A note on observations of gray whales in the southern Chukchi and northern Bering Seas, August-November, 1980-89

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ABSTRACT

A total of 176 sightings of 488 gray whales (*Eschrichtius robustus*) were made during 85.6 hours of aerial surveys in the southern Chukchi Sea and northern Bering Sea, east of the International Date Line, from August to early November 1980-1989. Surveys were flown infrequently and effort varied considerably between years and geographic areas. Gray whales were sighted in all areas where surveys were flown, with the exceptions of Kotzebue Sound and Norton Sound. Abundance indices of whales per unit effort (WPUE) in the northern Bering Sea were higher than those in the southern Chukchi Sea during every month except September, when survey coverage was inadequate for abundance calculations, indicating comparatively higher overall use of that area or suggesting the onset of the southbound migration. Most gray whales were feeding (57%, $n = 276$). Incidental sightings of gray whales observed in and near the study area by other researchers were reviewed to better assess gray whale activity and migration patterns.

KEYWORDS: GRAY WHALES; SURVEYS-AERIAL; BERING SEA; NORTH PACIFIC; DISTRIBUTION; MIGRATION

INTRODUCTION

The distribution and migration of the California-Chukotka stock of gray whales is well-documented for most of its range (Swartz, 1986). However, information is still limited for some regions, including the northernmost summering areas in Alaskan waters. Distribution, migration timing and observed behaviours have been described for gray whales in the northern Bering and eastern Chukchi Seas in the summer (Moore and Ljungblad, 1984; Moore *et al*., 1986b; Würsig *et al*., 1986), the northeastern Chukchi Sea in the autumn (Moore *et al*., 1986a; Clarke *et al*., 1989) and the eastern Alaskan Beaufort Sea in the autumn (Rugh and Fraker, 1981; Würsig *et al*., 1983). These reports are augmented by reviews of opportunistic sightings in Alaskan waters (Maher, 1980; Marquette and Braham, 1982; Braham, 1984). However, specific information on gray whales in the southern Chukchi Sea and northern Bering Sea east of the International Date Line (IDL) between late summer and autumn is particularly scarce. Aerial surveys have occasionally been conducted in this area since 1980 as one component of a larger survey effort for endangered whales in the Beaufort, Chukchi and Bering Seas. This paper summarises the sightings of gray whales reported during these surveys and reviews other relevant information from the literature.

METHODS

The study area included coastal and offshore regions of the southern Chukchi Sea and the northern Bering Sea (63° to 69°N) east of the IDL (Fig. 1) which was divided into survey blocks. The area approximates the boundaries of the Hope and Norton Basin Outer Continental Shelf (OCS) Planning Areas, as designated by the US Department of the Interior, Minerals Management Service (MMS) for decision-making regarding offshore oil and gas activities. Two types of aerial surveys were flown: transect surveys along randomly selected east-west transect lines in survey blocks; and search surveys while transiting to offshore survey blocks (Moore *et al*., 1986b). Surveys were flown in a *Grumman Turbo Goose* model G21G at 152-458m altitude and speeds of 222-296km per hour.

Data routinely collected at each sighting included aircraft altitude, time, latitude, longitude, ice conditions, sea state, visibility, species, number of animals at the surface, number of visible calves, orientation of individual(s) at first sighting, behaviour and inclinometer angle. Whale behaviour classifications included swimming, diving, resting, milling, feeding, mating, cow-calf interaction and displaying. Survey effort and gray whale distribution were analysed for each month. Temporal (by month) and spatial (by survey block) abundance were derived as number of whales per survey hour (WPUE, whales per unit effort).

RESULTS

A total of 85.6 survey hours was flown, with 47.3 hours in the southern Chukchi Sea and 38.3 hours in the northern Bering Sea between August and November 1980-1989[1] (Fig. 2; Table 1). Survey effort was not consistent between years (Fig. 3): there were no surveys in the study area in 1982, 1984, 1985 or 1988. Flight effort in September was limited to the northernmost section of the study area near Point Hope, while survey coverage was most widespread in October. Total flight effort per month varied from 6.4hrs in September to 34.9hrs in October, with 70% (50.9hrs) of total survey effort in October and November.

There were 176 sightings of 488 gray whales in the study area (Fig. 4; Table 2). Gray whales were sighted in all areas where surveys were flown with the exception of Kotzebue Sound (blocks 30 and 31) and Norton Sound (block 29). In August, whales were seen just south of St Lawrence Island and in offshore waters between the Bering Strait and St Lawrence Island, with a single sighting of three animals north of Bering Strait in the southern Chukchi Sea. In September, gray whales were nearshore south of Point Hope

[1] Limited aerial survey effort continued in the study area in November 1990 and 1991 (Clarke and Moore, 1993); no gray whales were seen and the survey effort is not incorporated here.

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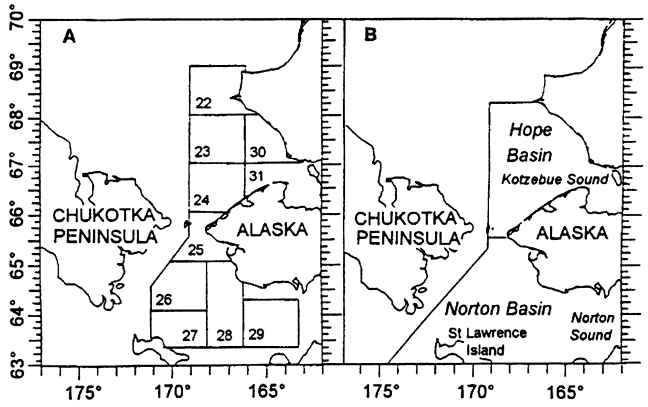

Fig. 1. Study area depicting survey blocks (A) and Hope Basin and Norton Basin OCS Planning Areas (B).

