

FROM THE
AMERICAN MUSEUM OF NATURAL HISTORY

The Lives of
WHALES
and
DOLPHINS

RICHARD C. CONNOR

and

DAWN MICKLETHWAITE PETERSON

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*Other books on animal behavior from
the American Museum of Natural History*

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by Lester L. Short

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To my parents,
who sent me
off to California to rekindle a dream,
to Jim and Elizabeth
for putting up with me that summer,
and to my friend John Hession,
whose stroke and recovery
kept things in perspective.

R. C. C.

To Erica, Sabrina, and Gabrielle,
who sacrificed many months of bedtime stories
so that this book could be written.

D. M. P.

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Having been interested in dolphins for as long as I can remember, I pursued my dream to the University of California at Santa Cruz, whose educational philosophy and stunning beauty suited my rebellious nature perfectly. There, I was fortunate to have the noted cetologist Kenneth S. Norris as my undergraduate mentor. I owe Elizabeth Gawain a huge debt for introducing me to the research possibilities at Shark Bay, Western Australia, where my colleagues and I have been studying bottlenose dolphins since 1982. Since the early 1960s, several dolphins have been visiting a fishing camp called Monkey Mia in Shark Bay, where people feed and stroke them. The tame dolphins and clear protected waters of Shark Bay make it ideal for a researcher, and I am incredibly fortunate to be working there. I am also fortunate to be working with researchers Rachel Smolker, Andrew Richards, Janet Mann, Per Berggren, and Amy Samuels. At the University of Michigan, I found a thriving intellectual atmosphere that I have not seen equaled elsewhere and two outstanding graduate supervisors in Richard Alexander and Richard Wrangham.

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PREFACE

From some of our earliest historical records we learn that humans were intrigued by the mammals that make their home in the sea. Their massive size alone would make them worthy of our attention, for many are counted among the largest beasts in the world. However, this book is devoted almost exclusively to the *behavior* of whales and dolphins because cetaceans, the taxonomic name for these creatures, are adapted to ocean life in many fascinating ways.

This book is the second of what will be a number of volumes devoted to animal behavior. The first was on the lives of birds, creatures most of us see everyday but that nonetheless continue to surprise us. To those inclined to pay attention to the fascinating and complex behavior of the other creatures that inhabit the planet, I recommend this series, which will explore the remarkable native abilities of many animals.

One of the marvels of nature is its astounding diversity with its millions of species. Unfortunately, we are currently in the midst of a mass extinction of species that may rival anything in the history of life on earth. Because of the grossly apparent evidence that it is we humans who are the cause of the current extinctions, we have been urged to more carefully consider the long-term consequences of our actions. We do not have to harpoon a whale to kill it. When we damage the ocean ecosystem with our pollution or by depleting the resources upon which whales and dolphins depend, we are indirectly contributing to their demise.

Although cetaceans of the same species are each other's strongest competitors for food and mates, they also cooperate with one another, especially when rearing their young, seeking safety from predators, or sharing food. One example of such cooperative behavior has been observed among sperm whale females which "babysit" a fellow whale's calf when (he other is diving for food. Without such cooperative behavior, the vulnerable young might well succumb to (lie ocean's many perils. Or consider the way bottlenose dolphins in South African waters have been observed dividing their foraging

labor. As the dolphins herded fish against the shoreline, some dolphins chased the fish, while others patrolled offshore, keeping the fish school from escaping out to sea.

Dolphins are responsible for some of the most remarkable examples of cooperation in the animal world. They even form symbiotic relationships with humans. One example of human-dolphin mutualism is found in a coastal Brazilian village. There, generations of bottlenose dolphins have been helping generations of fishermen catch the mullet upon whose sale the villagers depend. Armed with crude nets, the men stand at the shore, waiting for the dolphins in the bay to make a move. Then it comes! A dolphin dives, and is seen a moment later traveling at full speed toward the line of men. Just when it seems the dolphin will crash into the men, the animal comes to an abrupt halt and dives just out of range of the nets. The men quickly throw their nets, their efforts rewarded with a bulging catch. Simultaneously, the dolphin catches its reward: a belly full of fish, naturally.

Despite a widespread interest in these majestic creatures, most of us have yet to see one in the wild. Thus, it isn't difficult to understand why the average person tends to lump whales and dolphins into a single category, when there are, in fact, seventy-five species of mammals that belong to the taxonomic order Cetacea, many of them with markedly different habitats, social organization, and life-styles.

The purpose of this book is to better acquaint you with the creatures we call whales and dolphins because only by knowing them can we understand how remarkable their lives truly are.

