

By Mark Johnson, New England Wire Service

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## Experts unravel mystery of blue whale's death

Before the scientists set eyes on the creature, before they realized what it was and flocked to an event not seen on the East Coast since 1891, before any of that, a man named E. Howard McVay Jr. saw something strange in the water.

McVay, a 42-year-old ship's pilot from East Providence, has sailed around the world and witnessed his share of oddities. Days when a ship's steering failed for no reason. A night off the coast of Panama when lightning struck his vessel four times. Mariners have a phrase for such things -- "another mystery of the sea."

On the afternoon of March 3, 1998, McVay rode a pilot boat into a flat-calm Rhode Island Sound to meet a 486-foot tanker, the Botany Triumph. The tanker and its Korean crew had come from Belgium carrying a cargo of caustic soda bound for Providence.

McVay boarded the tanker about 5.7 miles south of Brenton Point, approaching it from the stern. The pilot boat captain then headed back to Newport, but he had not gone far when he radioed McVay. There was something on the tanker's bow. McVay peered down into the water.

"Holy!"

The bow jutted out at the bottom forming a lip, and draped over this lip was the largest whale McVay had ever seen. While most of the whale's body lay under two feet of water, its glossy, blue-gray tail broke the surface, undulating gently.

The Botany Triumph slowed, stopped and then eased backward. The whale slid free.

McVay and the tanker's crew stared into the water a long time, searching the great mammal for some sign of life. But the 66-foot whale floated languidly. Some of the men had tears in their eyes.

McVay knew that his job now was to ensure that the 40-ton whale posed no hazard to navigation. Although he did not know what kind of a whale it was, he had a feeling in his gut.

Someone's going to want to study this thing.

WITHIN A FEW DAYS, scientists from all over the Northeast would come to see the rare whale, men and women inspired to study whales by Jacques Cousteau, by their love of the sea or of animals, by a search for medical answers or an infatuation with the unknown.

Pieces of the whale's skin would travel to a lab in Belgium for DNA analysis. The left eye would go to the Mystic Aquarium, a block of blubber to Texas A&M in Galveston, the ears to the Woods Hole Oceanographic Institution. One researcher would haul the larynx, all eight feet of it, by minivan to a walk-in refrigerator in the basement of New York's Mount Sinai School of Medicine.

The pieces of the whale, foul-smelling and slimy, were clues in a detective story. With them scientists would try to unravel the mysteries of a species and the riddle of one whale's death. How had this whale lived? How did it die? And did the cause of its death carry a warning for the future of the species? Seldom before had scientists on the East Coast had the chance to address such questions.

"This was our version of winning Powerball," said Joy S. Reidenberg, an associate professor at Mount Sinai School of Medicine in New York City.

At first, though, scientists weren't sure what they had.

Their first clue came two days after McVay discovered the whale. Dana Hartley and three of her colleagues at the National Marine Fisheries Service filed into a dark office in Woods Hole to view a Coast Guard videotape of the whale.

Six months earlier, Hartley had taken over the job of coordinating the response to marine mammal strandings in the Northeast. Already, she had dealt with a mass stranding of common dolphins in Falmouth and a sperm whale stranding off Nantucket. The creature on the tape presented a new challenge.

The whale's impressive size marked it as a likely fin whale, the second largest animal on earth, and the largest commonly found in New England waters.

But as Hartley watched the videotape with her colleagues, all marine mammal experts, they noticed the whale's skin was mottled, an inky mix of blue and black.

All four knew what this meant. No one said a word.

Finally, Hartley broke the silence.

"Just for kicks," she said, "let's see how many pleats a blue whale has." Blue whales have between 55 and 88 pleats, grooves that help the whale's throat balloon outward as it gulps large amounts of water during feeding.

The next morning, March 6, Hartley showed the videotape to two other officials at the fisheries service, Phillip Clapham and Tim Cole, both experts at identifying whales.

"Oh my God," Clapham said as he realized what they were watching.

A blue whale, the largest animal ever to have roamed the earth, was a rarity in these waters. According to the Smithsonian Institution, the last recorded stranding of a blue whale on the East Coast was in 1891 near Ocean City, N.J.

If Hartley and her colleagues were correct, the tanker had delivered to their doorstep a major scientific find, and an endangered species.

They had to be sure.

Later that morning a Coast Guard patrol boat churned through Rhode Island Sound. Mystic Aquarium biologist Robert Nawojchik (pronounced nu-WAH-chek) reveled in the beauty of the day sunshine, miles of open ocean, a cool salt breeze blowing across his face.

