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Oil: A Cautionary Story

By Kat Long

William Scoresby threw his harpoon into the whale and the arrow-shaped tip landed deep within its lung. The bowhead jerked and dove out of sight. Seven men in the boat watched the harpoon's rope uncoil, and when it slackened, they knew the whale was coming up for air. They got their knives ready.

One minute later, the whale shot a plume of bloody vapor out of its blowhole. The men stood up and shoved sharpened lances into the whale. It writhed in a circle and slobbered the men with oily, icy gore. This grand finale told Scoresby the whale was about to die.

Scoresby was my third-great uncle, and the scion of the most successful whaling dynasty in British history. I have read Scoresby's book published in 1820, *An Account of the Arctic Regions with a History and Description of the North Whale-Fishery*. For 700 pages, he described the process and purpose of whaling in the Arctic. Buried in tales of storms, ice and shipwrecks, one theme emerged.

Whaling drove the British economy in the 18th and early 19th centuries. Whale oil greased the engines of progress; whale-oil gas lit the path toward the future. "Whales were the main source of oil—lighting and lubricating the early industrial revolution—rather than mineral oil which is now the interest in the Arctic," said Robin Diaper, curator of maritime and social history for Hull Culture & Leisure Ltd. in the U.K. "In both instances the Arctic was simply viewed as an open cupboard for anyone who could get there to make the most of the bounty."

The light increased the number of hours workers could toil every day, and allowed them to turn out more clothing, furniture and cookware. They could manufacture more guns, ammunition and trade goods, the tools for expanding empires.

British whalers like Scoresby hunted bowhead whales, the fattest species in the Arctic. A full-grown bowhead could reach 60 feet long and weigh 100 tons. They had the thickest blubber of any cetacean—20 inches between the skin and muscle. Between 1810 and 1816 the price of oil averaged £37 a ton, making each whale worth about £400 in Scoresby's time.

In an average year, Scoresby killed 23 whales. From 1803 to 1816, he killed or helped to kill 309 bowhead whales totaling 2,660 tons of oil, or 670,446 English gallons. From 1817 until his last voyage in 1823, when the industry was in extreme decline, he killed at least 47 more.

On a usual four-month voyage, he would come home with roughly 200 tons (50,400 gallons) of oil for a potential gross profit of £7,400 per voyage, or £566,000 in today's

money. He made additional income from the sale of whalebone, which varied in price from £30 to £150 a ton, for use in ladies' clothing, furniture, hats and accessories. Subsidiary goods included seal blubber for oil and sealskins for opera cloaks and shawls, polar bear furs for rugs and throws, bowhead jawbones to make gateposts, and narwhal tusks for natural history collections.

Exploiting Arctic resources made Scoresby fabulously rich. He calculated that he earned an average salary of £800 per year between 1812 and 1823—worth about £572,000 per year today. In the first half of the 19th century, the average male worker in England made about £41 annually.

The energy derived from coal, petroleum and natural gas shaped the 20th century like whale oil propelled the 19th. Without these fossil fuels, there would be no railroads, no airplanes, no automobiles. Imagine highways without asphalt, disco without polyester, rock n' roll without vinyl records. We need oil to grease industrial machinery, as well as our machine guns, Humvees and tanks.

Like 19th manufacturers used whalebone in products as different as corsets and carriages, companies in the 20th century found new uses for oil and chemicals derived from it. DuPont developed petrochemical-based synthetic fibers—nylon, Orlon, Dacron, Lycra, Tyvek and Kevlar—that prompted thousands of consumer products, like pantyhose, bulletproof vests and nonstick frying pans. In 1926, Waldo Semon, a chemist at the B.F. Goodrich Company, added polymers to oil-derived polyvinyl chloride to create vinyl, used to make millions of gramophone records by mid-century as well as fabrics, pipes and other plastic materials. In 1941, Ray McIntyre at Dow Chemical Company invented Styrofoam. In 2014, DuPont earned \$35 billion and Dow earned \$58.2 billion in net sales (B.F. Goodrich dissolved in 2012).