My own entire professional life is centered upon the study of dolphins and whales in the wild. Since my days as an undergraduate at the University of California I have been fascinated by these creatures, especially dolphins. In 1982, I had my first opportunity to study them in detail at Shark Bay in Western Australia. One of the many remarkable features of this dolphin research site is the story of how it began.

In the 1960s, people who came to vacation near this remote old fishing camp reported that dolphins would approach

the small boats returning to shore to beg for a portion of the day's catch. Eventually, the dolphins began accepting fish from people wading in the shallows. Elizabeth Gawain, a roving American teacher of yoga, was the first to realize the scientific potential of having wild but tame dolphins so near at hand. During her visits to Shark Bay, Elizabeth kept a detailed journal of her dolphin observations she later published as a book, *The Dolphin's Gift*. She also alerted scientists to the possibilities at Shark Bay, and it was during her presentation to a group of marine mammal biologists at the University of California at Santa Cruz that I met her. There were only two undergraduates listening to Elizabeth that day, myself and Rachel Smolker, and both of us knew immediately that we *had* to go to Shark Bay.

Our first visit there, in 1982, lasted three months, and by the time our work was completed, we were planning how to return. Since then we have been back to Shark Bay frequently, and today, the Shark Bay dolphin research project is an international effort conducting half a dozen separate studies of the behavior and ecology of bottlenose dolphins. I have concentrated on the behavior of males, who form alliances that are as complex as any to be found in nonhuman animals.

Only a small portion of the dolphin research cited in this book comes from our work at Shark Bay, however. The study of whales and dolphins is an international collegial effort and without the hard work of numerous scientists a book such as *The Lives of Whales and Dolphins* would not be possible.

Our hope for this and the other books in the animal behavior series is that they will fascinate you, teach you something of the wonders of the natural world, and kindle or feed your interest in the animals that share this planet with us. If we are to begin to heal the many problems that threaten its well-being, that is the first and most important step.

The Lives of
WHALES
and
DOLPHINS



At Sea with Whales and Dolphins

The whale was born on a warm July day in the tropical Pacific waters off the Galapagos Islands. His tail was the first part to emerge from the underbelly of his mother.

As the mother struggled to free her body of the burdensome cargo it had carried for fifteen months, she was surrounded by other females, many of whom she had known all her life. They provided protection from opportunistic predators, perhaps even offering reassurance with gentle strokes of their flippers. But the mother needed little help. She forcefully expelled her newborn, breaking the cord, and then gently nudged him to the surface. There, he inhaled his first breath of life-sustaining oxygen in an action that separates his kind from the rest of the sea's inhabitants.

The young whale gasped great gulps of the warm air. After his first need was satisfied, he felt a need of a different sort, probably the same sort of urgent emptiness that newborns of all species feel. Understanding, the mother slowed her pace, allowing her calf to take her large nipple into his mouth and drink the fat-rich milk that soon would transform his body into a formidable presence.

He was a sperm whale, the largest of the toothed whales, the *Odontoceti*, a suborder that includes dolphins, porpoises, and beaked whales. At birth he was a mere twelve feet long and weighed only one ton, small indeed compared to the size that he would someday attain. In the kingdom of whales he was certainly not the most beautiful. Neither elegant nor streamlined, the whale's body appeared to be in posses-

sion of a head that was too large. By the time he reached adulthood, his massive, boxlike snout would account for 40 percent of his entire length.

What they lack in beauty, however, the sperm whales of the world once made up for in utility. In the past, they were among the creatures most prized by all whales' most dangerous predator, humans. Literature's best-known whale, Moby Dick, was a sperm whale, who took a terrible revenge upon the men who had come to kill him because of the treasure contained within his gigantic head. It is here that the sperm whale's spermaceti organ rests, a huge cone-shaped structure filled with a waxy oil used as a sound conduit that humans found useful for the production of items ranging from lamp oil to lubricants. A sexually mature male could yield as many as three thousand quarts of this liquid gold in the days when men were allowed to hunt freely for the whales. But because this little whale's ancestors had been destroyed in such large numbers, it is now illegal to kill sperm whales and most other species of whale, as well.

The baby whale's mother was almost sixteen years old, having borne one other calf, six years earlier. Had she had been aware of statistics, she would have known that the chances of her latest arrival surviving to adulthood were not good. But she did know what he didn't, that the watery world he had just entered was full of hazards.

