half Mile Down* (New York: Harcourt, Brace, and Co., 1934). The quoted passages below are from pages 153–54.

A Fresnel lens brought into the sea embodies so much of the history of life (fig. 3). The lens and light were brought down as a way of revealing and reminding us of precious things that are usually hidden. But when looking at them, one sees reflections of much of the past that has shaped us, and some of the relationships that make life on Earth possible at all. The *Midnight Zone* system embodies the organization of energy in the forms of electricity and light. A combination of light and water is at the heart of oxygenic photosynthesis, the process that sent life swarming over the Earth, transformed our atmosphere with oxygen, and enabled the animal way of being.

The *Midnight Zone* device looks like an eye, but it emits light rather than receiving it, and the relation between light and electricity that the system embodies is a reversal of the ancient life-enabling transitions that I have emphasized here. In photosynthesis, light dislodges electrons, sends them cascading through the cell's molecules, and enables living activity; in the *Midnight Zone* system, electricity generates light at a depth below the reach of the sun. Electrical charges that permeate the ion-filled sea are also organized in the neuron-like wiring that controls the system, as they also do in hundreds of fish, mobile slivers of vertebrate life like us, lit up like stars as they revolve around the lens.

Midnight Zone





Knowing the Dark

Science and Sensory Bias in the Deep Sea

Amorina Kingdon

> Human beings, further, are inclined to favor visual information over the testimony of their other senses when learning an area, and to be more drawn to animals that approximate their own scale.
>
> Barry Lopez, *Arctic Dreams*

In the mid-twentieth century, when sonar technicians and research biologists first heard humpback whale song in the ocean, it was as echoes through a top-secret Cold War hydrophone network.[1] The song entranced them. It made them feel, though, exactly what is between them and their limbic systems. But it didn't, at first, make *sense*. Not what it meant, nor the signals it contained, or even what it ought to be called.[2]

The strange whoops and moans were not dubbed "song" until one researcher fed the whale recordings into a university laboratory sonograph. Consisting of a pen transposing sound into lines onto a spool of paper, this device evoked an old-school lie detector, scratching out sounds like notes on a musical staff, and had previously been used to visualize the songs of birds.[3]

Yet it was only when the long monochromatic printouts of the humpbacks' song were laid out and visible all in one glimpse that the scientists recognized the pattern. The whale sounds had structure, had repetition, had rhythm. So striking was this pattern when viewed on paper that when the team published the discovery in a 1971 issue of *Science*, it was not a whale that graced the magazine cover, but a photo of these visual printouts (fig. 1).

The seminal *Science* paper contained the following paragraph: "On first hearing humpback vocalizations," it reads, "one has *the impression of an almost endless variety of sounds*. Spectrographic analysis shows, however, that all prolonged vocalizations occur in long, fixed sequences and are repeated with considerable accuracy every few minutes. Because one of the characteristics of bird songs is that they are *fixed patterns of sounds that are repeated*, we call the fixed patterns of humpback sounds 'songs.'"[4]

This leaps out at me. It tells me that they, like most humans, did not initially perceive the auditory patterns, but needed them visualized. Then, the researchers were able to pick out and classify its discrete segments from otherwise continuously varying sound.

1 The cover of the 1971 issue of *Science*, depicting a sonogram printout of humpback whale songs. According to the scientists who created those printouts, the songs' acoustic patterns only became obvious to the human eye when they were transcribed into a visual format.

1 D. Graham Burnett, *The Sounding of the Whale: Science and Cetaceans in the Twentieth Century* (Chicago: The University of Chicago Press, 2012), p. 635.

2 Ocean Alliance, "The Discovery," https://whale.org/humpback-song/ [all URLs accessed in February 2025].

3 Burnett 2012 (see note 1), pp. 632–34; David Rothenberg, *Thousand Mile Song: Whale Music in a Sea of Sound* (New York: Basic Books, 2008).

4 Roger S. Payne and Scott McVay, "Songs of Humpback Whales," *Science* 173, no. 3997 (1971), pp. 585–97 [emphasis mine].

The ocean environment is an amazingly acoustic space.[5] Yet human ears evolved to work optimally in air and are rendered next to useless beneath the water's surface. This strong impression of hushed, distorted, or absent sound leads to our persistent impression of silent seas. Nothing could be further from the truth—sound in fact travels more quickly and easily in water than in air, and it is dense with meaningful signals which it carries further.[6]

Sound moves four and a half times faster in water than in air, transmitting signals at greater clarity over vast distances. At the same time, light is absorbed quicker, while scent and chemicals diffuse slower. Marine animals have evolved their senses accordingly, and nearly all of them, including invertebrates, can perceive sounds. Others, such as fish and mammals, are astoundingly acoustic. They perform the vital tasks of life—navigating, finding sustenance and shelter, fleeing predators, reveling in company and communion—with sound and hearing, a sense that humans scarcely perceive in water at all.[7]

To me, a sighted and air-breathing person in the twenty-first century (and especially as a writer whose job is to consider science and technology), it truly seems that humans are a primarily visual species. Our brains, our thoughts, and even our figures of speech; our science; and our technology too. We develop tools to reveal what we cannot directly sense, and then often translate chemical, electromagnetic, or acoustic data not via touch, smell, or sound, but into something that can be seen. Through visuality, with words, charts, maps, numbers, screens, spectrograms, and other scientific outputs. And I have noticed that this bias becomes even more obvious when we explore the ocean, a place so rich in nonvisual data.

Western scientific ocean exploration over much of the past two hundred years (driven by such forces as colonial expansion, the invention of steamships, and the advent of submarines and underwater warfare)[8] often amounts to collecting rich reams of marine acoustic data that could not have been sensed (or, as with humpback song, studied or understood) directly by us, but which needs to be imaged or visualized for us to best comprehend it. Certainly in the humpbacks' case, the song tempo was restrictive. Whale song is very slow, and humans can more easily recognize similar acoustic patterns in, say, birdsong. Yet even with birds we visualize, as evidenced by the very existence of the birdsong lab's sonogram.

Meanwhile, for animals who actually live in the ocean, science is revealing that their sensory experience is weighted very differently than ours, particularly toward sound. Thus, it seems that emphasizing the visual at the expense of other senses, especially hearing, separates us from the greater part of the living ocean world.

Having learned more about ocean sound, I have found myself looking deeper at the senses. I have become curious about whether there are things intrinsic to separate information modes, such as light and sound, and about what those might mean for what the *senses* of sight and hearing are broadly to *us*. For example, does the visual sense lead us to gently emphasize space over time, the discrete over the continuous, and the reproducible data point over intangible qualia?[9] These questions—which I am far from the first to ask—to me suggest potential subtler impacts of human visual bias when we explore new places, such as the ocean's depths.

When I look at our history of science, and especially at how its data is transmitted via writing and written language—including such pivotal inventions as the printing press—I see how a focus on reproducible visual data in constructing knowledge has at times shaped the questions we ask, the experiments we design, and so our understanding of the world we explore.

I don't at all wish to minimize the ingenuity and necessity of the devices we developed to approach and better understand places otherwise strange and dangerous to us, but as we, visual animals, explore the acoustic ocean at several sensory steps removed, I want to ask what we lose, and how we might reach a truer sense of the deep as we make decisions about its fate, far below the realm of light and breath?

Human visual bias is only an assertion, albeit one encountered so often I cannot recall the first time I heard it. Though it seems intuitively obvious to me, it is a complex theorem to prove.

But let me offer some facts for consideration.

More brain area is devoted to visual processing than to the other senses. If neural real estate is a proxy for importance, then sight is indeed at the apex of the human sensory hierarchy.[10] Our metaphors and figures of speech center the visual (something that only became apparent to me when I began to write about

5 Carlos M. Duarte et al., "The Soundscape of the Anthropocene Ocean," *Science* 371, no. 6529 (2021), p. 1 of 10.

6 Gail Scowcroft et al., *Discovery of Sound in the Sea* (Kingston, RI: University of Rhode Island, 2018), p. 135.

7 Duarte 2021 (see note 5).

8 Susan Schlee, *The Edge of an Unfamiliar World: A History of Oceanography* (New York: E. P. Dutton & Co., 1973).

9 Anne Carson, *Eros the Bittersweet* (Princeton, NJ: Princeton University Press, 1986).

10 Fabian Hutmacher, "Why Is There So Much More Research on Vision Than on Any Other Sensory Modality?" *Frontiers in Psychology* 10 (2019).

sound and had to consciously try *not* to use visual turns of phrase!). *We can see . . . Look at this . . .*

There are, of course, huge errors in this generalization of humans and their science as primarily visual. People lean on their senses in individual ratios, and at different times. Many people get by without their sight just fine. One person may be far more moved by music than any sight. When we eat or drink delicious food, at least I can vouch that the senses of taste and smell and touch come to the forefront. But it seems to me that Western science, the collection and transmission of data, and the tools used for this purpose, generally emphasize the visual.

For example, Europe's Scientific Revolution, from its very beginning, was entwined with a rich visual Renaissance with its crisp, idealistic perspective studies on one end,[11] and the bloody, (even, at times, ghoulish) appetite for anatomical studies on the other. As perspective drawing transformed the painting of spaces, dissection transformed both the painting of human figures and our nascent scientific understanding of animal structure (aided by distribution of drawings via the new printing press).[12] (Not always, as it turns out, to greater ultimate accuracy. The anatomist Iulius Casserius dissected the head of a fish and saw no spiraled cochlea inside. And so, contrary to common-sense observations back to the time of Aristotle and Pliny, many declared that fish could not hear. Subsequently, the question of fish hearing became a centuries-long debate of truly incredible proportions . . . But that is a tale for another time).[13]

Even unto the present, as I study the history of science—or at least, of its records—I see a visual history. In a new space, we map, we make schemas of spatial relationships. When we extend ourselves into the world via technology, I notice that we design our tools to, well, "see," or, as with echo sounder paper or birdsong spectrograms, to present data formatted visually. If we cannot perceive the very small or the very large, then we seem to turn to microscopes and telescopes—not microphones or tiny smell-o-scopes—to reveal cells or stars.

Why might this be? Much as we like our technology output in a visual format, we also like our scientific output in the very visual medium of print: images, books, and papers.

Perhaps much of this has to do with *proving*. Good science should be reproducible, an experiment or an observation that can be copied and repeated. The unit of science is data, contained in the (visual, reproducible) scientific paper: the number, the diagram, and most of all the word. I don't think it is a coincidence that the scientific revolution followed on the heels of the printing press. In whatever information channel it originates, data is almost always collected, explained, and disseminated, via the visual.

I'm reminded of a paper by two ocean scientists, contemporaries of the humpback researchers. In this case, they were trying to prove that sounds of knocking and clicking heard in the ocean were coming from sperm whales.

In March 1957, the Woods Hole Oceanographic Institution vessel *Atlantis* encountered five sperm whales. Listening to the underwater soundscape using the ship's instruments, they heard the mysterious knocking.

"During the hour spent with the whales," they wrote in their subsequent paper, "the engines were frequently shut off to permit listening by means of the echo-sounding receiver. Unfortunately phonographic equipment was not available. By far the most common sounds were series of sharp clicks, which were loud enough to blacken the sounding recorder paper . . ."[14]

This simple vignette (which I *read* in a scientific paper) illustrates how science is often done. Data must be gathered to prove something, and the data must be transportable, reproducible. In this case, the original information was acoustic. Since the scientists couldn't record the sound, they co-opted the boat's echo sounder and produced a record—a visual record—to serve as proof, *without which the story is just that*: a story. A wondrous day on the water, with no officiated evidence of anything at all.

So when we enter a new environment, I think humans bring this visual lens. In the ocean, we are forced by evolution and the hostile environment to do so with the aid of science and technology, which only compounds the bias to look for data that can be quantified and so reproduced in some visual form.

It is neither good nor bad to lean on one sense more than another. It is not a question of aesthetics, or a debate over intrinsic value. But I wonder what it means that it is *this* sense favored at the expense of *that* one. What are light and sound? What is sight and hearing?

11 Christopher W. Tyler, "The Intersection of Visual Science and Art in Renaissance Italy," *Perception* 49, no. 12 (2020), pp. 1265–82.

12 Jess Righthand, "The Anatomy of Renaissance Art," *Smithsonian Magazine*, October 18, 2010, https://www.smithsonianmag.com/science-nature/the-anatomy-of-renaissance-art-36887285/.

13 John Hunter, "Account of the Organ of Hearing in Fish. By John Hunter Esq. FRS," *Philosophical Transactions of the Royal Society of London* 72 (1782), pp. 378–83; G. H. Parker, "A Critical Survey of the Sense of Hearing in Fishes," *Proceedings of the American Philosophical Society, 1918* 57, no. 2 (1918), pp. 69–98.

14 L. V. Worthington and William E. Schevill, "Underwater Sounds Heard from Sperm Whales," *Nature* 180, no. 4580 (1957), p. 291.

We know a bit about what sight is. To me, it is all-at-once. From a closely examined screen to a misty hill in the far distance, it is the sense that often defines the outer boundaries of our world, without which we often feel deeply disoriented. The whale researchers perhaps experienced this too: seeing the printouts all at once was what made the pattern clear.

What then of sound?

Hearing is an interesting sense, in humans. It seems to be the distance sense that triggers a true startle response and wakes us from sleep.[15] Unlike light it works day or night, and around corners. Sound is the sensory channel in which social animals tend to send alarm and identity calls. Humans, for instance, usually shout first to warn others or ask for help if it is at all likely others will hear, rather than lean on sight or scent. Visual signals—say, white flags, or rescue flares—are almost always used only when a loud cry is either impossible or has already failed. Perhaps because sound can be modulated so rapidly in so many ways—frequency, amplitude—it is a busy channel for animal communication between individuals.[16] Sound is the sense of two great human achievements of human communication: music and language.

And yet, for most humans, since the advent of writing and especially of print technology, our visual bias has even shaped the realm of language.

In the poet Anne Carson's *Eros the Bittersweet*, she discusses one difference between voice and writing (the latter a visual technology):

> That words have edges is an insight most vivid, then, for the reader or writer of them. Heard words may have no edges, or varying edges; oral traditions may have no concept of "word" as a fixed and bounded vocable, or may employ a flexible concept. Homer's word for "word" (*epos*) includes the meanings "speech," "tale," "song," "line of verse" or "epic poetry as a whole." All are breathable. The edges are irrelevant.[17]

And, if you think about it, it's true. Listen to someone speak: a sentence is a single sound, just as a whale song is a single breath. In our brain, the discrete units of speech and language may exist, but in transition, as sense data, they are far more continuous.

It is interesting to me, then, that we first began to write with what seems to be a great deal of verse, where rhythm, tone, and even music are integral parts of words.

Writing translates our often blurry and unified breath and sound into discrete units and syntax. Writing separates words from the speaker and their context, in its slow evolution from speech through poetry and rhythmic verse and finally into printed prose.

Perhaps because I can write, I think of language—and thus a great deal of communication, with an element of spatial arrangement—as almost always a visual exercise. I am not alone in this. Print is the technology of individualism, Marshall McLuhan writes. "The interiorization of the technology of the phonetic alphabet translates man from the magical world of the ear to the neutral visual world."[18]

If this is true of the translation from speech to writing, what about the transition of an acoustic world into printouts and spectrograms, stripping out context, splitting into discrete parts, and translating into structures grasped in one glance?

What acoustic maritime meanings, greater than the sum of the discrete parts we record, might be lost, or never grasped? What is lost in translation?

Perhaps it is overly simplistic for me to see (the visual metaphors, always!) a parallel in the evolution of our language, our writing, and our science: from speech and unbroken breaths, through discrete words and lines still arranged in verse and song, coalescing finally as movable type and carefully cited papers. From a world where knowledge was touched and smelled and tasted and heard, through the codifications of Bacon's scientific method,[19] from sensed to observed, repeated, and seen: perhaps.

That we cannot hear well in the sea is a fact: that we can use technology to do so presents us with choice. We can transcend ourselves to enter new spaces. But in doing so, a filter is inevitably applied, allowing us to choose what we listen to, when, where, how, and at what volume, to best answer our questions. How wondrous for what we know: but how much do we never know to ask!

On a practical level, it's simply bad science. To enter a world of sound without really listening is to enter something of a void. In the ocean, we need to study what is important and meaningful *for ocean beings*, and that is sound.

I wonder if our inability to meet this way of being on its own terms, in combination with our visual bias and its peculiar lens of the discrete and quantifiable, may be why we are entering the deep sea now in a large part to glean its resources.

15 Thomas Götz and Vincent M. Janik, "Repeated Elicitation of the Acoustic Startle Reflex Leads to Sensitisation in Subsequent Avoidance Behavior and Induces Fear Conditioning," *BMC Neuroscience* 12, no. 30 (2011).

16 Jack W. Bradbury and Sandra L. Vehrencamp, *Principles of Animal Communication* (Sunderland, MA: Sinauer Associates, 2011).

17 Carson 1986 (see note 9), pp. 49–50.

18 Marshall McLuhan, *The Gutenberg Galaxy* (Toronto: University of Toronto Press, 1962), p. 18.

19 Sir Francis Bacon, *Novum Organum*, ed. Joseph Devey (New York: P. F. Collier, 1902).

In the years prior to the Second World War, some of the first serious, long-range attempts were made to study how sound moved through and across the sea. To do so, American scientists threw explosives into the water, creating immensely powerful submerged noise that would spread out, reflect off structures, and echo back, thus illuminating the greatest possible area. When studying the printouts created by the echoes, they saw features that powerful sounds could reveal, features that their human ears would never have discerned: the seafloor, yes, but also large geological structures beneath the seafloor where hard rock reflected the blasts.[20] Just as in later years the technology of ultrasound would reveal the structures of organs beneath our skin,[21] so those explosive noises returned images from many layers of rock: harder, softer. Into the depths beneath the depths, into unreachable time, the sounds traveled and returned with tales: of ancient forests transmuted into oil, of gas pockets and energy-dense deposits. Seismic surveying air guns still fulfill this same purpose, in the offshore oil fields of the Gulf of Mexico, the Bass Strait, and the North Sea.

Yet even as we draw down one resource, we turn our sights to another.

Here we are again.

Polymetallic nodules are rocky lumps that look a bit like shriveled potatoes. These nodules precipitated out of the seawater over the course of millions of years, and they contain rare metals and minerals that are used for the electronics and batteries that undergird our lives. If animals use sound to navigate, find food, mate, and stay together, modern humans use our phones, with their manganese and cobalt. Huge numbers of nodules currently lie scattered across the black and frigid lightless plains of the deep seabed. The most extensively mapped fields are in the Pacific Ocean.

Extracting them would be done by specialized vehicles that scrape along the seabed, and vacuum the nodules up to the surface, digging up the metals along with whatever else is in their path.[22]

Global bodies like the United Nations' International Seabed Authority, the governments of small Pacific island states, and international mining companies are currently discussing how to extract the metals, and bring them to the surface, to power the phones and cars of tomorrow. This involves a complex web of rights, treaties, and technological hurdles, all overshadowed by the fact that we know less about the environment of the deep sea than almost any other environment on the planet. We are planning to mine the seabed before we know how it works.[23]

And I do wonder if we find this trespass, this study, and this extraction so easy because we cannot experience the deep sea as it is, in all its sensory modalities—especially sound and hearing. And so we bridge that gap by default with technology that puts everything into the quantifiable visual, into spectrograms and sonar scans and bathymetric maps, at one stroke showing us a world that we can only look at and never be in.

It is certainly, to put it crudely, not our fault that we can't swim the deep sea or hear as one of its denizens does. But we know, now, that we need to listen here. We have lost the excuse of ignorance. We know there is sound in the deep sea, because we have measured it. Not a lot, but a little. We've recorded ship noise at the bottom of the world's deepest ocean trenches.[24] We've made the first long-term recordings of seamounts and deep-sea soundscapes.[25]

Over the past several decades, we've listened to coral reefs, and we've studied the tiny animals that live there, from larval fish to coral polyps. These tiny soft creatures, many of whom lack an ear or a central nervous system, nonetheless perceive sound. They perceive the sound of healthy reefs, and they use this sound to orient and navigate to a safe home on said reefs.[26]

Why would the same phenomenon not be playing out in the deep ocean, where light is utterly absent, but where mountainous islands of heat and nutrients and life arise here and there, a hydrothermal vent or a tumbled whale carcass? Why would animals not use their most powerful sensory channel in the deep—and why would we not at least listen, to find out if they do?[27] We know, now, that when we drag and rip and dig and drill and build without studying beforehand, we wreck things we do not understand.[28] We know, now, that the ocean is a world of sound, and we know, even, how animals tend to use it, and how we might try to listen. We know that by being so very acoustic,

20 J. B. Hersey and Maurice Ewing, "Seismic Reflections from Beneath the Ocean Floor," *Eos, Transactions American Geophysical Union* 30, no. 1 (1949), pp. 5–14.

21 Sarah Catchpoole, "Ultrasound Frequencies," *Radiopaedia*, April 20, 2023, revised on June 13, 2024, https://radiopaedia.org/articles/ultrasound-frequencies/.

22 Daisy Chung, Ernest Scheyder, and Clare Trainor, "The Promise and Risks of Deep-Sea Mining," *Reuters*, November 15, 2023, https://www.reuters.com/graphics/MINING-DEEPSEA/CLIMATE/zjpqezqzlpx/.

23 Ibid.

24 Bill Chappell, "Deep-Sea Audio Recordings Reveal a Noisy Mariana Trench, Surprising Scientists," *NPR*, March 4, 2016, https://www.npr.org/sections/thetwo-way/2016/03/04/469213580/unique-audio-recordings-find-a-noisy-mariana-trench-and-surprise-scientists.

