

Bowhead Whale Distribution in the Southeastern Beaufort Sea and Amundsen Gulf, Summer 1979

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ABSTRACT. The distribution of bowhead whales in the southeastern Beaufort Sea and Amundsen Gulf was determined from observations aboard commercial resupply vessels. Fifty-four to sixty-two whale sightings were recorded on the 2150 km (1160 nm) of transects. Distribution of whale sightings along transects was clumped. The proportion of whales seen near ice was significantly greater than the proportion of transect surveyed near ice.

Our observations and interviews indicate that bowheads are seen over a period of several weeks in many areas where they are seen annually. Both the locations and seasonality of whale occurrence appear similar to distribution patterns extracted from sightings of nearly a century ago.

Key words: Beaufort Sea - Amundsen Gulf, bowhead, cetacea, vessel transects, whale

RESUME. La distribution de baleines boréales dans le sud-est de la mer de Beaufort et le golfe Amundsen a été déterminé au moyen d'observations à bord de navires commerciaux de réapprovisionnement. Des observateurs ont déclaré avoir vu entre cinquante-quatre et soixante-deux baleines le long des 2150 km (1160 m.n.) des lignes de sectionnement. Les cas d'observations étaient groupés le long de ces lignes. La proportion de baleines aperçues près des glaces était de beaucoup supérieure à la proportion des lignes de sectionnement sujettes à des levées près des glaces.

Nos observations et entrevues ont signalé que les baleines boréales sont aperçues pendant plusieurs semaines dans de nombreuses régions où elles apparaissent chaque année. Les emplacements ainsi que les périodes saisonnières des cas d'observation de baleines sont semblables aux schémas de distribution extraits d'observations d'il y a presque cent ans.

Mots clés: mer de Beaufort, golfe Amundsen, baleine boréale, cétacés, sectionnement par navire, baleine

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INTRODUCTION

Bowhead whales (*Balaena mysticetus*) were once more abundant than today. From the early 1600s to the early 1900s, tens of thousands of bowheads were killed by commercial whalers in arctic waters (Ross, 1979; Bockstoce, 1980; Scoresby, 1823). Reduced population levels and a collapse of the market for baleen finally ended this commercial hunt in the early 1900s. The populations apparently have not rebounded to their former numbers, and the bowhead whale is now classified by the U.S. Government as endangered. The largest remaining population of bowhead whales is found in the western North American Arctic. Modern pressures of Alaskan Eskimo subsistence hunting and potential disturbances associated with oil development in the western Arctic have made precise knowledge of the population's size, annual recruitment, seasonal distribution and feeding habitat crucial to resolving management questions.

Previous research has provided some information on seasonal distribution of bowheads. Braham *et al.* (1979) described spring migration of bowheads from the Bering Sea to the western Beaufort Sea. Analysis of whaling records of the western Arctic (Cook, 1926; Townsend, 1935; Bodfish, 1936) show that bowheads were found in the eastern Beaufort Sea and Amundsen Gulf in summer months. Recent sightings of bowheads in the eastern Beaufort Sea have been reported (Fraker *et al.*, 1978; Fraker

and Bockstoce, 1980). We found little information in the literature on the distribution of bowheads east of the entrance to Amundsen Gulf.

The primary objective of this study was to determine the distribution of bowhead whales in Amundsen Gulf and the eastern Beaufort Sea, Northwest Territories, Canada, during the summer of 1979. Resupply vessels based out of Tuktoyaktuk (Fig. 1) make several transits annually throughout the area east of 130°W longitude to settlements and DEWline (Distant Early Warning) bases on Amundsen Gulf. In July and August 1979 we looked for whales while onboard these resupply vessels. We also recorded observations of whales sighted by other people during the summer of 1979 and talked with local inhabitants to learn more

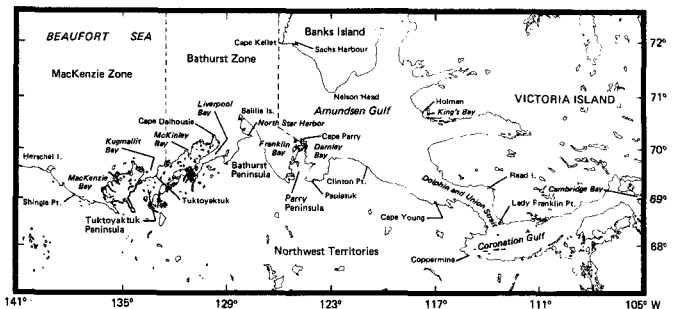


FIG. 1. Study region, Eastern Beaufort Sea-Amundsen Gulf.