Although there are anatomical differences between this male sperm whale now suckling his mother and a nearby female baby also engaged in nursing, it would be impossible for an onlooker to spot them because they don't become apparent for the first several years of life. Sperm males and females are, in fact, the most sexually differentiated of all whale species. The male is markedly larger (almost one and one-half times longer and more than three times heavier than the female, his head is proportionately bigger, and his spermaceti organ grows forward to project further beyond the tip of the skull. Another major difference is the age of sexual maturity. While the calf's mother had become sexually mature around the age of nine, lie and other males of his species

would be at least twenty-five years old before they sired offspring.

When they leave their mothers' group, sexually immature males form loosely organized groups with other similarly sized young males and gradually begin the movement away from the tropical breeding grounds into higher latitudes. As the males grow bigger and near sexual maturity, the groups fragment. Traveling alone or perhaps with one or two others, the huge bulls turn their course toward the equator in the direction of the females only as the breeding season nears. And, some speculate, it may well be that not every mature bull attempts to breed every year.

Few mammal communities are as stable and have members as helpful toward each other as the one into which this baby was born. It was a group of about twenty whales, females mostly, but with some immature young males who had not yet left their mothers. Males with young mothers typically leave the group before age ten, but those lucky enough to have older mothers may enjoy maternal attention for much longer periods. As they grow older, females give birth at longer intervals and spend more time raising and suckling each infant. One thirteen-year-old male was discovered to have milk in his stomach!

The bonds between this baby's mother and the others appeared to be strong, and the arrival of her young one and that of the female calf stimulated a spirit of cooperation throughout the group. Perhaps it was because the females were all related or so dependent upon each other that their maternal instinct extended to each other's infants, but the newborns found a world full of babysitters who wanted to help protect them. Naturally, each preferred its mother, but when she wasn't nearby, there was usually another female or even an immature male to look after it.

It is possible that the sperm whales form such a cooperative society, in part, because of the way in which they must search for food. The daily fare of the sperm whale in this part of the Pacific is the large squid that inhabit the ocean depths. Sperm whales are among the deepest divers, having been

tracked by researchers to as low as six thousand feet beneath the ocean surface. Many of the squid that live in deep water harbor luminescent bacteria, and may appear as small beacons of light to the hunting whale.

It was into this dark, mysterious world of which we know little that the mother whale was forced by the demands of her enormous appetite to retreat. Her infant, whose body may not have been capable of such arduous feats, remained closer to the surface. Alone, he would be easy prey for a shark or a killer whale, so the "babysitting" system may be essential for infant survival.

The mother whale had been foraging for squid almost an hour, while her son swam under the watchful eye of a caretaker female. It was getting to be time for her to surface, as she was nearing the end of her oxygen supply. Suddenly, like an enormous cannonball, she broke through the still water, her explosive exhalation shooting up at a forty-five-degree angle, as is characteristic of her species.

During his mother's absence, the young whale had not been idle. Like the young of many mammal species, he was curious.

In his earliest days he spent most of his time at the surface watching a frenzy of activity around him. There were the dorados, believed by many to be the most beautifully colored fish in the sea, with their ever-changing rainbow hues, which the whale saw not as colors but as waves of shimmer. The dorados chased the flying fish, who used a mighty thrust of their tail blades to fling themselves into the air, their breast fins opening like wings to carry them along until their momentum was lost and they plunged downward into the sea, only to do it again and again. Tiny schools of fish swam to and fro, small bits of life that from a distance seemed to merge together as one. Dolphins frolicked.

The whale was busy during his early weeks and months. When he wasn't drinking from his mother's breasts, he delighted in leaping and slapping the water surface with his tail. He learned that if he started to dive, he could then reverse his motions, accelerate speed, and propel his body out of the water, flying through the air until the demands of gravity sent

it crashing downward again. Called a breach, this display, however thrilling, required an awesome amount of energy. Another enjoyable way to pass the time was by "lobtailing," a maneuver in which the whale raised his tail flukes above the water's surface and brought them crashing down.

Scientists have long wondered about the significance of these aerial feats that whales perform. Is the purpose to remove the large sucking fish and whale lice that latch onto the animal's thick hide? Much breaching and lobtailing seems to be social, occurring at higher rates in the afternoon and when more than one group of sperms is together. We don't know its purpose, but we do know that females and young males like this one are much more likely to engage in such energetic behavior than mature males.