25 Chong Chen et al., "Baseline Soundscapes of Deep-Sea Habitats Reveal Heterogeneity among Ecosystems and Sensitivity to Anthropogenic Impacts," *Limnology and Oceanography* 66, no. 10 (2021).

26 Stephen D. Simpson et al., "Homeward Sound," *Science* 308, no. 5719 (April 2005), p. 221; Mark J. A. Vermeij et al., "Coral Larvae Move Toward Reef Sounds," *PLOS One* 5, no. 5 (2010).

27 Sabrina Imbler, "Could Listening to the Deep Sea Help Save It?" *The New York Times*, November 10, 2020, https://www.nytimes.com/2020/11/10/science/deep-sea-marine-biology-acoustics.html.

28 Among many I encountered, two such examples stand out to me strongly. One is the occurrence of beaked whale strandings long in advance of our understanding of how naval sonar can interfere with

it is also a profoundly unified and temporal place, at least for a perceiving mind. I hope I have argued above why we should at least try to understand the place as it is. Why would we not?

And this is our dilemma. We must learn to *look* deeper and more thoughtfully, but, even more, we must better our ability to listen. All senses are limited, but all are needed to know a place as a whole, in itself, or as close to it as one can get. And yet, as humans, we cannot survive in the deep sea, nor hear all its tones unaided, and so we must rely on some kind of translation to somehow see, touch, and *be in* the sea in a way that is continuous, experiential, and sensory.

This seems like a dilemma, a paradox. And it often is, through a scientific lens. But I believe a solution becomes possible through art.

I do not pretend to define art, any more than I can define language or culture—these are mutable terms. But art, to me, must connect ideas, has to transmute and transmit something we can know and understand as humans, and reflect it back to us, like an echo from the deepest seabeds, enriched with what we do not know, at least not yet. It must leave the path of the obvious and expected, the deducible. Art thus transcends both the rational and the empirical.

With the exhibition *Midnight Zone*, Julian Charrière does this by investigating the role that *all* our senses play in how that reality is constructed. The show is synesthetic in nature, with video, installation, and sculpture. And here, Charrière interrogates the default visual—data, footage, form—by contrasting it with deeply auditory experiences. Sound guides the visitor throughout, from a lamenting chorus of sea creatures to the very low frequency eruption of black smokers.

Bringing sight down into a realm marked by the near-total absence of light may appear paradoxical, but it seems to me that this is a profoundly honest confrontation of the very paradox that we see playing out in the ocean today, one that humans have wrestled with since they first used tools and technologies to explore rich realms beyond what their bare ears or naked eyes could perceive.

It is humbling to admit that we do not understand, that we cannot perceive. And yet it is also a gift. Charrière works to explore how by constructing reality; our senses themselves are tools, but more powerful tools than our belief systems have led us to think, if we move beyond the assumption that they are isolated and hierarchical. In the creation of liminal sensory space and new linkages, profound connection becomes possible, and our alienation from this space can be challenged.

So while I will never lie unprotected on the floor of the Pacific Ocean and listen to a whale fall, with art and mindful technology some of that chasm can be breached. By changing or reversing the flow of information from the acoustic to the visual; by using space and touch to shatter the silos of my senses; and most of all by leaping beyond the *provable* and playing in the space beyond.

If we are visual creatures with further visually biased technology, crashing (splashing?) into an acoustic world, we have some decisions to make.

It would be simple to ignore what doesn't present itself obviously to our senses, and repeat history, though we would lose so much. Context, data, baselines, good science, wonder, truth. The chance to better know our world.

Why, if we are not ignorant this time? We know, as we dive, and scrape, and broker, that there are more things in this deep world than are dreamed of in our terrestrial philosophy. We know the almost certain likelihood of consequences and losses which by definition we cannot foresee. We know what it is like when we commodify and ignore what we cannot sense.

Is it that, in the end, backed into it, we can only admit that, in the end, we do not care what we wreck? That we do not care about the consequences to what we do not know?

Perhaps. But in considering all of this—sight, sound, language, and knowledge—I begin to feel that it may instead be that we care too much. For if we listen instead of reading—if, to torture a metaphor, the ocean speaks to us in *an almost endless variety of sound* instead of writes from over the impersonal photocopy of a spectrogram—what then?

Why would we want to know more, when to know invites knowledge, relationship, communication, obligation? Does it not feel like we already have too many of these? And why would we want to know more of *sound*—when it is through this channel that we *communicate*?

their navigation and hearing. This is summarized in M. P. Simmonds and L. F. Lopez-Jurado, "Whales and the Military," *Nature* 351, no. 448 (1991); and it is discussed in Joshua Horowitz's excellent *War of the Whales: A True Story* (New York: Simon & Schuster, 2014). A second example is recent work by Australian scientists and their colleagues revealing damage to the sensory structures of shellfish and crustaceans by ship noise and seismic surveys, including indicators of long-term and sublethal damage. See Ryan D. Day et al., Final Report, "Assessing the Impact of Marine Seismic Surveys on Southeast Australian Scallop and Lobster Fisheries," ed. Fisheries Research and Development Corporation, University of Tasmania, Hobart, FRDC 2012/008 (2016).

Perhaps we are tired and scared and cannot bear to enter yet another realm where bitter experience tells us we will only learn of burdensome obligations and of evidence that we have already created chaos and probably already broken some beautiful things with our first gleeful steps. How can we bear to go where we will only hear the growl of our shipping lanes at the deepest sulfur vents, only find snatch plastic caught on the waving lures of benthic fish?

We have answered our own question. Can we bear not to know more? Can we continue to divorce ourselves from the world, not only in space, but in our senses and our understanding? If we have ever bemoaned isolation, or separation from nature, or the loss of connection and community, we know how we must be. The burden we feel comes not from the existence of a greeting, but from the guilt of our silence in return.

And if we will enter the deep—and we will, we have—we will know that there are precious things here, that we can tread lightly, that it can be done well. Relationships are not intrinsically burdensome. All life is relationships, whether we will it or not; we are born into a web of others, and we are none of us here for ourselves.

Choralography, 2025

Choralography is a spatial experiment that brings to the surface the bioacoustic landscape of coral reefs. Spanning several spaces of the exhibition *Midnight Zone*, it immerses the visitor in layers of oceanic sounds, challenging the persistent misconception of these regions as silent. From the rhythmic clicks of crustaceans to the harmonic calls of fish, the distant songs of whales to the crackling static of microbial life, it reveals an environment where auditory conversation is as vital as light in shaping life.

In *Choralography*, Julian Charrière listens closely to these delicate yet essential systems of communication, opening a channel usually beyond the register of the human senses. The arrangement begins naturalistically, as if the listeners were just dipping below the surface of a shallow sea. Yet, as it progresses, the score becomes increasingly distorted, adapting marine communiqués to the physiognomy of the human body. As the walls darken and deepen in color, an intensifying sonic uncanniness reveals the temporal dissonance between sound in water and in air, traveling 4.3 times faster in the former. As the visitor moves through the spaces, the soundscape itself undergoes a subtle but unsettling shift—evolving from a vibrant biophonic concerto into a sparser, more brittle acoustic environment, where anthropophony, the pervasive sonic footprint of human activity, slowly drowns out the natural voices of the reef.

This gradual erosion of the acoustic commons mirrors the realities faced by marine ecosystems worldwide, where human presence increasingly manifests not only through extraction and pollution, but through disruptive noise. It is a dichotomy where the life of the reefs is silenced, all while our anthropogenic presence grows louder. Yet reflected in *Choralography* is also the regenerative power of sound. This can be seen in a scientifically developed process known as acoustic enrichment, where underwater sound systems emit the songs of healthy reefs in areas that have become damaged or abandoned. This playback becomes part of a feedback loop that promotes increased biodiversity—sonic beacons for sealife to return, resettle, and regrow what once seemed irrevocably lost.

Flowing between these paradises and dystopias, the work sets the tone for the exhibition, oscillating between the poetics and politics of the sea. An intangible yet deeply physical installation, it stages a dialogue between presence and absence, past and future, inviting land dwellers to think through water—and meet the deep sea halfway.

The Gods Must Be Crazy, 2019

With *The Gods Must Be Crazy*, Charrière leads the viewer down toward the mysterious grounds of the deep sea, likely to be the most remote and least explored environment of our planet; a region mediated to us largely through the gathering and evaluation of scientific images. In the installation, forty-nine screens display a collection of found underwater footage. Each individual clip acts as a contemporary vanitas; yet together they appear as speculative windows into a post-human future, a destiny where all that remains of our civilizations is floating detritus. Some prospective dystopia—or utopia—where artificial intelligence scans the seafloor in search of remnants of human presence; the totems of our hubris, drowned in the abyss.

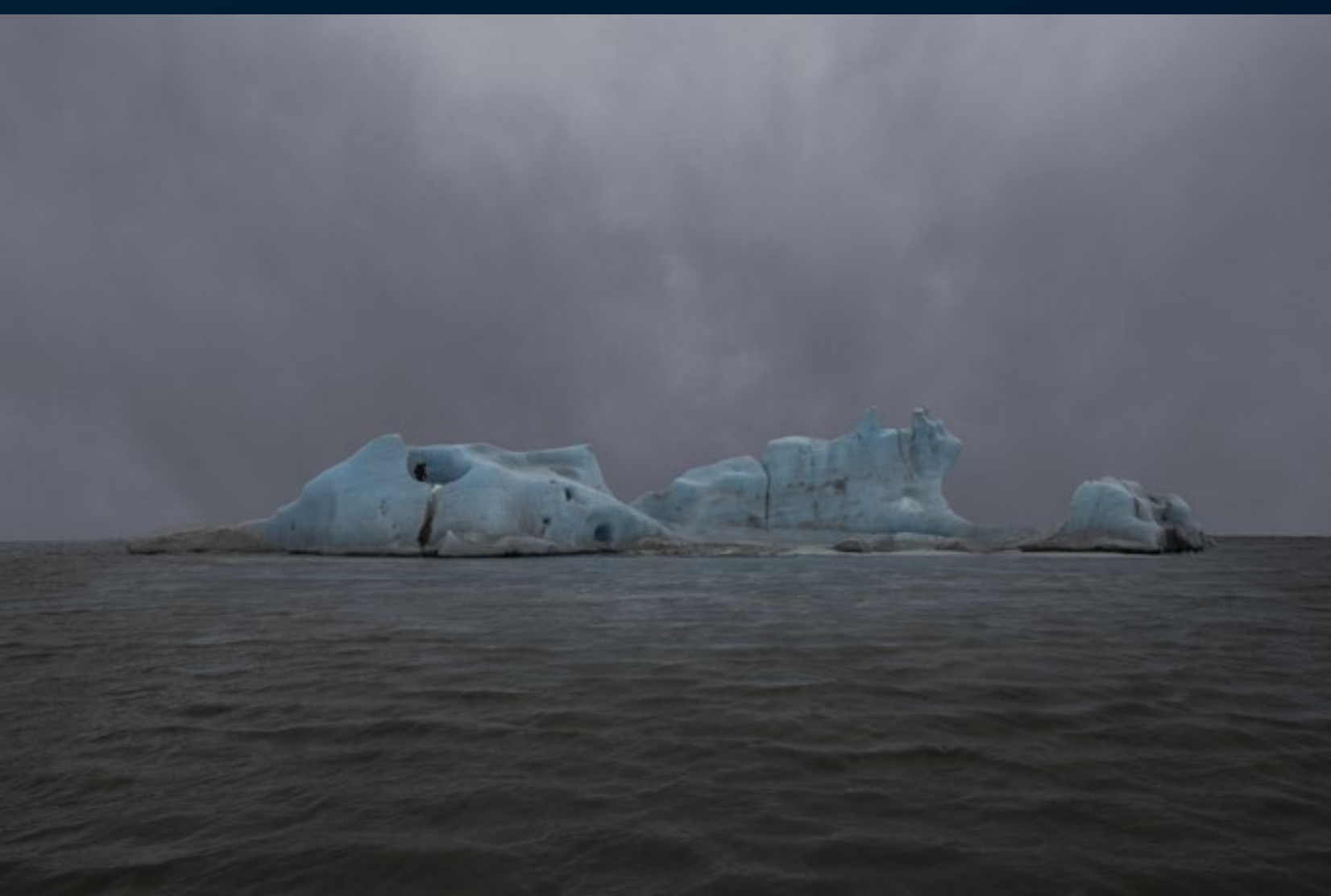
In reality, the artist carefully selected each sequence from hours of scientific footage, searching for the subtle appearance of human traces and apparitions at the bottom of the sea—relics of civilization, now slowly being repossessed by deep-sea dwellers. These fleeting visions reveal a submerged archaeology where culture and nature intermingle, where ruins turn into habitats, and objects once destined for the surface world reappear as spectral monuments of modernity.

Charrière's evaluation and enactment of this found footage brings to light how our endeavors of scientific exploration into seemingly uncharted territory are already preempted by the influence of our modern society. On these scientific journeys into the unknown, we encounter the traces of our culture manifesting in the dislocation of everyday objects which—sometimes as desolate ruins, sometimes inhabited by sea dwellers—turn into unintended monuments of modernity.

The Blue Fossil Entropic Stories, 2013

The Blue Fossil Entropic Stories is the photographic trace of an expedition the artist undertook in 2013, traveling to Iceland to climb an iceberg in the Arctic Ocean and melt the frozen water beneath his feet with a gas torch for eight hours. Like an absurd, quixotic hero, Julian Charrière confronts the elements in a seemingly hopeless battle—human time against geological time. And yet, it is a battle of which global warming is only the starting point. The act of ignition, here starkly isolated by one human upon one floating iceberg, speaks to the cumulative consequences of our individual actions, as well as inactions, in relation to global warming.

Our attention is drawn to the impacts of combustion, and to how the repercussions of our uncontrolled burns often play out in places which, though no less vital for planetary climatic stability, exist far beyond our daily purvey. With the intervention, Charrière reminds us that in the places our home world is not covered by plants, or oceans, it is covered by ice. And that it is here, in the glacial domain, that those impacts are registered most acutely. Visually, the three photographs documenting the action act as a kind of mirror to Caspar David Friedrich's iconic *Wanderer above the Sea of Fog* (ca. 1817), whereby, through reintegrating the human into landscape, Charrière questions the problematic relation to nature as inherited from the past.



Pure Waste, 2021

The video work *Pure Waste*, produced during a scientific expedition to a polar ice cap, documents a material reversal that inverts conventional mining. Set in North Greenland, it begins with atmospheric shots of the Arctic's serene desolation—until a human hand enters, revealing five diamonds, which are then tossed into a glacier mill.

With this intervention, Charrière aimed to repeal the anthropogenic acquisition of large masses of natural resources from the underground by extracting carbon dioxide molecules from the air itself. In an alchemical reversal of matter, these carbon molecules were then turned into diamonds. The process for achieving this was developed by a team of scientists from the Swiss Federal Institute of Technology (ETH Zurich), led by the mechanical and process engineering professor Aldo Steinfeld.

The collected carbon dioxide was then increased by including the CO_2-rich exhalations gathered from people from across the world using balloons, made particularly poignant by the politicization of breath during the Covid-19 pandemic.

The video heightens air's intangibility by transforming it into diamond, the hardest naturally occurring material. In this dizzying material shift, the weightless becomes solid. By returning these diamonds to the glacier mill, *Pure Waste* actively engages with the polar cap, offering the minerals back in atonement. The glaciers, distant yet deeply affected by human activity, become oracles of the twenty-first century—creaking, melting, and demanding our attention. Yet this act of "pure waste" becomes one of reconciliation. By casting away objects of ultimate value, Charrière challenges their arbitrary worth, returning them to the Earth. It is a symbolic hope that, one day, we might close the destructive cycles we so recklessly opened.

Water

Peter H. Gleick

Water is a simple molecule made up of two small hydrogen atoms and one oxygen atom. Simple, yet it lies at the heart of everything that makes us humans—the fundamental resource without which life as we know it wouldn't exist.

As if the miracle of creation that scientists call the Big Bang wasn't miracle enough, science now believes that water came into existence as soon as there were hydrogen and oxygen atoms, mere millions of years after the Big Bang. Now we're casting our eyes and instruments out into space and back in time and learning that all the forms of water can be found throughout the universe. It is ubiquitous, pervasive, in stars, on planets, asteroids, and comets, and even in the voids of interstellar space.

We see forms of water on every kind of celestial object in our own solar system, even hidden away in deep craters on blistering Mercury and our own moon (fig. 1). We see it in the frozen oceans and clouds of Uranus and Neptune. We see it in the atmospheres of Venus, Jupiter, Saturn, and many moons. And we see it in the ice caps, soils, and thin atmosphere of Mars. Many of the current and planned space missions are designed to explore these watery worlds more closely, searching for signs that we're not the only forms of life in the universe.

Our own planetary home has abundant water in its three major forms: ice, liquid, and vapor. Life originated in water, in the vast seas of the planet. If humans hadn't evolved into land-dwelling creatures but still lived in the seas, our planet would be called Ocean, not Earth, as the author Arthur C. Clarke once noted.[1] Our water came with the formation of the planet, or shortly thereafter, and it has played a central role in the success of our own species—as we evolved in our ancestral home in Africa and spread out across the planet, taking advantage of our flexibility to survive and adapt to extremes of weather and climate, and our ability to learn how to manipulate and manage the hydrologic cycle. Those abilities allowed Homo sapiens to outcompete other hominin species and become the dominant form of life on Earth.

Water is more than a simple molecule. It drives the beating heart of Earth: powering the atmosphere; nurturing the land; supporting life. The hydrologic cycle is a virtuous cycle, moving forms of water from one place at one time, to other places and other

1 Apollo 8 Mission, Earth over the horizon of the moon, December 24, 1968

1 Referenced in the opening paragraph to Chapter 6, "The Sea," in James Lovelock, *Gaia: A New Look at Life on Earth* (1979; repr., Oxford: Oxford University Press, 2000), p. 78.

times. The water molecules circulating in our own blood are the same water molecules that circulated in the forms and generations of life that preceded ours.

Water evaporates in a constant flow from land and water surfaces into the atmosphere. It circulates around the planet in clouds, storms, and water vapor, condenses into rain and snow, and precipitates back to oceans and the land, where it then flows by gravity down from the mountains into rushing streams and rivers to be stored in groundwater or back to the oceans, where the cycle loops again. There are also vast stocks of water, sometimes quite ancient water, trapped in the interstices of soil and rock, in vast aquifers, or locked up in ancient glaciers and ice caps. There is even evidence of massive amounts of primordial water from Earth's formation deep in the crust and core of the planet.

These stocks and flows of water are fundamental to the functioning and health of natural ecosystems and all species, including our own. They nurture nature. They support the growing of the food required for more than 8 billion humans. They are critical for the manufacture of all the goods and services on which we depend. They absorb the wastes that we discharge with little thought. And today, as the twenty-first century unfolds, they are critically endangered due to our use and abuse of the environment.

Water, or the lack of it, defines the ecosystems of the planet. Even the language we use to describe our environments revolves around water: wetlands, deserts, marshes, rainforests, icecaps, watersheds, lentic (freshwater systems), littoral (coastal waters), lotic (moving waters), oceanic. Aboriginal cultures and religions all have origin stories that revolve around water, including gods of water, symbols and rituals centered around water, and epic stories of floods and droughts. Our ancestors learned how to manipulate water for their benefit, inventing artificial irrigation in order to grow food for expanding populations, building canals and qanats and aqueducts to move water long distances, and constructing rudimentary dams to store water in wet periods for use in dry ones.

As science and technology improved over the past 500 years, we learned not only how to manipulate the hydrologic cycle to our advantage, but also how to take more and more water from natural systems to satisfy the growing demands of expanding populations and economies. When populations on the planet were relatively small, these demands were manageable, though in particularly water-short regions or during periods of extreme drought, history tells us that some early societies suffered or even perished from unsolvable water problems. A lack of rainfall is thought to have contributed to social upheaval, failed harvests, and the fall of the Tang, Yuan, and Ming dynasties in China. Archaeologists believe that the Pueblo people of the American Southwest abandoned the community of Mesa Verde around 1300 AD because of a long, severe drought. Water shortages and droughts, on top of existing social problems, warfare, and failing institutions, may have contributed to the collapse of Mayan cities around 900 AD.[2]

In order to support our own growing demands for water over the past few centuries, we have developed and deployed a vast array of technological, engineering, economic, and institutional systems. With pioneers like John Snow in London in the mid-1850s having uncovered the nature of water, water-related diseases, and pollution,[3] we built on lessons from previous generations and earlier mistakes to identify threats like cholera, dysentery, and parasitic diseases and to treat sources of water to provide water that is safe to drink and use. As our knowledge of chemistry advanced, we learned how to build large-scale water-treatment plants to meet the demands of growing cities—facilities that meet water needs but also treat the water pollution that modern civilization creates.

2 The reservoir of La Viñuela in Málaga, Spain, with a low water level due to the lack of rainfall, 2017

We improved on the early efforts of the Greeks and Romans to move water large distances, and we now rely on aqueducts and pipelines that distribute water over great areas. Dams of enormous size protect us from damaging weather and generate vast amounts of electricity by tapping into the power of falling water. We grow food for billions of people with increasingly sophisticated agricultural systems that take advantage of water from rain, rivers, and groundwater, often pulling water from hundreds of meters below ground. And a vast array of institutions tackle water issues: from irrigation districts, water utilities, and resource managers to engineering and construction firms and regulatory agencies at local, state, national, and international levels.

These advances have brought great benefits to many, though they are not evenly distributed around

2 Richardson B. Gill, Paul A. Mayewski, Johan Nyberg, Gerald H. Haug, and Larry C. Peterson, "Drought and the Maya Collapse," *Ancient Mesoamerica* 18, no. 2 (2007), pp. 283–302.