The land and seabed north of the Arctic Circle hold 90 billion barrels of oil, 1,670 trillion cubic feet of natural gas, and 44 billion barrels of liquid natural gas representing 22 percent of all the world's undiscovered fossil fuel reserves. Atlantic Richfield Company, ExxonMobil, ConocoPhillips, Chevron and Shell Oil drilled the seabed off Alaska and northern Canada beginning in the 1960s. In the 1980s, the Soviet government deployed geologists to Siberia and the Arctic Ocean. Greenland and Norway pursued offshore energy exploration on their continental shelves. But the biggest player today is Russia. Two state-owned companies, Rosneft and Gazprom, have the exclusive right to develop Russia's continental shelf north of Siberia and control 80 percent of the area open to exploration.

In 2014, U.S. corporations produced 3.18 billion barrels, the highest amount since 1985. Rosneft produced about 1.86 billion barrels and Norway's Statoil produced about 703 million barrels for the year. One barrel makes enough gasoline to fill up one 2016 Ford Explorer SUV.

The International Energy Agency estimates that global oil and gas demand could grow by more than 35 percent by 2035. Prospectors still go to the Arctic in search of oil and gas. We use such fungible commodities with the confidence that we can always get more.

But the whalers learned, too late, that the sea had limits. Maybe the best way to understand what is happening today is to know what happened 200 years ago.

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Each whaling ship served as a floating factory for processing whales into manageable slabs of blubber called Bible leaves. The crew packed them in barrels for the journey home. Once in port, dock workers would render the blubber in huge, malodorous vats at the water's edge. The ship's owners or their agents sold the oil and whalebone by the ton to wholesalers, who then sold it to merchants and public utilities.

Bowhead oil illuminated the cities of the British Empire. Street lamps, churches, houses, shops and factories glowed with burning whale oil. Even low-quality oil could be converted to gas for lighting.

Soap-makers used whale oil as the chief ingredient in soft cleansers. Clothiers cleaned wool and leather with whale oil before manufacturing garments. Paint and varnish containing it was more weather-resistant than those made with vegetable oils. Combined with tar, whale oil caulked ships and waterproofed rope and cordage.

Most importantly, bowhead oil greased the wheels of the England's industrial boom by reducing friction in the factory machinery that made the products. Then, the oil lubricated locomotive engines on trains that shipped the goods. The name of the commodity, train oil, erased the product's biological origins altogether.

Whalebone went into ladies' stays, umbrellas, parasols, hats and bonnets, chair backs and seats, cushions and mattress stuffing, hansom cab upholstery, brushes, portmanteaus and traveling trunks, carriage wheels and springs, weather instruments, ramrods for fowling-pieces, fishing poles, and coach whips. Like plastic, whalebone could be cut and molded into any shape. "An attempt has been made to build whale-boats of this material," Scoresby noted, but the inventors found that it sprung leaks.

No part went to waste. Cracklings left over from rendering blubber became ingredients in Prussian blue dye and ammonia. The whale's tail could be converted to glue. A notice in an 1812 issue of the Hull Packet newspaper advertised 80 to 100 tons of whale manure, "consisting of Grease, Finks [gristly remnants of rendered blubber], the refuse of whale-bone, &c." that "effectually destroys Flies in Turnips, Grubs and other insects."

Scoresby's harpoon skills vaulted him into the upper class in Whitby, his village on the

Yorkshire coast. Whaling had improved Whitby from a provincial backwater to an elegant company town. Brick buildings on elegant terraced streets rose above the River Esk, the artery that flowed into the town's harbor and the North Sea. He rented homes in the fashionable districts for his family, which included his wife, two young sons and a governess/housekeeper.

Scoresby once lived at 13 Church Street, a two-story house near the foot of the east cliff, a ten-minute walk from the harbor. Like his well-to-do neighbors, Scoresby probably decorated his homes with silver, tea sets, paintings, fancy writing desks and settees, and whale oil lamps in each room. Later the Scoresby family moved to 13 Bagdale, a large three-story stone villa on the west cliff, where Whitby's *nouvelles arrivees* showed off their success.