Although the whale observed the world to the extent his eyes and the murky blackness of the ocean would allow, by far his most important sense was that of hearing. Gliding through the darkness, he and the others in his group emitted steady streams of clicks, usually one every half second. Many other species of whales and dolphins also produce clicking sounds, packaged in a variety of ways. To the human ear, the rather monotonous cadence of the sperm whale seems simple compared to the variety of squawks, squeals, and other strange sounds that dolphins produce. But they are certainly loud, far louder than the sound of the hoofbeats of galloping horses or a carpenter's hammer meeting wood, because the sperms' clicks can be heard for miles beneath the sea. Nineteenth-century whalers were probably the first humans to be aware of sperm whale vocalizations. They reported hearing sperm whales' knocking and hammering sounds through the hulls of their ships.

The sperm whales' clicks are thought to originate from cartilaginous valvelike structures in the nasal passages toward the front of the head. The sound travels back through the spermaceti organ—the same organ that cost so many of their ancestor's lives—before being reflected off air sacs over the huge domed skull. The whole setup makes lot a huge reverberation chamber for broadcasting their characteristically loud clicks into the watery void.

Many toothed whales use clicks to "echolocate." The clicks bounce off objects in the animal's path, producing echoes from which it is able to create a sort of acoustical picture of its surroundings. It is in this manner that the animals are able to locate food in a dark world where the eyes are of little use.

During feeding the group would often become separated. But the whales would rise to the surface clicking and break through the water within sight of each other. Although the individual whales were not usually inclined to linger on the surface for more than ten minutes between dives, usually once a day—often in the afternoon or early evening—the group of sperms would gather for a few hours at the surface, resting in tight clusters, still clicking, but in different patterns from before, patterns that suggest social communication.

Some sperm whale clicks occur in repetitive patterns called "codas," which may be the whale equivalent of a conversation, albeit a simple one. A coda is usually anywhere from three to thirty clicks and may be directed toward another whale. While gathering with her group, the whale's mother emitted a coda of eight regularly spaced clicks and then paused. Another whale responded with seven clicks. One can only guess at what the two were saying to each other, but researchers who have analyzed recorded codas from whales off the Galapagos have categorized twenty-three distinct types of codas, based on the number and spaces between clicks. A team from the Woods Hole Oceanographic Institute led by Bill Watkins has found that many conversations include the same five-click coda. They suspect the shared calls might be a not-so-friendly greeting meaning something like "Get lost." Because each whale appears to have a distinctive coda, it isn't unreasonable to suspect that one purpose of this form of communication may be, in fact, to identify individuals—useful information in a world with little light.

By the time the whale neared his first birthday, he had experienced many changes. He still frequently visited his mother's breasts and would continue to take some nourishment from her for several more years. But by now the whale

also had begun to dive for solid food, although his body was not yet capable of the deep dives characteristic of more mature sperms. It is difficult to know whether any of his teeth had as yet erupted but it is believed that sperms' teeth have little influence on their feeding behavior; they may not need them to consume the squid that is their dietary staple. The prey the young whale had "selected" was undoubtedly smaller and less varied than his huge mother's diet and even less similar to the diet he would someday have as a sexually mature male. Some scientists have speculated that although young whales such as this one are physically capable of eating larger squid, they may prefer smaller prey because they are easier to catch.

In April a major change occurred in the composition of the group. The large bulls had returned, for it was the breeding season, the only time of the year when the huge males are known to associate with the female groups. The whale's mother was not ready to breed and would not mate for several years yet, but a few females in the group were at the right time in their reproductive cycle and it was for these cows that the bulls searched.

Our knowledge of exactly what takes place during breeding season in the world's community of sperm whales is rather sketchy because these deep-diving creatures spend most of their lives shrouded by the ocean's black curtain. On occasion, however, human observers in airplanes or boats have witnessed what might be interpreted as mating behavior among sperms.

In one such sighting a group of nine cows and a bull were observed, with the male underneath the group of females, only one tip of its pair of triangular tail flukes showing above the surface. Other observers have reported seeing sperm bulls and cows resting belly to belly, one on top of the other, for thirty seconds or longer.

The (licks were like nothing the yearling whale had ever heard, loud, widely spaced, and metallic. A dark shadow appeared in the direction of the booming clicks, as a huge bull, one of a handful of bulls roaming the area, joined the whales' group.

At fifty-two feet in length and weighing more than forty-three tons, the newcomer dwarfed the females, who until then had seemed so majestic; now, in the presence of the male, they were almost petite. Aside from his imposing size and the larger head that was a hallmark of his status as an important whale, the breeding male was further distinguished by wounds and scars, most of which were on his head, but a few even around the flipper.

