Made in United States of America
Reprinted from THE BOWHEAD WHALE
Special Publication Number 2
The Society for Marine Mammalogy

Chapter 14

COMMERCIAL WHALING IN THE NORTH PACIFIC SECTOR

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Commercial bowhead whaling in the North Pacific sector focused on two populations: that of the Okhotsk Sea, which initially probably numbered about 3,000 whales; and that referred to (in this book) as the Bering Sea population, which included perhaps as many as 23,000 animals (Chapter 10). The former was essentially confined to the Okhotsk Sea, which is entirely ice-free in summer. The latter may have had two subpopulations (Bockstoce and Botkin 1983, Fraker 1984, Bockstoce 1986) with some whales formerly remaining in the Bering Sea during the ice-free summer, while most undertook extensive seasonal migrations into the eastern Beaufort Sea and then counterclockwise across the Beaufort and Chukchi seas, southeastward in the western Chukchi and into the Bering Sea where they wintered (Chapter 9).

Commercial bowhead whaling in the North Pacific sector was the culmination of over 400 yr of arctic whaling that began in the North Atlantic and saw Basque whalers pursuing them, as well as right whales, on the coast of Labrador by at least 1537 (Barkham 1984, Chapter 13). The Basque whaling efforts were the gradual outcome of their expanding activities (as well as those of other nations) in the northern seas where the Basques are known to have had whaleships in Icelandic waters by 1412 (Proulx 1986). The chronology and history of subsequent whaling for bowheads in the North Atlantic, as well as the tremendous impacts it had on the whales, on the aboriginal peoples of western Greenland and the eastern Canadian Arctic, on other marine and terrestrial animals, and on the general understanding of the regions touched by the whalemen are detailed in the preceding chapter.

Arctic whalers did not move directly from the North Atlantic to the North Pacific sectors. Rather, bowheads of the extreme North Pacific were discovered as the result of almost 60 yr of intensive hunting starting in the South Pacific for sperm whales (*Physeter catodon*), and gradually shifting northward. This chapter covers the expansion of whaling to the two populations that were, as late as the mid-1840s, yet undiscovered by Euro-Americans. Though ships and men from many nations were involved, this phase of the grand fishery was largely dominated by American ("Yankee") ships from New England and a few notable ones from Long Island. The subject material of this chapter is already largely available in other works

including Bockstoce (1977*a*, *b*, 1980, 1986), Bockstoce and Batchelder (1977), and Bockstoce and Botkin (1982, 1983).

BACKGROUND

In the middle of the eighteenth century the American whaling industry began a period of dramatic, though interrupted, growth partly resulting from two innovations: shipboard tryworks which enabled whalers to render blubber into oil at sea, and discovery of a method for making a superior grade of candle from the spermaceti of sperm whales (*Physeter catodon*). By 1750 the nearby whale stocks in the North Atlantic were greatly depleted and the whaleships made longer voyages much farther from their home ports. The tryworks were probably a necessity for whaling in the warmer climes where storage of blubber was a problem due to spoilage, and the at-sea processing allowed the whalemen to become truly pelagic hunters. They quickly spread southward in the Atlantic in search of sperm whales. Only in 1787 did the first whaleship enter the Pacific and the hunting there was, at first, limited to the lucrative sperm whale. Whaleships first reached Hawaii in 1819 and the Japan grounds soon after. In the 1820s and 1830s they mainly cruised the Pacific from 50°S to 40°N, chasing the nomadic sperm whales. The length of these whaling voyages gradually increased from about 15 to about 30 mo as the number of sperm whales declined. By 1840 the stocks were severely diminished and the fleets hunted ever northward.

By then the North Pacific had been criss-crossed by merchants and traders who were well aware of the stocks of right whales (*Eubalaena glacialis*) on the rim of that ocean, and it is likely that directly or indirectly they passed this information onto the whalemen. The quest for right whales was intensified by a fad in European and American fashions. In 1840 the price of whalebone (baleen) began a rise that more than doubled its value by 1844. Whalebone had been a saleable by-product of baleen whales for more than four centuries. Because it could be cut into long, thin strips—or indeed any shape that the baleen plate would allow—without sacrificing its strength or flexibility, and could be molded by steam to hold a new shape, it was used in a number of items were resilience was required, among them: umbrella ribs, hat brim stiffeners, buggy whips, brush bristles, and corset stays. The length of baleen plates from a right whale, often more than eight feet for the best pieces, made it especially desirable to the fashion market for dress hoops because it was the lightest and least fragile material for keeping skirts fully ballooned. In 1840 the Parisian French and English began a 20-yr trend calling for fully flaring skirts. Demand for, and use of, baleen in Victorian fashions, in the face of limited supplies, drove the price up. Emphasis quickly shifted from sperm to right whales because the combined value of baleen and oil from the latter exceeded that of the scarce sperm whales.

Because the Atlantic and Indian oceans and most of the Pacific had already been thoroughly searched for stocks of whales, the whaling merchants, short of withdrawing their capital from the industry, were left with only the North Pacific in which to seek and hunt right whales. In 1843–1845 a large number of ships from several nations was cruising the rim of

the North Pacific for right whales along the Kurile Islands, near Kamchatka, and in the Gulf of Alaska—very close to the margin of bowhead habitat.

