Observations of western gray whales by ship-based whalers in the 19th century

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ABSTRACT

Animals belonging to the small, endangered population of western gray whales (*Echrichtius robustus*) are observed today primarily during the summer open-water season in feeding areas off the northeastern coast of Sakhalin Island, Russia. The migration route(s) and wintering area(s) used by this population are largely unknown. Gray whales once had a fairly extensive distribution in the Sea of Okhotsk but little detailed information has been published on when and where they occurred. Open-boat, ship-based whalers from the United States and a few other countries conducted an intensive hunt for bowhead whales (*Balaena mysticetus*) and North Pacific right whales (*Eubalaena japonica*) in the Sea of Okhotsk from the 1840s to 1870s. According to entries in voyage logbooks, the American whalers regularly encountered (and sometimes hunted) gray whales in the far northeastern corner of the Okhotsk Sea (Shelikhov Bay, Gizhiginskaya Bay and Penzhinskaya Gulf) between early May-late August. They also observed gray whales in summer along the northern coast of the sea (especially Tauskaya Bay), around the Shantar Islands, in Sakhalin Bay, off Cape Elizabeth at the northern tip of Sakhalin Island and along the west coast of the Kamchatka peninsula. No evidence was found in the logbooks studied of gray whales (and indeed of whaling effort) off northeastern Sakhalin Island where most observations of gray whales occur in the present day.

KEYWORDS: GRAY WHALE; WHALING-HISTORICAL; SEA OF OKHOTSK; NORTHERN HEMISPHERE; BOWHEAD WHALE; NORTH PACIFIC RIGHT WHALE

INTRODUCTION

Recent and current interest in gray whales (*Eschrichtius robustus*) from the western Pacific (Korean-Okhotsk) population has centred on that population's endangered status and the ongoing threats to its survival and recovery (e.g. IWC, 2004). Specifically, there is concern about: (a) the small number of whales in the population; (b) environmental degradation and disturbance from oil and gas development on the northeastern Sakhalin Island shelf, the main area where the population is presently known to congregate in summer to feed; and (c) mortality of gray whales in Japanese waters, mainly in set nets.

The history of this population has been reviewed by Mizue (1951), Nishiwaki and Kasuya (1970), Brownell and Chun (1977), Omura (1984; 1988), Weller *et al*. (1999; 2002), Kasuya (2002), Uni and Kasuya (2002) and Kato and Kasuya (2002). In addition to those reviews, Henderson (1972; 1984; 1990) made reference to ship-based whaling on the western population during the 19th century, primarily by American and French whalers. In our recent studies of whaling history in the North Pacific (e.g. Josephson *et al*., 2008), we have examined a sample of American voyage logbooks that contain substantial unpublished data on western gray whales. The present paper uses those data to describe where and when western gray whales were observed by ship-based whalers during the 19th century.

The data confirm that in the past gray whales used various parts of the Okhotsk Sea, probably as feeding grounds and as routes to and from such grounds. Given the rapid proliferation of offshore oil and gas operations around the perimeter of the Okhotsk Sea as well as on the entire Sakhalin Shelf (e.g. Reeves *et al*., 2005), understanding the historical (and thus both current and potential) summer range is essential.

BACKGROUND

Offshore or ship-based whaling for gray whales along the Asian coast from southern China to Japan and in the Sea of Okhotsk has been less well documented than shore-based whaling there. Among the reasons for this difference is the death in June 1999 of David Henderson, who authored classic studies of the American pre-modern, ship-based fishery for *eastern* Pacific gray whales (1972, 1984) and was working on a similarly exhaustive study of the Okhotsk fishery for *western* Pacific gray whales (e.g. see Henderson, 1984, p.176, note 14; Kugler, 1984, p.157, note 6). Henderson (1972) provided only limited information on western gray whales although on his Map I, he offered an intriguing sketch of their distribution (Fig. 1). Henderson (1984, pp.176-7) indicates that gray whales were not hunted by the American whalers in the Sea of Okhotsk until sometime in the 1840s and that catches of 6-7 whales were being made by some ships by the 1850s. He judged that the total kill of gray whales in the Okhotsk Sea by the American fleet was probably similar to that in the Bering Sea and Arctic Ocean, i.e. a few hundreds (his estimate of total kill in the latter areas between 1845-1874, adjusted for hunting loss, was 539); (Henderson, 1984, p.169). Some American whaling for gray whales continued in the Sea of Okhotsk until at least the mid-1880s (Henderson, 1984, p.177), by which time most of the remaining Arctic fleet was committed to the 'hazardous, though profitable, whaling in the Arctic [i.e. Bering, Chukchi and Beaufort seas]' (Clark, 1887, p.19). The Sea of Okhotsk was also a frequent destination of French whalers from the mid 1840s until perhaps the mid 1860s (Du Pasquier, 1982, pp.183, 192, 245-9; Kugler, 1984, p.152) and they probably took at least some gray whales although we have not found any direct evidence for this (Du Pasquier, 1986, p.274). At least three