The breeding system of the sperm whale has been compared to that of the African elephant. In a world in which there are relatively few ready females during any given year, it may be that the best way for the sperm bull to maximize his breeding opportunities is to travel from group to group, searching for any chance to spread his genetic heritage.

Such opportunities do not come easily. It stands to reason that in a society where a relatively small number of females are ready to mate in any given breeding season, the competition between males is intense and sperm males do not appear to be shy in expressing their hostility toward one another. Scientists who have examined the corpses of the large bulls have ruled out the possibility that a giant squid or other prey could have caused the scars that are often found on the males, for the wounds run in parallel lines, typically in pairs or in threes, damage that could not be inflicted by the hooks on the arms or tentacles of squid. As further evidence that breeding males can be each other's worst nightmare, researchers point to the spacing between the scars, which conforms with the dental pattern of the mature male sperm.

The bull's intent was clear. He stayed for several hours, possibly as long as a day, mating with any available female, and then left, presumably in search of another group within which to broaden his reproductive horizons.

After the bull left, the females, the two calves, and the immature males were once again back to their normal routine. For any whale or dolphin, a large part of everyday life—as much as three-quarters—involves searching the depths of the ocean for enough food to enable them to survive. The yearling's mother and the other mature females needed to eat

approximately three hundred squid a day; the young whale's needs were undoubtedly less because of his smaller size and the additional nourishment he was still getting from his mother's milk, but he, too, spent most of the day foraging.

Typically, sperms dive for about forty minutes and then surface for ten minutes before diving again. Whalers have described them as "lined up almost like soldiers," and studies have confirmed that the sperms do indeed forage in ranks aligned perpendicular to the direction of travel, with a distance of about one hundred and thirty feet between each whale when feeding. Why this particular method? At the very least, it may keep the whales from getting in each other's way. Some people speculate that rank foraging may increase the chance that some whale in the group discovers food, because by spreading out they can search a larger area. The whale's mother, for example, may come across a source of squid. Through her clicks, she might communicate her discovery to other group members. Even if she makes no concerted effort to share her find, the fact that she stops and begins to feed may be all a nearby whale needs to redirect its movements.

In its undersea dominion the sperm whale had little to fear, now that the International Whaling Commission had banned man from stalking with his harpoons, a ban that most, although not all, nations have complied with. After all, none of the creatures that make their home within the ocean is larger than the sperm, except some other species of baleen whales, which have no teeth. The group of whales often came across fellow mammals in their forages. These the sperms eyed with mild curiosity, certainly no hostility. The various species played, swam, foraged in the same waters, separate but coexisting, and then went the ways dictated by the unwritten rules of their individual species, neither the worse for the experience.

Two species of fellow ocean dwellers, however, had a taste for blood and preyed upon the sperm whales: sharks and the pack-hunting killer whales.

that is half as long and a fraction of the weight of the larger species could pose a serious threat to a mature sperm whale,

so long as the sperm is healthy and traveling in a group. There may be an occasional bite from a shark or killer whale, but it is unlikely that they pose a serious threat to life. The same cannot be said, however, for the calves and weakened older whales, both of which are prime targets for predation. One sperm calf stranded on a beach in South Africa was missing part of its left tail fluke and bore a host of other scars courtesy of killer whales. And oceanic white-tipped sharks have been observed following schools of sperm whales in the southwest Indian Ocean. Normally, the sharks are scavengers, dining on the ocean's garbage. (One shark was observed eating the after-birth of a sperm whale calf.) But stranded sperm calves bearing shark bites are evidence of this fearsome creature's potential menace.

One day the yearling whale was to learn firsthand what it is to be stalked by a formidable enemy.

The whale's group and a similar-sized neighboring group had split into smaller subgroups of one to three whales, each traveling in the same direction in a line several hundred yards long. The whales regularly lifted their flukes and dived more than twelve hundred feet beneath the surface, clicking continuously. All of a sudden, the clicking stopped. The ocean was filled with an eerie silence. The sperms at once coalesced again into two groups. A moment later, ten killer whales had surrounded one of them, the group in which the whale and his mother swam.

The sperms did not attempt to flee from the faster killer whales. Nor did they elude the attack by diving to depths to which the killer whales could not have followed them. This may have been because the whale calf was still incapable of making such a deep dive. Rather, the sperms under attack immediately formed a circle, with each member packed tightly against the next, and the young whale, the most vulnerable, in the center. Slowly, the sperms began to move toward the nearest group of killer whales.

As the killer whales attacked, the sperms turned, in an attempt to face their attackers. Apparently, both the sperms and the killer whales consider the front of the sperm whale to