On this brilliant morning Nawojchik headed out to confirm the species of the mysterious whale now floating seven nautical miles south of Lands End, Newport. Much was riding on his mission. The species would determine whether scientists left the whale in the ocean, or organized a massive effort to haul it ashore for research.

As the patrol boat rounded Castle Hill a few miles from its destination, Nawojchik saw two bumps on the glistening horizon.

"Oh, you've got two boats out there," he remarked to a member of the Coast Guard crew.

"No," the crew member replied. "One of them's the whale."

Nawojchik's heart bucked inside his chest.

The patrol boat drew close and he saw the whale's lifeless form rise from the water like a dark rock polished by the ocean. His eyes focused on the skin with its distinctive blue mottling.

In that instant he wanted to say, "It's a blue whale." But he hesitated.

"Let's drive around it a couple of times."

He wanted to be sure. Officials in Boston, Woods Hole and Washington awaited phone calls announcing his verdict.

As the boat circled the mammal, Nawojchik focused on its dorsal fin. A blue whale, larger even than the dinosaurs when full grown, has a dorsal fin almost comically tiny. Nawojchik turned to the Coast Guard officials.

"Yep. It's a blue whale."

TO NAWOJCHIK and other marine mammal experts, the death of a blue whale, an endangered species, was both a tragedy and a rare opportunity. Fewer than 10,000 blue whales remain on earth -- the exact number is unknown because the whales swim over vast areas of the ocean, surfacing only 10 to 25 percent of the time.

The whales, which at maturity weigh more than twice as much as a fully loaded Boeing 737, were once plentiful. Early whalers focused on other species, because blue whales swam too fast and were too heavy for boats to tow ashore.

But technology caught up with the blue whale. the early 20th century, men hunted the whales in faster, steam-powered catcher boats, fired on them with exploding harpoons and processed the dead whales at sea on factory ships hundreds of feet long. Between 1924 and 1971, 280,000 blue whales were killed, according to the Smithsonian Institution.

Today scientists know relatively little about blue whales, and much of what they do know they learned from the industry that almost wiped out the species. From whaling, scientists learned the size and weight of blue whales, what they ate, how often they reproduced and some of the places they traveled.

Many basic questions about the species remain unanswered. Scientists estimate that the whales live 70 years or longer, but they aren't certain. They don't know how the population has fared since the end of whaling. They don't know where blue whales go to breed -- the whales simply disappear for several months.

Nor do scientists know how blue whales make some of the loudest and lowest sounds on earth, deep, rumbling moans that travel a thousand miles or more through the ocean.

So little is known of blue whales that the few experts tend to see themselves as explorers of a vast, uncharted territory.

"We're still on the tip of the iceberg," said Frederick Wenzel, who co-authored a book on blue whales with fellow whale experts Michael Williamson and Richard Sears.

"It's just like outer space and the depths of the ocean."

AS IT WOULD for other scientists, the blue whale off the Rhode Island coast became an instant priority for Wenzel.

On the day Nawojchik confirmed the discovery, Wenzel heard the news and rushed to finish the animal biology class he teaches at Northeastern University in Boston. He was accustomed to improvising his life around whale events, changing plans and apologizing to his girlfriend at the news of a pilot whale stranding.

A blue whale was bigger news.

On virtually any other day the news would have reached Darlene Ketten, an associate scientist with the Woods Hole Oceanographic Institution, who has spent the last five years studying the hearing systems of baleen whales. Blue whale ears are quite rare and little is known about their hearing. For Ketten, a well-preserved blue whale's ear was a high priority.

But on the day fate deposited a blue whale in New England waters, Ketten was in Egypt, and unreachable. Her lab was informed of the find and research assistant Scott Cramer prepared to recover the whale's ears.

At Mount Sinai School of Medicine, Joy Reidenberg tried to focus on the paper she was writing, but her mind was on the blue whale. She wondered what shape the carcass would be in and she tried to imagine how officials would tow something that large onto a beach.

That question and many others now confronted Dana Hartley, the marine mammal stranding coordinator.

Hartley called the town of Middletown, which had hosted scientists in 1995 when an extremely rare right whale washed up on Second Beach. Once again town officials proved eager to help, summoning bulldozers to move the whale and police to protect it. The Coast Guard agreed to tow the blue whale.

While Hartley worked the telephone arranging for the whale to be brought ashore, Phillip Clapham, a federal fishery biologist, worked in another office phoning any scientist who might be interested in a blue whale.