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about bowhead whale distribution in Amundsen Gulf and the eastern Beaufort Sea in past years.

METHODS

Vessel Surveys

Observers rode towboats on six transects through Amundsen Gulf: (1) 23-24 July, Tuktoyaktuk to Sachs Harbour and (2) 29-30 July, Sachs Harbour to Tuktoyaktuk aboard the *Angus Sherwood* (JC); (3) 23 July - 4 August, Tuktoyaktuk to Lady Franklin Point via all DEWline bases along the south coast of Amundsen Gulf (Nicholson Peninsula, Cape Parry, Clinton Point, Cape Young, Lady Franklin Point) and (4) 7-9 August, Lady Franklin Point to Tuktoyaktuk aboard the *Frank Broderick* (KH); (5) 12-13 August, Tuktoyaktuk to Holman and (6) 18-27 August, Holman to Tuktoyaktuk via Paulatuk and North Star Harbour aboard the *Frank Broderick* (KH). Transect locations and width as defined by visibility conditions are shown in Figure 2.

The *Sherwood* is a 51 m long, 2 m draft, river towboat of 4300 hp. The *Broderick* is an 88-m vessel with 3 m draft and 2250 hp. Height of eye above sea level was 8 m on the *Sherwood* and 10 m on the *Broderick*. The vessels traveled at 12-18 km·hr⁻¹ depending on their load, and more slowly when ice was encountered.

Observers recorded vessel position (via dead reckoning or from radar-determined range and bearings on landmarks),

time and count of marine mammal sightings, bearings to whales, approximate distances of whales from the vessels, precipitation, wind, sea state and visibility limits. Water depth at whale-sighting locations was derived from nautical charts. When the observer was uncertain as to whether a whale had already been counted, the observation was termed a conditional duplicate. Observers calibrated their distance estimates by comparing estimates of distance to shore with actual distances as determined by radar.

Interviews

Bowhead whale observations were reported by people at Sachs Harbour, Holman, Paulatuk, Tuktoyaktuk (Tuk), at DEWline bases at Cape Parry, Clinton Point, Cape Young and Lady Franklin Point, and by personnel at Northern Transportation Company Ltd. and Canadian Marine Drilling Ltd. (Canmar). We also talked with people from Coppermine and Cambridge Bay, although these villages were not visited. Thus whale observations came from seal hunters, villagers who travel in skiffs, traders who traversed Amundsen Gulf in schooners, ship crew members, Canmar personnel, DEWline employees, airplane and helicopter pilots, and people who had seen whales from their villages. These interviews were opportunistic and qualitative. Whale sightings from summer of 1979 for which informants reported the date, site, and number of whales seen were distinguished from more general interview results and were called incidental sightings.