3 Peter Gleick, *The Three Ages of Water: Prehistoric Past, Imperiled Present, and a Hope for the Future* (New York: PublicAffairs, 2023).

the world. And they have also brought unexpected, adverse consequences. Pervasive water pollution from industrial and human wastes is still contaminating rivers, lakes, and oceans. Inefficient and unsustainable use of water in agriculture is draining our reserves of groundwater, threatening future production. Overuse of water is damaging natural ecosystems and driving many aquatic species to the point of extinction or beyond. Human-caused climate change is altering the frequency and intensity of extreme events like floods and droughts (fig. 2). And water poverty—the failure to meet basic needs for safe water and sanitation for all—is widespread, with billions of people still lacking access to this basic human right.

Perhaps the most discouraging water problem is this issue of water poverty. Despite having sophisticated technologies and sufficient money to provide safe water services to all, the United Nations estimates that more than 3 billion people lack adequate sanitation services and around 2 billion lack safe and affordable drinking water free of contamination. The United Nations declared a formal human right to water in 2010,[4] but despite this declaration, these rights are still not met for vast populations. This failure leads to much of the misery brought on by poverty: illness, unemployment, underemployment, lack of education (especially of women and girls), social and political unrest, and economic stagnation. I've visited the Kibera slums in Kenya, Palestinian communities in the West Bank and Gaza, and townships in South Africa, all places where water poverty is severe. These problems are not the result of a lack of money or a need to invent some new technology; rather, they arise from social and institutional failures to commit the resources needed to eliminate water poverty permanently.

Human use of freshwater is also a major contributor to the wide range of ecological problems facing society. Overextraction of water from rivers and lakes deprives aquatic ecosystems of the water they need to survive. Damming of rivers destroys fisheries and traps vital nutrients and sediments that used to nourish coastal wetlands and the oceans. Water pollution like untreated human and industrial wastes, pesticides and herbicides, urban garbage, and plastics pour into the world's waters, killing aquatic organisms. Overall, the most endangered ecosystems and species around the world are aquatic systems. Freshwater ecosystems make up less than 1 percent of land surfaces but are astoundingly productive, supporting hundreds of thousands of species of fish, insects, plants, animals, and mollusks. But the World Wildlife Fund's Living Planet Index,[5] a measure of the health and condition of freshwater ecosystems, has declined by 83 percent since 1970, and freshwater fish have the highest extinction rates among vertebrates. More than a third of all wetlands (fig. 3) have been destroyed over the past half century, and some rivers are now running dry due to human withdrawals of water.

We have also seen a major increase in water-related violence in recent years. The Water Conflict Chronology, a database of historical and current water conflicts maintained by the Pacific Institute,[6] has seen a marked increase in the number of events in the past two decades, where water is a trigger, target, or weapon of conflict. Violence has spiked in the Middle East, North Africa, Ukraine, and South Asia as water has become scarcer, as disputes over land and water rights have escalated, and as nations continue to fight over water that crosses political borders. We've also seen a marked increase in attacks on civilian water infrastructure in wars raging around the world, in direct violation of international humanitarian law.

All of our current water problems are now being made worse by human-caused climate change. As we have continued to pour climate-altering gases like carbon dioxide, methane, and nitrous oxides into the atmosphere, the climate has begun to shift in complex ways, and those changes are accelerating. Many of the most severe impacts of climate change are impacts on the hydrologic cycle and freshwater resources. Rising temperatures mean more energy to strengthen storms and more evaporation of water into the atmosphere, increasing water scarcity in some regions. Precipitation events are becoming more intense in many regions, and severe droughts are deepening and lengthening. Rising sea levels are contaminating coastal freshwater aquifers and threatening coastal marshes. Hurricanes are getting stronger and leading to more extreme rain events, causing flooding, killing people, and damaging infrastructure. There is a saying in the climate community that if climate change is a shark, water resources are the teeth, because that's where the damage will come from, and those damages are already accelerating.

Fast and dramatic changes are required in how we manage and use our water resources if we are to have any hope of solving these problems and moving to a more sustainable future. I believe such changes are possible. I believe we are in a transition today—a shift from our current crises and challenges to a more positive future. There are many solutions to our water problems, being developed and deployed here and there, in small, single efforts, or in the growing movements of communities, innovators, and industries. What is needed is larger-scale, more rapid efforts to identify successful solutions and expand the scale and scope of their applications. We must look to those regions where water problems are the worst, because those communities have begun to change, to adapt, to alter their behaviors and technologies and institutions. We must relearn how to live within the constraints of nature, to become more aware of our connections to the water cycle, and to draw on the lessons of early societies that

4 United Nations, "Human Rights to Water and Sanitation," https://www.unwater.org/water-facts/human-rights-water-and-sanitation [all URLs accessed in February 2025].

5 World Wildlife Fund, "Living Plant Index for Migratory Freshwater Fishes," updated in 2024, https://www.worldwildlife.org/publications/2024-living-planet-index-update-for-migratory-freshwater-fishes.

6 Pacific Institute, "Water Conflict Chronology," https://pacinst.org/water-conflict-chronology/.

understood those constraints and overcame them. It is always difficult to see changes happen slowly and incrementally, but over time, such changes become visible, like the slow movement of the stars across the sky, or the outward growth of a tree, ring by ring, season by season.

We know how to provide safe water and sanitation to everyone—no new technologies need to be invented. What is needed is to provide information, financing, and technical support for infrastructure investment in rapidly growing cities, and smaller-scale support for rural and small communities. The current aim of the United Nations' Sustainable Development Goals is to provide safe water and sanitation to everyone by 2030,[7] and while it now seems unlikely that this objective will be achieved, far more could be done to accelerate progress.

The ecological failures of the twentieth century are slowly being addressed by restoring water to aquatic ecosystems, taking down damaging dams that kill rivers and fisheries, reducing water pollution that contaminates our waterways and water supplies, and protecting endangered species and systems. In the United States, more than 1,000 old dams have already been removed, and major new dam-removal projects—such as the recent removal of four major dams on the Klamath River shared by Oregon and California[8]—are proving that rivers and fisheries can be restored. Within a few months of the last dam being removed, salmon have already been found spawning upstream of the work sites.

3 Wetlands in a Canadian landscape

Calls are growing for more attention to strategies to cut violence over water, by resolving disagreement over water rights, pushing for diplomatic solutions to transboundary water disputes, enforcing international laws that protect civilian water systems from war, and building resilience to extreme floods and droughts that disrupt economies and destroy lives and livelihoods.

As climate changes worsen, it is vital to both reduce emissions of climate-disrupting gases and to strengthen defenses against extreme weather events, especially droughts and floods. We must stop burning carbon as quickly as possible, while expanding the ability to provide the new sources of energy that poorer communities need. Many of the strategies to do these things make sense for other reasons as well, and the economic costs of reducing the threat of changes in climate are far lower than the economic costs of failing to do so.

I call the comprehensive strategies for improving our water situation "the soft path for water." This path differs from the old approaches used to manage our water needs, which focused on building hard, capital-intensive, centralized infrastructure, like dams, large water treatment plants, and narrow, rigid institutions.

A key element of the soft path is to refocus from assuming more and more water supply is always needed to the concept of improving the efficiency of water use. Evidence clearly shows that improving the efficiency of water use and rethinking water demand is far cheaper and faster than trying to always find a new source of supply to tap, at the expense of our environment. And massive improvements in water-use efficiency are possible, in all sectors. We're starting to grow more food with improved irrigation systems, remote sensing and monitoring, and careful water application. Our industrial sectors are producing more goods and services with less water than several decades ago. And our homes can be built with more efficient appliances, smart applications that can rapidly detect leaks, and, in arid regions, efforts to replace water-consumptive landscaping with low-water-using gardens. In the United States and many European countries, the amount of water required per person, or per unit of economic activity, is starting to decline rather than grow—clear evidence of improving water-use productivity.

The soft path also identifies new sources of water that do not require taking more "new" water from the environment. In particular, efforts are rapidly expanding to improve advanced wastewater treatment and to reuse water directly. Regions like Singapore, Israel, and California are increasingly using high-quality treatment to boost water reuse. Indeed, the technology exists to produce ultrapure water from the most contaminated sources and to reuse that water over and over. And in places where water use is already efficient and carefully reused, it is possible to desalinate brackish or ocean water. Desalination is expensive compared to most alternatives, but in some cases it is valuable for boosting water supplies and availability.

Another characteristic of the old, hard path for water was the development of narrow institutions for managing water, often in the form of large utilities,

7 United Nations, Sustainable Development Goals, "Goal 6: Ensure access to water and sanitation for all," https://www.un.org/sustainabledevelopment/water-and-sanitation/.

8 Governor Gavin Newsom, "News: Klamath River dams fully removed ahead of schedule," October 2, 2024, https://www.gov.ca.gov/2024/10/02/klamath-river-dams-fully-removed-ahead-of-schedule/.

irrigation districts, or government ministries. But because water is critical for food and energy production, industrial development, ecosystem health, and many other social needs, our water institutions must be interdisciplinary, flexible, and fast-moving, not slow and inefficient. New institutions, or improvements in existing institutions, are needed in order to facilitate the transition to the soft path for water. A key example of this is the strong connection between energy and water. Water is required for the production of energy, and energy is required for the collection, treatment, distribution, and use of water. Yet energy and water are typically managed separately and in isolation, missing the opportunity to find integrated solutions that can serve the needs of both resources, reducing energy demands for water systems and cutting the amount of water required to produce energy.

Rethinking economics is another key to improving water management and use. Water is often underpriced. The ecological costs of our water use are rarely quantified and considered in economic decisions about water investments and policy. It is time to end damaging subsidies for bad water choices and to apply the concepts of ecological economics, which consider ecological values, the impacts on future generations, and values not often measured in traditional terms.

We live on a water planet, home to the only known form of life in the universe. That life began in the rich waters of our world, and we still carry the traces of our aquatic origins in the very DNA that defines us. Yet the relationship between water and life is more intimate still. The seas breathed life into the atmosphere, creating the oxygen that sustains us and the ozone shield that protects us from the sun's radiation—conditions that allow water, and us, to persist and thrive.

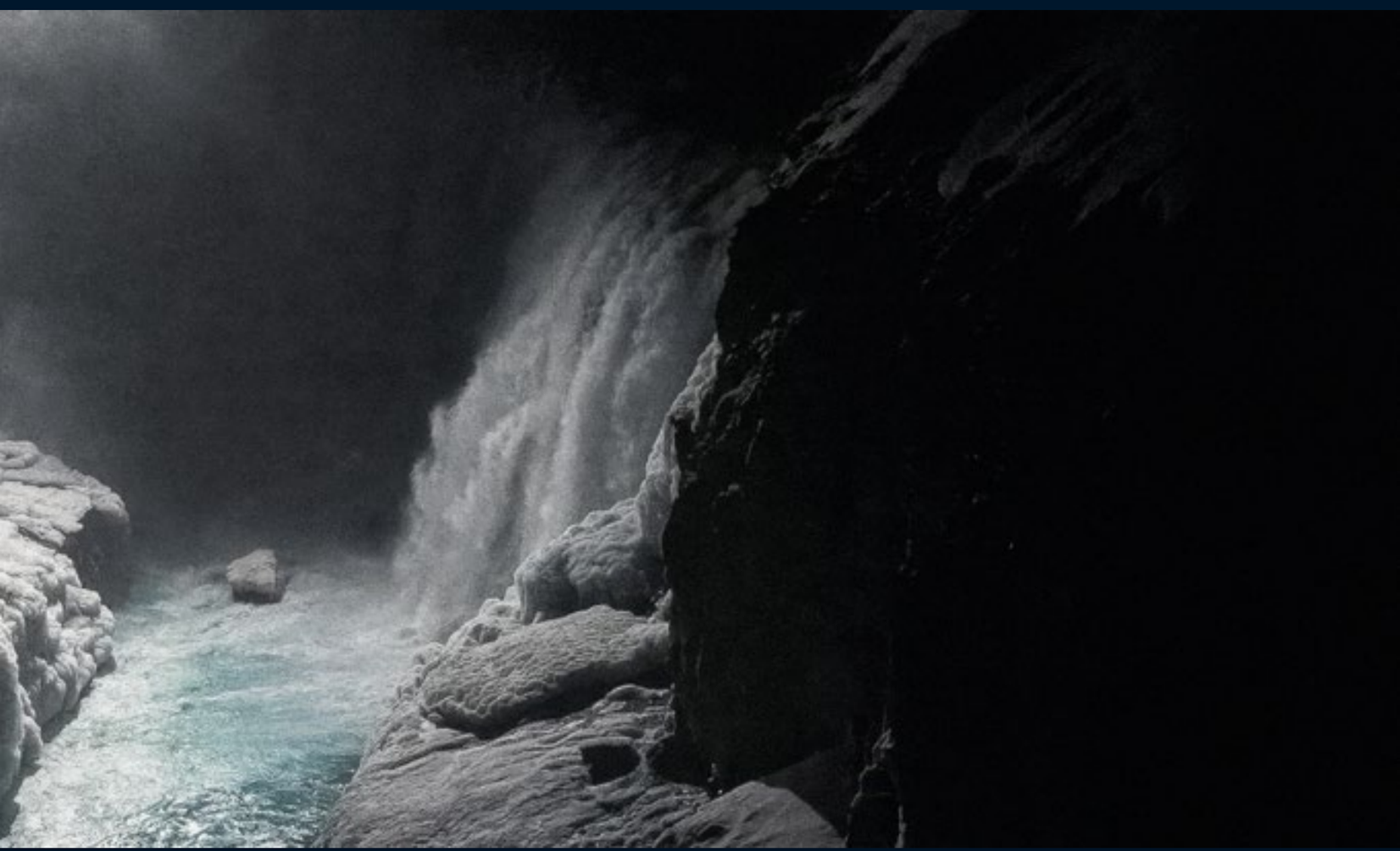
It would be a shame if humanity—having evolved intelligence and spawned great cultures and civilizations to the point of understanding much about the universe and the role of the miracle of water—failed to apply that intelligence to protect this critical resource. It is time for new stories, new narratives, and new thinking about water supply and demand, the design of our communities, economic approaches, and technological innovation. By adding strong commitments and actions on the part of different levels of society, I believe we can accelerate the transition from today's water crises to a more sustainable, equitable, and just world. A positive future is possible, but it requires moving more rapidly along a soft path for water, rather than making incremental changes in the failed policies of the past. The innovative efforts of people around the world show that a new age of water is possible. Let's get there faster.

Towards No Earthly Pole, 2019

Glacial landscapes have never before had such a strong visual presence in popular culture, where they serve as prominent symbols of anthropogenic climate disturbance. Although few people have visited their remote geographies, glacial regions loom large in the collective imagination, as a last stronghold and melting ideal of a fantasized reality. *Towards No Earthly Pole* was conceived in 2017, when Julian Charrière was invited aboard a Russian research ship as part of the first Antarctic Biennale, witnessing the shocking emergence of icebergs at night. Playing with the act of reconstructing landscapes, the film interrogates the processes through which images, like fragments or drifting ice floes, accumulate to form terrains we may never have encountered, but which nonetheless inhabit our memory. Composed of footage gathered across multiple cryospheres—alpine glaciers, the Icelandic ice fields, the Greenland ice cap, and the drifting icebergs of the Arctic Ocean—distant places converge into a single, composite geography.

The resulting topography, neither real nor entirely imaginary, belongs more to the realm of dream than to the cartographic. Distances collapse, borders blur, and the landscapes become projections, sedimented from countless mediated images.

The video footage for the film was recorded with self-developed technological equipment at night. A spotlight carried by a drone reveals the massive landscape in snippets, limiting the range of vision and heightening its drama by the deep shadows the icebergs cast. Eerie sounds of cracking ice and water flowing remind us that this frozen landscape is very much alive, breathing, moving, and constantly evolving. All of these elements combined underline an otherworldly presence and a scenario in which one begins to lose all sense of grounding or scale, highlighting that the Western human's limited experience—and, at times, falsely constructed perception of the polar regions—is both reinforced and challenged.



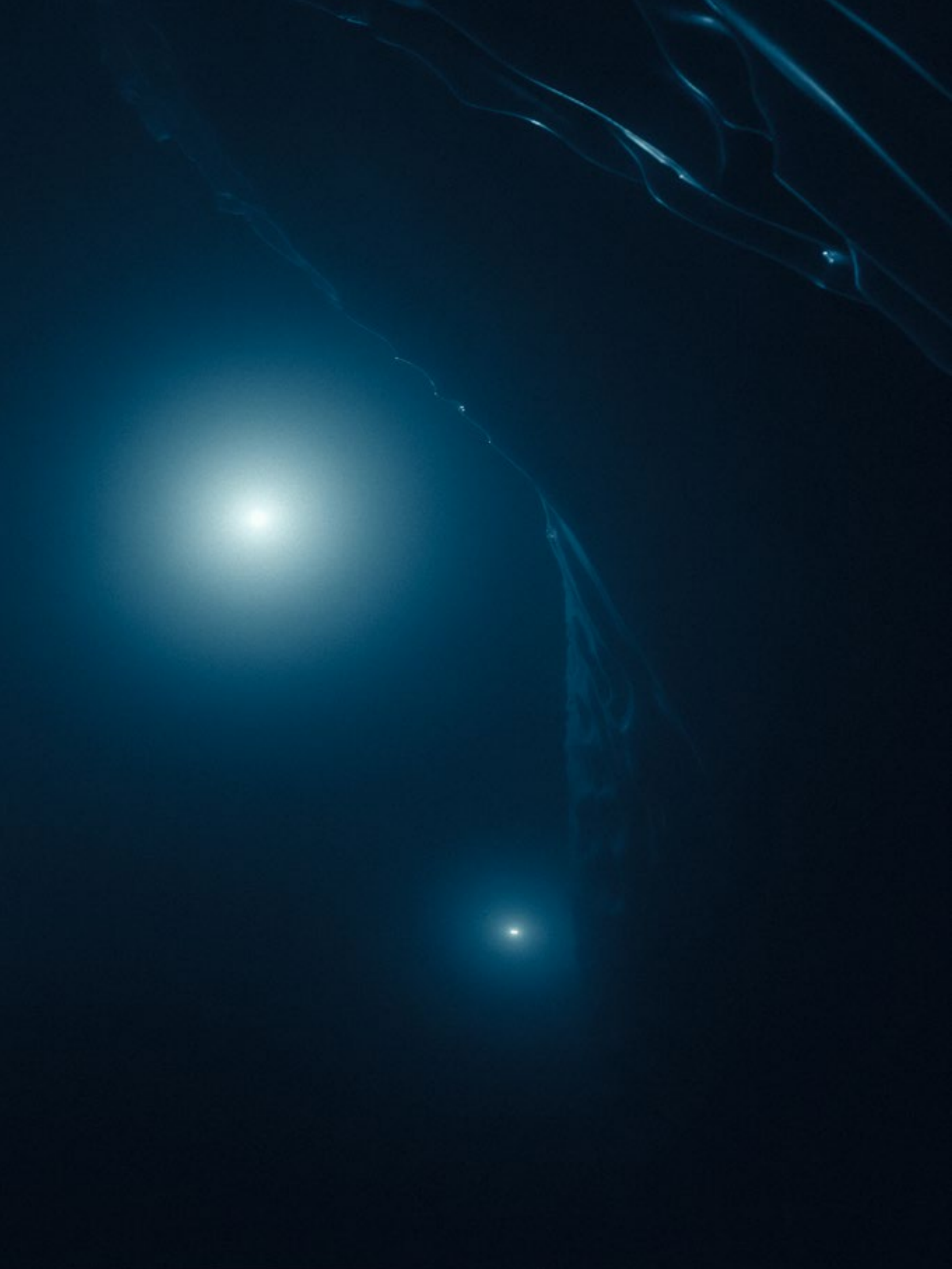
Albedo, 2025

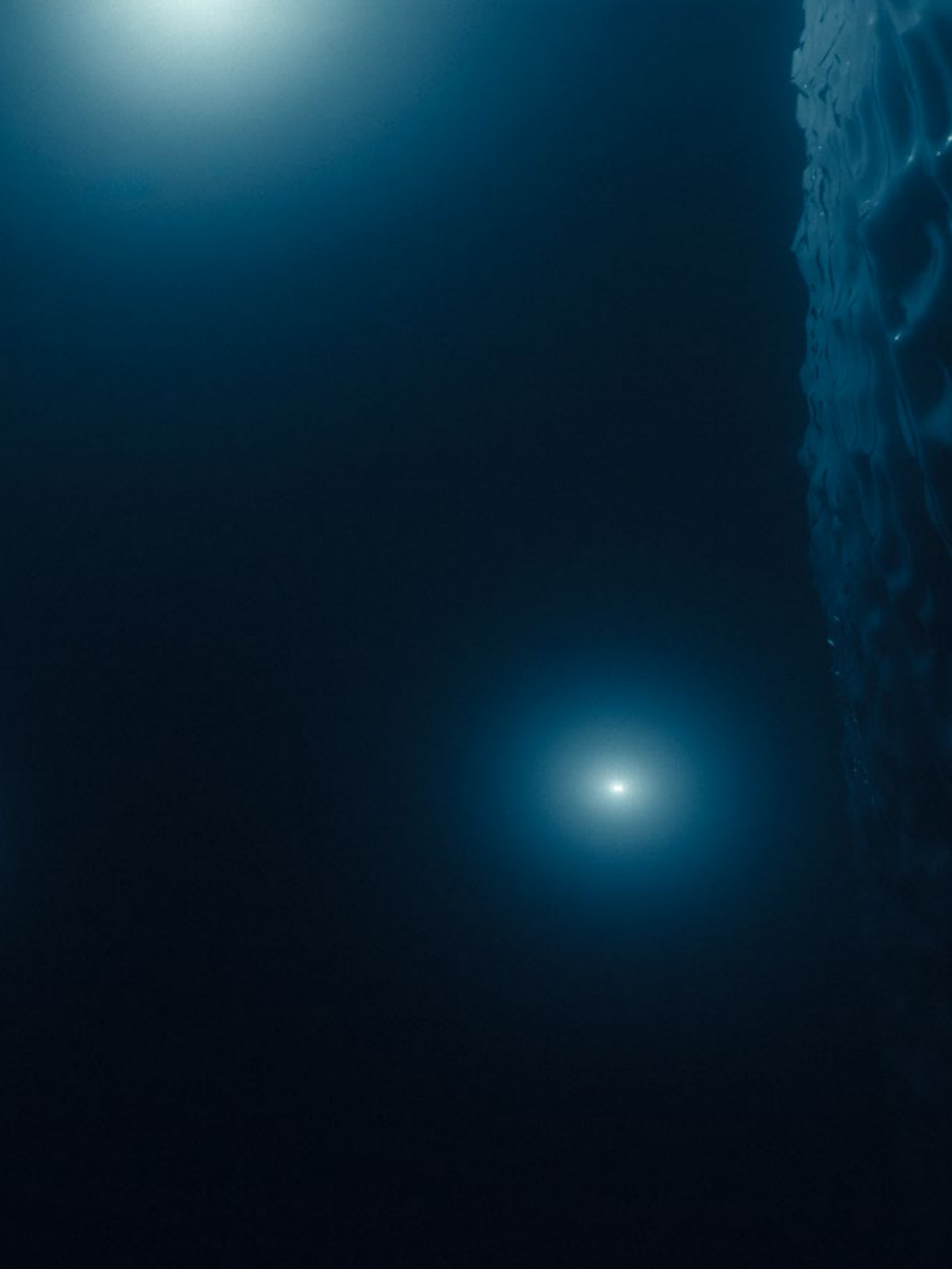
Shot in the icy water of the Arctic Ocean, *Albedo* flips our perspective on the imaginaries that have formed around the deep sea and deep space. The central motif of the video is the world of melting glaciers and icebergs, ontologically complex objects that hold strong socioecological symbolism in our collective consciousness. *Albedo* inverts our view on this submerged realm, which, projected onto the ceiling of the museum, questions our sense of orientation and stability. Here the very notion of landscape is destabilized, rendered towering above a sea of sunken stars. In the video, these frozen mountains act as both subject and structure, their underbellies and melting borders becoming territories unto themselves, like celestial bodies cast adrift in a liquified cosmos.