"Boy, we've got a lot of work to do," thought David J. St. Aubin, director of research and veterinary services at the Mystic Aquarium.

On the cool, gray afternoon of March 7, he stood on Middletown's Second Beach, watching as bulldozers dug a trench in the sand and hauled the whale up the beach. He would have two hours of daylight in which to examine the whale. Dissection would begin early the next morning.

St. Aubin, who has studied marine mammals for 25 of his 46 years, had been chosen to lead the necropsy, a post-mortem examination of the whale.

The blue whale stirred conflicting emotions in him the excitement of a scientific challenge; and the disappointment of a scientific loss. Too few blue whales remain to have one die.

But the whale had died, and scientists were now obliged to learn what they could from it. St. Aubin would focus on a question with implications for the future of this endangered species

How did this happen?

Was the whale killed by the tanker? Was it already dead or near death when the tanker struck it, and if so what caused its illness? A manmade toxin? A parasite?

Such questions were seldom if ever asked in the days when whales were plentiful. For many years stranded marine mammals were left to the tides, unreported and unstudied. Photographs from the 1800s show families on Cape Cod picnicking beside the carcasses of beached whales.

But in recent decades government has taken note of the scarcity of blue whales and other species, particularly right whales. The National Marine Fisheries Service calculates what is called "a potential biological removal" for various species. This figure represents the most deaths a species can sustain from unnatural causes before its recovery is threatened. For blue whales in the western North Atlantic, the figure was 0.6.

"That means if even one blue whale is removed from the population for factors other than natural mortality this could inhibit the continued recovery of this population," St. Aubin said.

That was why it was so important that he and the other scientists understand the story of this blue whale's death.

THE WHALE, a juvenile male — or 4 years old, rested on its back, belly exposed, the tide pooling around its head. St. Aubin walked around the carcass taking a mental inventory of the whale's injuries the large white patches where the whale's blue skin had rubbed against the tanker and worn away; the large crease behind the left flipper where the tanker had struck.

He tried to imagine the scenario of death the tanker approaching at 10 to 12 knots; the blue whale, which can swim up to 16 knots, unable to get out of the way for some reason; the thud as the tanker strikes the whale mid-body.

Now St. Aubin noticed something curious.

The whale had sustained a very sharp v-shaped cut to the lower jaw about two feet long. Fragments of the broken jaw protruded. At first, St. Aubin simply added the cut and broken jaw to the list of the whale's injuries.

But the more he thought about it, the more it puzzled him. The tanker had struck the whale broadside, nowhere near the jaw. How had the jaw been broken?

As darkness settled over the beach, the whale's body yielded one more insight. Under the glow of headlights, Michael Moore, of the Woods Hole Oceanographic Institution began measuring the thickness of the whale's blubber using an ultrasonic probe. While a thin layer of blubber may indicate poor health, Moore's measurements showed that the blue whale had a healthy layer of blubber, anywhere from about 4 to 6 inches.

At dawn the next morning St. Aubin gathered the dozen scientists together to assign teams for the dissection and outline a game plan that would allow researchers to retrieve the pieces they needed without bumping into one another.

Under a clear blue sky the dissection began.

The scientists made a series of long, parallel cuts across the whale's body using flensing knives, which resemble hockey sticks topped by two-foot metal blades.

Even with such equipment, their arms and shoulders tired as they sawed through the thick blanket of blubber that keeps whales warm and acts as an energy reserve. A heavy, oily odor rose off the whale and attached itself to the scientists' clothing.

It would be a day of fatigue and adrenaline.

Mount Sinai researcher Joy Reidenberg felt a surge of excitement as she cut into an area near the whale's throat. The connective tissue, the layer between blubber and muscle, was a glistening white. The whale was fresher than she'd imagined.

Deeper yet lay an important clue for St. Aubin's investigation. As the scientists cut through the blubber to the muscle tissue below, St. Aubin paid close attention to the color of the muscle. In the area where the tanker had struck, the muscle looked extremely dark and gelatinous. There had been bleeding into the muscle -- essentially a bruise.

If the whale had been dead when it collided with the tanker there would have been no bruise. The blood would have ceased to flow and the muscle would have retained the dull red shade of beef steak.

So the whale had been alive when the tanker came along.

The first full day of dissection lasted 10 hours, ending as clouds moved in signaling an impending storm.

Now the scientists headed home with their prizes. While St. Aubin would work on and off for several weeks learning how the blue whale had died, other scientists expected to spend years learning how the whale had lived.