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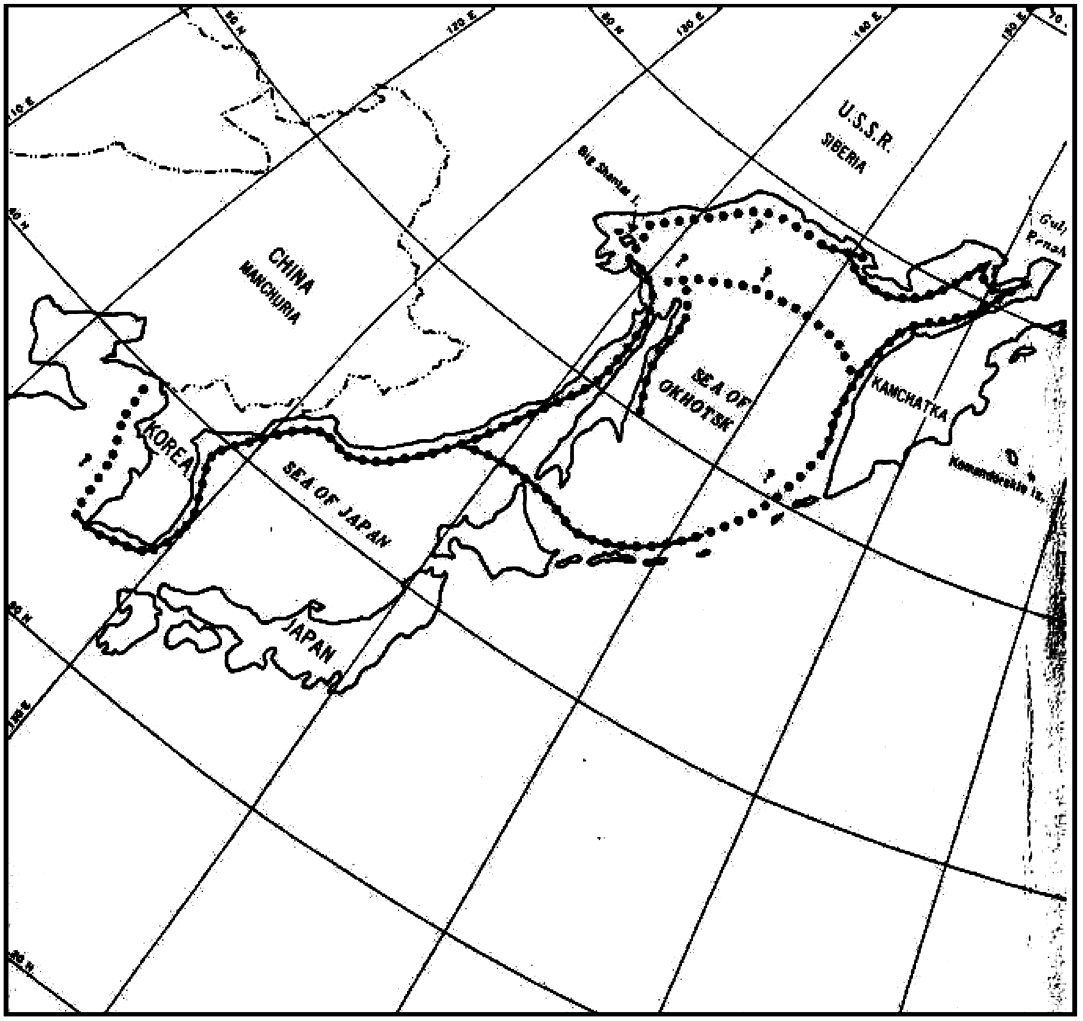

Fig. 1. Excerpt from 'Distribution, Migration Routes, and Calving Grounds of Pacific Gray Whales' in Henderson (1972). Cited sources used by Henderson as the basis for this map include Mizue (1951), Tomilin (1957) and 'Scammon's and other historical records'.

Russian whaleships (all originating from Finland) also visited the Okhotsk Sea in the 1850s (Clark, 1887, pp.206-7).

The Okhotsk Sea fishery for balaenids was most intensive from 1847-1867, with nearly 1,400 vessel-seasons, 90% of them from the United States and the rest from France, Bremen, Russia and the Hawaiian Islands, and occasionally Great Britain, Norway and Chile (Kugler, 1984, p.153). As an example of the intensity of this fishery, one ship's logbook reported that 65 other whaling vessels were in sight on 27 August 1854 in Shantar Bay (*Good Return*). In that same month, Lindholm (1863) counted 82 ships in the bay and on one day 363 whaleboats were in sight from his ship (*Storfursten Constantin*). Bowhead whales (*Balaena mysticetus*) and North Pacific right whales (*Eubalaena japonica*) were the principal targets and, according to Henderson's preliminary analyses (as reported by Kugler, *op cit.)*, more than 15,000 bowheads and 2,400 right whales were killed and processed by the Okhotsk whalers in those first 20 years. The fishery continued until the 1890s.

Henderson's only publication containing data on western Pacific gray whales (apart from the few references to Okhotsk whaling in his 1972 book and his 1984 book chapter) was a short article on American whaling in southern China in the 1860s (Henderson, 1990). There he recounted two voyages to the 'Chinese gray whale ground' in the winter of 1868-69 (by the New Bedford ships *Cornelius Howland* and *Onward*). Although they failed to strike any, the crews of these vessels sighted gray whales near the Chinese mainland coast at c.25-26°N off the island of 'Hatan Ho Tan' (Haitan, Pingtan Dao, or Tao on modern maps, according to Henderson), in the middle of Taiwan (Formosa) Strait and off the northern coast of Taiwan. Ellis (1991) cited two references to Chinese whaling, one a report by John Nieuhoff in 1673 describing the hunt for a species of baleen whale near Hainan Island, the other a more detailed account of Chinese coastal whaling in a September 1844 issue of *The Friend*, a Honolulu newspaper. The newspaper story noted that whales with young congregated 'in great numbers' south of Hailing Shan in January and February and were hunted with harpoons in very shallow water. Although the author of the article suspected these were right whales, the description is consistent with their being gray whales – 'covered with barnacles', breaching frequently, occurring over shallow sandbanks and yielding an average of about 50 bbl of oil (not unusually high for female gray whales that are near term or in early lactation). Just as Scammon (1874, p.23) concluded that a report of gray whales on the coast of China and about the shores of the island of Formosa 'needs confirmation', a certain degree of uncertainty still surrounds the topic of whether western gray whales were heavily hunted on their wintering grounds in the nineteenth century.

MATERIALS AND METHODS

In addition to a search of the literature, whaling voyage logbooks from the Kendall Whaling Museum and Old Dartmouth Historical Society collections, both available at the New Bedford Whaling Museum library in New Bedford, Massachusetts, were sampled. Okhotsk Sea logbooks were identified using library finding aids, Starbuck (1878) and Sherman *et al*. (1986) and through references in logbooks to other vessels sighted or 'spoken' on the grounds. Data from the logbooks, including date, position, details concerning whale observations, and other vessels spoken, were entered into a Microsoft Access database and plotted using ArcMap.

Frequently, the exact location could not be determined from the logbook and therefore it was necessary to estimate positions by interpolation, extrapolation and reference to landmarks. A particular problem encountered while working with this material was that place names used by the American whalers did not always correspond to the Russian names. For that reason, a gazetteer was compiled in the course of logbook reading as a research tool. Sketch maps prepared by the whalers themselves were useful in that regard (Fig. 2). A composite map of the region was developed from a variety of sources (Fig. 3). When places are mentioned throughout the text of this paper, alternative names have been indicated in brackets.