Scoresby capped his whaling career by designing and building a state-of-the-art ship, which cost £9,500, an unusually high amount for the time. After a couple voyages on it, he sold it and retired at age 34. Now a gentleman of leisure, he lived comfortably on savings, income from properties in England and Ireland, and a small salary as an Anglican minister for the following 33 years.

"My conclusion is that he was very good with money," said Fiona Barnard, acting curator of the Scoresby collection of papers and artifacts at the Whitby Museum.

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The whale stopped moving and floated on its side. That was good; it meant the whale had thick blubber.

A slick of oil spread from the whale's body and calmed the sea. The crew congratulated each other on the kill. Each man thought of the banknotes coming to him, and not of the grisly task of reducing the sum of the whale to its parts.

Scoresby picked up the ropes that trailed from his harpoon and the lances in the whale's back. He pulled the boat closer, and then tied another rope around the dead whale's tail. The five other boats came toward them and lashed lines to the body. The little fleet towed the huge carcass back to the ship. The crew who made the kill had the honor of stripping its fat, but first, they would have a round of grog to celebrate.

"Given the significance of whaling to Britain at the time, and the fact that the slave trade in humans was only abolished in 1807, I suspect there would have been very little thought for the actual whales," said Diaper, the maritime history curator, "or indeed the other wildlife also killed or captured as part of whaling voyages—seals, polar bears, walrus."

Even deeply religious men like Scoresby saw no contradiction in their bloody work. They

knew from the Bible that one of God's first actions in creating the universe was to give man dominion "over the fish of the sea" and "over every creeping thing that creepeth upon the earth."

"Christians then believed that God had created the world and everything in it for the benefit of mankind, the pinnacle of his creation," said Barnard, the Scoresby archivist. "There was no moral difference between using plants or using animals to meet human needs."

Scoresby found that God, conveniently, made whales especially submissive to man. "The Providence of God is manifested in the tameness and timidity of many of the largest inhabitants of the earth and sea," Scoresby wrote. "A bird perching on its back alarms it."

Before Darwin published his theories of evolution and extinction in 1859, many naturalists believed that men could not extirpate species that God had put on earth. Yet whales had become scarce in the Greenland seas by the 1820s. "My labors for three years had been increasingly unprofitable. They now hardly promised to me the supply of my necessary wants," Scoresby wrote privately in his diary.

Scoresby endeavored to help struggling whalers and revive the lagging industry, which he saw as essential to Britain's continuing prosperity. In a letter to the government's Board of Trade, he proposed a search for whale populations not yet depleted.

On a mild, wet afternoon in January 1821, he arrived at 70 Whitehall Street in London to pitch his idea to the Board's president, Frederick Robinson, and the Admiralty secretary, John Barrow. Robinson had written an encouraging response to Scoresby's letter, but now, in person, he changed his mind. Though the fishery certainly showed decline, the president believed "it would soon find its proper level."

Instead, ships ventured farther north to chase their prey amid thicker ice and turbulent waters. Disaster ensued. More ships got stuck in the ice and more men died from accidents, exposure and scurvy. The ship owners' returns on their investments decreased, and fewer ships were sent to the Arctic in the following decades. The ships that did go caught an adequate number of whales, but economic policies at home began to favor other commodities—seed oils for the clothing industry, coal gas for illumination.

After retiring from whaling in 1823, Scoresby found ways to help his sailors and society through scientific endeavors. Modern iron ships made compasses deviate, which hindered navigation and put lives and cargo in peril. Scoresby invented new compass needles that resisted ships' magnetic pull. As the vicar of Bradford, a major industrial city, he built nine schools for the children of factory workers—whose parents could work longer hours because of the whale oil lamps in their workplaces. In 1831, he

helped to establish the British Association for the Advancement of Science as a populist revolt against the elitist Royal Society, which had refused to support Scoresby's research in Arctic science.

Scoresby's protégé, the physicist James Prescott Joule, helped the organization set standardized units for electrical current. The findings contributed to the development of the incandescent light bulb, which obviated the need for whale oil or coal gas for illumination.