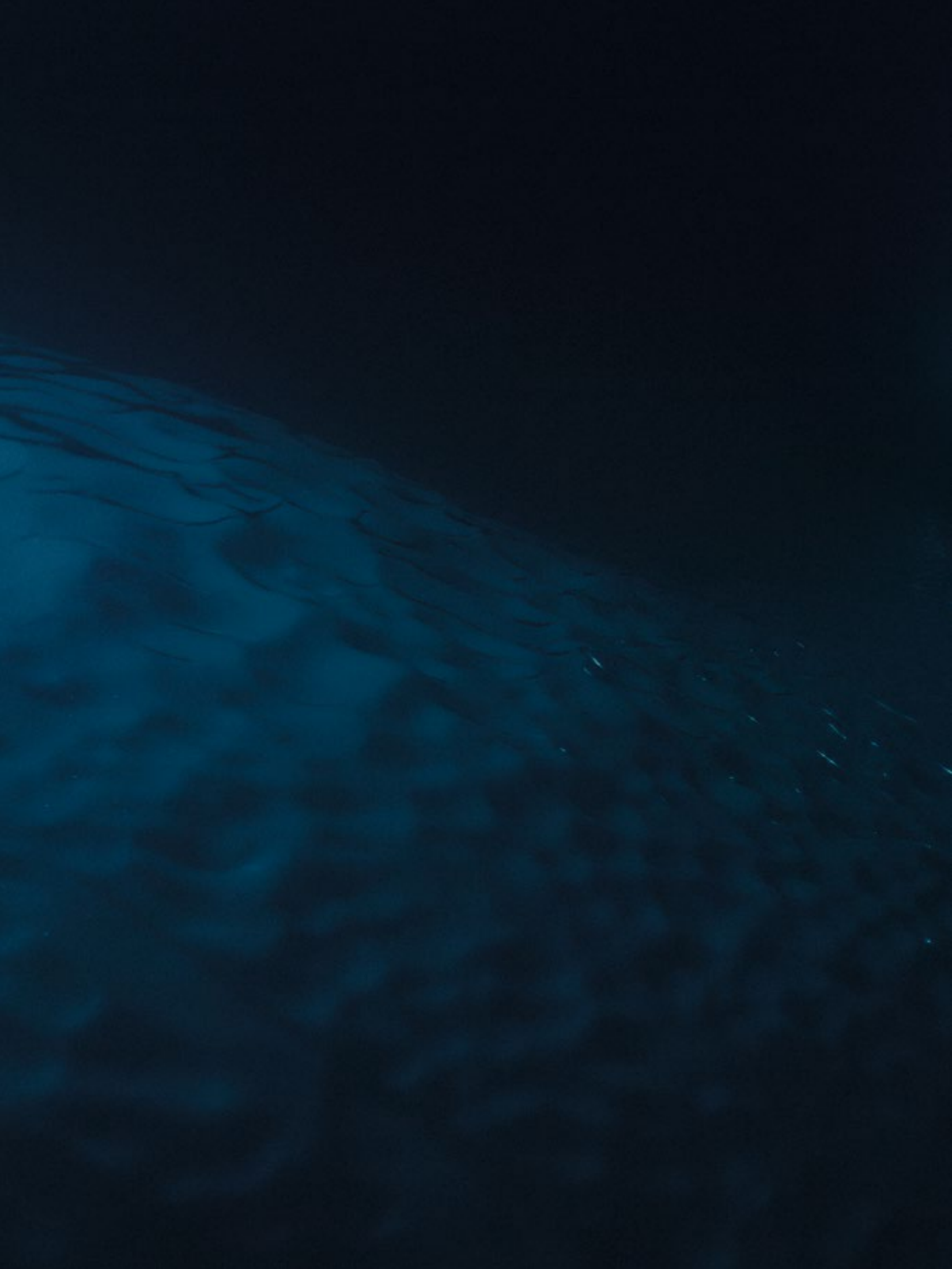
Albedo acts as a diptych together with Julian Charrière's 2019 video work *Towards No Earthly Pole*, which renders an uncanny and eerie blackened vision of the cryospheres at night.

Albedo furthers this project, reaching down into the Arctic Ocean and similarly contrasting the white vistas of dazzling snow and bright daylight. Doing so sheds new light on the trope of climate catastrophe, questioning our orientation and our ancestral patterns of looking and perceiving by casting our eyes both into the iridescent biomes of planetary waters, where many believe life first emerged, and upward, beyond our exosphere, to where nonhuman forms may await.

Foregrounding the importance of listening to both human and nonhuman languages, the score is composed using hydrophone recordings. Structured around a chorus of marine vocalizations, it brings together the calls and echolocation clicks from orcas, sperm whales, bowhead whales, and humpback whales, forming a submerged lexicon of species unseen. A meditation on perception, disorientation, and planetary change, *Albedo* dissolves the boundaries between sea and space, ascent and descent, the known and the unknowable.







Descend

Sara A. Rich

Sometime, when you're flying on a clear night over the sea, look outside the aircraft's window and try to orient yourself. There is no perceptible horizon, only blackness. Sky bleeds into water, ocean into atmosphere. At first glance, lights from outer space seem reflected on the surface of Earth's inner space, but this is an illusion. Rising Sirius, red Mars, and faraway Deneb dance over the lights of ships at sea, creating oceanic starlight.

I wonder if Giizhigookwe saw something like this when she fell to Earth. Of course, back then, they would not have been ships' lights but bioluminescent organisms that drifted over the sea, floating as stars.

Giizhigookwe (or Sky Woman in the Ojibwe language, Anishinaabemowin) is the hero of a creation story common to the Tribal Nations of the Great Lakes of North America.[1] Variations of the story abound and differ between communities and over time, but certain features are shared. In one version, Giizhigookwe was a Manitou living on the Moon in the time before human existence. One day, or one night or dusk or dawn, she fell into one of Moon's holes. Giizhigookwe descended further and further down through a seemingly endless space. Eventually the round, blue form of Earth appeared to her, and as she kept falling toward it, the blueness of Earth's ocean was all she could see. She kept falling, and she watched as Moon behind her pulled at Earth's ebbing and flowing waters. As she neared, the vast blue threatened to swallow her whole. Closer and closer to the water's surface she fell, until she could make out individual waves of water, crashing in circular forms and rhythms, and she knew her end was soon.

1 Donald Chrétien (Nbissing Anishinaabe), *Otter • Ni-gig*, 2010

But then the waterbirds noticed her falling, and with their flapping splashing wings, they flew up to catch her before the waves did. Because Giizhigookwe was accustomed to living on Moon's solid surface, riddled with caverns, craters, and wormholes though it may be, the animals knew they would need to recreate a ground on Earth to welcome the mysterious newcomer. Turtle came up from the depths to the surface, and the waterfowl helped her land on his back. But the animals wanted to do more for their guest, who bore with her so many seeds of possibility. For those seeds to germinate, they would need soil, the very earth that gave Earth her name. The animals looked around and saw only water, but then they remembered what lay beneath the waves. Turtle was stuck at the surface holding Giizhigookwe, whom he could not abandon. So the waterbirds dove down, one by one, but they could not reach the soil at the seafloor. Beaver, Frog, and Snake all tried but failed. Finally, when all hope seemed to be lost, little Muskrat (fig. 1) offered to assist. No one had confidence in Muskrat's deep-diving abilities; nevertheless, he took a long breath and dove into the blue. Muskrat was gone for a very long time, and the animals thought he must have drowned. They began

1 This story is not from my own culture; I am a member of the Waccamaw Indian People, an East Siouan tribe unrelated to the Iroquoian and Algonquian communities who have retained through retelling Sky Woman's story. I have tried to retell it here with respect for those who kept her story alive by passing it along through the generations. For more on its significance, see Vanessa Watts, "Indigenous Place-thought and Agency amongst Humans and Non-humans (First Woman and Sky Woman Go on a European World Tour!)," *Decolonization: Indigeneity, Education & Society* 2, no. 1 (2013), pp. 20–34.

to mourn him. But just then, the surface of the water broke, and there he was. Brave Muskrat's lungs were filled with seawater, but inside his closed fist was the earth they needed to create a home for their new arrival. The animals moved quickly to bring Muskrat to Giizhigookwe, who pulled the water from his lungs until he could breathe air again. Gently, she took the ball of soil from his small fist and spread it over the back of Turtle. As she moved, the seeds of possibility fell from the pockets of her dress, and over time, two human children also fell to Land from the body of Sky Woman, as they were born from her womb.

Like other Manitous, Giizhigookwe personifies possibility, just as her story also opens the way for a wealth of meanings. Embedded in this story is the mysterious productivity of chance and error, the inevitability of occasional failure despite good intentions, the courage to be small in the midst of a sea of uncertainty, diverse communities coming together to work for a common goal, and the acceptance that there is no going back to times before—time's arrow wobbles in space but moves forward nonetheless. Each of these lessons resonates deeply, frighteningly so, with our own time.

The Fresnel lens in Julian Charrière's video work *Midnight Zone* (2024) journeyed through black, horizonless oceanic depths, revealing the magnificence of life undersea. In so doing, the possibilities for a harmonious existence, akin to that intended by Sky Woman and her Earth Mother, are also revealed. The lens, removed from the safety of its lighthouse, is made vulnerable through its submersion. Its outcome is unknowable in this new, yet ancient, environment. As light emanates from the diamond-faceted lens, it exposes curiosity as a primordial sense, reflected in kind by the schools of fish encircling it, as if orbiting this strange new satellite. Audiences viewing the footage of its descent are left to wonder if this littoral entity would ever return to the surface, and if it did, what new knowledge, new potentials and possibilities, it would bring with it from the seafloor.

One of the things it resurfaces is the reinforcement of Georges Bataille's assertion that we are always enraptured by things that shine,[2] but Charrière's lens takes this observation further by illuminating that we are not alone in our fascination with light: far from it. Encircled by the curiosity of sea creatures, the lens is an oscillating eye that opens itself up to the sheer absence of a lifeless void in oceanic spaces.

The descent of the lens, the eeriness of light where there should be none, doubles as a metaphor for a post-Enlightenment inquiry into the nature of Ocean.

In the 2000 book *Ocean*, blue humanist Steve Mentz embeds such oceanic duality into the structure of the book itself, with each section taking two opposing sides of Ocean's way of being-in-the-world: its ebbs and flows, reflection and absorption. He opens his treatise with the guiding question of whether Earth's waters are alien or core: that is, whether Ocean emerged from the core of a still-forming Earth itself, or if water was formed through the landings of innumerable extraterrestrial entities, such as meteors and comets. For Mentz, the alien-core duality indicates not just epistemological limits, or scientific indecision, but rather the very nature of Ocean as giving life and taking it, of wounding and healing, as complicit and agential.[3]

After peering into the *Midnight Zone*, and hearing Giizhigookwe's story, an immediate response to Mentz's proposition is that, naturally, Ocean is both alien and core. Julian Charrière brings a small, anthropogenic pulsar into the blackness of deep water, while the Ojibwe story tells of an extraterrestrial entity bringing life to Earth while acknowledging that life was already here and that it originated in water. However, an impulse to refuse the alien–core binary would be to ignore the vital presence of Moon. Our planet's only satellite is the daughter of Earth Mother, having been violently rifted from her as in a difficult birth. Moon pulls and tugs at Earth Mother's water-filled heart, until she can take it no more. When Giizhigookwe slips through a crater and falls to Earth, she is falling—or being pulled—back into the arms of her mother, even as she radically differentiates herself from whom she was born. Maybe Earth Mother wanted to witness the birth of her grandchildren, cradle them as they are bathed for the first time, absorbing the rainfall of amniotic fluids that kept them alive inside her daughter's own water-filled womb. From this account, Ocean can only be understood as the Native condition of Earth. Ocean's indigeneity should be understood as reason enough for her sovereignty.

Postcolonial conditions in the 1960s produced simultaneous civil and environmental rights movements, suggestive of the renewed understanding that neither category is separable from the other. Over time, the slow but swirling focus on water rights has gained traction in the aftermath of the whaling industry, the impact of which was made broadly legible by popular writers like Farley Mowat. His 1972 book *A Whale for the Killing*[4] followed the cultural imprint of Rachel Carson's widely read publications that exposed Ocean's poetic ecology and the industrial pollution that threatened to silence Earth Mother's music.[5]

Somewhat paradoxically, this symphony was depicted as silent in the contemporaneous undersea films of Jacques Cousteau. Bringing water-bound beauty and tragedy into the deep, these early underwater films imagined the ocean as a dark, Gothic realm, devoid of sound—an alien inner space that

2 Georges Bataille, *The Limit of the Useful*, trans. Cory Austin Knudson and Tomas Elliott (Cambridge, MA, and London: The MIT Press, 2022); *Visions of Excess: Selected Writings, 1927–1939*, trans. Allan Stoekl (Minneapolis: University of Minnesota Press, 1985); *Inner Experience*, trans. Stuart Kendall (Albany: SUNY Press, 2014).

3 Steve Mentz, *Ocean* (New York and London: Bloomsbury, 2020).

4 Farley Mowat, *A Whale for the Killing* (1972; repr., Vancouver: Douglas & McIntyre, 2012).

5 Rachel Carson, *Under the Sea Wind* (New York: Simon & Schuster, 1941); *The Sea Around Us* (Oxford: Oxford University Press, 1951); *The Edge of the Sea* (New York: Houghton Mifflin, 1955); *Silent Spring* (New York: Haughton Mifflin, 1962).

mimics the dangers of outer space. Nevertheless, these films provoked awe in viewing audiences as the public was awakened to the extraordinariness of oceanic life, which, in turn, inspired new generations of oceanographers, marine biologists, and underwater archaeologists.

Cousteau's ocean may be a silent world, a world seemingly without sun, but as every diver knows, Ocean is never without Moon. Cousteau's team of masked and compressed-air-breathing aquanauts, buoyantly drifting through the great blue, presaged the astronauts who would make the first footprints on Moon's dusty surface. One such astronaut, Bill Anders, would assume, unwittingly, the perspective of Giizhigookwe when she spotted distant Earth while falling from Moon. Anders's photograph of Earthrise as seen from Moon (p. 114, fig. 1) would instill wonder in millions of viewers back on Earth at the vulnerability of our blue planet drifting in the lifeless void of outer space. The photograph's orb and its unmistakable blueness would galvanize Earthbound ocean conservationists anew. (Had Sky Woman gone into the water, as did Muskrat, she would have been overwhelmed with the lifefulness of Ocean, in opposition to the lifelessness of outer space.)

But blueness, like the conflation of starlight and ships' lights, like the analogy of outer and inner space, is often illusory. Veins carrying red blood appear blue because of the way light interacts with skin and fat, scattering red light and leaving the blue. From Earth, Ocean appears blue because other colors have longer wavelengths whose energies are absorbed by water at different depths. If you bleed below 7 meters, you bleed green. Below 20 meters, blood is blue, and that blue light can travel another 1,000 meters deep before the lights go out altogether, and water, blood, and everything else turn black. From the life-deprived blackness of outer space, the entirety of Earth appears blue because vast Ocean scatters all but blue light.

The reflection of cosmic lights from Ocean's surface is amplified when she is draped with crystalline layers of sea ice. Blue becomes white, but as on the dark side of a mirror, blackness is also intensified in these waters. Julian Charrière's video *Albedo* (2025), shot in polar seas, bears witness to melting sea ice as an unraveling of the frozen layers of time and weather that constructed it over an unfathomably deep past. As icebergs and glaciers succumb to rising temperatures, ancient ice churns into waters where light enters for the first time in millions of years. A formerly impenetrable black realm is suddenly exposed as outer and inner spaces interact, horrifically. Beauty and horror mingle alchemically as solid turns to liquid, black and white into blue. And suddenly, the fable of eternity is rendered as vulnerable as the stories we tell ourselves about the nature of discovery. What is really being uncovered in the processes we witness? As we encounter the melting icebergs of *Albedo* and drowned starry skies of bioluminescent beings, in a descent set to the mournful songs of marine animals, we begin to understand that Ocean is no longer hiding, swallowing, her history: she shows us the wounds made by mere centuries of the crossings, conquests, and violence of colonial expansion—and with the warming they have caused, an internal bleed in the blackness.

Experiencing firsthand the albedo effect, Giizhigookwe also anticipated the blackness of oceanic oblivion. Waters rose toward her even as she fell into them, even as three hearts pumped red blood inside her body, threatening to turn green, then blue, and black. We equate unmediated animal life in its truest form as red blood, yet this is also how we encounter the imminence of death. Blood forms the gateway between life and death, vitality and decay; this salty, ferrous fluid creates the liminal space that every living thing will cross through before succumbing to the aphotic midnight zone. In a three-tiered cosmos that locates the underworld in the deepest caverns and lowest abysses, where water gathers and turns red to green, blue, and black, there appears to be a contradiction with the Native American maxim that water is life. But the sublimity of the abyss is the wound of wonder that might never heal, the awe of consciousness at a standstill, and therein is an encounter with the ultimate source, where life and death dwell together. That precipice of annihilation, in the unspecified moments before being engulfed by the Unknown—World Mystery, Giizhe Manitou, Wakan Tanka—makes vulnerable even the mightiest of mothers.

Human contact with the abyssal midnight zone increases, and as it does, still more mysteries are revealed, confounding the episteme. As Charrière's Fresnel lens testifies, curiosity itself doesn't compromise the sublimity of the primordial abyss, but when submarine and ROV video footage records images of deep-sea chip bags and beer bottles, as in Charrière's 2019 video installation *The Gods Must Be Crazy* (fig. 2), we are again reminded of Bataille and his meditations on the many falls of humankind. In the essay "The Blue of Noon," he writes that "Nature giving birth to man was a dying mother: she gave 'being' to the one whose coming into the world was her own death."[6] Would Giizhigookwe agree, I wonder? And what of her mother, the waterworld called Earth?

Undoubtedly, underwater artifacts of capitalism's excesses are experienced differently from the ruins of old ships, whose skeletal remains swarm with new life and seem microcosmically indicative of the generative potentials of death.[7] Somehow, the aesthetics of destruction in the form of so many mass-produced remnants of modernity are of a different nature that upsets human expectations for what constitutes a pristine environment, untouched and ageless. These visuals hold an ugly mirror to viewers, seated comfortably in an armchair, disturbing us with undeniable evidence for the profundity of our addictions to convenience and comfort. But we do not like that reflection and so avoid looking for too long. And so, nothing changes. What's left of the

6 Georges Bataille, "The Blue of Noon," in Bataille 2014 (see note 2), pp. 80–96.

7 See the detailed discussion in Sara A. Rich, *Shipwreck Hauntography: Underwater Ruins and the Uncanny* (Amsterdam: Amsterdam University Press, 2021).

2 Julian Charrière, *The Gods Must Be Crazy,* 2019, video still

fish deposit roe in floating islands of refuse, turtles scramble over beached water bottles to lay their eggs, shells acidify, corals bleach, business goes on as usual.

How much longer will it be until NASA adds wreckage to Europa's lunar ocean, looking for life elsewhere when we are surrounded by it, struggling, right here?