The American whalemen used several different terms to refer to gray whales, including ripsacks (rip sacks), musseldiggers (mussel diggers), devil fish, scrags, scamper downs, California grays, gray backs and California whales. Henderson (1972, pp.34-5; (1984, pp.163-4) included mud digger, digger, California ranger and hard head in the list of names used for the gray whale by American whalemen, but these terms were not encountered in the limited sampling of logbooks for this study. Another term, rock hopper, may have been used although it was not confirmed in the reading conducted for this study. Scammon (1874, p.24) listed only hard-head, mussel-digger, devil-fish, gray-back and rip-sack as the names he and other whalemen used besides California or gray whale (or California gray whale).

The American whalemen called bowheads polar whales (great polar whales according to Scammon, 1874), steeple tops, bowheads (bow heads) or often just whales (in most but not all instances, the species can be inferred from the context; see later). The term bunchback was applied to some bowheads, referring to a low dorsal hump on the caudal peduncle, and young bowheads in the Sea of Okhotsk were sometimes called poggies (Scammon, 1874, pp.60-1). Blue whales (*Balaenoptera musculus*) were consistently called sulphur (sulfur) bottoms. Right whales, humpback whales (*Megaptera novaeangliae*) and 'finback' whales (probably mainly fin whales, *B. physalus*, although this name also may have been applied to sei whales, *B. borealis*) were referred to as such. Scammon (1874, p.67) stated that American whalers called the North Pacific right whale 'north-west whale' to distinguish it from southern right whales but that term was not found in any of the Okhotsk logbooks examined for the present study. Scammon also made reference to a ''scrag' Right Whale' in the North Pacific (note that Mead and Mitchell, 1984 associated the term 'scrag' with the gray whale). Roys (in Maury, 1851, p.198) referred to the right whale in the western North Pacific as the Kamchatka whale but seemed to realise it was the same species as the north-west whale. No reference was found in any of the logbooks read for this study to sperm whales (*Physeter macrocephalus*) in the Sea of Okhotsk.

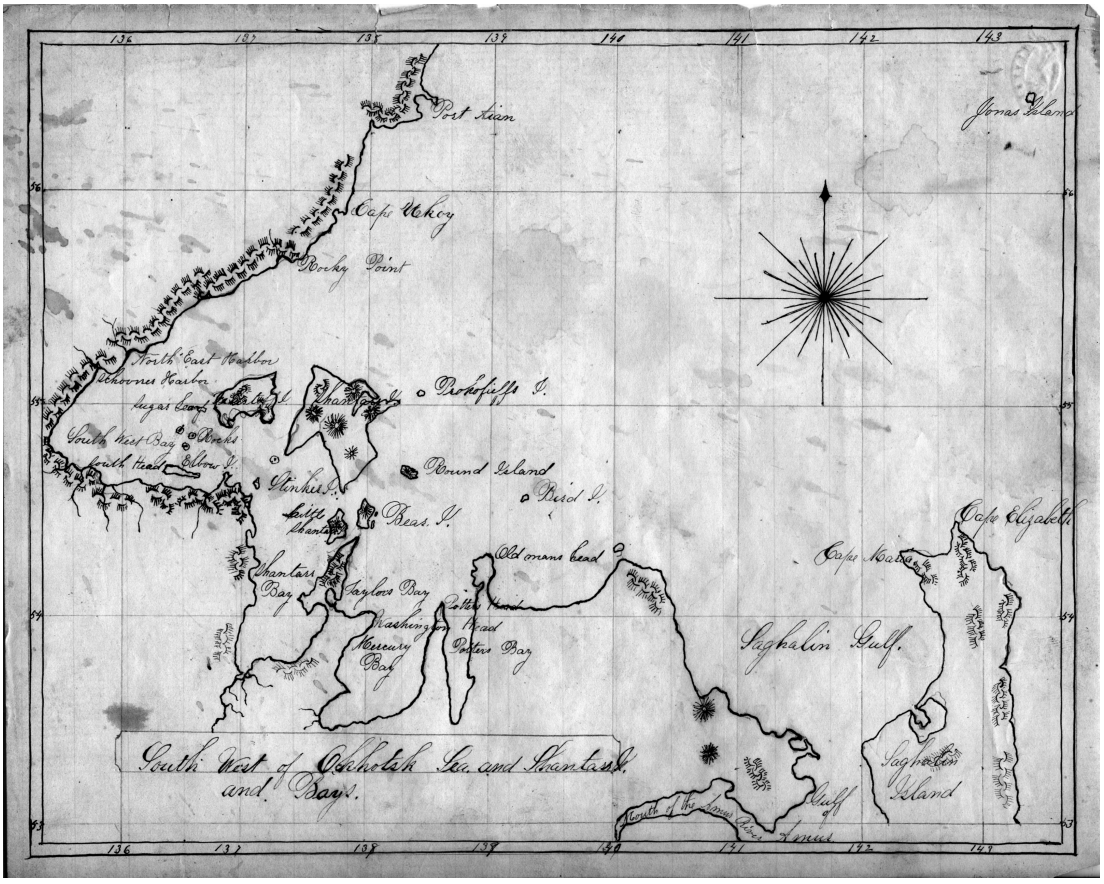

Fig. 2. Sketch map from logbook of ship *Cossack* of New Bedford, 1852. [Courtesy of the New Bedford Whaling Museum]