The year 1845 was extremely important for whales and whaling in the North Pacific sector for chance discoveries led the whalemen to the two remaining, unexploited populations of bowheads. It is known that in that year Captain Mercator Cooper briefly took the whaleship *Manhattan*, of Sag Harbor (Long Island), into the Okhotsk Sea to search for right whales. Also, several other whaleships including the *Josephine* of Sag Harbor (Captain Thomas Welcome Roys) and the Danish ship *Neptun* under command of Captain Soldering touched at Petropavalovsk-Kamchatskiy, on the Pacific side of the Kamchatka Peninsula. Roys remained ashore to recuperate from injuries sustained when a fighting right whale broke three of his ribs with its flukes. Roys apparently learned that a "polar whale" was taken in that year by the *Neptun* and that several other ships had taken the oil- and baleen-rich bowheads in waters between Kamchatka and the Commandorskii (Commander) Islands. While ashore he learned from a Russian naval officer that polar whales were to be found in Bering Strait, far north of the whaling activity. The whalemen knew nothing of that region but luckily, according to Schmitt (1971/1986, p. 103), Roys was able to purchase charts from the Russian officer for $100.

Roys returned to Sag Harbor aboard the *Josephine* in May 1847 without having ventured to Bering Strait. He suspected that the whales about which he had heard were the same as the "Greenland" whales that Europeans, and later Americans, had been taking for more than four centuries in the high latitudes beyond the North Atlantic. While at home he consulted the published works of explorers (Schmitt 1971/1986, p. 103; Bockstoce 1986, p. 22) who had sailed north of Bering Strait and, according to Bockstoce (1986, p. 22), found reports of whales in the narratives of British Royal Navy Captains James Cook and Frederick William Beechey.

Roys' next command was aboard the bark *Superior* of Sag Harbor, a relatively small ship of 275 tons, outfitted for an ostensibly short and inexpensive voyage of less than a year to the southern Indian and Pacific oceans. According to Bockstoce (1986, p. 22):

> He put to sea in July 1847 as if on a normal whaling voyage during which he would follow the strategy outlined to him by the owners. Once on the whaling grounds they had designated, it would be up to him to devise the best tactics for taking whales. He was to follow orders—apart from the usual discretion allowed to masters of ships when out of touch with the owners.

He had poor success and, after touching at Hobart, Tasmania, set out on an equally unsuccessful cruise to the South Pacific. After again returning to Hobart to refit for a year's cruise, he wrote to the owners informing them of his intention to go to Bering Strait, knowing that by the time they received his letter he would be in the Arctic Ocean (Bockstoce 1986, p. 23).

The *Superior* sailed north, entered the Bering Sea about May 31, and worked the area below Bering Strait, as far as 60°N, during June and most of July. Apparently no bowheads were captured or seen. Over protestations from officers and crew, Roys then proceeded north. On 23 July 1848, he reached Bering Strait, a thousand miles beyond the nearest whaleship, and soon discovered the great stock of bowheads there. Despite continuing

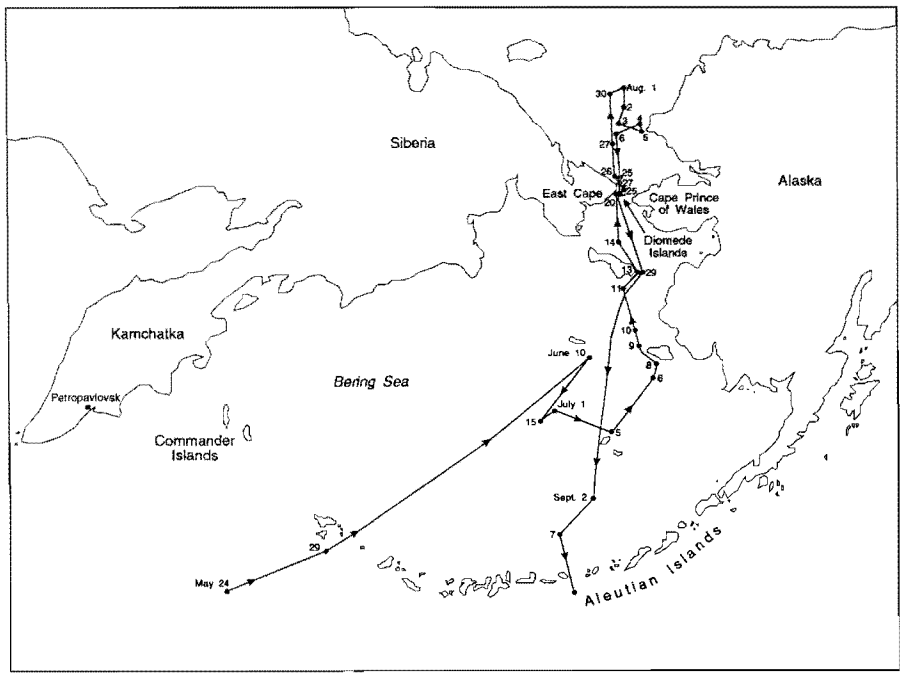

Figure 14.1. The route of Thomas Roys' discovery cruise in the *Superior*, May–September 1848 (from Bockstoce 1986, with permission).

concern of the crew, the *Superior* cruised 250 mi farther north before turning back. He returned south through Bering Strait on 27 August, having filled his small ship to capacity with 1,600 barrels of oil and a vast amount of baleen. He headed straight for Hawaii arriving at Honolulu on 3 October, and the news of his discovery and success was immediately announced. The route of this epic whaling voyage to the Bering Sea and Arctic Ocean is shown in Figure 14.1.