The skin, blubber and organs the scientists took offered the potential to tell humans a great deal about blue whales -- what they hear, what they use to make sounds, what poisons they are ingesting in the ocean. But pieces of the whale held another possible legacy a lesson about ourselves. Some scientists believe that by viewing the special abilities and adaptations of blue whales, we may discover something of use to humans.

"If we can see a structure in their eye that's similar to our own, it helps us with a general understanding of vision," explained Sharon Young, a marine mammal specialist with the Humane Society of the United States on Cape Cod.

"To study other animals is to study ourselves and to understand our world."

ON THE RAINY drive back to Mount Sinai, Joy Reidenberg closed the windows, and a potent smell filled her minivan from the trash bags containing the whale's larynx. For the last decade she and colleague Jeffrey T. Laitman have been studying the respiratory systems in mammals, work that may one day increase our understanding of Sudden Infant Death Syndrome (SIDS) and a potentially serious ailment called gastroesophageal reflux, in which acid shoots up from the stomach into the esophagus.

The whale's respiratory system -- adapted for life at sea and thus very different from our own -- may contain special features that medical science can learn from and use to make the human respiratory system safer.

"Whales, for us, are like a big laboratory," said Reidenberg. "Nature has already modified them for us."

While Reidenberg wanted to investigate the whale's throat, Gary LaFleur, who studied reproductive and developmental biology at Brown, wanted to see what was in the creature's genes. LaFleur had spent much of his time studying sea urchins, focusing on the investment of energy the mother sea urchin makes to her eggs. But he could not pass up the rare chance to look at the DNA of a blue whale.

He returned to Providence with an ice chest containing a thumb-sized sample of blubber, dark red muscle and nerve cells. Someday perhaps he would use the sample to examine what makes a blue whale's breast milk so potent -- a calf gains about nine pounds an hour while nursing.

"The blue whale represents an extreme of creation," he said. "Its proteins represent extremes of protein evolution."

When LaFleur moved to Louisiana this summer to accept a teaching position at Nicholls State University, his piece of the blue whale went with him.

Fred Wenzel and Michael Williamson, two whale experts, returned with blubber samples to test for toxicology -- the presence of poisons like PCBs -- and skin samples to test for genetic information. What they learn may tell us to what degree manmade toxins are penetrating the ocean and entering the food chain. When beluga whales from the Gulf of St. Lawrence beach, they are treated as toxic waste because they have ingested so many toxins.

The genetic information may tell us how much diversity there is among blue whales. The more diversity, the greater the chance that the species can survive whatever diseases or parasites nature sends its way.

Alan Abend, a Texas A&M grad student who works for Zoo New England, brought back a one-foot cube of blubber, which he would send by Federal Express to his university adviser in Galveston. Abend planned to use the blubber to examine fatty acids, the building blocks of fat.

Fatty acids can tell scientists about an animal's diet and exposure to contaminants. The whale's diet, in turn, can be an important clue to its migration patterns, a mystery in the case of blue whales and therefore a subject of great interest.

Scott Cramer, the Woods Hole research assistant, had labored for six hours with a hammer, chisel and various surgical instruments to remove the two ears, which he packed in a plastic bucket and immersed in a solution to prevent decay. Darlene Ketten did not know it then, but she would have a new whale ear to examine.

Ketten returned from Egypt after the first day of dissection and received news of the blue whale on her answering machine. She will study the blue whale ears on and off for the next three years or more, seeking to understand the range of sounds the whales hear and the frequencies they hear best.

Knowing what these whales hear, she said, may allow scientists to design devices for ships that will alert whales of their approach.

"If we learn enough from this blue whale, maybe we can avoid other collisions," Ketten said.

AS ST. AUBIN drove back to Mystic, Conn., after the first day of dissection, he thought about the progress that had been made and the work that remained. He kept returning to the broken jaw and the long cut with its smooth edges. What would explain such an injury?

It was not easy to cut into whale flesh, a point reinforced all day as the scientist labored away with their flensing knives. But St. Aubin had seen similar long, smooth-edged cuts on the bodies of large whales and manatees. The cuts had been made by ships' propellers.

Of course, the blue whale had been struck by the tanker's bow, not its propeller. But what if the propeller of another vessel had broken the blue whale's jaw?

St. Aubin had begun to imagine a new scenario

The healthy whale swims toward the surface, hears the roar of a ship above and veers to avoid it. But the whale doesn't move soon enough and is clipped hard by the ship's propeller. The propeller breaks the great mammal's jaw and leaves a deep cut.