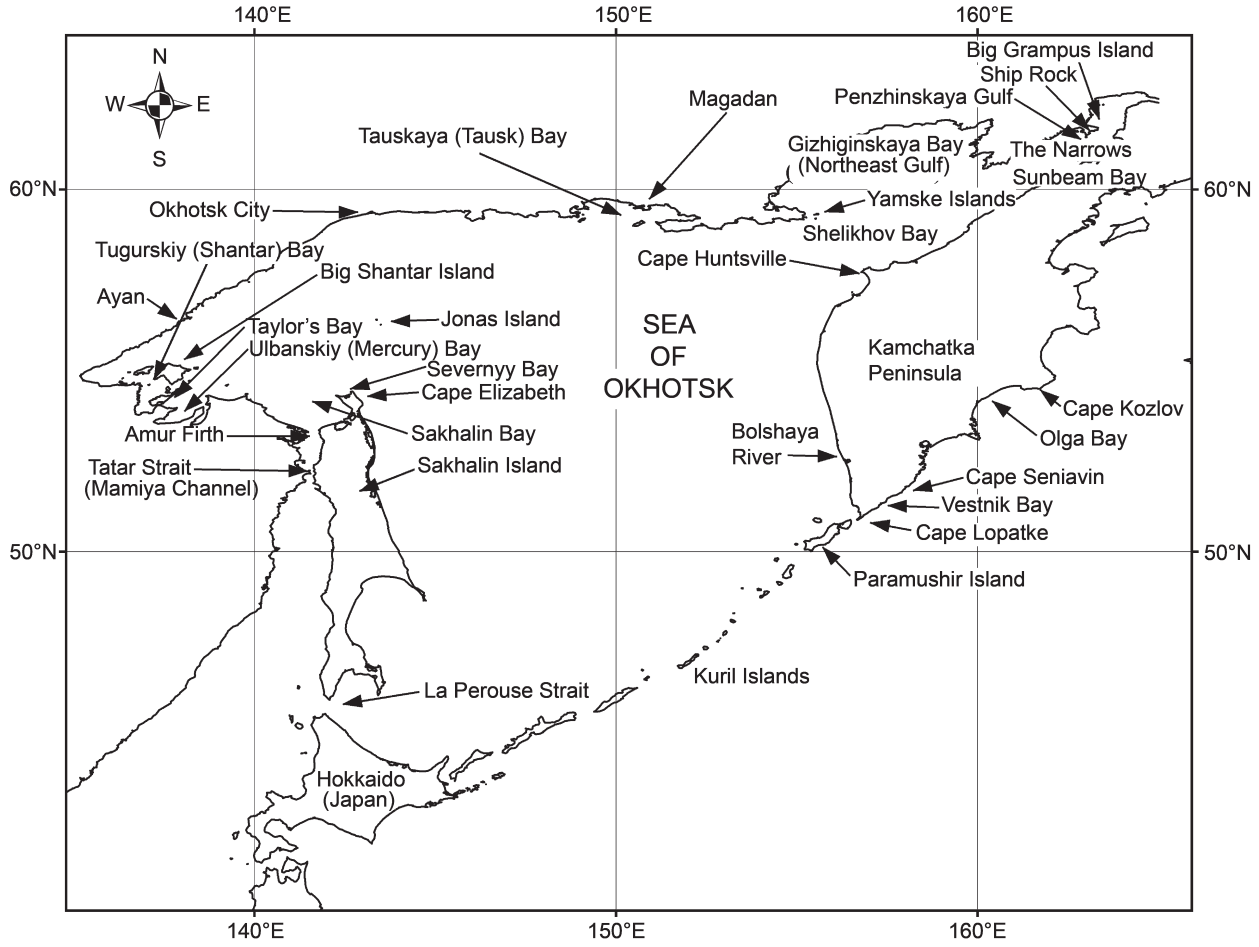

Fig. 3. Places mentioned in text.

RESULTS

The sample of logbooks examined for this study included 21 multiyear voyages that visited the Okhotsk Sea one or more times, for a total of 43 'vessel-seasons' in the Okhotsk. The ships were in the region for more than 5,000 vessel-days and daily positions were determined or estimated for most of those days (Fig. 4). The sampled voyages spanned the period from 1847-1885 though the majority of them took place in the 1850s and 1860s. Logbooks of 14 voyages, including 24 vessel-seasons in the Okhotsk, contained references to sightings of gray whales. There was a total of 160 daily entries with observations of gray whales, including sightings, chases, strikes and captures (Fig. 5).

Occurrence

Citing early Russian literature, Yablokov and Bogoslovskaya (1984) described gray whales (and humpback whales) as having been 'very common and even abundant in the coastal waters of the northern part of the Okhotsk Sea and off the western shores of the Kamchatka Peninsula'. They surmised (as did Tomilin, 1957, p.314) that gray whales migrated into the Okhotsk Sea from the Sea of Japan via both Tatar Strait (Tatarskiy Proliv) and La Perouse Strait. Indeed, American logbook data imply that gray whales at least occurred in or near La Perouse Strait in mid-June (e.g. some were sighted and chased there by the *Cicero*, 16 June 1859, c. 46°N, 142°E). Vladimirov (2004) questioned the feasibility of gray whales entering (or leaving) the Okhotsk Sea via Tatar Strait 'due to the small depths of the Amur Firth (2-3m) … which must be a natural obstacle for migrating animals'. In contrast, Rice and Wolman (1971, p.20), citing Mizue (1951), suggested that all gray whales passed through Tatar Strait 'as none was ever seen in La Perouse Strait'. According to Mizue (1951, p.79): '… it is reported by Mr. Tago that they reach Hokkaido or the western coast of Sakhalin in May or June and then through the Mamiya [Tatar] Channel go to the northern part of the sea of Okhotsk, where they seem to spend their summer. On their southwards migration they seem to take the same course as they come up north. It is not probable that grey whales pass through the Soya [La Perouse] Channel to the farther north, for fin and hump-back whales are captured there from the landstation in Hokkaido but not grey whales'. However, during the late 19th century the gray whale was considered the most frequently encountered baleen whale off the Sea of Japan coast of northern Hokkaido (i.e. Teshio) in late spring and early summer (T. Kasuya, pers. comm.). A total of 149 gray whales (13-29/yr) was taken by Japanese whalers off Teshio in the years 1889-1896 and some additional gray whales were taken off southern Sakhalin in the same period (Uni and Kasuya, 2002). It would seem, then, from the available evidence that at least in the past gray whales moved through both Tatar and La Perouse straits into, and possibly out of, the Sea of Okhotsk.