Whalers usually shared their discoveries, realizing that there was safety in numbers in remote waters of the world, and the *Superior*'s voyage set off a flurry of excitement. What news was not spread by word of mouth was quickly broadcast by the Honolulu missionary newspaper *The Friend*, and by early 1849 most of the marine journals of the world had carried the story.

Roys made the most important whaling discovery of the nineteenth century. Over the next seven decades the richness of the Bering Sea stock of bowheads would lure vessels of the United States, France, Germany, Hawaii, and Australia through Bering Strait. This vast foreign presence was carried out on 2,700 annual whaling cruises which resulted in the killing of over 20,000 bowheads (Table 10.1), almost led to their extinction, and involved the loss of more than 150 whaleships. The bowhead population in the Okhotsk Sea, where many of these vessels also hunted, was reduced even more severely (Chapter 10). As in Davis Strait and Hudson Bay, activities of the whalers also depressed other marine and terrestrial mammals and caused great hardship to aboriginal peoples of the region (Allen 1880, p. 769; Chapter 13; Bockstoce 1984; Bockstoce and Botkin 1982).

Surprisingly, Roys made only one more trip to the Bering Strait whaling grounds. According to Schmitt (1971/1986), after returning to Sag Harbor on 5 May 1849, having completed his pioneering cruise of 21 mo and 21 d, he was immediately engaged as master of the Cold Spring Harbor whaleship *Sheffield,* which was fully three times larger than the *Josephine.*

He sailed again for the Bering Strait grounds on 17 August 1849, stopping enroute at San Francisco and Honolulu. He went to Bering Strait in the summers of 1850 (took 3,200 bbl of oil) and 1851 (1,400 bbl). The region where he whaled in 1852 is not known with certainty, though it was probably in the South Pacific as he refitted at Wellington, New Zealand, having arrived there in late December. From there he took the *Sheffield* to the Okhotsk Sea in the summer of 1853 (1,400 bbl), touched at Honolulu in September—with an outbreak of smallpox among the crew—and then sailed for New York, whaling enroute. The *Sheffield* arrived home on 23 January 1854, after a cruise of almost four and a half years.

After that he continued whaling in other parts of the world and devoted much of his efforts to development of rockets and bombs for use in the whale fishery. His successes diminished and at the time of his death on 27 January 1877, in Mazatlan, Mexico, he was an incoherent, penniless, and broken man, even as the fishery he pioneered was still in progress. Additional information about Captain Roys can be found in Schmitt (1971/1986), Schmitt *et al.* (1980), and Bockstoce (1986).

DEVELOPMENT OF THE FISHERY

In 1849, on the strength of Roys' report, 50 ships went through Bering Strait to the Arctic Ocean. They enjoyed phenomenal success, averaging more than 1,300 barrels of oil per vessel, as well as high yields of whalebone. More and more ships were drawn north each year until, in 1852, more than 200 were cruising in what was broadly referred to as the Bering Strait region. The Yankee whalers quickly established a routine they would vary only slightly during the next 60 yr. Leaving New England and New York in the autumn and rounding Cape Horn in the austral summer, they outfitted at Hawaiian ports or San Francisco, sailing for the Arctic in late March. By late April they reached the pack ice of central Bering Sea. In the first decades of the fishery they were often able to take whales as they worked their way north in ice-free waters. By early June, however, most of the bowheads had passed them and gone deep into the ice on their northward spring migration to feeding grounds mainly in the eastern Beaufort Sea (Chapters 6, 9, and 11).

As the fishery progressed into its second decade, the whalemen generally would not see their quarry again until late July, when easing ice conditions allowed the ships to approach the north coast of Alaska and intersect the whales travelling westward from the Beaufort Sea to their autumn feeding grounds in the western Chukchi Sea (and sometimes beyond). The ships often cruised near Herald Island and Long Strait until violent weather and advancing ice of early October drove them back to ports in the Pacific Ocean.

The whalemen usually repeated these summer voyages once or twice more before returning to their home ports. Some alternated their summer hunts with cruises to the Arctic, the Okhotsk Sea, or the Gulf of Alaska, depending

on where the best catches were being made; nevertheless, they rarely hunted more than one of these areas per year.

The intensity of hunting in the early years quickly reduced the bowhead populations. From the Bering Sea population the whalemen made one-third of their total kills by 1852 and one-half by 1864 (Table 10.1). Total catches, even in the early years, were highly variable to the point that, after the low catches in 1853 and 1854, the fleet virtually abandoned the Bering Strait and arctic grounds in 1855, 1856, and 1857, turning instead to the Okhotsk Sea grounds. It is possible that in the Bering Sea population the whales themselves responded to the first onslaughts by fleeing the accessible hunting areas. The Okhotsk population was quickly decimated, and the fleet returned to Bering Strait in 1858, to cruise there, and farther north, for the following half-century. Whaling effort (ships), catch, and product value over the duration of the fishery are presented in Figure 14.2.