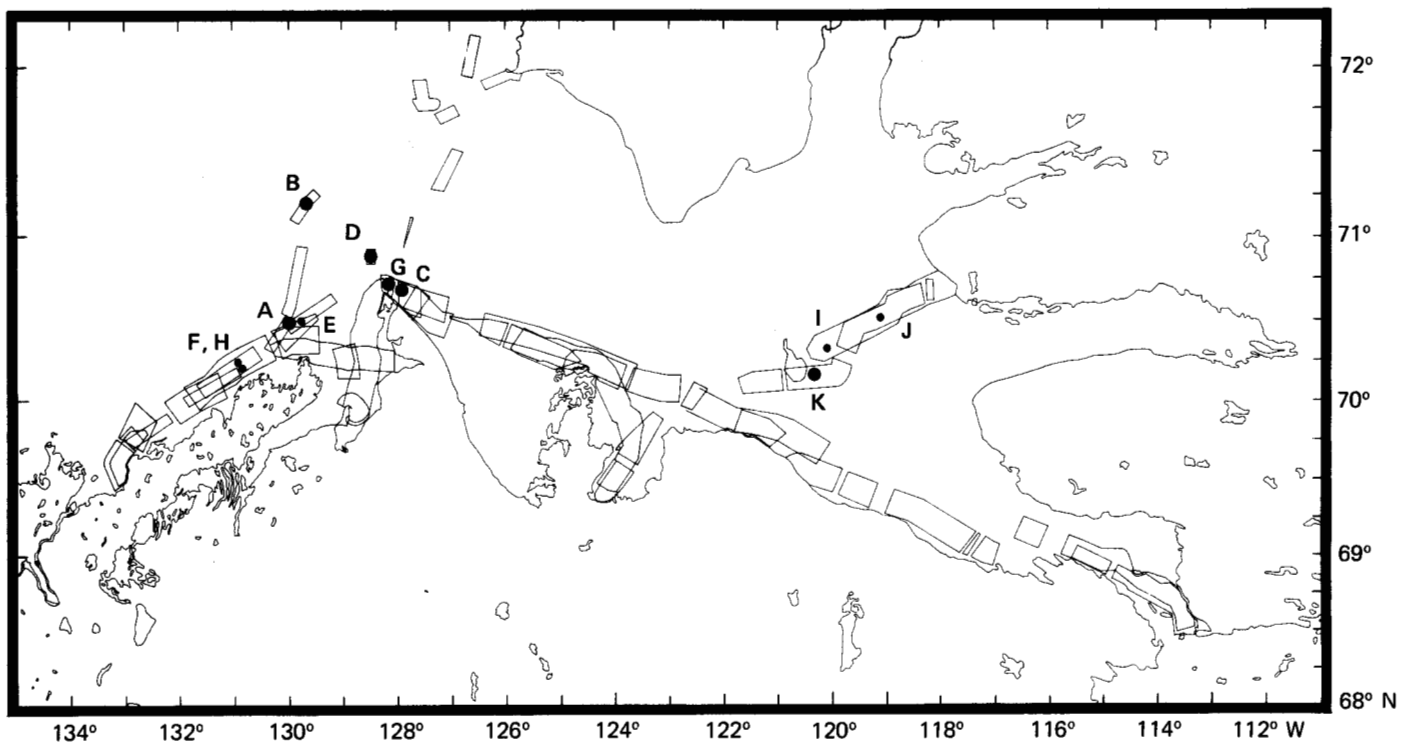


FIG. 2. Distribution of bowhead sightings along transects. Large dots signify four or more whales seen near that location along one transect; small dots signify three or fewer whales. Letters key sighting positions to information in Table 1. Transect width reflects the estimated outer limit at which whales could have been seen.

TABLE 1. Positions of bowhead whale sightings made from vessel transects during opportunistic surveys in Amundsen Gulf, July-August 1979