Many voyages to the Okhotsk Sea originated in Hawaii and therefore the ships entered via the northern Kuriles (usually in the vicinity of Paramushir Island) and then worked northwards along the western shore of Kamchatka. According to Henderson (1972, p.87, citing reports from *Fortune*, 6-8 June 1855; *Mary and Susan*, 19-30 August

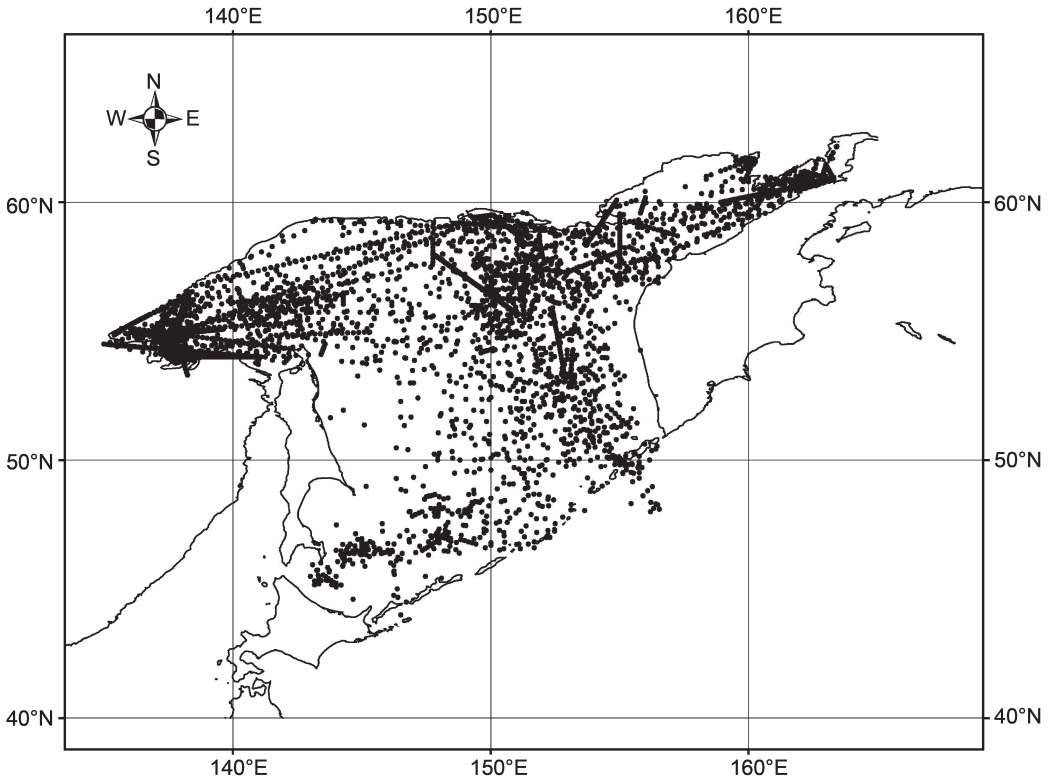

Fig. 4. Approximate positions of whaling vessels in and immediately outside the Sea of Okhotsk based on logbook records of 21 voyages (43 vessel-seasons). Note the nearly complete absence of search effort along the northeastern coast of Sakhalin Island.

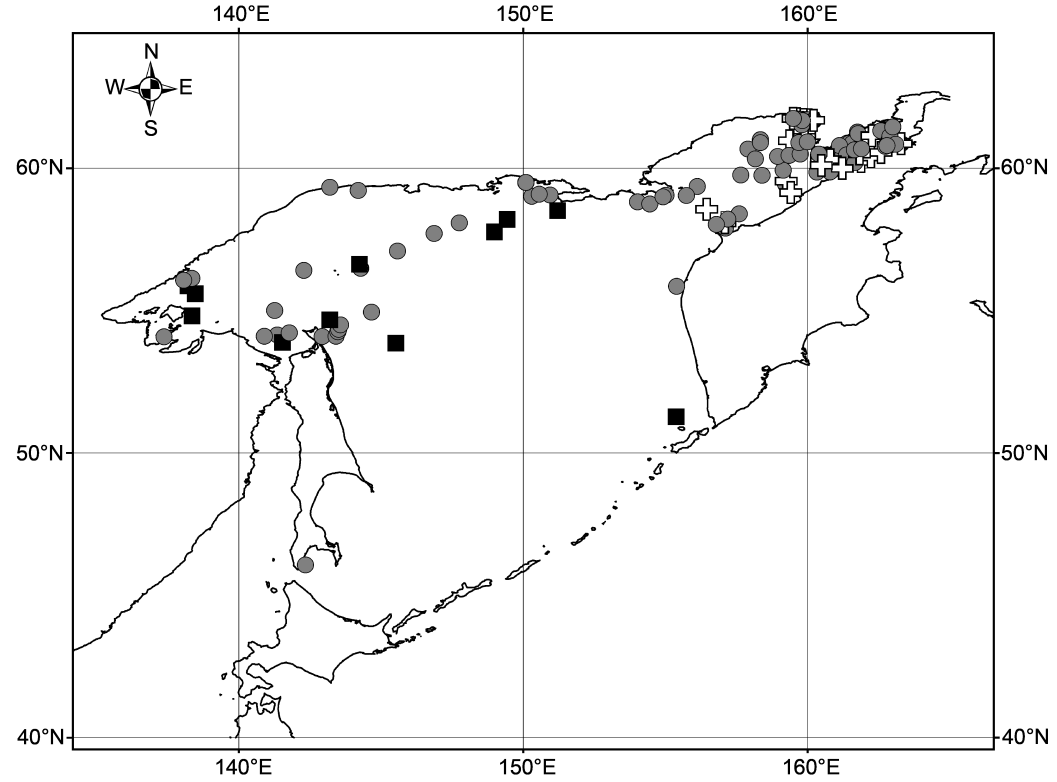

Fig. 5. Approximate positions of 160 sightings (including kills) of gray whales in the Sea of Okhotsk by 19th century American whalers. Note that some symbols are overprinted in areas with many observations. Crosses: May; circles: June-August; squares: September-October. Also note that many positions are based on extrapolation or interpolation from ship positions reported on days before or after that of the gray whale sighting. All data are from logbooks; see text.

1848; and *Montezuma*, 30 May and 29 September 1860), gray whales were observed mainly along the northern coast of the Sea of Okhotsk, and this is consistent with the information in Yablokov and Bogoslovskaya (1984).

Gray whales were observed consistently by the American whalers in the southeastern portion of Shelikhov Bay (Zaliv Shelikhova) and in Penzhinskaya Gulf (Penzhinskaya Guba) from early May (earliest record 6 May 1885; *Mary and*

Helen II) to the end of August (approximately 43 observations in the present sample; Fig. 5). They were seen in Gizhiginskaya Bay (North-east Gulf) between mid-May and late August (approx. 46 observations, including a report of 'thousands of devilfish but no bowheads' in the logbook of the *Benjamin Cummings* on 3 June 1869) and in the vicinity of Magadan along the north central coast of the Sea of Okhotsk (i.e. in Tauskaya Gulf/Guba, generally called Tausk or Taousk Bay) from at least early June to early July and from mid-August to mid or late September (approximately 19 observations). Gray whales were seen occasionally just east of Okhotsk City in the northwestern Sea of Okhotsk (*Lancaster*, 12 September 1860; *Oliver Crocker*, 29 August 1861). There is little evidence that they still occur in any of those northern areas (Maminov and Blokhin, 2004) although it is unclear how much search effort has been expended there at the appropriate times. It should also be noted that humpback whales were sometimes seen in large numbers – e.g. on 23 July 1854 between the Yamske Islands and Jonas Island (*Gov. Troup* 1853-56).