In the spring, once the ships had reached 50°N, or in the later years 57°N or 58°N, the whalemen began to watch for bowheads. For the next five or six months they generally kept themselves in constant readiness to lower their whaleboats. When they saw a whale, if the seas were not too rough or the ice too dense, four or five boats usually went after it. If the men were lucky, a boat got close enough to strike the whale with a harpoon. The whale would then "run," towing the line and boat after it, eventually becoming sufficiently tired that the whalers could pull themselves close enough and kill it with a lance. Frequently, however, whales escaped into the ice, towing the lines and gear with them. In response to these losses the whalemen, after 1860, increasingly used darting guns (which were fixed to the harpoon shaft and fired a small bomb into the whale the moment it was struck) and shoulder guns (heavy bronze smooth bores that fired a similar bomb from a distance) and thus generally replaced the lance. The darting and shoulder guns are depicted in Scammon (1874/1968, p. 227 and pl. 24). Once the whale was dead, or if a dead whale was found, the carcass was towed to the ship where the crew took the baleen aboard and stripped off and "tryed out" (rendered into oil) the blubber.

Information of this sort was recorded daily by the whalemen in their logbooks and journals (a logbook is an official ship's record; a journal is a private document). Information that was usually recorded included the ship's position, the wind velocity and direction, sea state, visibility, and ice conditions. Similarly, if animals were encountered, the whalemen usually noted the species and numbers seen. If they were whales or walruses, the men recorded whether the boats chased, struck and lost, captured, or found them dead. When they were processed, the yield of oil and baleen was often noted as well.

By 1866 the hunting pressure had put the Bering Sea population in steep decline. To offset poor catches the whalemen began taking walruses (*Odobenus rosmarus divergens*) and gray whales (*Eschrichtius robustus*) in the "middle season" between their spring and autumn encounters with the bowheads. They captured nearly 150,000 walruses (Bockstoce and Botkin 1982) and killed about 840 gray whales, of which 539 were captured (Bockstoce *in* Henderson 1984: table 1) and another 300 were lost (Bockstoce 1986, p. 73). The whalers also pushed their ships farther north and did so earlier in the season. In the 1860s they probed the northwest corner of the

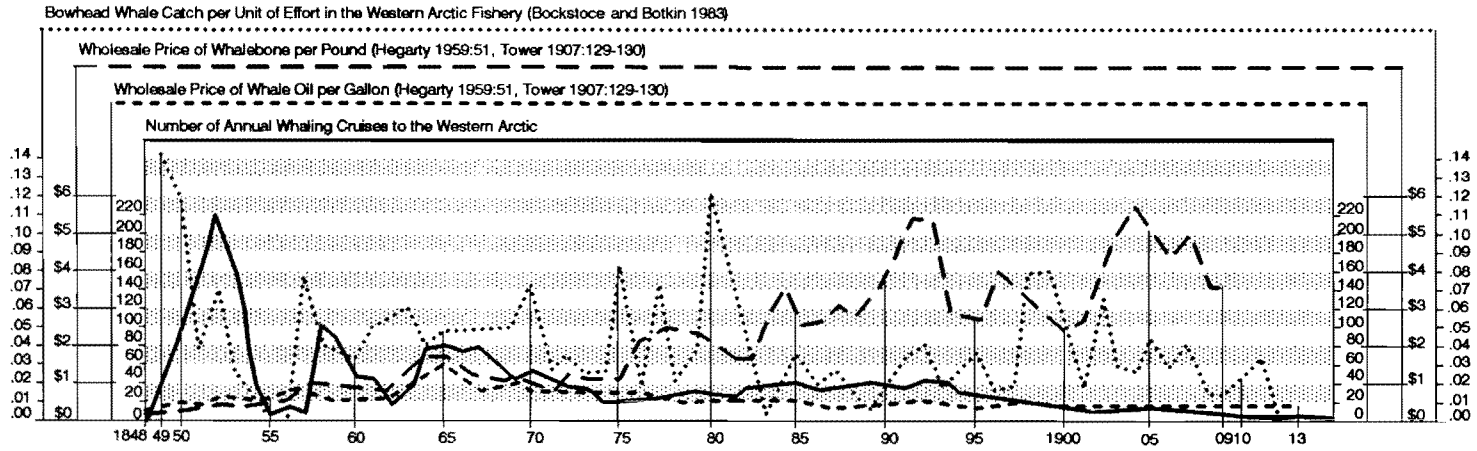

Figure 14.2. Yearly variation in number of vessels, catch per unit of effort (CPUE), and product prices during the pelagic fishery for bowheads in the Bering, Chukchi, and Beaufort seas, 1848–1914 (from Bockstoce 1986, with permission).