Here, when spacecraft are decommissioned, they are directed to Point Nemo in the South Pacific Uninhabited Region, mathematically the most remote location on Earth.[8] Once removed from orbit, wasted spacecraft fall through blue skies and smash into the waters near Point Nemo where their impact on humans is a possibility as remote as the GPS point in the South Pacific is from land. Following their oceanic collision, pieces of space debris descend through a new blue about 2.5 miles to the seafloor, where, once again, they are shrouded in black. If there were light at such depth, or if a Fresnel lens were submerged there, the silvery metals of orbiter debris might be mistaken for the broken bodies of great fish, their scales reflecting the slow dancing of light at depth. Perhaps, with sufficient accumulation of these mangled bodies, they might yet reflect sunlight again, thereby assuming the place in Earth's memory of albedic sea ice that was so heated by industrial interference that it turned back to water. In time, the designated spacecraft cemetery might rise up, space station upon Starlink satellite, and form a new, metallic island. But instead of Turtle, this island would be Nemo—no one. Not a soul.

A hypothetical dead spacecraft surface breach seems to be the logical outcome of centuries of capitalist traditions of discovery and industry. Shipwreck graveyards the world over push through the unhallowed grime of industrial waste with rusted steel fingers; long smokestacks from junked steamers self-disinter as they rise up through low tides to remind anyone who might be passing by that what gets dropped into the waters of oblivion doesn't necessarily stay there. On Earth, unlike in space, there is no infinity, no "eternal sea," and so there can be no true oblivion. As a result, waste discarded is never really gone because there is no "away" where trash might be thrown.[9] The water cycle may be continuous, but the myth of oceanic infinity is what needs to be dumped. Twisting artist Richard Serra's *Verb List* (1967)[10] into a trashier version reveals waste as an active participant, not something that vaporizes once removed from sight, or light.

to waste
to trash
to ruin
to litter
to accumulate
to drift
to float
to blow
to tangle
to strangle
to kill
to feed
to churn
to wash
to cut off
to fester
to ruminate
to dam
to jam
to stick
to flow
to land
to bury
to disintegrate
to choke
to suffocate
to catch
to hide
to heap
to billow
to waft
to spread
to concrete
to accrete
to sink
to rest

Unlike the first several words on the verb list, the noun "refuse" means something very different from its infinitive, "to refuse." To refuse, in Mohawk scholar Audra Simpson's analysis, is akin to refusal in that it puts a foot down with the insistence of keeping certain private or sacred knowledges to oneself.[11] The noun "refuse," by contrast, is characterized by its proliferation, its extreme lack of privacy despite a certain insidiousness. And yet, the abundance of refuse in which we earthlings live and breathe should be a sign to refuse—to know when to stop.

Instead, and with irony, the ever-growing list of diverse options for refuse's self-expression seems to have filled the void left by the annihilation of so many verb-based Native American and other Indigenous languages. Their slow death made room for all these

8 Cullen Murphy, "Point Nemo, the Most Remote Place on Earth," *The Atlantic*, October 11, 2024.

9 See further discussion in Brian Thill, *Waste* (New York and London: Bloomsbury, 2015).

10 Richard Serra, *Verb List* (1967), https://www.moma.org/collection/works/152793 [accessed in February 2025].

11 Audra Simpson, *Mohawk Interruptus: Political Life across the Borders of Settler States* (Durham, NC, and London: Duke University Press, 2014).

trashy possibilities. Only one of them is that Earth's own womb might be morphed into a sink where wasted water- and spacecraft rest in the black alongside forever-chemical runoff, junk-food wrappers, and beer bottles.

But like all internal feminine spaces whose sovereignty is undermined by patriarchal political and religious institutions, what's dropped and forgotten inside Ocean is only one half of the trespass; the other half is defined by the assumption of ownership of what lies deep inside.[12] It is as if the bags and bottles and all the other remnants of something once desired are meant as tokens of exchange for the extraction of oil, cobalt, nickel, and polymetallic nodules from Ocean's dark ground. But this exchange is easily made analogous to the pieces of paper duplicitously swapped for vast swaths of land, with no intention to abide by whatever was written on that paper that most couldn't read anyway and those who could thought it facile. They cannot be serious, thought the Ancestors. Everyone knows you cannot own land, whether it's growing trees or algae or kelp or polymetallic nodules. So, okay, sure, fine: waště.

If the sequence of events were altered, what would Muskrat bring to the surface in his little balled fist? A plastiglomerate (fig. 3)?

In English, we often speak of depths in terms of depravity, despair, and perversion. We descend into madness. As Bataille explained decades ago, these are the secret basements of being where darkness is hidden away, but also where sources of life with all its joys and torments can be found. This oscillation is keenly felt in *Midnight Zone* as an abyssal oscillation between light and darkness. While dualistic belief systems place darkness in opposition to light, and with moral—not to mention racial—implications, the falling Fresnel lens testifies to a more ambiguous reality wherein the same object can be as pollutive and disruptive as it is illuminating and wondrous.

3 Plastiglomerate rocks show a wide variety of shapes and compositions.

Wickedness lies neither in depths nor in the dark. If anything, it sits sprawling wide open, basking in a false sense of freedom, oblivious to its obligations to Land, Water, Ancestors, Children. And in this way, neither are deep, dark waters places of oblivion, but rather places of remembrance—ancient memories held closely and deeply but which are so powerful that they cannot be exposed all the time without serious consequences. Muskrat knew about life after depth, and when he awoke, he remembered why he risked so much.

And he knew that it was worth it.

12 Max Liboiron, *Pollution Is Colonialism* (Durham, NC, and London: Duke University Press, 2021).

Spiral Economy, 2025

At the close of the nineteenth century, vending machines began appearing in bustling train stations—mechanized dispensers of drinks and foodstuffs. Around the same time, the oceans, long regarded as vast and inexhaustible, were being reshaped by industrial expansion. Small-scale fishing gave way to mechanized trawlers, sweeping the seas with unprecedented force. Once an untamed wilderness, the ocean was to become an extension of global commerce—its depths transformed into extraction sites for oil, minerals, and gas. The sculptural vending machine in *Spiral Economy* reframes mechanized consumerism. Traditionally stocked with plastic-wrapped goods, its spiraling coils instead cradle ammonites—fossilized remnants of ancient seas, suspended in deep geological time. An infinity mirror amplifies their slow, perpetual turn, extending their spirals into eternity—a hypnotic meditation on seemingly limitless cycles of the natural world. Once living oceanic creatures, these ammonites have now become petrified relics, yet their forms persist—echoing the ceaseless churn of life and death beneath the waves.

Trade, commodities, and currency underpin the work's conceptual core. The coin slot is shaped like a conch shell, referencing one of the earliest objects used in exchange—the ancestor of modern currency. Just as the conch once held value across civilizations, the ammonite here becomes a new form of commodity, its worth measured not in scarcity or market speculation, but in slowness, accumulation, and deep time. The fossilized shell stands as a symbol of all mineral concretions and fossil fuels extracted from the Earth's crust—lifeforms long buried, now consumed as effortlessly as a vending machine snack.

Through the spiraling ammonites and reflective mirror, the work challenges the illusion of limitless consumption, urging viewers to confront time on a geological scale. It evokes the ocean not as an infinite resource, but as a fragile, imperiled reservoir of life—held in the balance between extraction and extinction, spiraling toward an uncertain future.

Controlled Burn, 2022

Controlled Burn invites the viewer on a cosmic journey through deep time, soaring through an aerial landscape of imploding fireworks. Shot with a first-person drone, this disorienting voyage takes in open-pit coal mines, decommissioned oil rigs, and rusting cooling towers, celebrating their dereliction.

Throughout, amid whirling smoke and fire, implosions are interrupted by flashing images of primordial unfurling ferns and fluttering moths—beings that evolved during the carboniferous geological period. Appearing at subliminal speed, Charrière offers these organisms as both spirit guides and living tokens for the vitality of fossil fuels—and, additionally, as markers for how the agency of coal, oil, and tar has come to haunt our contemporary imagination. It has taken root in our dream life, infesting visions of the world to come. Particularly the oil rig in the video acts as both monument and warning—a relic of the hunger that drives us to extract, exhaust, and abandon. It speaks to our careless framing of the oceans as machines: engines of transformation that crush, dissolve, and remake matter across immense timescales, which we hubristically imagine that we can tap into, plunder, and control without consequence. Linking celebratory pyrotechnics with extraction architectures, explosive momentum with technological obsolescence, *Controlled Burn* questions this state of affairs—staging the fantasy of a dramatic return to sources of energy via implosion: a time before smoke.

Pitch Drop, 2016

The oldest ongoing experiment in the history of science began in 1930, in a laboratory in Queensland, Australia. Conceived by the physicist Thomas Parnell, the Pitch Drop experiment was initiated to demonstrate the fluid dynamics of pitch—a highly viscous fluid derived from petroleum. Though it would appear solid and rocklike to everyday observation, over the course of years it behaves as a fluid. Appropriating the technical format of this slow-motion theater, Julian Charrière's performative sculpture changes and expectantly drips only once every decade. Echoing the principle of the clepsydra, an ancient water clock, but replacing water with pitch, *Pitch Drop* recalls how fluids were essential to the earliest human attempts to measure time—where the steady flow of water laid the foundations for time-reading itself.

With a total of 1,000 individual drops, this piece is designed to span a symbolic 10,000-year time frame, a temporal scale that reaches beyond the horizon of human memory and history. As a time-based artwork that plays out at the rate of centuries, it is also allegorical of the deep sea, as a shifting threshold where the solid and liquid blur—a realm of molten rock cooling into new crust, minerals crystallizing in the heat of hydrothermal vents, and ancient organic matter dissolving into petroleum, seeping through fractures in the seabed. Static yet phantasmagorical, it gestures to geological time frames beyond the human lifespan, inviting an aesthetic toggling away from the here and now.

And Beneath It All Flows Liquid Fire, 2019

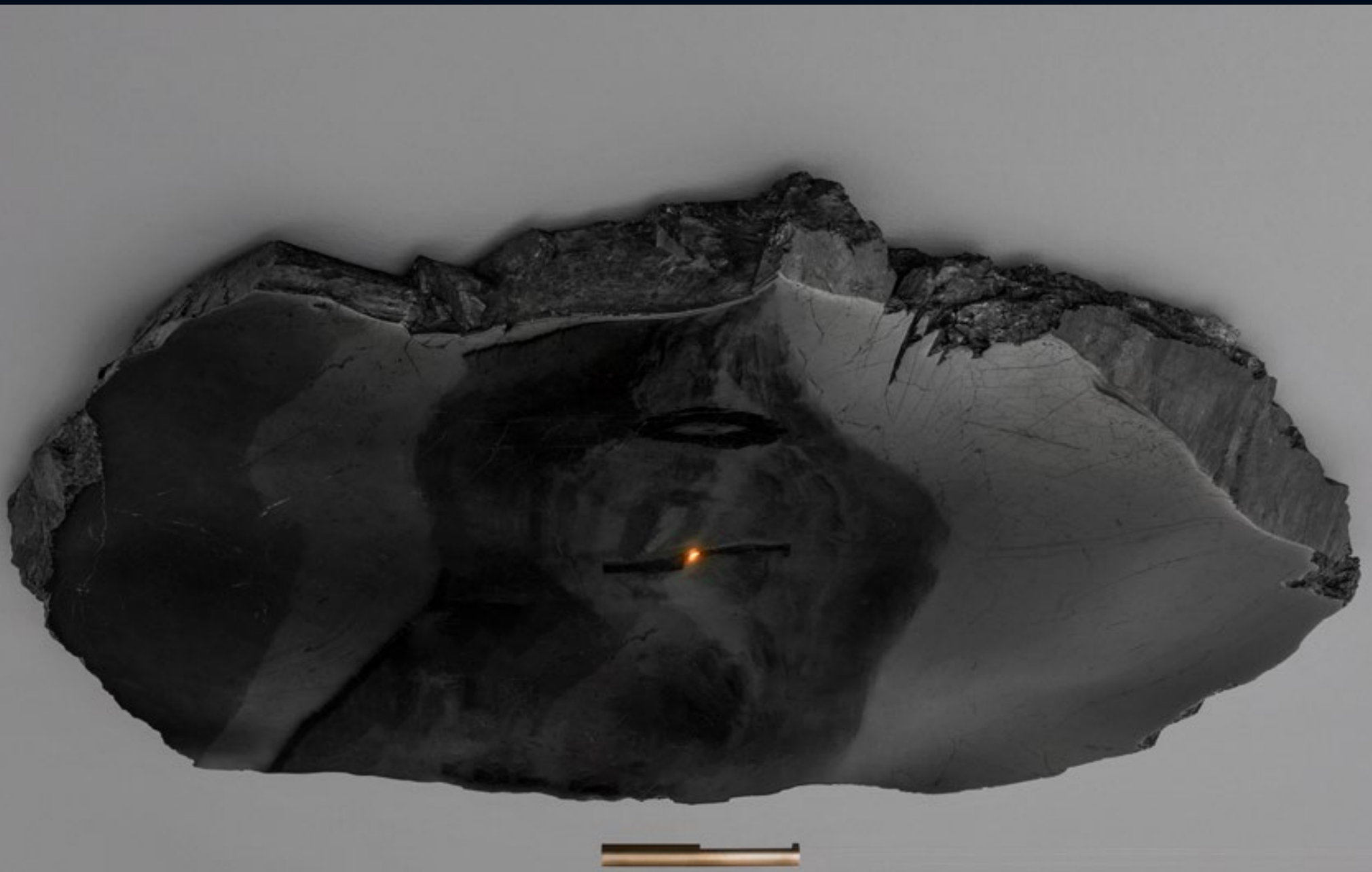
In *And Beneath It All Flows Liquid Fire*, a classical fountain fantastically spouting liquid flames takes us beneath the Earth's crust to evoke the constant churning of magma within its mantle. Even in the most frigid regions of the Earth, this "liquid fire" constantly flows. Likewise, beneath the layers of politics and symbolism inherent in ideas of nature, a certain autonomous state of the planet persists—and occasionally erupts to the surface. The fountain is an ancient symbol dating to some of the earliest human settlements. In this video, Charrière's fountain depicts an absurd state that implies the coexistence of opposite elements: water and fire, both of which humankind has hubristically sought to control. It foregrounds how the ability to manipulate water has shaped the rise and fall of civilizations, from the irrigation networks of Mesopotamia to the aqueducts of Rome, turning arid landscapes into fertile ground. Dams, canals, and reservoirs have not only tamed rivers but also concentrated power, determining who thrives and who is left to thirst. Maritime trade routes carved the paths of empires, while the race to harness hydroelectricity redefined the boundaries of industry and progress. Even now, as glaciers melt and groundwater depletes, the struggle to command water remains a defining force in geopolitics, survival, and the fate of the planet. The extravagant and wasteful visage of the fountain embodies our inability to come to terms with this. Still, *And Beneath It All Flows Liquid Fire* turns this traditional iconography of the fountain on its head, with the spring of life now dominated by flames licking upward. Here, fire has an ambiguous significance, for it is at once a figure of destruction and creation: across many cultures, the mythos of fire's conquest corresponds to the beginning of civilization.

Coalface, 2024

The sculpture *Coalface* consists of a thick piece of sliced anthracite coal that has been polished into a mirror and suspended in the space, projecting a lightness that contradicts its apparent mass. Approaching it, the viewer encounters an uneven surface, the ripples of which are reminiscent of a fun-house mirror, distorting reality. An otherworldly presence, *Coalface* is at once earthly and uncanny, impenetrable yet bottomless. Though the discovery of coal as a form of energy was irrevocably transformative, accelerating us toward a techno-industrial future that has long since lost the hopeful promise it once seemed to hold, it is here rendered solely as a tool for reflection. Lit ominously by an oil lamp, the flame of which is never directly visible, the warped imagery which appears reveals our emotional disconnect from the natural world and our struggle to recognize ourselves in the materialities that embed us. This discreet arrangement enacts a subtle yet crucial tension—between fuel and combustion, between the combustible and its flame.

The fire, withheld yet present, performs on the skin of the coal, drawing together the paradox of a material that is at once the promise of energy and the threat of its own undoing. Through this confrontation by our own likeness imposed upon the fossil fuel (a compound which suffuses our reality, but with which we rarely interact) we are asked to question our own complicity with it.

In the process, *Coalface* also reflects the complex relationship between human beings and the geological, where since our conception we have sought meaning in and through stone, from cave paintings to the black volcanic glass of obsidian used to gaze into other realms, and now into the screens of our iPhones, animated by the necessity of mining rare earth metals. *Coalface* thus foregrounds coal as a vehicle for both accelerationism and entrapment, the economic power of which is almost magnetic and can seemingly twist our view of the world, while also showing how humankind, in our pursuit of such fossils, contorts the planetary timeline, unearthing buried strata of coal, petroleum oil, and natural gas—ransacking the past to fuel the present. An act which, if left unhindered, might burn the future before we even arrive in it.



Midnight Zone

Where Waters Meet, 2019

In his photographic series *Where Waters Meet*, Charrière captures the ghostly apparitions of naked free divers descending into the abyss of aquatic caves in Mexico known as cenotes. As the divers' bodies penetrate the chemocline—an obscure and uncanny layer of bottom water full of sulfurous bacteria—they appear to dissolve in both pictorial and metaphorical terms, sinking not only toward the seafloor but into their psyches, entering a state of togetherness with their surroundings which Sigmund Freud described as the oceanic feeling—of being bound with and belonging to the whole of the world outside oneself. It was a primal sensation which Freud believed may underpin the human longing for transcendence; similarly, the iconographic unconsciousness of *Where Waters Meet* conjures up a sea of metaphorical allusion.

The series figures both this metaphysical dive and the physical descent by the divers themselves. For the latter, water emerges not as an environment, but as a mirror—one that reflects only to a limit, before turning to absorption. The divers first encounter themselves on this liquid surface, meeting their own gaze on its fluid veneer, only to pass beyond it and leave the familiar image behind. Here they enter a realm where mirrors dissolve and only the pressured depth remains. The ocean, then, becomes not merely a backdrop for the oceanic feeling, but its very embodiment—a space where self and world blur, where the horizon of reflection gives way to the opacity of immersion.

By depicting the chemocline, the series contributes to a picture of the oceanic system that has grown significantly more complex in recent decades, where such worlds within worlds are relatively recent discoveries. As we come to better understand the sea, domains from evolutionary theory through to climate science are being quietly transformed. Sliding into this previously silent (unseen and unthought) realm, Charrière's free divers seem caught in some kind of a dance; a graceful fall. From where—and to what?

Beneath

Geraldine Kirrihi Barlow

We each take a deep breath, and dive
the blue all around, deepens
fins and legs propel us, down
into the cool. Sunlight, shifting lengths
of long-traveled energy, reveal
Enabling growth, sight, understanding
the hunt. And reach only so far

Julian sees a reef shark
He follows its planar movement
I turn, stretch, look to the surface
as if this one breath were infinite
A turtle swims slowly by
mysterious of purpose, navigating
an ancient invisible highway, as do I
Water between and within

Surfacing, we remove our snorkels
laughing, alive with all there is to see
the possibility to be, differently
Water, conveying risk, potential, and energy

Julian Charrière dives, as do I. We all do, as human beings, to differing degrees. We need only slow down, hold our breath, dip beneath the surface and focus on extending the moment. Traveling not only deeper, but further back in time and evolution, our most distant ancestors were permanent water dwellers. Millions of years later our bodies still carry the imprint of this watery state in deeply encoded ways. We share this history collectively, and personally, from the first nine or so amniotic months of our lives, our earliest unfolding consciousness in our mother's womb. Is it this sense of shared connectedness and nurture that draws us back to dive beneath the water's surface with such curiosity? And compels us to seek out ways to extend our time in this alternate state?

Water connects us with life. All the life we know of. As we dive down into the depths, we become vulnerable, and we see, feel, and understand this interconnectedness in new ways. To be in the water breaks the usual flow of time, sparking meditation, affording us the space to recalibrate and reach other forms of comprehension. The experience of art can also be a circuit breaker, stimulant, or invitation to travel deeper; it works in different ways, no held breath, or special breathing apparatus required.

Julian and I met working on an exhibition. We were excited to realize that we shared an interest in diving and the underwater world. A friendship grew and we decided to plan a period diving together, traveling to a small island at the southernmost reach of the Great Barrier Reef. In this essay, I reflect upon these special days, Julian's new video and exhibition *Midnight Zone*, his artistic practice, and diving itself. I hope to explore how the extended experience of being beneath the water might have elicited a shift

in consciousness, a kind of "dive-consciousness," that has impacted Julian's artistic practice, in ways which stretch beyond creating works in the underwater realm.

I first became curious about this question upon encountering Julian's photographic series *Where Waters Meet* (2019). The images are taken underwater and in themselves suggest an altered state of consciousness. Each features a single naked human figure, apparently suspended at a distance in a vast black expanse. They are compelling and unsettling. In some instances, the entire figure cannot be fully discerned. In one, only the feet are really revealed; the legs and body are hinted at, but they disappear into a foggy, cloud-like substance. In another, the figure seems to float horizontally over a diffuse mist-like layer. We have the sense we might be looking at a celestial, almost cosmological space; it is not immediately evident that these images have been taken underwater. Each work has a subtitle: *3.77 atmospheres* and *3.98 atmospheres*. For most of us, the word atmosphere evokes the layer of gases surrounding a planet, including the air we breathe, thinning as gravity diminishes and finally giving way to the infinite black volume beyond. On the surface, at sea level the atmospheric pressure is one. Divers are keenly aware of what it means for this number to increase. For every 10 meters we descend, a further full atmosphere of pressure bears down upon our bodies. In only 10 meters, a further full atmosphere, as water has a much greater density than air. We feel the impact upon our bodies as we descend, over the first few meters particularly, and must maintain awareness and adapt our behavior if we are to survive. At two atmospheres of pressure, a volume of air would compress by half. Think of this happening to a balloon, or in your bloodstream, with each tiny suspended bubble of air being similarly compressed. 3.77 atmospheres is 27 meters in depth, a long way to descend without weights, or supplementary air—to be simply one sole human being. One conscious body.