The ex-whaler emerged as a popular lecturer on Arctic phenomena, and traveled throughout the United States, Canada and France on speaking tours. But his experiments in science for the public good also prompted friendships with the leading naturalists and thinkers of the time, including Alexander von Humboldt, Humphrey Davy, Michael Faraday and Darwin.

"The more Scoresby could earn from whaling, the more he could spend on science experiments. In other words, it was only commercial success which enabled him to pursue his passion for science," said Barnard, the Scoresby curator.

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After Inupiat hunters in Alaska told geologists about oil seeping out of the permafrost in the late 19th century, companies started poking around the state's North Slope. Albert H. Brooks, head of the United States Geological Survey's Alaska department, wrote in his 1909 annual report that an oil field probably existed near Prudhoe Bay. But he felt the inhospitable climate reduced its value to nothing.

In 1968, the Atlantic Richfield Co., known as ARCO, and Standard oil drilled the first well in Prudhoe Bay. They realized the frozen seabed held the largest oil field in the western hemisphere: 15 billion gallons of recoverable crude and 26 trillion cubic feet of natural gas. British Petroleum and the predecessor of ExxonMobil also bought leases at the field. The companies formed the Alyeska Pipeline Services Company in 1970 to build the 800-mile Trans-Alaska Pipeline linking the bay to the ice-free port of Valdez.

ARCO hired a Scottish biologist, Angus Gavin, to assess the ecosystem surrounding the oil field. After 10 years, Gavin had an optimistic understanding of the region's flora and fauna. "Although the development of an oil field at Prudhoe Bay and the building of a pipeline to Valdez, together with all the other attendant activities, have at times disrupted and disturbed some of the wildlife within the area, this should not have any lasting or detrimental effects," he wrote in his report. "Most species of wildlife adapt quite readily to changing environmental conditions."

Since 1977, the Trans-Alaska Pipeline has carried 13 billion gallons of North Slope crude out of the Arctic. The *Exxon Valdez* carried 53 million gallons of it when it ran aground in

Prince William Sound in 1989. The accident spewed a fifth of its cargo, which coated the sea and shoreline for 3,000 square miles. Until then, the nutrient-rich waters supported major commercial fisheries and diverse wildlife. Afterward, cleanup workers estimated 250,000 seabirds, 2,800 sea otters, 22 killer whales and millions of fish died.

A spill north of the Arctic Circle, where the sea is covered with solid ice for 10 months of the year, could be much worse. Shell Oil Company, which has a license to explore for oil 150 miles off Alaska's coast, spent \$7 billion on its drilling fleet and cleanup technology. But the Arctic presents obstacles that even those with decades of experience can't avoid. Of the 91 British whaling ships deployed to the Greenland seas in 1830, for example, 19 were crushed by ice, 21 returned without having captured a single whale, and the rest caught 161, the fleet's lowest seasonal total.

"Shell is not bad at this, they have the best technology, but we've seen them stumble a few times," said Lauren Strickler, a consultant for the Clean Air Task Force who studies in Arctic policy.

"It's not rocket science why it's different there," Strickler said. "Nobody really knows how to clean up a spill in the ice."

Oil and gas extraction could decimate the fragile Arctic ecosystem as surely as continuous whaling depopulated the polar oceans. In the short term, a spill would coat sea ice in black goo. As the ice melted and refroze from season to season, the oil would be trapped within, like an environmental bomb for global warming to detonate. In the long term, dark ice would absorb more of the sun's heat, melting the ice faster. Sea levels would rise. The Arctic food web that depends on ice would fragment. Plants and animals would face extinction.

Before the whalers moved in to Spitsbergen, 46,000 bowheads swam in its bays and inlets. Whales could not reproduce fast enough to maintain their numbers. English whalers like Scoresby, plus the Dutch and German fleets, killed 86,644 whales between 1669 and 1800. Assuming one out of five harpooned whales escaped or sank before retrieval, the total rose to 122,000. "This stock was totally exterminated by whaling," wrote Louwrens Hacquebord in a study published in the journal *Environment and History*.

In Scoresby's logbooks, he drew a whale's tail to indicate a kill on a particular day. It is difficult to flip the pages without seeing the pictures.