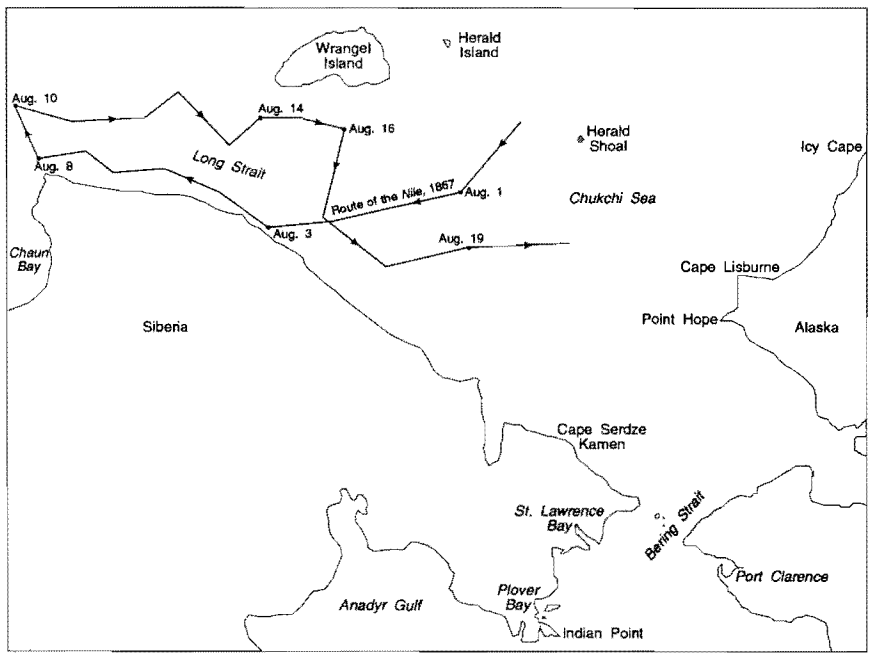

Figure 14.3. The route of Thomas Long's cruise to the East Siberian Sea in the *Nile*, August 1867 (from Bockstoce 1986, with permission).

Chukchi Sea near Wrangel Island and, during the exceptionally light ice summer of 1867 several whaleships, most notably the *Nile* and the *Monticello,* penetrated the East Siberian Sea and were the first foreign ships to do so (Fig. 14.3). Captain Thomas W. Long of the *Nile* named Wrangel Island (known to the whalers as Plover Island) in honor of the explorer von Wrangell. The strait between Wrangel Island and Siberia was named Long Strait. Neither ship encountered bowheads and both returned to the Chukchi Sea.

In the 1870s the whalers worked aggressively, and at considerable risk, into the northeastern part of the Chukchi near Point Barrow. One result of this was that in the 1870s 57 whaleships were lost including 31 of them near Point Belcher in 1871 (Bockstoce 1977*a*, 1986) and 12 near Point Barrow in 1876 (Bockstoce 1977*a*, Bockstoce 1986).

In the 1880s, although the price of whale oil had been falling due to the pressure of substitutes from the developing petroleum industry, the price of baleen rose steeply, once again driven by demands of the fashion industry for narrow waists—hence the need for "whalebone" corset stays. This development encouraged incorporation of two important innovations into the fishery, both of which provided access to the remaining whales of the greatly depleted stock. These were shore whaling (see Chapter 13) and steam power aboard whaleships.

Shore whaling stations were set up at Point Barrow in 1884, and at Point Hope in 1887, to catch the bowheads during their spring migration through the narrow nearshore leads where the ships could not hunt them. The

stations were successful, putting out multiple crews, and by 1895 there may have been as many as twenty stations operating between St. Lawrence Island and Point Barrow. From the date when shore stations were first established, until 1914, commercial shore whalers of all races captured more than 1,000 bowheads (Braund *et al.* 1988, Table 10.1).

In addition to the shore stations, whaleships with steam auxiliary power immediately proved successful in pursuing bowheads to what were formerly the most inaccessible corners of their summer range, particularly in the eastern Beaufort Sea region. In 1889 such ships reached the delta of the Mackenzie River and in the following year they were the principal vehicle that enabled whalemen to set up an arctic advance base camp near there, at Herschel Island, on the coast of the Yukon Territory, Canada. It was from this staging point that, in 1891, the bowheads' summer feeding grounds near Cape Bathurst in the Northwest Territories were discovered (see below). From then until 1914 the focus of the industry was largely on the waters of the eastern Beaufort Sea and, as in all other areas, the bowheads were reduced to near extinction (Fraker and Bockstoce 1980, Bockstoce 1986). Several steam whalers engaged in the Beaufort sea fishery were lost near Point Barrow in what has come to be known as the Arctic whaling disaster of 1897. These "great steam whalers were never to be replaced because, although the price of baleen continued to climb, the catch declined faster" (Bockstoce 1977*a*).

Discovery of the bowheads' summer feeding grounds in the eastern Beaufort Sea region initiated the last great phase of the fishery and was conducted mainly by ships that overwintered (see Bockstoce 1986, pp. 255–289). In the 1870s whaleships began sailing east of Point Barrow to search for whales off the Mackenzie River Delta, Canada, but did not succeed in finding them. Based on persistent information from Eskimos arriving at Point Barrow from the east, a small whaleboat with a crew headed by "Little Joe" Tuckfield was dispatched from a shore whaling station at Barrow in July 1888 in order to overwinter in the Mackenzie Delta area, trade for furs, and verify the Eskimo reports. Tuckfield returned to Barrow in August 1889, having found whales "as thick as bees" (also having taken one) and the news was out. Several ships immediately set out, but most of them turned around without sighting whales. Two ships, the *Orca* and the *Thrasher*, continued eastward and took two whales each despite very poor conditions. They saw many more before returning west without overwintering.