Julian created *Where Waters Meet* in Mexico working with free divers who were expert in reaching such depths without any additional specialized gear. He had himself scuba dived in the cenotes, caves, or sinkholes housing bodies of deep water, largely fresh, of remarkable clarity. He was drawn to them for this project as he knew some were home to a sulfurous algae evolved to live at a particular point, or layer, within a body of water where the chemical composition suddenly shifts, for instance from saltwater to fresh, a chemocline. In the darkness, the presence of this algae creates the visual effect of a cloud, so what we see in the images is not dust or vapor, but a form of life, evolved to inhabit these specific conditions, where two bodies of water meet.

In each photograph we see only one human figure, entirely alone. The vulnerability of this body seems enormous. While diving to these depths would not be unusual for an experienced free diver, it is something else entirely to ask them to pause at such a depth. It is Julian's awareness of what might be achieved through bringing these conditions together which makes these images possible. For each living person or body we see at depth, drawing from a single, long, ultra-extended breath, there are others behind the scenes, including Julian, to support the sustenance of this one life—and the creation of the image. To do their part, this supporting team needs time, along with specialized diving, photographic, and lighting equipment, and many breaths.

For me, scuba diving deepens my sense of what it is to be alive. It has a meditative quality, at times instilling a heightened awareness of the sound and beauty of each breath we take, the particularity of the air and atmosphere we usually inhabit. We may not be conscious of how precious this is until we leave it behind, or need to carry an air supply with us and realize this is finite. Time will now be measured in breaths, depth, pressure. Similarly, we are not usually conscious of our bodies as a wondrous weave of interdependent biological functions until they are extended via the apparatus of our scuba diving equipment. This additional equipment, and the human ingenuity behind it, remind us of the evolution and precision of our body's function, previously unconscious and invisible. For instance, when we breathe, the sound of each breath resonates through the cavities and diaphragm of the second stage regulator positioned in our mouth and connected via the first stage to the tank on our back. We hear each breath differently also, as sound travels more quickly through water, and within our own bodies, sound is also felt from within. Before diving, we carry out a number of checks, for instance, that our regulator is working, that we have sufficient air, that valves, weights, clips, buckles, fins, and mask are all as they should be. When we check on the function of the equipment that extends our own body's capacity, we take responsibility for our own life and safety. We perform the same series of checks for our buddy, and hope they will carefully do so for us.

In this way, to dive asks us to be aware, take care, and seek knowledge. To be responsible. At a bare minimum, it could be seen as procedural: do this, then that—

a sequence of checks and balances. But diving benefits from many different types of knowledge. In a moment of urgency, knowledge can be life-saving: enabling us to better handle a gear failure, a turning current, a change in surface conditions, a medical emergency, or wildlife incident. Like artists, the best divers are responsive, deeply curious encyclopedias of unusual information. Across both disciplines, there is a benefit to keeping such knowledge lightly and at the ready. Being underwater, like making or experiencing art, is about attention. The diver, the artist, and the viewer attend the unknown, the unexpected. Being prepared allows us to better travel toward the unknown, to ask: If we go to the very edge, the edge of the edge, what will we find? What might we see? What can we bring back?

In the stretching black emptiness of the *Where Waters Meet* images, it is highly unusual that we can see the distant diver so clearly. We barely sense the presence of the water itself. This is due to the distinctive clarity of the water in the cenotes, which very slowly filters down through surrounding limestone over extended periods of time. Elsewhere, across the Earth, most bodies of water include a much "soupier" mix of particles, debris, and life. In the tropics, generally known for good visibility, we might see up to 30 meters into the distance; after this, details become indistinguishable. In a lake or river, or polar waters, we may only gauge a third of this distance, even less. Good visibility, or in diving terms "good vis," is relative. The slow-filtered waters of these underground caverns are amongst the clearest to be found.

1 Julian Charrière, *Where Waters Meet [2.31 atmospheres]*, 2019

Just as the water we look through is not visible, we have few cues to realize that the subject of each photograph is a diver. Free divers would most often be depicted with fins, or as they were pulled downward by a weighted sled. The discipline of constant weight diving, particularly without fins, relies on the body alone. It is one of the most physically demanding and, many might argue, "pure" forms of free diving. In *Where Waters Meet*, the diver extends their usual training to suspend their motion and pause at the very point where we would imagine they must surely need to swiftly return to the surface and breathe again. From these moments of stillness, a more universal quality emerges, focused not so much on diving as an activity, or this diver in particular, but on a sense of the limits the human body can reach toward. At the very edge of where it seems possible to exist, life itself becomes the subject.

2 Hieronymus Bosch, *Ascent of the Blessed*, ca. 1505–15, Gallerie dell'Accademia di Venezia, Venice

The coordination and expertise necessary to create such an image are more of a tool to achieve this effect and are not made evident. Space and distance are key, and we rely upon the presence of the mysterious cloudbank of bacterial life to further read a sense of depth. Various liminal states are suggested: a prelife space of endless potential, the in-between-ness of purgatory, or the passage toward a final experience of an external life after death.

Where Waters Meet [2.31 atmospheres] (2019) (fig. 1) evokes *Ascent of the Blessed* (ca. 1505–15) by Hieronymus Bosch (fig. 2), where above the clouds, angels shepherd each soul through the darkness, and toward a radiant and a tunnel of light. Each individual in this state of transition is naked. In Julian's photograph, the single naked figure is alone, unaided, apparently without direction. Suspended in space, it isn't clear whether they are being drawn toward the light or falling away from it. The soaring potential of human invention—and closely connected to this, the tragic potential of hubris, that is, excessive pride or overreach—is one of the central motifs of the story of Icarus and his father the inventor Daedalus, as Ovid recounts.[1] Daedalus fashions two sets of wings, thrilled to experience flight, yet Icarus is distracted from his father's warning not to fly too close to the sun. He doesn't pay sufficient attention to the technology which supports him. Just a child, he forgets to take care. Tragically, his behavior leads the wax in his wings to melt and he falls to his death. In a version of this scene long thought to have been painted by Pieter Bruegel the Elder, which is not clearly attributed until today, we see only the feet of Icarus as he disappears into the ocean (figs. 3, 4). Julian evokes a very similar image in the black depths of the cenote (fig. 5). Having

1 Ovid, *Metamorphoses Book 8*, trans. Brookes More, *Theoi Classical Texts Library*, https://www.theoi.com/Text/OvidMetamorphoses8.html [all URLs accessed in February 2025].

escaped the usual spaces inhabited by humanity, Daedalus searches for his son:

> "Where are you, Icarus?" and "Where are you?
> In what place shall I seek you, Icarus?"
> He called again; and then he saw the wings
> of his dear Icarus, floating on the waves;
> and he began to rail and curse his art.

The same tensions connecting what can be achieved through exploration, invention, the pursuit of knowledge, and the exercise of care underlie Julian's artistic practice more broadly, just as he is concerned with the dangers of a lack of foresight, hubris, the potential for calamity and loss. How do we navigate a path to a better future, and ensure we don't inadvertently fly too high?

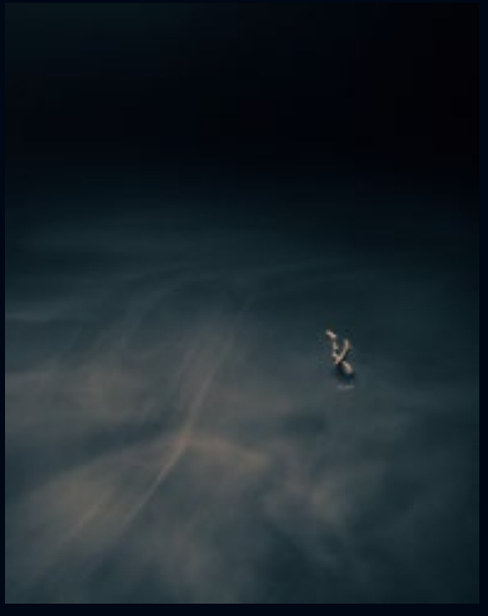
These questions find new form in Julian's recent work *Midnight Zone* (2024), also filmed underwater, this time in the Clarion–Clipperton Zone of the central Pacific Ocean between Hawaii and Mexico. This abyssal ultra-deep-sea area of remarkable biodiversity includes ancient thermal vents, seamounts, and seabeds which are home to a diverse range of barely known life-forms, some adapted to inhabit vast fields of polymetallic nodules containing high concentrations of rare minerals such as manganese, nickel, copper, and cobalt. It is now the largest single area of focus of deep-sea mining exploration and contracts granted by the International Seabed Authority. The nodules grow exceptionally slowly, a centimeter over several million years. Mineral layers accumulate around a core, sometimes of ancient biological matter such as a shark tooth. They might grow to the size of an egg or potato. So much so that underwater strip mining of these "fields" has been likened to harvesting potatoes. Soon to be scaled up from early tests, it will require the use of specialized, remote-controlled deep-water robots: imagine the progeny of a mole and a garbage truck. Whilst these metals are vital to technologies expected to facilitate our global transformation to a low-carbon economy, there is something horrifying about the destruction of this ancient habitat, these little-known life-forms, occurring with so little awareness. "These areas are the Earth's least explored. It's estimated that only one out of ten animal species living down here has been described by science," notes the marine ecologist Thomas Dahlgren, part of a 2024 research expedition. "We need to know more about this environment to be able to protect the species living here."[2] As mining technology and international legal frameworks are swiftly developed, we face a complex and threatening future where we may destabilize a vast yet largely unknown environment thousands of meters below our daylight reality—before we fully understand its role within our greater Earth systems. A recent study found that polymetallic nodules seemed to be producing "dark oxygen" that is creating oxygen without the presence of light.[3] In such deep waters, oxygen is rare but vital to surrounding organisms. Many scientists believe that life itself originated in the hydrothermal vents of these deep waters.

In *Midnight Zone*, Julian creates a beacon to illuminate these depths, inviting us to relate these issues to our own lives and understanding of the world. To do so, he built a Fresnel lighthouse lens, effectively creating a submarine lantern. This is no easy feat given the exceptional pressures involved. The results are mesmerizing, brilliant shades of blue that wrap around us as we sink, giving way to the deepest tones of navy, then black. A slow envelopment. Our eyes adjust, and we become aware of a suggestive hint of light sweeping through the midnight dim. As if, like the inhabitants of the abyssal realm, we too are realizing that there is more to see here. The light becomes stronger. We cannot see the source yet. Suddenly, a fish swims by. As the beam of light passes, other fish are momentarily illuminated, also in motion. Then the black returns.

Evocative of the unconscious, or a symbolic "witching hour," Julian borrows the title of his work *Midnight Zone* from the region of the sea where sunlight no longer penetrates—below 1,000 meters. Red, orange, and yellow light cannot pass through more than the first few meters of water; after this we see only blue, ever deeper and darker, until the black. The midnight or bathypelagic

3 Pieter Bruegel the Elder, *Fall of Icarus*, undated, Royal Museums of Fine Arts of Belgium, Brussels, inv. 4030

4 Detail: Pieter Bruegel the Elder, *Fall of Icarus*, undated, Royal Museums of Fine Arts of Belgium, Brussels, inv. 4030



5 Julian Charrière, *Where Waters Meet [3.71 atmospheres]*, 2019

2 Keith Cowing, "Away Team Report: Unknown Species Discovered on a Deep-Sea Expedition to the Clarion Clipperton Zone," *Astrobiology*, June 9, 2024, https://astrobiology.com/2024/06/away-team-report-unknown-species-discovered-on-a-deep-sea-expedition-to-the-clarion-clipperton-zone.html.

3 Andrew K. Sweetman et al., "Evidence of Dark Oxygen Production at the Abyssal Seafloor," *Nature Geoscience* 17 (2024), pp. 737–39, https://www.nature.com/articles/s41561-024-01480-8.

zone is the single largest habitat on the planet, comprising about 70 percent of all seawater; beneath this, deeper still, are the abyssal and then hadal zones, where light must come from life itself. In the video, the sweeping signal of the lantern, a sequence of wider and narrower beams of light, becomes an unusual mid-ocean beacon, drawing to it a myriad of different creatures who themselves circle and explore this visitor.

The larger fish such as trevally and sharks cruise by comfortably, while others school and move protectively in unison. In *Midnight Zone*, the water itself is much more visible than in *Where Waters Meet*, with light in motion through it and illuminating clouds of particles, algae, and other organic material. The soup and cycle of life.

We get our bearings as we come to see the lamp and light source itself, the sculptural form of the magnifying ridged glass lens rotating within the lantern. The Fresnel lens design was first conceived in the early nineteenth century to concentrate and magnify light, enabling a much further reach across the ocean and curvature of the Earth. When we think of a lighthouse, we might imagine this distinctive lamp at the top of a tall, elevated structure on a cliff or promontory. A symbol of both danger and safety advising, "Beware, check your course, steer away from these rocks" and, reaching out across the darkness, "Take comfort, I am on duty."

By contrast, the lantern in *Midnight Zone* is visually unanchored, with no connection to land. It is in fact suspended beneath a boat. Sometimes our perspective is from underneath the light. We have the sense of a space of infinite depth and vastness stretching around the beacon. There are periods when no fish swim by, and we might again come to imagine that this black underwater realm is perhaps air, or deep space. Then the reverie breaks as we see the silhouette of head, fins, and tail cross the brilliance of the lamp. At times, another kind of dream space opens, a multitude of small fish circle the lamp counterclockwise, another larger species swims to its own rhythm, and they move around each other, separating as if governed by an invisible force field. Patterns are interwoven and change, from circles and curves to sudden switchbacks. I am reminded of a time-lapse image of the stars in the night sky, no longer single points of radiance, but each star transformed into a curved streak of light.

Some creatures bring their own illumination. One swims by, a bristle worm, reminiscent of a submerged centipede. A long, spiraling tail bearing a train of lights has the beauty of a fractal dream. The creature is crowned with long, radiant, reaching antennae. The light arrays move together but are difficult to connect to a more familiar anatomy in our mental catalogue. It is only the light of the lantern sweeping past that reveals an extraordinary transparent body with each leg terminating in a kind of petal, all seeming to flutter and propel this curious entity through the water. Bioluminescence has a special place in the deep: not only a signal, but potentially an evolved decoy; a shining lure. Just as fires were sometimes lit to create a false lighthouse and call sailors and their cargo toward dangerously rocky shores.

A moment of darkness again, a pulse of light. The distinctive shape of a vampire squid floats into the sweeping reach of the lamp, head downward, mission-focused. The bell-like spread of its membrane-connected limbs point upward. Darkness again. Then another pass of light illuminates the deep red-black skin and black interior membrane. The squid's own bioluminescent features remind me of flying over a city at night. A starship in the deep, small and vast.

In *Midnight Zone*, the rhythmic circling of each beam of light is counterbalanced by a measure of blackness in a way which seems to describe our experience of knowing and not knowing, seeing and yet not fully understanding. How we address this space of not knowing, blackness, or the process of seeking knowledge is vital to achieving a deeper understanding. It isn't only effective to do this through book-learning, stories told, or relayed knowledge; sometimes we must extend our own somatic tools of learning and perception. Swim through dark waters.

I see a rolling, clambering motion
Many limbs, coordinated and well camouflaged
The eye, and head. An octopus
I surface and catch Julian's attention

Diving again, I reorient myself and search
It has frozen, wary
In the same spot. We watch for as long as we can
Intrigued, before resurfacing

Returning below, we find s/he
has sought refuge, under a nearby ledge
Peering beneath, I am momentarily—connected
eye to eye, with another life

Is there such a thing as a "dive-consciousness," as I proposed earlier, and if so, how might it infuse Julian's artistic practice? What did I learn from our time diving together? We began our underwater adventure, excited by the prospect of a period of focused scuba diving in a diverse marine environment. For both of us, an opportunity to reconnect with the experience of being underwater, to step away from work, to renew and reenergize. To be, differently.

To dive, to scuba dive, you are transformed and become another kind of creature. On land, breathing air, we can believe our body is autonomous, separate from the world and under our control. The clothes we wear further isolate us from our environment, enabling us to wrap ourselves in a protective microclimate. We do so without thinking, as a default position; it would take more explanation to move around the world without this protective, enculturated layer.

When preparing to scuba dive, you are very conscious of the sensation and function of everything you add to your body, everything you carry. The insulating skin of the wetsuit can be hot and uncomfortable on land or the boat. Then you add your buoyancy control device and weights, fins and mask. Out of the water you are ungainly.

Diving from a boat, there can be a sense of controlled chaos as everyone scrambles to assemble their gear. I remember our first dive; we did our checks, and next ran through the same process with each other. Then into the water, releasing air from our buoyancy control device, we swam slowly downward. As we left the warm light of the sun, it became cooler, and a deeper shade of blue. After the first few meters, you can easily descend faster than you realize. All the gear that seemed so awkward out of the water suddenly operates as an extension of your body.

While there can be a greater sense of connectivity underwater, you also have a stronger sense of your own internal world; you can feel more vulnerable, more distant from those of your own kind. Without speech, you instead tap for attention and use a vocabulary of hand signals. We translate our consciousness differently without speech. Perhaps it becomes a distraction, noise. A cardinal rule of scuba diving is to stick with your dive buddy, to take care of each other. Scuba—the acronym stands for *self-contained underwater breathing apparatus*—is a reminder of the artificiality of one's underwater acclimatization. If something goes wrong with this system for you or your buddy, you have a limited window of time in which to respond. In extreme circumstances, you may need to offer your spare regulator, or perform an emergency ascent together. And in the most catastrophic of scenarios, you may need to perform a diver rescue—the swift return of an unresponsive diver to the surface. If your buddy isn't nearby or paying attention, your life will be endangered.

6 Julian Charrière on a dive with Geraldine Kirrihi Barlow, Lady Elliot Island, December 25, 2022

This need for awareness and preparedness sharpens your attentiveness to the quality of engagement you share. When you find a strong connection, or are with a trusted diving buddy, you can more safely relax and find yourself less conscious of the equipment which sustains you. It feels possible to extend your awareness outward into the surroundings. Just as water, with its greater density, relays sound more efficiently, you come to feel more vibrationally connected to the person you are diving with and the environment around you. I believe our brain and body change. There is a flow of feeling or energy between the waters of the marine environment and our bodies. I experience a more decentralized, embodied sense of self. As if my brain were no longer the sole director of my body, as if my mind and self now extended out into the water, perhaps atomized, or dispersed.

This sensation is perhaps amplified when you are in the water without a wetsuit, or without much gear at all, only fins, a snorkel, and a mask. Diving beneath the surface, the sense of becoming another kind of creature recurs in amplified form. There is so little to separate you from everything else around. Moving through the water, perhaps under a ledge or a swim-through, feels very much like flying. As you become comfortable with holding your breath, there seems to be more and more to explore.

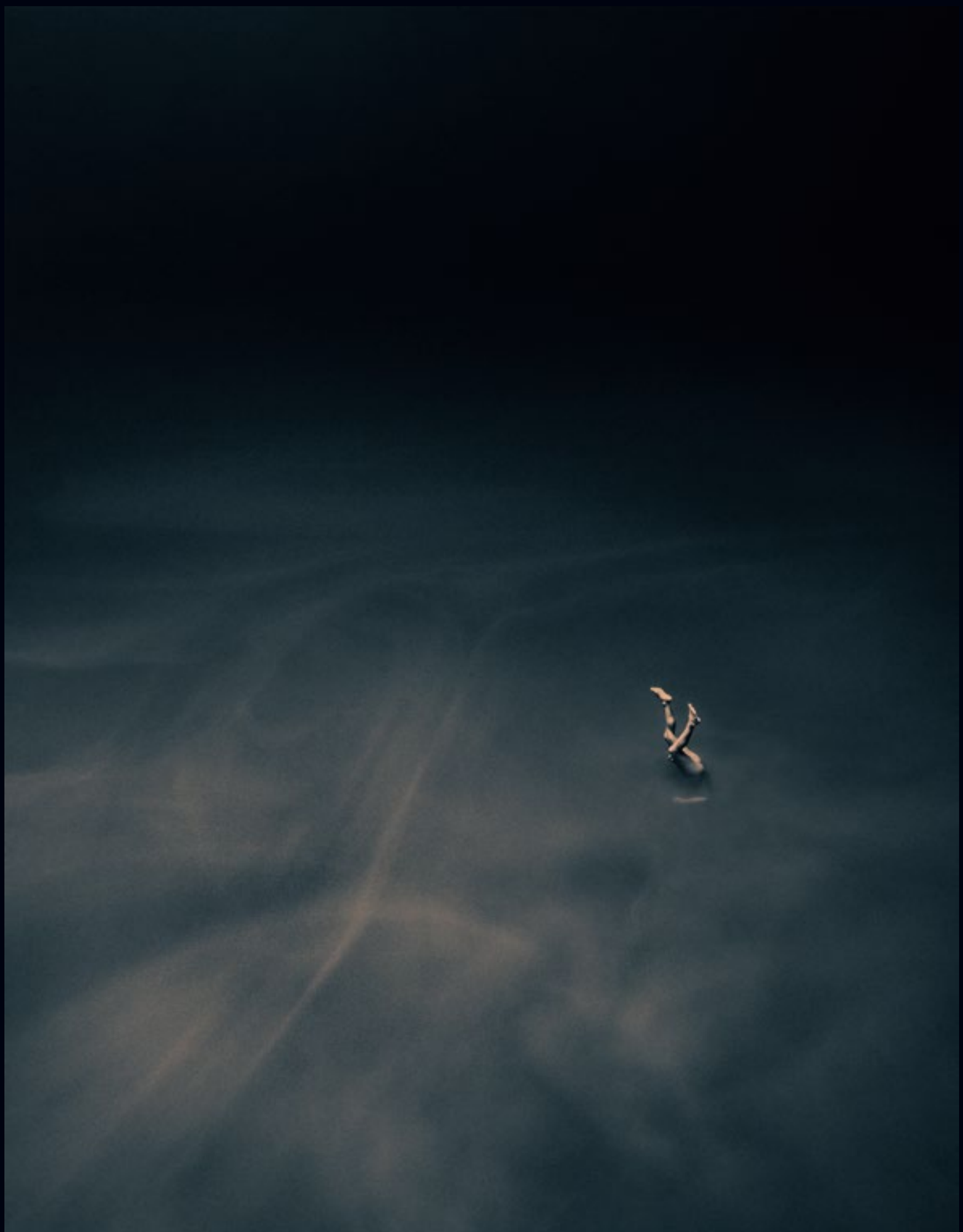
Over 60 percent of our bodies are water; just as sound will move more swiftly through us, in this environment other forms of awareness do as well. We become more connected to the surrounding life: seen, sensed, imagined, yet to be discovered. Yet to be.