Injured and stunned, the whale remains at the surface. Sometime later the tanker bears down on the whale, which has still not recovered. The unfortunate whale is unable to rally itself to avoid the second and fatal blow.

Such a scenario would explain the whale's injuries. But St. Aubin would have to see if the whale's internal organs told a different story.

On the second full day of dissection, a Monday, the rain fell in sheets. A handful of scientists -- a smaller crew than on the first day -- descended on the whale which lay half-dismantled, its head removed, its tissue a dull, reddish-brown. Now the scientists probed deeper into the animal's organs.

Here, they found new evidence that the whale had been healthy prior to being struck. Inside its stomach -- roughly the size of a desk and divided into three compartments -- were the remains of a last meal of krill. The tiny shrimp-like creatures that make up the bulk of a whale's diet were partially digested and resembled a dark pink soup.

The whale had been feeding not long before it was killed. If St. Aubin were correct that the whale had been struck twice, then the two strikes probably occurred within a day or so. Otherwise there would have been little left in the whale's stomach.

Now St. Aubin searched for signs of another potential culprit in the whale's death. He examined the whale's left kidney looking for the kind of scarring that would indicate damage from a parasitic worm. Perhaps parasites had severely weakened the whale before its encounter with the Botany Triumph.

As he inspected the brownish-red kidney, however, he saw no evidence that the whale had been weakened by parasites.

The salvage of the blue whale would continue for two more days until the last of its bones had been removed from the beach and hauled to New Bedford where they had been promised to the city's famed whaling museum.

But St. Aubin had finished his examination.

In his six-page report, St. Aubin summed up the whale's death in four words "Trauma. Struck by ship."

Those words told the federal government something important it didn't know. Though blue whales were no longer hunted, the collision of our world and theirs had produced a measurable cost.

In a 1995 report, the National Marine Fisheries Service said it didn't know how many blue whales, if any, in the western North Atlantic had been injured or killed because of human activity, "but it is believed to be insignificant and approaching a zero mortality and serious injury rate."

St. Aubin said the tanker had struck the blue whale mid-body on the left side, and estimated that the whale had died on March 1, two days before Howard McVay discovered its carcass draped over the bow of the Botany Triumph.

One blue whale killed by a ship in the western North Atlantic was not in itself cause to panic about the future of the species. But the unnatural death of one whale a year in these waters is considered too many.

"If we have another (ship strike) next year we have to pay greater attention," St. Aubin said.

THE DEATH of the blue whale was noted in July when the fisheries service adopted a recovery plan for the species. This time the report expressed no doubt that whales have been paying a price for human activity on the seas.

"Vessel strikes and entanglement in fishing gear are known to kill and injure blue whales," the recovery plan stated. How often blue whales are struck and killed by ships isn't known, but the whale that turned up in Rhode Island probably wasn't the first to die in this manner.

Other deaths, "have almost certainly gone unrecorded," said the authors of the recovery plan.

The plan recommended that steps be taken to track whale populations, protect their habitats and prevent deaths and injuries from ships and fishing gear. For example, fisheries officials hope to study the volume of shipping traffic in areas favored by blue whales.

The fisheries service has already proposed a mandatory ship reporting system designed to protect right whales in the North Atlantic. Right whales swim in shallower waters than blue whales and are considered more likely to cross paths with ships. Even so, the reporting system may help protect blue whales.

"We're hoping other large whales will benefit also," said Greg Silber, a whale biologist in the service's protected resources division.

A committee of the International Maritime Organization is expected to vote on the new reporting system in December. If the measure passes, by next July ships of 300 tons or greater will be reporting their positions and courses and monitoring right whale sightings in the waters of Cape Cod Bay, Massachusetts

Bay and the Great South Channel east and southeast of Massachusetts.

WHERE THE BLUE whale was killed by the Botany Triumph isn't known.

The fisheries service requested and received the ship's operation log, hoping it would show that the tanker had slowed when it began plowing the 40-ton whale through the ocean. But the log proved inconclusive. St. Aubin offered his best guess based on what he presumed to be the tanker's course. The whale was struck somewhere southeast of Nova Scotia.

In his report, St. Aubin addressed the other major puzzle, how the whale's jaw had been broken. He described his theory that the whale had been hit twice by different ships, a possibility that he acknowledged might seem remote.

For a single whale to have been struck by two different ships in a vast ocean would have been exceptionally bad luck, a little like a person getting struck twice by lightning. Unusual perhaps.

Perhaps another mystery of the sea.

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