Only a handful of references to gray whales in the vicinity of the Shantar Islands were found in the logbooks: lowered for them on 13 August 1855 (*Gov. Troup*), saw 'a few rip sacks' northeast of Big Shantar Island on 5 June 1860 (*Oliver Crocker*), saw 'muscle diggers' on 7 September 1855 (*Nassau*) and saw 'Devilfish or Ripsack whales' in Taylor's Bay, off Ulbanskiy Bay, on 13 August 1885 (*Mary and Helen II*). Another sighting was recorded about midway between Ayan and the Shantar Islands on 14 June 1860 (*Lancaster*). Tomilin (1957, p.314) cited Russian observations in Akademii and Ulbanskiy bays. Also, in recent years a few observations have been reported in September in Tugurskiy and Ulbanskiy bays (Maminov and Blokhin, 2004). Humpback whales were chased occasionally in the Shantars as well (18 August 1854, *Gov. Troup*) but this was primarily a bowhead whaling area.

The American whalers observed gray whales, sometimes in sizeable concentrations (e.g. 20-30 seen in a day, references to 'plenty' being seen), in Sakhalin Bay (Sakhalinskiy Zaliv) and off Cape Elizabeth (Mys Yelizavety) at the northern tip of Sakhalin Island (*Mary and Susan*, various entries between 18 August-9 September 1848; *Gov. Troup*, 11 and 14 June 1855). A sighting of two gray whales in summer 2005 in Severnyy Bay, just southwest of Cape Elizabeth (Tyurneva *et al*., 2006), demonstrates the continued use of that area by the extant population. In addition, gray whales were seen in southern Sakhalin Bay in August 2000 (Maminov and Blokhin, 2004).

Finally, American whalers sighted gray whales at least occasionally near the northwestern (Cape Huntsville, 58°05'N, 157°06'W; *Europa*, 17 May 1869), central-western (vicinity of Moroshechnoye, 55°51'N, 155°52'E; *Mary and Susan*, 13 July 1849) and southwestern coasts of Kamchatka (51°16'N, 155°23'W; *Europa*, 14 September 1868). Although Blokhin (1996) reported that gray whales had not been seen along the western coast of Kamchatka in many years, one was reported in August 2000 at the mouth of the Bolshaya River (Vertyankin *et al*., 2004). In that regard, the logbook of *Mary and Helen II* refers to arrival at the Bolshaya mouth on 12 September 1885, the vessel having departed the Shantar Islands on 23 August bearing east 'for 'Bolshaya River' for Right Whales'. The 13 September logbook entry states: 'I am bound back to the west end of the Sea north of the Shantar Islands for I am convinced there are no whales to be seen about this locality or where I have been expecting to find 'Ripsack Whales' off the mouth of the 'Bolshaya River''. Having found neither right nor gray whales off Kamchatka, the *Mary and Helen II* relocated to the Sea's central-northern coast at Tauskaya Bay, with the top of the logbook page for 19-20 September declaring, 'In 'Tausk Bay' among the 'Ripsack Whales''. Within a few days thereafter, the vessel had again gone south to the centre of the Midas Ground at 53°02'N, 152°30'E (28 September) in pursuit of right whales.

In recent years, sightings of gray whales have become regular in Olga Bay (between Cape Seniavin and Cape Kozlov) and Vestnik Bay (at c. 51°35'N just north of Cape Lopatke) on the southeastern coast of Kamchatka (Vertyankin *et al*., 2004) and at least some of the individuals seen there have been photographically matched to individuals observed off northeastern Sakhalin (Yakovlev *et al*., 2007).

No evidence was found, beyond that presented by Henderson (1990), that American whalers observed or took gray whales in Chinese waters where sightings and a few strandings and kills were reported in the 20th century (Blokhin and Blokhin, 2006; Wang, 1984; 1993; 1999; Zhu, 1998; 2002). However, the present logbook sample included little coverage of whaling in those waters.

Removals

Our reading of logbooks thus far has not revealed any major inconsistencies with Henderson's (1984) findings as summarised above. Gray whales clearly were secondary targets and they were pursued mainly at times when the preferred bowheads and right whales were unavailable. For example, in 1859 the ship *Oliver Crocker* arrived in Tauskaya Bay at the end of May, with its first sighting of 'mussel diggers' reported on 3 June. Within a few days the boats were engaged in the pursuit of bowheads in the bay. Three were bomb-lanced and/or harpooned, but lost, between 6-10 June. By 15 June, the run of bowheads had ended and after a few more days the hunt for gray whales began. Between 19-30 June the *Crocker*'s boats were lowered daily and no fewer than nine gray whales were taken and processed. In addition at least two were lost when the harpoon drew or the line was cut. Two of the processed whales had sunk initially and, in both instances, were only recovered two days later. Three other ships were spoken in the bay during the second half of June – *L.C. Richmond*, *Robert Morrison* and *Cambria* – but it is unclear whether any of them took gray whales (the *Richmond* was seen taking a bowhead on 13 June; the *Cambria* reportedly had taken three bowheads that season as of 30 June). On 1 July, the *Crocker* sailed towards the Shantar Islands where bowheads were plentiful and hunting for them resumed on 11 July. There is no further mention of gray whales that year in the *Crocker* logbook. In the next two years, even though the *Crocker* followed a broadly similar itinerary, there is nothing in the logbook to suggest another episode of intensive gray whaling. Two were taken in North-east Gulf on 3 August 1861, the only day during the 1861 season when the logbook indicates the boats were lowered for 'ripsacks'.