Diving beneath the water, I remember we were both so curious. I took a photo of Julian perhaps 4 or 5 meters beneath the surface. He had paused to look at a green sea turtle as it swam between us (fig. 6). The turtle would usually have blended into the deep blue of the water, but it now stood out clearly against Julian's black shorts, top, and fins. They must have been less than 2 meters apart, and appeared to be studying one another intently. Both would eventually need to return to the surface and breathe, Julian sooner. Water can be a medium of such precious connection, curiosity, and extended consciousness. Where we feel closer to one another, and to life in all its complexity.

Julian brings these same qualities of care, curiosity, and deep awareness to his artistic practice. In *Midnight Zone*, the rhythmic pulse of the lantern sets a framing tempo, not dissimilar to our awareness of our own breath. We are encouraged to extend our senses out into the depths, to consider what we see and to take some responsibility for it also. Not only in these particular waters, but the larger interrelation of all life on this planet, aware of its first emergence and the potential of the future to come.

In the shallows, they change from inky black
to a milky shade of sandy-gray
Via a dappled movement of pattern, a field of elongated
stealth bombers, or self-propelled arrowheads
Iridescent. Momentarily streaked with gold
And turquoise. Eyes large

A small school, of twenty or so squid
Rise and fall together in the waves
Protected, almost invisible from above
Our first wonder. We swim out
The sun on our backs, as we turn
Toward the deeper edges of the reef



The Feeling of Depth

Julian Charrière in Conversation with
Andreas Beitin and Roland Wetzel

Roland Wetzel (RW) _ The exhibition *Midnight Zone* explores the deepest regions of the ocean, areas that are barely accessible to humans. It addresses human interventions in pristine natural environments. How did you come to this theme, and what significance does it hold for your artistic practice?

Julian Charrière (JC) _ My work often engages with environments that lie beyond the limits of direct human experience—places shaped by deep time and elemental forces, yet fragile in their present reality. The deep ocean is one of the last true frontiers on Earth, a vast and largely unseen realm that remains profoundly connected to planetary systems. I was drawn to this space precisely because, despite its seeming inaccessibility, it is increasingly impacted by human influence—whether through climate change, deep-sea mining, or pollution. *Midnight Zone* is an attempt to render this hidden world more perceptible, to confront viewers with the paradox of a place so distant yet deeply entwined with our existence.

The ocean spans 65 percent of the Earth's surface, but in three dimensions, it comprises 95 percent of the biosphere—meaning that, in a very real sense, this is Planet Ocean. And yet, we have disproportionately focused on the mere 5 percent of terrestrial space we inhabit. Science has mapped, measured, and categorized the deep, but a map is only a surface—it does not allow us to enter, feel, or inhabit the space it describes. This realization led me to question whether art could offer something beyond scientific knowledge—whether culture could act as a tether between the surface and the deep, fostering another kind of relationship with the ocean.

We need to develop a culture for the deep sea—an awareness that extends beyond scientific data to embrace a more visceral, poetic, and affective connection. Before we can protect this realm, we must first acknowledge it—not as an abstract resource or service provider, but as a living, dynamic space that is integral to planetary balance. In my own way, I hope my work can contribute to this effort—not by offering access, but by creating a sense of proximity to this vast, uncanny, and still largely unknown world that, paradoxically, is vital to the survival of those living at the surface.

Too often, we impose artificial divisions on the natural world—separating the terrestrial from the aquatic and the celestial from the earthly—as if they were discrete, isolated domains. But the deep ocean is not separate from the atmosphere, just as the sky is not separate from the land. Everything is entangled. Ecology is not a set of independent systems but the very binder that holds them together. We need to recalibrate the way we see and describe the planet—not as fragmented parts, but as a continuous, interwoven reality.

Andreas Beitin (AB) _ How do you approach the conceptual phase of your new video works? Which thematic elements build on previous subjects, and what aspects are new? To what extent do you draw inspiration from outside the art world, for example, from scientific research?

JC_ Both *Albedo* and *Midnight Zone*—the work that lends its title to the exhibition—extend my ongoing engagement with the ocean, probing its fluid, elusive nature while reflecting on the ways that we attempt to comprehend and embrace the unknown.

Albedo continues my inquiries into the cryosphere, particularly in dialogue with *Towards No Earthly Pole*, yet from an entirely different perspective—this time from beneath rather than above. *Midnight Zone*, in turn, marks the beginning of a deeper inquiry into the abyssal plain, a space largely unseen yet increasingly inscribed by human presence. Both works question how we orient ourselves within unfamiliar environments and how perception—whether shaped by light, sound, or movement—structures our relationship to these ecosystems.

In *Albedo*, the audience rests upon the museum floor, gazing upward rather than forward, as though descending into the abyss from below, immersing themselves in the celestial. This inversion destabilizes our habitual relationship to space, mirroring the perceptual recalibrations I encountered while working in the Arctic, where distance, depth, scale, and even the notion of surface become uncertain. *Midnight Zone* extends this logic further: here, the camera is untethered, orbiting the lantern rather than adhering to a fixed vantage point. As underwater species gather and disperse around the light, the film acquires an anti-gravitational quality, dissolving any clear sense of direction. No longer positioned as observers, we drift within the scene itself—moving with the light rather than imposing meaning upon it. This subverts the hierarchical structures through which we traditionally frame knowledge and vision; we are no longer explorers mapping the unknown but merely another presence, navigating its depths.

At its core, *Midnight Zone* probes how we relate to spaces beyond our reach—places where human disturbance is already unfolding, yet where awareness has scarcely arrived. The descent of the lantern is both an act of inquiry and an encounter, revealing the entangled ecosystems of the deep. In the ocean, there are no rigid borders, only ecotones—gradual transitions rather than fixed separations. As the work moves into the so-called midnight zone, where sunlight ceases and light exists only as bioluminescence, the lantern itself becomes an ambiguous presence: both a beacon and a disruption, illuminating yet intrusive. It embodies the paradox of our presence—an attempt to see, to understand, yet one that inevitably alters what it touches.

Ultimately both, *Albedo* and *Midnight Zone*, seek to unmoor the viewer from familiar perspectives. In *Albedo*, we dive upward instead of down, inverting spatial expectations. In *Midnight Zone*, we descend into an unfamiliar realm, only to realize that we are not alone. Both works call into question the limits of perception and the ethics of presence, asking whether we can forge a relationship more in harmony with worlds that remain largely unseen, yet are inextricably linked to our own survival.

AB_ In the production of video works like *Midnight Zone* and *Albedo*, you work under extreme conditions. How do you prepare and execute these projects? How many people are involved, and what safety measures do you take, especially when filming underwater or in the Arctic?

JC_ These projects require months—sometimes years—of preparation. Each expedition is shaped by the unique demands of the landscape, the logistical complexities, and the unpredictable forces at play, making them both exhilarating and profoundly challenging. Working in extreme environments demands a careful balance between meticulous planning and an openness to uncertainty. Every project begins with extensive research, logistical coordination, and assembling a team with the expertise to navigate these conditions—scientists, divers, cinematographers, engineers, and local guides, each playing an essential role in realizing the work.

For *Midnight Zone*, filming in the deep ocean meant working with submersible and specialized camera systems, contending with immense pressure, shifting currents, and absolute darkness. The team included the cinematographer Antoine Drancey, who guided the remotely operated vehicle (ROV), assisted by Brieg Dufée, along with the underwater camera operator Adil Schindler and the marine engineer Christophe LeClercq, who oversaw the drifting lighthouse. Runar Jarle Stray Wiik contributed as both a producer and a diver, while Sten Johansson managed underwater safety. On-site coordination was led by Tanya and Sten Johansson, while Captain Pablo and his crew ensured the smooth operation of the vessel and its complex logistics.

By contrast, *Albedo* took shape in the Arctic, where the challenges were just as relentless—subzero temperatures, shifting ice, and extreme isolation. The work demanded not only technical expertise but physical and mental endurance, as the team worked around the clock, pushing the limits of what the body and mind could withstand. Nearly a year after my initial trials, we set out for Eastern Greenland, establishing a temporary base in an Inuit house—one part serving as living quarters, the other as a workshop and control center. The team included the polar scientist and expedition coordinator Morten Rasch, with Antoine Drancey once again piloting the ROV and Christophe LeClercq managing the underwater lighting systems. Felix Deufel, sound artist and audio engineer, worked to capture the Arctic's sonic environment, while Runar Jarle Stray Wiik, acting as both a freediver and pilot for the lighting system, helped maneuver the equipment beneath the ice. Mikael Rasch assisted in production, ensuring precision at every stage, while Inuit guide Kasper Broberg oversaw safety and logistics as we worked tirelessly on the frozen sea.

The ice itself was an immense threshold. We cut through the 80-centimeter-thick surface using a combination of chainsaws and traditional Inuit tooq tools, carefully carving an opening wide enough to lower the ROV into the abyss. Custom-made, 360-degree spotlights illuminated the otherworldly, submerged terrain—glassy ice keels and shifting formations, suspended in a way that unmoors any clear sense of scale or gravity. In the film, these formations seem to float, untethered from familiar spatial references, challenging the viewer's perception of space itself.

Beyond the visual, sound played a crucial role. Hydrophones captured the Arctic's acoustic environment—the brittle crackle of shifting ice, the calving of glaciers, and the echoes of whale songs reverberating through the depths.

Filming in these environments is never predictable. In Greenland, sudden temperature shifts caused the ice to fracture and drift, transforming navigation into a high-stakes negotiation with the elements. Tidal movements altered the landscape daily, requiring constant recalibration of plans. Every piece of equipment had to be shipped months in advance, and replacements were obviously impossible once on site.

In the middle of the Pacific, in turn, we were entirely at the mercy of the ocean—the waves, the wind, the relentless currents. The constant motion of the sea turned even the simplest tasks into endurance exercises, while the crew battled persistent seasickness. Every maneuver became a physical and mental challenge, making the work as tedious as it was demanding.

However, beyond the technical complexity, these projects require something deeper—they need a shift in perception, a willingness to relinquish control and to become attuned to the forces at play. Whether in the deep sea or the Arctic, the challenge is not to impose structure but to listen, to observe, to adapt—to allow the environment to dictate the rhythm of the work. These places exist outside of human time, beyond the frameworks through which we seek to define the world. To enter them is to accept that we are not in command; we are participants in something far greater, navigating landscapes that not only reshape how we see and hear, but challenge the very way we relate to the world itself.

RW_ How have your personal experiences as a diver influenced the sensory and aesthetic language of your works?

JC_ Diving is a return to something primordial; it is a state where individuality dissolves, and the body merges with its surroundings. It awakens a latent memory, an echo of the womb, which resurfaces once submerged. Underwater, the structures that define experience on land—gravity, direction, the boundary between self and environment—vanish. Currents do not merely press against the body as wind does; they envelop, absorb, and carry it, as if one were not moving through the ocean but becoming a part of it. Mass and volume cease to be fixed; one moves not through space, but within it.

This is where perception begins to shift. Unlike terrestrial movement, which remains bound to a single plane, diving is multidirectional—an expansion beyond gravitational constraints, a negotiation between buoyancy and depth. Orientation is no longer a certainty; without a fixed horizon, up and down become relative, undefined. Light fractures unpredictably, red wavelengths disappear first, and the world is gradually absorbed into an ever-deepening spectrum of blues. Unlike the sky, which remains a distant canopy, the ocean is a medium that fully envelops—one does not pass through it but is contained within it.

Few experiences reveal this dissolution more clearly than a drift dive in the open ocean—descending 30 meters into the blue, surrendering to the current. Here, the body enters a state of suspension, freed from its usual anchors. Breath becomes the only constant, its exhaled bubbles the sole indicator of direction. The experience is both disorienting and ecstatic: a loss of reference that paradoxically heightens awareness. It is not an encounter with the unknown but a return to something fundamental—an immersion into the very substance from which life emerged.

The ocean collapses the illusion of separation. It is not a space to observe but one to be absorbed into, to attune to rather than impose upon. This dissolution of boundaries—between body and medium, above and below—has profoundly shaped how I think about space, time, and sensory experience. The sea is not simply a subject but a condition, a means of recalibrating perception. To dive is to recognize, viscerally, that we are not distinct from the world but embedded within it, our blood still carrying the salinity of a single, continuous ocean.

RW_ Amorina Kingdon, in her essay in this publication, describes the underwater sphere as a world of sound. Has this different perceptual realm influenced the concept of the exhibition?

JC_ Absolutely. The world beneath the surface is anything but silent. It is dense with life—and with sound. Fish chirp, croak, and rumble, sometimes so loudly that their voices carry above the water. Amorina was right to suggest rethinking the metaphor—rather than singing like a bird, it would be more accurate to say *singing like a fish*. Fish have been vocalizing in the seas far longer than birds have in the skies, yet for most of history, we assumed the ocean was silent. That assumption reveals less about the nature of the sea than it does about the limits of human perception.

Sound moves four and a half times faster in water than in air, but our ears are not attuned to register it. We have mistaken our own sensory constraints for an absence. This realization became central to the making of this exhibition—not just as a conceptual thread, but as a means of rethinking how we engage with the deep. What if sound, instead of sight, were the primary sense through which we experience and navigate space?

The exhibition foregrounds sonic elements—hydrophone recordings, the clicks and pulses of marine life, the infrasonic hum of industrial activity—to immerse the viewer in a sensory logic foreign to terrestrial experience. It is about shifting our mode of perception, relinquishing the primacy of sight in favor of something more fluid, more diffused, more aligned with the way life actually unfolds in the depths.

We already rely on sound to navigate the unseen—marine science maps the deep through acoustics, using sonar to render what cannot be directly observed. But if we can visualize the ocean through sound, can we also expose the damage we inflict upon it? How do we make tangible the extent to which anthropogenic noise—shipping corridors, seismic surveys, deep-sea mining—is distorting the sonic fabric of marine ecosystems, disorienting species that depend on it for survival?

This is where works like *Midnight Zone* emerge. The vibrating mirrors in the exhibition translate human-generated sound waves into physical distortions, making the invisible disruptions of the ocean's acoustic world something we can see—and, in turn, something we can no longer ignore. If sight dominates our terrestrial reality, sound is the defining sense of the ocean. To disrupt that balance is to unravel an entire world.

AB_ In *Black Smoker*, you take us on a journey deep into the ocean, where geological, biological, and human frequencies intertwine. Can you describe how this work immerses the audience in the hidden soundscape of the deep sea, and why you chose to present it in total darkness?

JC_ For years, I've been drawn to the frequencies of geology—the imperceptible voices of the Earth, vibrating beyond human perception. *Black Smoker* plunges into the deep sea, where hydrothermal vents—black smokers—release mineral-rich plumes into the abyss. These submerged volcanic chimneys exist in total darkness, their activity shaping the very foundation of the seafloor. Here, sound becomes a bridge to an inaccessible world—where fire and water meet, unseen but not unheard.

Much like *Stone Speaker* at Palais de Tokyo in 2024, which explored the seismic resonances of the planet's interior, *Black Smoker* listens to another form of planetary expression. But this time, rather than journeying from a caldera toward the center of the Earth, we descend 6,000 meters below the surface, into a soundscape where geological, biological, and human frequencies converge.

The ocean's depths are not silent—they pulse with the murmur of shifting tectonic plates, the guttural tremors of submarine volcanoes, the crackling breath of vents exhaling mineral-laden plumes. This geophony, largely imperceptible to human ears, sets the foundation of the piece. Layered within it are the sonic traces of life—the deep echoes of whale calls, the flickering biophony of deep-sea organisms navigating a world without light. Threading through it all are the distant echoes of human presence: the low hum of deep-sea mining probes, the seismic thuds of industrial intrusion, the spectral reverberations of a civilization pushing ever further into the abyss.

What makes this piece unique is that it relies on a live data stream from deep-sea cables and hydrophones—such as those at the Monterey Bay Aquarium Research Institute (MBARI) in California or on the undersea Axial Seamount volcano—capturing the ceaseless movements of the oceanic world in real time. The result is a continuously evolving soundscape, attuned to the rhythms of the deep, where tectonic shifts and underwater eruptions unfold as an ongoing planetary symphony.

The piece is to be experienced in near total darkness. Without clear visual anchors, perception shifts—hearing becomes spatial, tactile. This deprivation mirrors the deep sea itself, where vision ceases to be the dominant sense, and reality is grasped through vibration and resonance.

Imagine sitting on the ocean floor, enveloped in darkness, your body suspended between silence and sound. As the pressure of the deep settles around you, the Earth begins to whisper—low, guttural tremors that ripple through stone, the sighs of molten rock coursing through unseen veins. Time slows, dissolving into the ebb and flow of the planet's breath. In this vast, hidden world, you are no longer just an observer. You are listening, becoming a part of the rhythm of the deep—drifting between past and future, submerged in the murmurs of a world still in the making.

AB_ On the one hand, your works are technically elaborate and aesthetically staged. On the other, you play with elements of mysticism, the sublime, and the enigmatic. How important are these components to you?

JC_ I see no contradiction between technical precision and poetic ambiguity—if anything, they are mutually reinforcing. My work often navigates the space between empirical knowledge and a more intuitive, sometimes speculative understanding of the world. Science provides tools to understand the world, but it does not necessarily

capture how it feels to encounter this same world. This is where art comes in—not to illustrate knowledge, but to expand its dimensions, to evoke rather than explain.

The deep sea, for example, is inherently sublime—not in the Romantic sense of mere grandeur, but as a space that resists scale, defies familiarity, and oscillates between wonder and unease.

This tension between the measurable and the immeasurable, between rational inquiry and the unknown, has always been central to my work. I'm interested in how scientific methodologies intersect with more poetic, even mystical, ways of knowing. While my work is rooted in material, ecological, and geopolitical concerns, it also opens a space for the ineffable—for a kind of experience that is not purely intellectual but deeply felt.

RW_ In your work, you frequently merge science, technology, and art. How have you interwoven these disciplines to explore the concepts behind *Midnight Zone*?

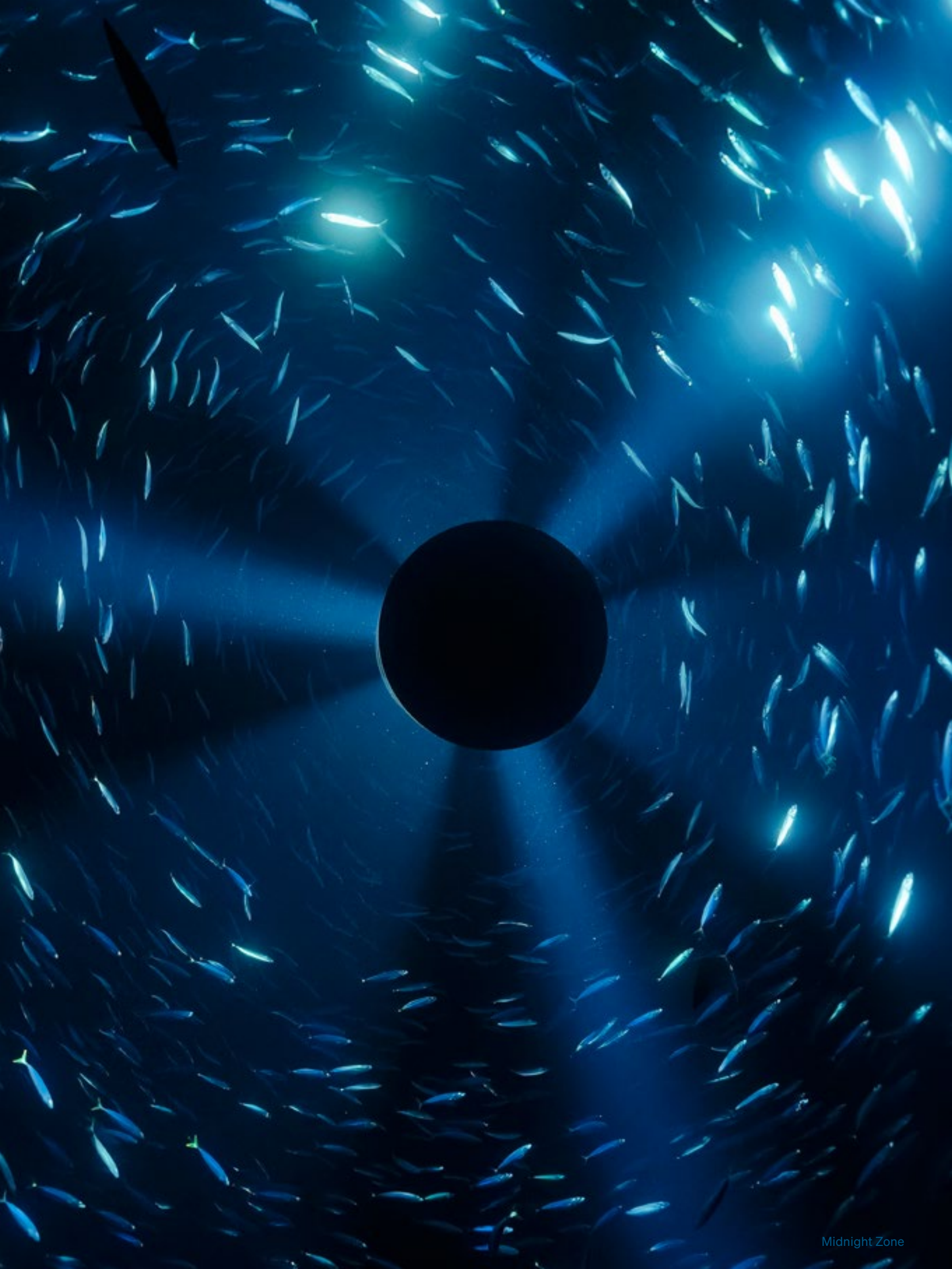
JC_ Science, technology, and art each offer distinct ways of engaging with the world. Science and technology equip us with the tools to reveal the deep ocean—charting its trenches, measuring its currents, cataloging its life—yet scientific knowledge alone does not create connection. A map may outline the contours of a place, but it does not allow us to inhabit this place. It does not make us feel. And the deep ocean, more than any place on Earth, demands to be felt.