Date	Time (GMT-6)	Location code*	No. of adults	No. of calves	No. of Conditional		Latitude N	Longitude W	Depth (m)**
					Adults	Calves			
23 Jul	1806	A	6				70°26'50"	129°55'30"	30
23 Jul	2321	B	1				71°15'50"	129°30'00"	45
23 Jul	2323	B	1				71°16'25"	129°28'10"	45
23 Jul	2330	B	1		1		71°16'40"	129°27'20"	45
23 Jul	2331	B	2				71°17'30"	129°29'00"	45
28 Jul	0717	C	1				70°38'30"	127°47'00"	50
28 Jul	0727	C	3				70°39'05"	127°36'50"	160
28 Jul	0748	C	2		1		70°39'00"	127°27'50"	190
28 Jul	0745	C	1		1		70°36'35"	127°30'50"	205
28 Jul	0753	C	1				70°35'25"	127°22'30"	230
28 Jul	0813	C	2		1		70°34'20"	127°21'00"	235
30 Jul	1447	D	1				70°52'45"	128°29'00"	35
30 Jul	1500	D	1	1			70°52'10"	128°28'10"	40
30 Jul	1522	D	1				70°50'55"	128°28'30"	40
30 Jul	1945	E	1				70°29'05"	129°44'05"	30
30 Jul	2005	E	1				70°28'45"	129°49'45"	30
30 Jul	2005	E	1		1		70°29'25"	129°43'40"	30
30 Jul	2325	F	1				70°13'25"	130°54'30"	25
8 Aug	2025	G	1				70°37'25"	127°58'35"	25
8 Aug	2030	G	1				70°37'00"	127°51'10"	45
8 Aug	2054	G	1				70°39'30"	128°08'10"	25
8 Aug	2101	G	2				70°39'50"	128°09'00"	20
8 Aug	2109	G	2		1		70°40'45"	128°09'40"	25
12 Aug	0947	H	1				70°13'10"	130°55'00"	25
13 Aug	1731	I	1				70°18'15"	120°13'20"	370
18 Aug	1532	J	1		1		70°29'40"	119°08'00"	320
18 Aug	1558	J	1				70°28'20"	119°14'40"	320
18 Aug	1850	K	2				70°14'00"	119°51'15"	400
18 Aug	1858	K	1				70°12'30"	119°53'10"	400
18 Aug	1920	K	1				70°10'25"	119°54'20"	390
18 Aug	1937	K	1				70°08'45"	120°01'40"	400
18 Aug	1953	K	1	1			70°08'15"	120°07'00"	400
18 Aug	2038	K	2				70°09'00"	120°23'30"	405
18 Aug	2048	K	1				70°07'30"	120°24'30"	405
18 Aug	2057	K	1				70°08'25"	120°32'00"	405
18 Aug	2121	K	1				70°10'10"	120°31'20"	495
18 Aug	2145	K	1		1		70°10'25"	120°39'00"	395
18 Aug	2150	K	1				70°10'50"	120°50'55"	390
Totals			52	2	7	1			

* These letters refer to positions in Figure 2.

** Depths were taken from nautical charts and rounded to the nearest five meters.

RESULTS

Distribution of Bowhead Sightings Along Transects

During 150 hr and 33 min of observations, we searched along 2150 linear km for whales. Figure 2 shows vessel transect routes and bowhead whale sightings. We saw a minimum of 54 bowhead whales of which two appeared to be calves (Table 1). An additional eight whales were recorded as conditional duplicates. These conditional sightings were not included in calculations. All whales within approximately 500 m of each other were recorded as being together and were described by a common latitude and longitude because of the low resolution of the navigation system.

In order to evaluate distribution of whales along transects, the 2150 km of vessel transects were divided into 10 equal units of 215 km each. If distribution were uniform, an average of 5.4 whales would be seen in each 215-km section. Distribution of whale sightings along survey units was significantly different from a uniform distribution (Chi-square test, $\chi^2 = 64.1$ $p < .005$). The coefficient of dispersion (Sokal and Rohlf, 1969) was large (7.13). Both tests show that the whale sightings were clumped.

Association with Ice

Ice coverage of greater than one octa occurred within 8 km of the vessels along 14% of the survey. Fourteen

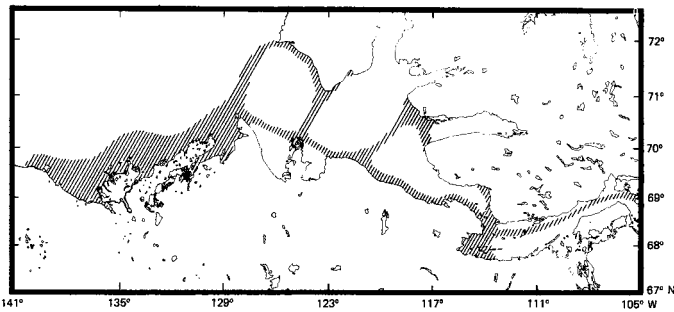


FIG. 3. Main travel routes of people interviewed.

whales (26% of the total number seen) were seen within 8 km of ice. The proportion of whales seen near ice is significantly greater than the proportion of transect surveyed near ice ($p < .05$, Z-test for difference of proportions).