The ship *Europa* arrived in Gizhiginskaya Bay (North-east Gulf) early in the 1868 season, with its first bowhead sighting on 19 May. From then until 28 June, when the first bowhead was taken, only one more bowhead was seen by the crew (on 7 June), whereas gray whales (and 'finbacks') were seen often and the boats were lowered on at least three occasions with the explicit intention of hunting gray whales (none was taken by the *Europa* until 20 June). The logbook records that on 5 June 1868: 'Lowered for Ripsacks for the

purpose of trying our new whaling guns, tried four shots and the irons would not enter the blubber'. In 1869, the *Europa* followed the same itinerary but had more success finding and taking bowheads, and there was only one brief lull (11-12 June) when attempts were made to take both gray whales and a 'finback'. Later that season (26 July), the *Europa* 'picked up' and processed a dead gray whale found floating in Penzhinskaya Gulf between Ship Rock and Big Grampus Island and the log refers frequently to 'ripsacks' being observed (e.g. 17 August near Ship Rock, '…not seeing anything but Ripsacks') but with only one more desultory attempt made to hunt them (27 August).

In 1885, the *Mary and Helen II* reached the northeastern part of the Okhotsk Sea by the end of April and gray whales were sighted on 6 May and again on 20 May, by which time no bowheads had yet been seen. In fact, only one brief sighting of a bowhead (21 May) was made before mid-June. Even though gray whales were seen many more times, the boats were not lowered to chase them (except on 21 June and 11 July 'by mistake') until the episode in Tauskaya Bay in mid-September (mentioned above) when at least 4 gray whales were taken.

The following gray whale catch information was found in the documents examined for this study: 1 struck/lost by *Gov. Troup* in 1854; 9 (plus 2 struck/lost) by *Oliver Crocker* in 1859 and 3 in 1861 (see above); 1 by *Florida* (15 bbl) (Williams, 1964, p.185) and 1 by *South Boston* in 1861 (Williams, 1964, p.186); 4 by *California* in 1863 (Henderson, 1972, p.87); 1 each by *Endeavour*, *Rainbow* and *Europa* (plus 1 salvaged) in 1867 (*Europa* 1867); 1 by *Europa* (salvaged) in 1869; and 4 by *Mary and Helen II* in 1885.

The estimated total landed catch of western gray whales by modern whaling and Japanese net whaling between 1890-1966 was 1,800-2,000 (Kato and Kasuya, 2002). No other catches are known to have taken place during that time or since 1966 although some unreported catches may have been made by catcher boats from the People's Republic of China or the Republic of Korea, neither of which belonged to the International Whaling Commission until 1980 and 1978, respectively. It is also possible that some catches were made by whalers from the Democratic People's Republic of Korea or from Taiwan.

DISCUSSION AND CONCLUSIONS

Occurrence

Mizue (1951) analysed catch dates and positions for 545 gray whales in the 'East Sea Area' of Korea (i.e. in the Sea of Japan). The catches all occurred between November and May with a strong peak in December (63%) and January (22%). The infrequency of catches in other months from September through March apparently was not related to effort because, as Mizue (1951, p.76) points out, the same area was an important whaling ground for fin whales and 'many catcher-boats work during the season, from September to March next year' and so the whalers 'would have certainly caught grey whales if they had seen them in the months of October, November, February and March'.

The speculation by Mizue (1951) that gray whales migrated northwards from Korea through the Mamiya Channel (Tatar Strait) in May or June and thence to summering grounds in the northern Sea of Okhotsk is not inconsistent with some of the American whalers' observations. It is unclear, however, whether Mizue was correct in his belief (shared by Andrews, 1916, p.210) that gray whales calved and mated in Korean waters. There is no reason to doubt that at least some of the whales migrated to as far south as 25°N along the Chinese mainland and moved though Taiwan (Formosa) Strait (Henderson, 1990). It is also important to consider that Mizue's reasoning that gray whale females with large foetuses taken in mid-December off Korea were 'immediately before birth' and that 'delivery is made among the islands at the southern extremity of the Korean Peninsula' was without the benefit of Rice's (1983) analysis showing a 'prenatal diapause' in eastern Pacific gray whales such that foetal growth 'virtually ceases' during the final month of pregnancy and birth occurs between early January and mid-February (median 27 January). It is therefore plausible that the strong peak in occurrence of female gray whales in Korean waters from early December to early January (Mizue, 1951, his table 5) represents primarily a movement of migrating animals towards a destination farther south for parturition.

Based on the American whalers' observations summarised in this paper, gray whales were consistently observed in specific portions of the Sea of Okhotsk during the middle decades of the 19th century. Although most of the observations reported in the logbooks occurred on grounds where bowhead whales were the primary targets, some observations were also made on right whale grounds (e.g. on the Okhotsk side of Paramushir Island at 51°16'N, 155°23'W, 14 September 1868, *Europa* 1867-1868). While no sightings were reported on the northeastern Sakhalin Shelf where western gray whales are observed most often today, none of the logbooks read for this study contained evidence of the American whalers visiting that area (Fig. 4). The ship positions of whaling voyages into the Okhotsk Sea between 1844-1852, as plotted by Josephson *et al*. (2008), indicate some effort off the far northern, east-central and southern shores of Sakhalin but almost none along the northeastern coast on or near the present-day feeding areas. Lindholm (1863), a whaleman with much experience in the southern part of the Okhotsk Sea (particularly around the Shantar Islands), reported that gray whales were 'found in large numbers close to Cape Elizabeth [northern end of Sakhalin Island] and in the northern section of the sea during the summer'.

It is important to emphasise that the spatial and seasonal coverage of the Sea of Okhotsk represented by the logbooks was dictated primarily, if not solely, by the whalers' interest in catching bowhead and right whales although it was also influenced by sailing conditions, ice coverage and day length. It is fair to question whether the relative concentration of sightings of gray whales in the far northeastern reaches of the sea (Gizhiginskaya Bay and Penzhinskaya Gulf; Fig. 5) reflects relative density or is instead the result of a strong bias in search effort. It was not possible to address this issue rigorously given the biased nature of the effort data (the whalers went where they hoped to find bowhead whales and right whales) and the uncertainty about how consistently observations of non-target or secondary-target species like the gray whale were reported in the logbooks.

Removals

As indicated earlier, Henderson (1984) suggested that commercial ship-based whalers in the Sea of Okhotsk took about as many gray whales between the 1840s-1880s as were taken over roughly the same period in the Bering Sea and Arctic Ocean. The findings presented here are consistent with Henderson's suggestion. It is clear from the logbooks read for this study that gray whales were of little interest to the whalemen during the early years of the Okhotsk fishery

when bowheads and right whales were available in good numbers. In the 1840s and early 1850s, few masters bothered to lower the boats when gray whales were observed on or *en route* to the bowhead or right whale grounds. This seems to have begun changing by the mid 1850s when logbooks record gray whales being chased more often (e.g. *Gov. Troup*, 9 and 17 July 1854 near the Jamskiye Rocks [Yamske Islands]; *Cicero*, 16 June 1859 in La Perouse Strait).

