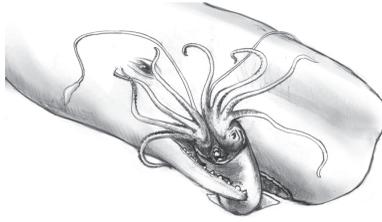


PROLOGUE THE EPIC OCEAN



If you stand on a beach and stare out toward the horizon, perhaps squinting at the sunset or the vaporous plume of a distant whale, you can see about 3 miles out. If the weather is clear, you might be looking at 10–20 square miles of ocean surface—a fairly large habitat by most wildlife standards. But the global ocean is actually 10 million times the size of your view out to the horizon, and on average there are more than 2 miles of water under every square foot of surface. The most extreme thing about the ocean is its sheer, inconceivable size.

In that enormous volume—the biggest habitat on Earth—lives a kaleidoscope of animals, plants, microbes, and viruses. Indeed, the ocean nurtures the most fascinating and unique creatures in the natural world. They occupy many different habitats and deploy diverse survival strategies. None lead particularly easy lives. The ocean might seem bucolic from a beach house's front deck, but it's usually too hot or too cold, lousy with microbes, or piled with tier upon tier of predators.

But extreme life thrives in the oceans—whether through speed or guile or infrared vision, by dint of marvelous specialized adaptations. Walt Whitman wrote, “I am large, I contain multitudes” in his “Song of Myself,” but the famous line perfectly describes the sea.¹ Dark, deep, and filled with alien creatures, the ocean chills our bones as it stifles our breathing. Its psychological gravity pulls human imagination back to the oldest stories of man struggling against the squalling sea. Our goal in this book is to illuminate the species that have risen to the challenge of the oceans, in the most extreme environments and in the most familiar: the ones using the wildest survival tactics in

the sea. We bring you the fastest, the deepest, the coldest, and the hottest, drawing in some of the smallest details of their lives but also painting the backdrop of their role in the oceans.

What lies beneath the sea is more intricate, compelling, and fascinating than the storm-whipped sails of literature or the sensational fearmongering of *Shark Week* television. Most sharks, after all, are not actually that extreme—excepting the few big ferocious ones. Look closely at any plot of water on Earth and a fascinating and awe-inspiring dance unfolds among the ocean's wild denizens. Flying fish flash across the waves with lightning-fast mahi mahi in pursuit. Tropical reefs chatter with the sounds of distant firecrackers as tiny pistol-clawed shrimp fire off powerful sonic weapons. Black dragonfish use infrared vision to ambush hapless passers-by in the depths.² Life is a carousel of struggle and success, of beauty and beautiful ugliness.

Over the past few decades ocean science has drawn more eyes toward ocean life than ever before. It's brought more answers to the surface, using an arsenal of scientific approaches and technological instruments to solve mysteries. In 1930, as famed scientist and explorer William Beebe climbed into his bathysphere and dropped into the warm Bermuda seas, he had only an electric searchlight to see in the darkness and a telephone line to describe to the surface what he saw. Today there are submarines, DNA sequencers, robot chemistry labs that skim the waves, and respiration chambers tiny enough to measure the breath of a barnacle. Since Beebe's time we've accumulated more than 80 more years of basic scientific knowledge, without which hardly any serious biological mystery can be solved.

When splashing into the sea with a SCUBA tank and mask, it is hard to predict which of these tools might help you understand something as simple as a bleached coral head. But two things you are certain to need: a delighted sense of wonder at every mystery, and a spark of joy at each discovery, in every creature in creation. Our aim is to give you both.

The world's biggest predator meets its most fearsome prey

It's dark and cold and very deep. A sperm whale (*Physeter macrocephalus*) cruises through the ink, descending toward the floor of the world. He's hunting: powerful muscles and hot blood collaborating to run down rare prey in the cold, oxygen-poor depths. Down and up, dive and ascent, each cycle punctuated with foul-smelling blowhole gasps at the surface. A long life and great bulk lend the bull patience, and he passes by trivial morsels in search of more

substantial fare. His broad tail and heavy muscles produce a steady cruising speed. Tiny eyes little bigger than a cow's peer through deepening blues, oriented to look down and not ahead. In the dark, that patience bears fruit: a mile down, the world's biggest predator meets its most fearsome prey.³

The silver behemoths known as giant squid measure between 20 and 55 feet in length.⁴ Eight short arms are joined by two long, slender tentacles with paddles on the ends: like whips, they're used for hauling prey toward a viciously sharp beak. A typical fish-market squid carries nothing but gentle suckers on its arms and tentacles, but the deep's titans are far better armed. Some have swiveling hooks on the tips of their tentacles; others have serrated suckers like circular saws to rend flesh to ribbons.⁵ Prey, so preciously rare in the deep sea, can't be allowed the slightest chance to escape.⁶

Our bull whale follows the same philosophy. Picture the scene: 40 tons of flesh and hot blood colliding with a 30-foot mother squid at 10 feet per second.⁷ Though she weighs only 1,000 pounds, much of that mass is pure muscle. The bull whale uses the prow of his skull as a battering ram, perhaps broadcasting a sonic boom forward from the powerful echolocation machinery in his huge head. The squid slows and deploys her arms, spreading them wide and rotating like a parasol in the dark. When they collide, the squid's boneless body absorbs the impact. She rolls with the blow, wrapping her arms around the attacker's head and jaws. Hooks tear long gaping wounds in his skin, layering fresh damage on top of chalky white scars. He's no stranger to this kind of fight.

He feels her arms between his jaws and chomps down, severing two completely. Blue and red blood, from squid and whale, mingles in black water.⁸ One swipe of a club-like tentacle knocks out a tooth but does nothing to slow the bull's chewing. Every stroke of his jaws is another awful wound, and for all her fighting spirit, she just can't win. Her razor-edged suckers rip painful chunks from the bull's flesh, but the damage is only skin deep. The squid tries to break away, but half her arms are gone or hanging by ribbons; her siphon works as hard as it can to jet her to safety. But it's not enough. He's too strong, too fast, the fire in his blood fanned by rich oxygen inhaled from the surface.⁹ One more strike ends her life in a gush of dark fluids and pink detritus. The whale drifts away, angling his fins like bowplanes toward the surface. What's left of his prey dangles from his mouth as he seeks his next breath of air.

These epic tales are written in scars, published on the skin of victorious whales. The squid sign their names in those scars: colossal squid (*Mesonycho-*

teuthis hamiltoni) leave long parallel gashes, but the saw-suckers of the giant squid *Architeuthis* etch eerily perfect circles.¹⁰ A sperm whale hunting a giant squid has never been directly observed. Instead we read the scars and count the squid beaks in a whale's stomach and know that in the deep basement of the sea, there is a battle going on.

This is not an exotic fantasy. It is a picture that has been built up over a century of careful cataloging and serendipitous encounters. It is matched by an ocean of other battles, from the serial kleptomania of hermit crabs to the war over gonads in sea squirts. It pitches ancient adaptation against today's fight for a meal. It's the sort of thing that happens every day in the extreme life of the sea.