For centuries, we have navigated the world with a terrestrial bias, ascribing significance only to landscapes we can walk upon, breathe within, or claim as our own. The deep ocean remains different—too remote, too alien, too unyielding to human presence. Yet it is not an absence but an archive, the silent engine of planetary rhythms, the primordial cradle of life itself. To leave it unmapped in our collective imagination is to leave ourselves stranded in an incomplete world.

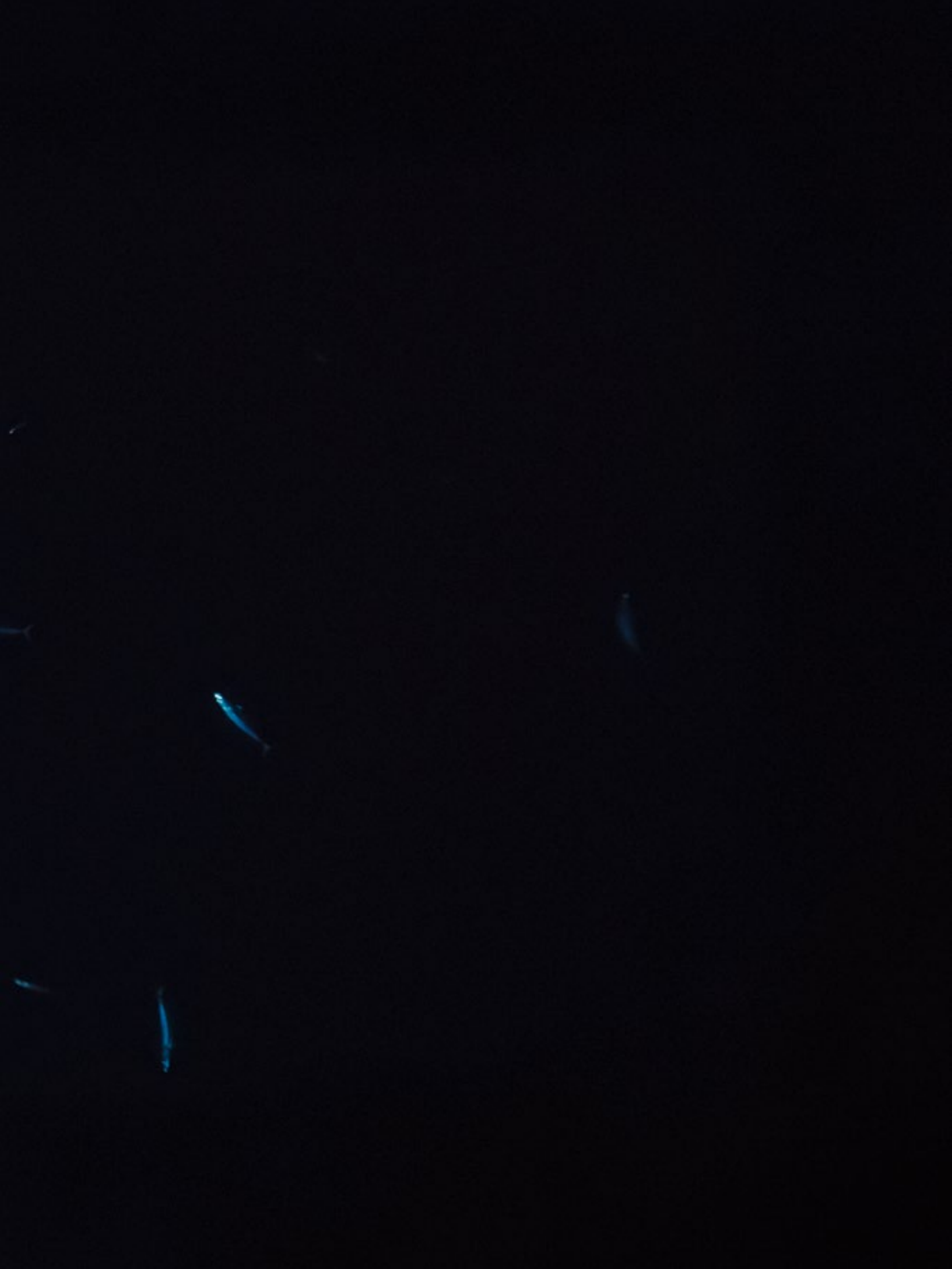
The exhibition *Midnight Zone* arose from this entanglement, merging scientific methodologies and knowledge—deep-sea imaging, hydroacoustics, and environmental data—with an artistic sensibility that seeks not just to document, but to evoke. Several projects in the exhibition were realized through close collaboration with marine scientists, geologists, and biologists, whose expertise shaped my understanding of the ocean and our evolving relationship with it.

The deep is no longer untouched—it is a threatened ecosystem, transformed by climate change, industrial extraction, and noise pollution at a rate faster than we can comprehend. Scientific knowledge alone will not protect it. What is needed is connection—a cultural consciousness of the deep that fosters not only understanding but care and stewardship.

Only when we feel the deep—when we recognize it not as a resource but as a part of our own story—can we begin to imagine new ways of protecting it. And in doing so, we may finally understand what has always been true: that our fate and the fate of the oceans are inseparable.



Midnight Zone



Julian Charrière

Julian Charrière, a Swiss-French artist based in Berlin, engages with the cultural and environmental histories embedded within natural landscapes. His works collapse geological and human timescales, revealing the slow and often invisible forces that shape and reshape both terrains and historical imaginaries.

Spanning film, sculpture, photography, and installation, his multidisciplinary practice is marked by immersive projects grounded in fieldwork within ecologically and symbolically charged sites—glaciers, volcanoes, nuclear test zones, and deep-sea ecosystems. Through these intimate encounters with fragile environments, Charrière explores how human activity inscribes itself into the fabric of the planet, subtly altering its surfaces, atmospheres, and futures.

Fusing scientific observation with speculative poetics, his works foreground landscapes as physical processes, repositories of memory, and vessels of cultural imagination. Rather than illustrating environmental crises directly, Charrière creates spaces where wonder and disquiet coexist, allowing viewers to experience the contradictions and tensions of our contemporary condition.

His practice probes the colonial and extractivist legacies embedded within acts of exploration, landscape representation, and the technologies of seeing.

Charrière graduated from the Berlin University of the Arts (UdK) and was a participant in Olafur Eliasson's Institute for Spatial Experiments. His works of art have been widely exhibited internationally, with solo exhibitions at ARKEN Museum of Contemporary Art, Denmark, Palais de Tokyo, France, San Francisco Museum of Modern Art, United States, Dallas Museum of Art, United States, Langen Foundation, Germany, Museo d'Arte Moderna di Bologna (MAMbo), Italy, Aargauer Kunsthaus, Switzerland, Berlinische Galerie, Germany, and Parasol Unit, United Kingdom, among other art venues. His work has also been presented at the Centre Pompidou, France, Fondation Beyeler, Switzerland, Mori Art Museum, Japan, and ZKM | Center for Art and Media Karlsruhe, Germany, among multiple Venice Biennales. Charrière is the first recipient of the Eric and Wendy Schmidt Environment and Art Prize awarded in 2024 by The Museum of Contemporary Art (MOCA), Los Angeles.

Author Biographies

Stacy Alaimo

Stacy Alaimo is the Moore Professor in English and Core Faculty Member in Environmental Studies at the University of Oregon. She is the author of *Undomesticated Ground: Recasting Nature as Feminist Space* (2000), *Bodily Natures: Science, Environment, and the Material Self* (2010), and *Exposed: Environmental Politics and Pleasures in Posthuman Times* (2016). She has edited two books, including *Material Feminisms* (2008), and has published many articles. Alaimo's new book is *The Abyss Stares Back: Encounters with Deep-Sea Life* (2025).

Geraldine Kirrihi Barlow

Geraldine Kirrihi Barlow (Ngāpuhi) is a curator, writer, and creator based in Brisbane, Australia. Charrière and Barlow traveled and dived together in 2022. Their friendship developed after the artist featured in her 2019 exhibition *Water*. Barlow is Head of International Art at the Queensland Art Gallery and Gallery of Modern Art, both in Brisbane. Her other enviro-socially related exhibitions include *Air* and exhibitions focused on history, culture, and memory such as *Plenty* and *Concrete*.

Andreas Beitin

Andreas Beitin studied art history, applied cultural sciences, and modern and contemporary history. After earning his doctorate in 2004, he worked at the ZKM | Museum of Contemporary Art in Karlsruhe. Initially employed in various research and curatorial positions, he became the museum's director in 2010. Since then, Beitin has curated or cocurated a large number of internationally acclaimed exhibitions. He publishes scholarly texts in Germany and abroad, gives lectures, and has edited numerous publications. Beitin has been a member of various art juries and scholarly committees for many years and has received several awards for his curatorial work. From 2014 to 2015, he taught as a lecturer in art history at the State Academy of Fine Arts Karlsruhe. From 2013 to 2018, Andreas Beitin was chairman of the Advisory Board for Visual Arts at the Goethe-Institut. From February 2016 to March 2019, he was Director of the Ludwig Forum for International Art in Aachen. Since 2019, Andreas Beitin has been Director of the Kunstmuseum Wolfsburg.

Susan Casey

Susan Casey is the author of four *New York Times* bestselling books: *The Devil's Teeth: A True Story of Obsession and Survival Among America's Great White Sharks* (2005), *The Wave: In Pursuit of the Rogues, Freaks, and Giants of the Ocean* (2010), *Voices in the Ocean: A Journey into the Wild and Haunting World of Dolphins* (2015), and *The Underworld: Journeys to the Depths of the Ocean* (2023). Casey is the former editor-in-chief of *O, The Oprah Magazine* and *Sports Illustrated Women*, editor-at-large for Time Inc., and creative director of *Outside* magazine. She is a National Magazine Award-winning journalist whose work has appeared in *Vanity Fair*, *Esquire*, *Sports Illustrated*, *Fortune*, *Time*, *Outside*, and *National Geographic*.

Peter H. Gleick

Peter H. Gleick is a leading environmental scientist, innovator, and communicator on water and climate issues. He cofounded the Pacific Institute, California, which advances solutions to global water problems. His work addresses the human right to water and issues related to water and climate, as well as water, peace, and security. Gleick is a MacArthur Fellow, member of the US National Academy of Sciences, and author of many scientific papers and books, including *The Three Ages of Water: Prehistoric Past, Imperiled Present, and a Hope for the Future* (2023).

Peter Godfrey-Smith

Peter Godfrey-Smith is Professor of History and Philosophy of Science at the University of Sydney. He works in the philosophy of biology and the philosophy of mind. He is the author of seven books, including *Darwinian Populations and Natural Selection* (2009), which won the 2010 Lakatos Award, and *Other Minds: The Octopus and the Evolution of Intelligent Life* (2016). His most recent book is *Living on Earth: Forests, Corals, Consciousness, and the Making of the World* (2024).

Amorina Kingdon

Amorina Kingdon is a journalist and writer living in Victoria, Canada. She is the author of *Sing Like Fish: How Sound Rules Life Under Water* (2024). She also studies the history and philosophy of science, and the role of sensory biology in the creation of knowledge. If not writing, she is likely hiking up a hill on Vancouver Island or attempting an unproven recipe in her very small kitchen.

Sara A. Rich

Sara A. Rich is Associate Professor of Theory and History of Art and Design at the Rhode Island School of Design and a citizen of the Waccamaw Indian People. Rich is a maritime archaeologist, art historian, and artist, as well as an author of speculative fiction, whose recent scholarship includes essays in the *Journal of Aesthetics and Art Criticism*, *Heritage*, and *Contemporary Philosophy for Maritime Archaeology* (which she also coedited). Her most recent books include *Mushroom* (2023) and *Shipwreck Hauntography* (2021).

Helen M. Rozwadowski

Helen M. Rozwadowski is Professor of History and the founder of the University of Connecticut's Maritime Studies program. She has authored three books, most recently, *Vast Expanses: A History of the Oceans* (2018), and edited three volumes on the history of oceanography; she also coedits the University of Chicago Press book series *Oceans in Depth*. Rozwadowski has recently spent time at the University of Oslo and at the Rachel Carson Center for Environment and Society in Munich.

Roland Wetzel

Roland Wetzel has been Director of Museum Tinguely in Basel since April 2009. Previously, he worked at the Kunstmuseum Basel from 2000 to 2009. At Museum Tinguely, he conceptualizes an exhibition program that distinguishes between Tinguely's role models, his contemporaries, and his topicality in the contemporary era. Wetzel has curated numerous exhibitions, including: *Robert Rauschenberg*, *Le Mouvement*, *Robot Dreams*, *Car Fetish*, *Vladimir Tatlin*, *Zilvinas Kempinas*, *Les Affichistes*, *Prière de toucher*, *Jérome Zonder*, *Gauri Gill*, *Lois Weinberger*, *Pedro Reyes*, *Bruce Conner*, *Anouk Kruithof*, *Janet Cardiff & George Bures Miller*, *Temitayo Ogunbiyi*, and *Mika Rottenberg*.

List of Works

***A Thousand Worlds,* 2025**
Silver mirror made using silver reclaimed from gelatin silver prints
Dimensions variable
(p. 32)

***Albedo,* 2025**
4K video, 16:10 aspect ratio, 3D ambisonic soundscape, continuous video loop
Video score by Jana Irmert
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***And Beneath It All Flows Liquid Fire,* 2019**
UHD video, 16:10 aspect ratio, stereo sound, continuous video loop
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***Black Smoker,* 2025**
Immersive multimedia sound installation, 4D sound system, live seismic data feed, self-generative composition
Dimensions variable
(pp. 60–61)

***Calypso,* 2019**
Chinese-made LC4 chaise longue replica with neoprene sleeve cover, diving cylinder, Nitrox 96, chromed full-face diving mask
80 × 62 × 160 cm
(pp. 30–31)

***Choralography,* 2025**
Site-specific multichannel sound installation
Dimensions variable
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***Coalface,* 2024**
Anthracite coal, stainless-steel oil lamp
Dimensions variable
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***Controlled Burn,* 2022**
4K video, 16:9 aspect ratio, 3D ambisonic soundscape, 32 min., continuous video loop
Video score by Felix Deufel
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***Midnight Zone,* 2024**
4K video, 16:10 aspect ratio, 3D ambisonic soundscape, 56 min., continuous video loop
Video score by Laurel Halo
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***Midnight Zone,* 2025**
Fresnel lens, multichannel sound installation, mirror foil, transducer, haze
Dimensions variable
(pp. 68–75)

***Pitch Drop,* 2016**
Bitumen, stainless steel, borosilicate glass
185 × Ø 47.5 cm
(pp. 176–77)

***Pure Waste,* 2021**
FHD video, 16:10 aspect ratio, stereo sound, 5:30 min., continuous video loop
(pp. 112–13)

***Silent World,* 2019**
Top-down video projection on round basin surface, water, and mist
600 × 600 × 250 cm
(pp. 55–59)

***Silent World – Saratoga,* 2018**
Archival pigment print on Hahnemühle Photo Rag Ultra Smooth paper
80 × 120 cm
(pp. 28–29)

***Spiral Economy,* 2025**
Vending machine with infinity mirror, lighting, and fossils
199.4 × 69.9 × 90 cm
(pp. 171–73)

***The Blue Fossil Entropic Stories I/II/III,* 2013**
Archival pigment print on Hahnemühle Photo Rag Ultra Smooth paper
160 × 240 cm each
Courtesy of Dittrich & Schlechtriem
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***The Gods Must Be Crazy,* 2019**
49-channel multimedia installation, found underwater footage, 5:4 aspect ratio, 5:30 min., continuous video loop
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***Towards No Earthly Pole,* 2019**
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Video score by Robert Lippok
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***Where Waters Meet,* 2019**
***[2.31 atmospheres]* (p. 202)**
***[2.98 atmospheres]* (p. 203)**
[3.18 atmospheres]
***[3.23 atmospheres]* (p. 211)**
***[3.35 atmospheres]* (p. 212)**
***[3.43 atmospheres]* (p. 213)**
***[3.66 atmospheres]* (p. 214)**
[3.70 atmospheres]
***[3.71 atmospheres]* (p. 215)**
***[3.75 atmospheres]* (p. 216)**
***[3.77 atmospheres]* (p. 217)**
***[3.81 atmospheres]* (p. 218)**
[3.93 atmospheres]
***[3.98 atmospheres]* (p. 219)**
Archival pigment print on Hahnemühle Photo Rag Ultra Smooth paper
58 × 45.3 cm each

Unless otherwise noted, all works courtesy of the artist.

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***Midnight Zone*, 2024**
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Brieg Dufée
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Christophe Leclercq
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Underwater Guide & Safety Diver
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Production Management Assistant
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***Midnight Zone*, 2025**
Installation

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Spatial and Sound Design
Bryce Edwards
Underwater Lighting Development & Engineering
Christophe Leclercq
Fresnel Lamp Design & Fabrication
Dan Spinella
Fresnel Lamp Casing Supervision
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***Albedo*, 2025**

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Spatial Sound Designer
Felix Deufel
Post Production
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Underwater Lighting Development & Technical Supervision
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Underwater Video Footage and Advice
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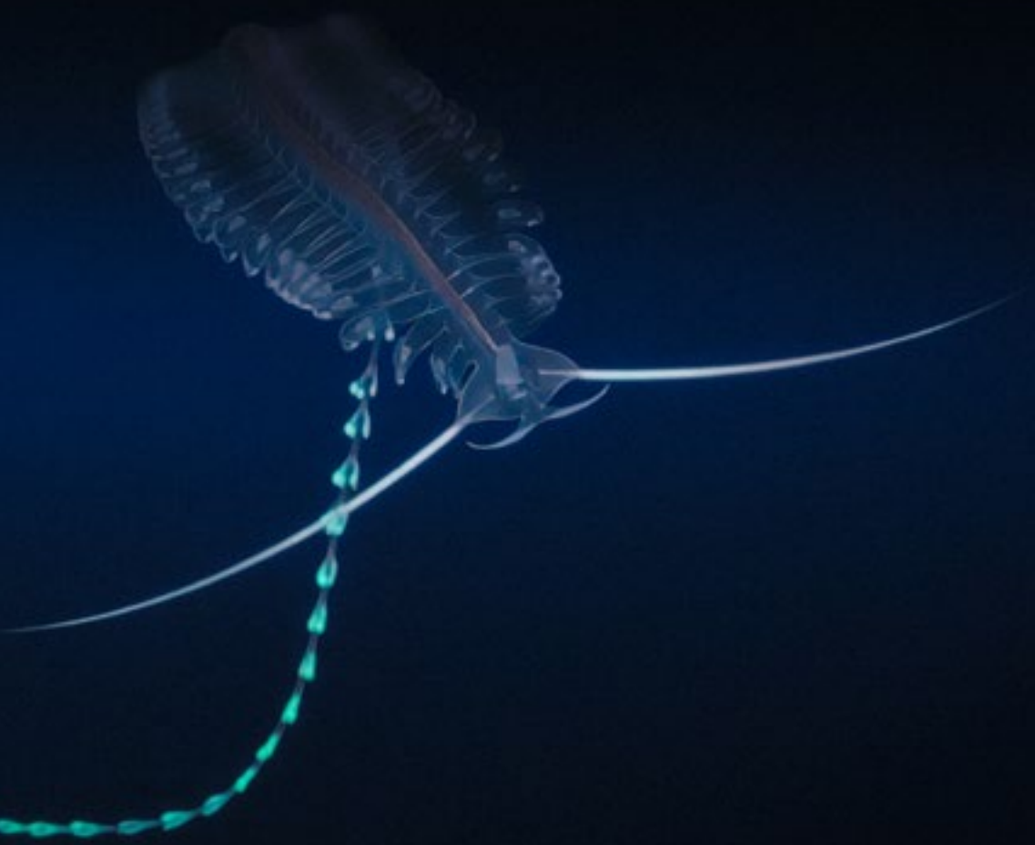
Midnight Zone



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