Within a given voyage, particularly from the 1860s onwards, it was not unusual for the crew to pursue *eastern* gray whales in the Mexican lagoons or alongshore Baja California and California in the winter, and *western* gray whales in the Sea of Okhotsk in the summer. Kugler (1984, p.153-4) referred to these as 'loop voyages', with the southern and northern components separated by visits to Hawaii and perhaps the Sea of Japan in the spring. Charles M. Scammon, for example, on the San Francisco ship *William C. Nye* during his last year as a whaling captain, sailed to the Okhotsk Sea for bowhead whaling in summer 1862 and then to Magdalena Bay for gray whaling in the following winter (Henderson, 1972, pp.86, 271).

The gray whale's reputation as a 'devilfish' is borne out by occasional statements in the logbooks. For example, when boats from the ship *Europa* (1866-1867) attacked a 'ripsack' in North-east Gulf on 19 August 1867, the bow boat 'got stove' after making the first strike, and then the other boats made the kill.

Historical vs current distribution of gray whales

In the sample of logbooks examined, there was no evidence that American 19th century whalers visited the northeastern coast of Sakhalin Island where gray whales have been studied intensively over the past decade. However, gray whales were observed regularly in certain other parts of the Sea of Okhotsk where the ship-based whalers hunted bowhead whales during the summer. They observed and hunted gray whales relatively often in the northeastern corner of the sea, especially in Gizhiginskaya Bay (North-east Gulf) and Penzhinskaya Gulf (Fig. 5). Gray whales were present in Gizhiginskaya Bay as early as mid-May when (or at least very soon after) the whalers arrived and gray whales continued to be observed there through the end of August. Good numbers also were observed in early June and as late as the third week of September in Tauskaya Bay (Magadan coast) and in late summer (mid-August to mid-September) in Sakhalin Bay off the northwestern coast of Sakhalin Island.

The early-season sightings of gray whales in the far northeastern part of the Okhotsk Sea are especially noteworthy. For example, when the steam bark *Mary and Helen II* reached the entrance of Penzhinskaya Gulf in the first week of May 1885, having encountered relatively heavy ice from 57°30'N and northwards, two 'ripsack whales' were observed on 6 May. On that same date the logbook records: 'Ice all along the west side of the Gulf and seemingly packed on the land as far to the north as we can see while on the east side it's perfectly clear'. If, as has been generally assumed, the gray whales that occupy the summer feeding areas off northeastern Sakhalin Island enter the Sea of Okhotsk in spring (early May to early June) via either La Perouse Strait or Tatar Strait (Vladimirov, 2004; Yablokov and Bogoslovskaya, 1984), the question arises whether some whales over-winter in the Okhotsk Sea or, alternatively, enter it *via* an inter-island route in the Kurile chain, having moved northwards along the Pacific coast of Japan. Once in the Okhotsk, they would continue northwards along western Kamchatka to arrive in the northeastern gulfs of the Sea of Okhotsk by early May.

The historical distribution of gray whales in the Sea of Okhotsk appears to have been much more extensive than it is at present although increased search effort at appropriate times in areas of historical occurrence is needed to confirm their absence from such areas. Although not definitive, the information on western gray whales obtained from American 19th century whaling logbooks is of potential value in the following ways:

(a) to inform the timing and spatial coverage of modern survey effort;
(b) to support, in principle if not also in planning as to time and location, a satellite tagging and tracking programme to learn more about the movements of western gray whales;
(c) to contribute to an accurate reconstruction of catch history for input to population models; and
(d) to provide a basis for formulating hypotheses regarding sub-stock structure.

Other species

Another topic related to the present study that deserves further investigation is the occurrence and distribution of other whale species in the Sea of Okhotsk. For example, interest has been expressed in clarifying 'possible confusion between right and bowhead whales in the Townsend data' (IWC, 2009). Scammon (1874), who stated that bowheads were first taken by American whalers in the Pacific in 1843 off Kamchatka, and in 1847 in the Okhotsk Sea, provides a starting point for such an effort. He cites (1874, p.60) Tchantar Bay (the Shantar Islands area), Taousk Gulf (Tauskaya Gulf) and Penjinsk Gulf (Penzhinskaya Gulf) as 'noted whaling-grounds [for bowheads], as well as several other points about the coasts'. He also claims (1874, p.68) that right whales were found 'toward the northern borders in the early part of the season; later, the ships cruise [for them] in the southern quarter, about the Kurile Islands'. Published correspondence between various whalemen and M.F. Maury (1851), fuelled by the momentous 1848 voyage of Thomas Roys to the Bering Strait region where he 'discovered' bowheads, illustrates the considerable extent to which the whaling fraternity was itself still trying in the late 1840s to resolve the distinctions in morphology, distribution and ecology between the North Pacific right whale and the bowhead whale.

Judging by preliminary results of this study, clarification of the respective historical ranges of the two species is not likely to be achieved without detailed examination of a substantial number of logbooks, particularly for the early years of the Okhotsk Sea fishery when both right whales and bowheads would have been much more numerous than they were in the later years. For example, in the logbook of the Stonington ship *Mary and Susan* (1847-1850), it is reported that on 29 June 1849 '10 or 12 R Whales and 1 Steeple top' were seen in the northeastern Sea of Okhotsk at 57°11'N, 152°56'E, suggesting that both right whales and bowheads were observed on the same day in the same area. Earlier in the season, the crew had unsuccessfully chased a 'Polar whale' on 7 June and then secured one of two 'Polar whales' observed on 8 June, both encounters in the vicinity of 57°N, 151°E. Many whales are reported as seen and chased between the first and last weeks of June but the species is specified only for one sighting – a 'small Right whale' on 15 June at 57°53'N, 152°32'E. During the previous year's

voyage to the same ground (bounded approximately by 56°30' to 57°45''N × 150° to 153°E), the *Mary and Susan* reportedly found and hunted 'right' whales on many days from 28 May to 23 June, with no reference in the logbook to 'polar whale' or any other name that could be interpreted as referring to the bowhead.

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