Water Depth at Whale Sightings

To determine possible correlation of sightings with water depth, we used two tests. In the first test, number of whale sightings vs. depth at whale sightings as derived from nautical charts were sorted into 25-m depth classes. The number of whale sightings vs. depth at whale sightings showed no correlation ($r^2 = .0564$, $n = 20$). In the second test, water depths at sightings were sorted into four classes (0-125 m, 126-250 m, 251-375 m, 376-500 m) and the proportion of total linear kilometers the vessels were in each depth class was used to derive an expected proportion of the total number of whales (at least five) seen in each depth class. Chi-square analysis did not allow us to reject the hypotheses that the greater proportion of whales seen in shallow water is an artifact of more observation time devoted to shallow water areas ($\chi^2 = 7.705$, $n = 4$, $p > 0.1$).

Interview Results

Figure 3 shows the main travel routes of people interviewed. From this information one can roughly assess in which places an absence of whale sightings reflects a lack of survey effort. Figure 4 shows the location of bowheads as reported to us in interviews.

Summaries of interviews are presented in the following paragraphs. Interview summaries are listed by prominent locations starting in NW Amundsen Gulf and progressing clockwise around the gulf to Herschel Island. The number in parentheses next to the place name represents the number of people with whom we spoke about the named area.

Banks Island (10): Residents of Sachs Harbour first see bowheads off Cape Kellett in May when leads form in the ice. As the ice moves out of Cape Kellett in June the number of whales declines. Bowheads are seen less frequently and only in small groups during the remainder of the summer. Whales are also seen around Nelson Head in the summer.

Holman (6): Bowheads are seen often by the people of Holman, usually in late July and during the first half of

August. Although sometimes seen at the mouth of King's Bay, whales are more commonly seen 19 - 28 km south or southeast of the village, where residents hunt seals. One man said he has sometimes seen as many as 20 or 30 whales off Holman Island.

Dolphin and Union Strait and East (7): People who have spent time in southeastern Amundsen Gulf, in Dolphin and Union Strait, and in Coronation Gulf said they rarely or never see bowheads in these waters. Observers include seal hunters from Coppermine, merchants who have sailed the area annually during the past 20 years, and a helicopter pilot who flew intensive surveys of the area during the summer of 1979. One bowhead was reportedly seen in Cambridge Bay two or three years ago, though residents considered this an unusual occurrence.

Paulatuk (5): Reports from Paulatuk showed more discrepancies. People said bowheads sometimes come into Darnley Bay, even to the bay's head near Paulatuk. Some residents said bowheads come in only rarely, others said bowheads come in nearly every year.

South Coast of Amundsen and SE Beaufort Sea:

Clinton Point (2) — Two employees at the DEWline base reported that over the course of several days in late July or August of 1977 they saw "lots of bowheads, at least a hundred", headed west.

Baillie Islands (8) — Waters off Baillie Islands were mentioned by nearly all those interviewed as a place where bowheads are likely to be seen. One man who lived on Baillie Islands from 1930-1944 remembers watching whales from shore during the summers. The captain of the *Broderick* reported seeing two whales off Baillie Islands during an eastbound transit on 29 August 1979, in addition to sightings from our transects in July and earlier in August.

Cape Dalhousie (2) — Cape Dalhousie was also mentioned by two people as a place with whales. One informant saw approximately 30 whales off the cape one year in late September.