Shell suspended its exploration after its initial wells yielded little, but other companies are doubling down. Rosneft earned 5,503 billion rubles (or 82,543,514,190 U.S. dollars) in 2014 and plans to invest in offshore drilling as a national long-term energy strategy. The company signed an agreement with Norway's Statoil (which made 622,700,000,000 kroner, or 71,690,130,876 U.S. dollars, last year) to develop sections of the Barents and

Okhotsk Seas. Rosneft will invest \$40 billion in the exploration and has joined forces with ExxonMobil, Statoil, and Italy's Enri to take advantage of their offshore technology. In return for giving Russia a 33.3 percent stake in the joint ventures, the companies get access to Russia's offshore fields that private companies in Russia are prohibited from entering. Rosneft and ExxonMobil are developing fields in the Kara Sea, and with Enri the Russians are developing the ice-free areas of the Barents Sea.

Gazprom, Russia's state-owned natural gas monopoly, holds the world's largest natural gas reserves, totaling 17 percent of the global supply. Gazprom built the world's first permanent Arctic oil platform, in the Pechora Sea, the site of a Greenpeace protest in 2013 that failed to slow the company's operations.

"It's about what they hope to find," said Strickler. "The big finds from the 1980s are starting to decline, so these companies are looking for other options. It's just a matter of locating it."

"Russia had committed a lot of money to exploration," Strickler added. "Billions."

Against the investments from ludicrously wealthy oil companies, the billions from philanthropists, foundations and rich governments won't slow climate change without political will behind the money. That requires legislation to regulate emissions and develop energy resources beyond fossil fuels.

As Scoresby intended in the 1830s, the current mission of the British Association for the Advancement of Sciences (now called the British Science Association or BSA) focuses on engaging the public in scientific inquiry and promoting science in the public interest. Recently the organization selected "the future of energy" as the theme of the annual British Science Festival. A BSA media fellow, Jo Barstow, argued that the country must fight climate change by reducing its emissions from fossil fuels. While the technology for harnessing solar and wind power exists, she said, by adopting cleaner forms of energy, but that the government prefers to subsidize oil and gas exploration in the North Sea.

Is Arctic whaling the origin story of our global society and our insatiable need for energy resources? Fiona Barnard doesn't think so. "To me, they have only the Arctic in common," she said.

Barnard suggested that politics, not necessity, prompts the pursuit for Arctic energy. "There are alternatives to fossil fuels, but at the moment it suits politicians and oil companies to ignore them." The only alternative to whale oil in the 18th and 19th century, on the other hand, was more expensive whale oil from elsewhere.

The British whaling industry decimated only a few species. An oil spill resulting from drilling in the Arctic could unleash an environmental catastrophe.

Studies published this year have suggested that the average temperatures in some parts of the world will become too hot for human habitation by the end of this century. Thousands of plant and animal species could face extinction. Mass migrations from warmer to cooler parts of the world's oceans may upend food webs that evolved over millions of years. The question is not whether we can we stop this from happening, but whether we have the will.

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Scoresby's crew fastened the whale alongside the ship and attached ropes and pulleys to its head and tail. They began with the fattest part of the belly. The flensers cut the blubber into a large ribbon, with one loose end and the other still attached to the muscle. To the free end they affixed a hook and rope. A winch on the ship's deck began to heave. The blubber unspooled from the whale like the peel of an apple. But the whalers were not done: they cut away the fins and tail, sliced off the whale's lips and denuded its mouth of whalebone. The sailors separated the whalebone into smaller sections and bundled them on deck. They removed the tongue and jawbones, saving the bones for sale in England.

Now the making-off process began. Two sailors sawed the strip into mattress-sized slabs. Others cut those into chunks the size of a book with parallel slices and sent them down a chute into the bowel of the ship. There, workers shoveled the portions into casks. The floor became as slippery as an ice rink.

The last step was to cut the carcass free. Every pound of fibrous fat had been removed, diced and stuffed into barrels. No one thought to harvest the tons of meat still attached to the skeleton; whale meat didn't sell. Scoresby took up an axe and chopped the ropes that held it close to the ship. The mutilated body left an oily slick in the water as it floated away.