Their news and success was encouraging. In 1890 the 90-foot tug *Mary D. Hume* departed San Francisco with the intent of overwintering in the eastern Beaufort Sea region. No whales were taken that year, but she and two other ships (*Grampus* and *Nicoline*) took up winter quarters behind Herschel Island. The ships left the island on 10 July 1891, the *Nicoline* returning to San Francisco and the other two heading east. The men of the *Hume* saw their first whale near Cape Bathurst, about 200 mi farther east, on 24 July. In August and September the *Hume* took 27 whales, and the *Grampus* took 21, after which the latter sailed back to San Francisco with the baleen from both ships. The *Hume* returned to Herschel Island to spend another winter. She went out from the island again on 4 July 1892, reached Cape Bathurst on 28 July, took seven whales as fast as was possible, and started for home on 15 August. Her success was electrifying and initiated

almost 20 yr of overwintering voyages to the region. During her 29-mo absence, including little more than 3 mo of actual whaling, she had taken 37 bowheads with bone valued at some $400,000. Hers was among the most profitable voyages in American whaling history.

During the 1890s as many as 15 whaleships a year overwintered at Herschel Island and greatly reduced the remaining accessible remnant of the Bering Sea population.

Changes in fashion forced the baleen market to collapse in 1908, dragging the industry with it, and indirectly saving the remaining whales (Bockstoce 1977*b*, p. 52). After 1914, although a few vessels cleared port as whaleships, they were, in fact, primarily on fur trading and freighting voyages, and only a few whales were taken by ships thereafter. The absolute end of commercial bowhead whaling came in 1921, when the gasoline-engine-powered schooner *Nanuk* caught the last one taken at sea. It is estimated that by 1914 pelagic and shore-based whalers (commercial and non-commercial) had caught 20,070 bowheads, the whaleships having taken 93% of that total (Bockstoce and Botkin 1983, Table 10.1).

REDUCTION OF THE POPULATION

Bockstoce and Botkin (1983) surveyed all extant logbooks and journals from the fishery and extracted daily data from 516 cruises (19% of the total), comprising more than 66,000 d of observations. The record contains quotidian information about operations and observations as previously mentioned. These and other information have revealed that the southernmost range of bowheads of the Bering Sea population was probably about 53°N or 54°N, near the coast of Kamchatka. Distribution was no doubt influenced by annual variations in extent of sea ice. As the fishery wore on, the southern limit of these whales retreated northward about 3° of latitude every 10 yr. This retreat, together with the progressive reduction of whales, forced the whalemen to push farther north in the Chukchi, and then east in the Beaufort Sea, to maintain catches. They finally reached as far as 73°N and as far east as 114°W.

In the first period of commercial exploitation they took bowheads from spring to autumn in the northern and southwestern Bering Sea. It seems reasonable to assume, therefore, that those bowheads were on their normal feeding grounds and not merely migrating through these areas. Based on this reasoning, it is also possible that what we refer to as the Bering Sea population was comprised of several subpopulations, each with its own normal range and feeding area, and each of which was successively exterminated or extirpated as the fleet steadily expanded its hunting range (Bockstoce and Botkin 1983, Fraker 1984).

Alternatively, it is also possible that the bowheads were a single, integrated population that responded rapidly to the activities of whaling ships and fled from areas of intensive hunting, receding farther and farther north and east to temporarily safer areas. The whalemen found that within only a year or two of their discovery of the Bering Strait whaling grounds the whales, in the opinion of the whalers, began to adapt to the threat. In particular they vanished for several years in an area where a large number of kills had been made. Furthermore, the bowheads apparently quickly

learned to distinguish the sound of a whaleboat approaching them, and when a whale was struck, all nearby bowheads would dive and flee. Such responses are similar to those reported by contemporary subsistence hunters (Chapter 15).

Similarly, when a boat did approach close to bowheads, the animals were often noticed dodging or slumping in the water to avoid the harpoon. Whales that had been wounded in the past were noted to be particularly wary (Bockstoce 1986, p. 101).

The analysis of the population reductions is further complicated by indications that there may have been some exchange between the Davis Strait and Bering Sea populations. There are reports of two whaling irons taken from whales in the Chukchi Sea that apparently came from ships that only cruised in arctic waters of the western North Atlantic sector (*Cornelius Howland* 26 August 1870; San Francisco Chronicle, 17 November 1878; Nelson 1887, p. 293; Hooper 1884, p. 38). For a number of reasons it is highly unlikely that these irons would have been carried to the Chukchi Sea aboard a ship. At their farthest points of advance vessels in the eastern Beaufort Sea region were only 500 mi from those hunting in the eastern Canadian Arctic. The influx of uniquely identifiable species from the North Atlantic sector to the North Pacific sector is a matter of record. These include various marine mammals that normally occur in the eastern Canadian Arctic being sighted or caught in waters of western Canada and Alaska, including harp seals in the Beaufort Sea (Porsild 1945); hooded seals in the eastern Pacific, Bering Strait, and Beaufort Sea (Porsild 1945; Burns and Gavin 1980; Dudley 1992; Diomede Islanders, local knowledge); and narwhals from southern Bering Sea to Amundsen Gulf (Geist *et al.* 1960; Ljungblad *et al.* 1983, 1987; R. Quimby, personal communication, 25 April 1984). There is no way to recognize immigrants of species that have identical geographic counterparts such as bowheads and belugas.