Tuktoyaktuk (8): Bowhead whales do not usually come in near shore at Tuktoyaktuk. However, hunters, pilots, and

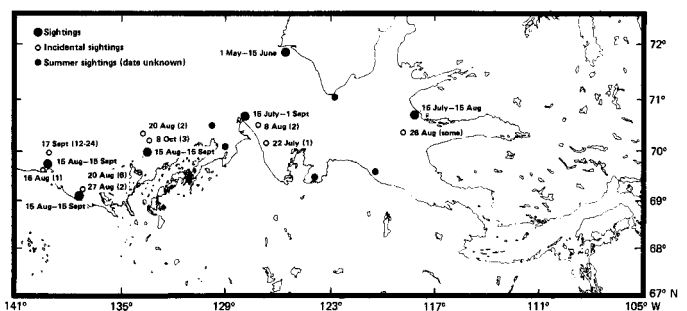


FIG. 4. Locations of bowheads as reported to us in interviews. Large black dots mark sites and seasons of whale occurrence from consensus of informants. Numbers in parentheses adjacent to dates of 1979 incidental sightings represent the number of bowheads reported to have been seen.

oil exploration personnel all said they see bowheads 50-70 km north of Tuk. Although there is human activity and hence the opportunity for sightings during the late spring and all summer, most people said the best time to find whales in the area north of Tuk is in late August and in September. According to informants, bowheads start heading west in mid- to late September. Descriptions of whale group size varied widely. One hunter said no groups were composed of more than four or five animals. Another person recalled seeing a group of 100.

As of 27 August 1979, Canmar aircraft and ship personnel, who operate mostly in the area north and northwest of Tuk to approximately 150 km offshore, had reported only one bowhead sighting.

Shingle Point (3): During the summer and early fall there is a semi-permanent fishing and hunting camp at Shingle Point. Bowheads are seen annually in August and sometimes in September, near shore and up to 35 km offshore (the range of hunters). This year six whales, two and then four, were seen westbound on 20 August.

Herschel Island (3): Bowheads are also seen near Herschel Island between August and October. In September of 1977, a resident of Herschel watched westbound whales from shore for three days. Canmar drillship personnel reported sightings of one or two dozen bowheads in the area northwest of Herschel (69°45'N, 139°45'W) for ten days, beginning 17 September 1979.

DISCUSSION AND CONCLUSIONS

Comparison of historical with contemporary sightings suggests that since the early 1900s, whales may have inhabited many of the same locations during the same times of year. From the 1880s to early 1900s, industrial whalers found bowheads at Baillie Islands, north of Cape Dalhousie, Nelson Head (off south Banks Island) and north of the MacKenzie River Delta (Fraker and Bockstoce, 1980; Townsend, 1935). Contemporary sightings derived from transects, interviews, incidental sightings and current literature (Fraker *et al.*, 1978; Fraker and Bockstoce, 1980) are reported from each of these areas.

Though historical sighting records from eastern Amundsen Gulf are rare, our results indicate consistency in whale distribution in this area also. Residents of Holman report that they have seen bowheads in the area during the summer for many years. The paucity of historical sightings near Holman may reflect the inaccessibility of this area to commercial whalers, rather than a lack of whale presence. Our transects, interviews and the absence of incidental sightings in southeastern Amundsen Gulf indicate that few if any bowheads presently inhabit these waters.

Time of whale occurrence in many areas of the southeastern Beaufort Sea also appears to be similar to seasonal distribution patterns extracted from sightings of nearly a century ago (Townsend, 1935; Fraker and Bockstoce, 1980). Our observations of whales at these general locations on different transects also suggest a tendency for whales to be

in certain areas. The apparent consistency in bowhead distribution in the Beaufort Sea and Amundsen Gulf over the last century, and the continued habitation of these areas even with a reduced population, suggest that these areas are prime habitat.

The specific habitat characteristics with which whales associate are not well-defined. In this study, however, the proportion of whale sightings near ice was significantly greater than the proportion of transects conducted near ice, which may indicate that even on summering grounds, sea ice may be a habitat characteristic of bowheads in the western Canadian Arctic.

Although our results showed no correlation between water depth and the frequency of whale sightings, Fraker and Bockstoce (1980) report a consistent tendency for bowhead sightings to occur in waters <50 m deep in the vicinity of Tuktoyaktuk in August and September. Bodfish (1936) also reported the 20-25 fathom contour (40-50 m) to be the best whaling ground in that vicinity. We suggest that this reported tendency for whales to occur in shallow water may be a function of location of whales in the fall rather than an association with water depth *per se*.

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