In general, the largest bowheads were taken in the earliest years of the fishery although, paradoxically, one or two very big whales were taken in the last years. The greatest yield reported from a bowhead of the Bering Sea population may well have been 375 barrels of oil (1 barrel = 31.5 U.S. gallons or about 119 liters), although a rule of thumb was that cows yielded 140 barrels and bulls 100 barrels (Old Dartmouth Historical Society T-6, Anonymous 1868). The longest slabs of baleen taken in the fishery were 4.87 m long (Old Dartmouth Historical Society T-1), and the greatest amount was 1,596.7 kg (Old Dartmouth Historical Society T-4). The yield of baleen from the "average" 100-barrel whale was considered to be 680–771 kg. The longest measured bowhead was 24.54 m (*Majestic* 26 July 1850). There is little historic data on the longevity of bowheads, but one that was killed in the Bering Sea in 1890 had been previously struck and carried an iron from the whaleship *Montezuma* (Dall 1899). The last arctic whaling cruise of the *Montezuma* was in 1854, 36 yr before. Again, for several reasons, it is unlikely that any other ship would have carried the *Montezuma*'s irons.

The progressive suppression of the Bering Sea population no doubt altered the age and size distribution. Although there is no evidence of the whalemen consciously selecting one whale over another (apart from the closest one), it may have been that the whales themselves were segregated, as found by Nerini *et al.* (1987) and also reported in Chapters 7 and 11,

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The analysis of the population reductions is further complicated by indications that there may have been some exchange between the Davis Strait and Bering Sea populations. There are reports of two whaling irons taken from whales in the Chukchi Sea that apparently came from ships that only cruised in arctic waters of the western North Atlantic sector (*Cornelius Howland* 26 August 1870; San Francisco Chronicle, 17 November 1878; Nelson 1887, p. 293; Hooper 1884, p. 38). For a number of reasons it is highly unlikely that these irons would have been carried to the Chukchi Sea aboard a ship. At their farthest points of advance vessels in the eastern Beaufort Sea region were only 500 mi from those hunting in the eastern Canadian Arctic. The influx of uniquely identifiable species from the North Atlantic sector to the North Pacific sector is a matter of record. These include various marine mammals that normally occur in the eastern Canadian Arctic being sighted or caught in waters of western Canada and Alaska, including harp seals in the Beaufort Sea (Porsild 1945); hooded seals in the eastern Pacific, Bering Strait, and Beaufort Sea (Porsild 1945; Burns and Gavin 1980; Dudley 1992; Diomede Islanders, local knowledge); and narwhals from southern Bering Sea to Amundsen Gulf (Geist *et al.* 1960; Ljungblad *et al.* 1983, 1987; R. Quimby, personal communication, 25 April 1984). There is no way to recognize immigrants of species that have identical geographic counterparts such as bowheads and belugas.

In general, the largest bowheads were taken in the earliest years of the fishery although, paradoxically, one or two very big whales were taken in the last years. The greatest yield reported from a bowhead of the Bering Sea population may well have been 375 barrels of oil (1 barrel = 31.5 U.S. gallons or about 119 liters), although a rule of thumb was that cows yielded 140 barrels and bulls 100 barrels (Old Dartmouth Historical Society T-6, Anonymous 1868). The longest slabs of baleen taken in the fishery were 4.87 m long (Old Dartmouth Historical Society T-1), and the greatest amount was 1,596.7 kg (Old Dartmouth Historical Society T-4). The yield of baleen from the "average" 100-barrel whale was considered to be 680–771 kg. The longest measured bowhead was 24.54 m (*Majestic* 26 July 1850). There is little historic data on the longevity of bowheads, but one that was killed in the Bering Sea in 1890 had been previously struck and carried an iron from the whaleship *Montezuma* (Dall 1899). The last arctic whaling cruise of the *Montezuma* was in 1854, 36 yr before. Again, for several reasons, it is unlikely that any other ship would have carried the *Montezuma*'s irons.

The progressive suppression of the Bering Sea population no doubt altered the age and size distribution. Although there is no evidence of the whalemen consciously selecting one whale over another (apart from the closest one), it may have been that the whales themselves were segregated, as found by Nerini *et al.* (1987) and also reported in Chapters 7 and 11,

and were thus differentially available, at least in some years. Logbook data indicate that the size of bowheads decreased from inception of the fishery until 1874, after which the data are sparse. Such a decrease is evident in the decline in barrels of oil per whale during that period. This indicates a decrease in the average size of the whales and, therefore, in the average age.

One can speculate that the shift from larger to smaller (older to younger) whales in the population would tend to have a negative effect on the reproductive potential, which in turn would hamper, at least initially, the rate of recovery after a period of intense exploitation (Bockstoce and Botkin 1983).

The best available data suggest that from 1848 to 1914 the Bering Sea population was reduced from a maximum size of 23,000 to perhaps 3,000 (Chapter 10). In the Okhotsk sea the reduction occurred more rapidly and the record of harvests remains less complete. It appears, however, that the population was reduced from 3,000 (Chapter 10) to perhaps less than 200 at most. Ivashin (1988) estimated the size of this stock in 1986–1987 to be on the order of 150–200 animals, with no extrapolation for unseen whales or whales in areas not surveyed. Zeh *et al.* (Chapter 11) suggest that it is probably twice as large based on what is known about census methods and relevant behavior. In either case the Okhotsk population remains severely depressed, though it has been almost a century since cessation of the bowhead fishery there.

THE IMPACT OF WHALING

The familiar sequence of events established in the North Atlantic bowhead fisheries also occurred in the North Pacific sector and was, as eloquently stated in Chapter 13, basically the phases of discovery, high initial yields, rapid increase in effort, reduction of the target resource, diversification, improvement of harvesting techniques, diminished returns, reduced effort, and cessation.

In the North Atlantic sector (except in Hudson Bay) these phases spanned more than four centuries and involved sequential dominance by several nations. In the North Pacific sector they were played out over perhaps three decades in the Okhotsk Sea, and six decades in the Bering Strait and arctic fishery, and involved primarily one nation. At the time these stocks were discovered, there was already a large catching capacity operating in closely adjacent areas and targeting on seriously depressed species. The shift from the North Pacific rim to the Okhotsk and Bering Strait fisheries was immediate and intense.

In the Bering and Chukchi seas when the inevitable shift to alternate resources was made by the whalers, it was to walruses and the effects were devastating. According to Bockstoce (1986, p. 131) walrusing began as early as 1859, and by the 1870s almost the entire fleet was hunting them in the period between early summer and autumn whaling. An estimated 150,000 walruses were caught of which 85% were taken in the period between 1869 and 1878. The total kill was probably twice the catch (Bockstoce and Botkin 1982, Bockstoce 1986, p. 135–136).

The whalers were aware of their impact on bowheads and walruses, and

the hardships that the great reduction of these animals was causing to aboriginal peoples of Alaska and Chukotka (see Chapter 15). A letter from Captain C. F. Nye, written on 2 August 1879, aboard the bark *Mt. Wollaston* off Cape Lisburne (Boston Advertiser, 4 October 1879 *in* Allen 1880, p. 769) indicates that in that year the whalers were ". . . destroying them [walruses] by the thousands; about 11,000 having been taken and 30,000 or 40,000 destroyed this year. Another year or perhaps two years will finish them . . . ."

The native peoples suffered greatly from the extreme reduction of walruses. The extent of these and other consequences are covered in detail by Bockstoce (1986, pp. 136–141). Considering all locations, sporadic famines occurred from the winter of 1878–1879 to that of 1890–1891. Starvation in the walrus-dependent villages in and near Bering Strait was especially acute and affected settlements from St. Lawrence Bay to the Gulf of Anadyr in the Chukotka region, the maritime islands of St. Lawrence, King, and the Diomedes, and Kingigen (Wales) on the Alaska mainland. In addition to the high mortality—half the people of the St. Lawrence Bay region, two-thirds of those on St. Lawrence and King islands, and unknown numbers elsewhere—the shortage of animals also resulted in movement and redistribution of the survivors. Recovery of the vast walrus herds was relatively rapid (Fay 1982), while recovery of the bowhead populations continues to be very slow (Chapter 11).

Many natives, Alaskan and Siberian, participated in commercial whaling, especially when it entered the phases of shore stations and overwintering aboard ships. The transfer of whaling technology was important, and the basic implements of the whalers, particularly darting and shoulder guns, are still used today, though the bombs have been improved recently (Chapter 15). Whaling equipment and other trade goods were secured by native hunters as payment for services rendered, by salvage and plunder of stranded whaleships, and later through trade, primarily for baleen and furs.

With respect to bowheads the impacts are felt strongly to this day and shape the nature and extent of current policy and regulation. Whaling as a subsistence pursuit had ceased essentially in western Canada and Siberia, though efforts are being made to revive it (Chapter 15). It was resumed recently in the Mackenzie Bay area, as authorized by the Canadian Department of Fisheries and Oceans, with one bowhead taken near Shingle Point, Mackenzie Bay, in September 1991. The bowhead remains on the U.S., Canadian, Russian, and international lists of endangered species. In spite of a current population estimated at about 7,500 (IWC 1992, Chapter 11) that is increasing in the face of subsistence hunting in Alaska that permits 54 strikes per year (Chapter 15) and exhibits a gross annual reproductive rate of about 5% (Chapter 7), other Canadian, Alaskan (Diomede Islanders), and Russian Eskimos who wish to resume subsistence whaling have so far not been authorized to do so. The arguments and justifications for their resumption of subsistence whaling are essentially the same as those accepted by the IWC for some Alaskan whalers (IWC 1992).

In addition to the impacts on subsistence whalers, there are also long-term implications for most other human endeavors that may affect bowheads and their habitats. Some of the areas of our concern are amply demonstrated by the diversity of subjects in this book, and by the variety

of funding sources to conduct the different studies (Table 1.3). Issues now involve much more than the killing of a relatively small number of bowheads for subsistence purposes. They involve all of the potential effects of our modern industrial and technological presence that can, directly or indirectly, affect bowhead populations severely reduced by commercial whaling.

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