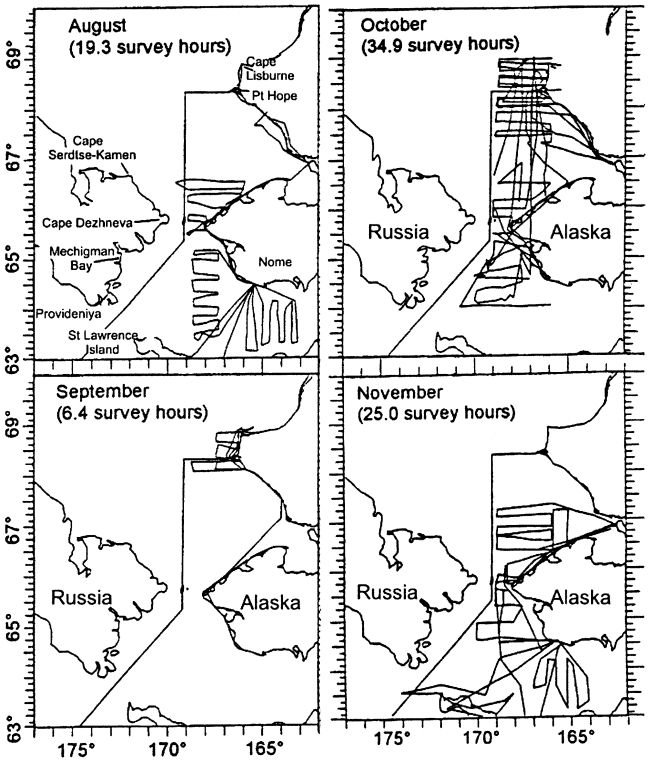

Fig. 2. Monthly composite flight tracks, 1980-89.

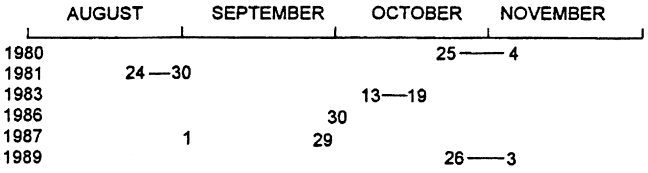

Fig. 3. Breakdown of monthly survey effort, 1980-89, showing dates on which flights occurred.

peninsula. The October sightings were offshore in the south-central Chukchi Sea and north-central Bering Sea, with scattered sightings along the coast. In November, gray whales were seen west of St Lawrence Island and in offshore areas south of Bering Strait, with one whale north of Bering Strait.

Monthly abundance indices (WPUE) for the southern Chukchi Sea (Table 1) were highest in October (5.3) and September (5.0) and negligible in August and November (< 0.5). WPUE in the southern Chukchi Sea was highest in block 23 (12.3) in October and block 22 (6.4) in September. In the northern Bering Sea, WPUE values were highest in October (11.3) and November (10.8) and considerably lower in August (3.0). The highest WPUE value was in block 26 in November (32.1). Comparing the two regions, WPUE was higher in the northern Bering Sea during every month except September, when survey coverage (0.8 hours) was inadequate. The indices were probably influenced by the sporadic survey effort, but may indicate comparatively greater use of the northern Bering Sea region or be an indicator of the onset of the autumn southbound migration from the Chukchi Sea.

The majority of whales seen were feeding (57%, $n = 276$), as evidenced by mud streaming from the whale's mouth or by the presence of conspicuous mud plumes, which are large billows of sediment brought to the surface by bottom feeding whales. For a significant proportion (25%, $n = 124$) of whales, no behaviour was recorded. Other behaviour observed included swimming (16%, $n = 78$), diving (1%, $n = 7$) and displaying (1%, $n = 3$). Feeding whales often changed swim direction while at the surface and generally

Table 1

Relative abundance of gray whales by survey block, August-November 1980-89 (does not include 12 whales seen in unblocked areas in August 1981 and November 1980). WPUE = whales per unit of effort (i.e. per hour).

	August			September			October			November			Total		
Survey block	Hrs	No.	WPUE	Hrs	No.	WPUE	Hrs	No.	WPUE	Hrs	No.	WPUE	Hrs	No.	WPUE
Southern Chukchi															
22	0.5	0	0	4.4	28	6.4	11.1	61	5.5	0	-	-	16.0	89	5.6
23	0	-	-	0	-	-	5.3	65	12.3	1.1	0	0	6.4	65	10.2
24	2.4	3	1.3	0.2	0	0	4.2	2	0.5	4.8	1	0.2	11.6	6	0.5
30	1.5	0	0	0.7	0	0	2.9	0	0	0.8	0	0	5.9	0	0
31	2.9	0	0	0.3	0	0	0.5	0	0	3.7	0	0	7.4	0	0
Total	7.3	3	0.4	5.6	28	5.0	24.0	128	5.3	10.4	1	0.1	47.3	160	3.4
Northern Bering															
25	3.6	12	3.3	0.7	0	0	4.0	38	9.5	3.5	44	12.6	11.8	94	8.0
26	0.9	17	18.9	0	-	-	4.9	83	16.9	3.3	106	32.1	9.1	206	22.6
27	0.6	1	1.7	0	-	-	0	-	-	1.3	3	2.3	1.9	4	2.1
28	3.5	6	1.7	0.1	0	0	2.0	2	1.0	4.1	4	1.0	9.7	12	1.2
29	3.4	0	0	0	-	-	0	-	-	2.4	0	0	5.8	0	0
Total	12.0	36	3.0	0.8	0	0	10.9	123	11.3	14.6	157	10.8	38.3	316	8.3

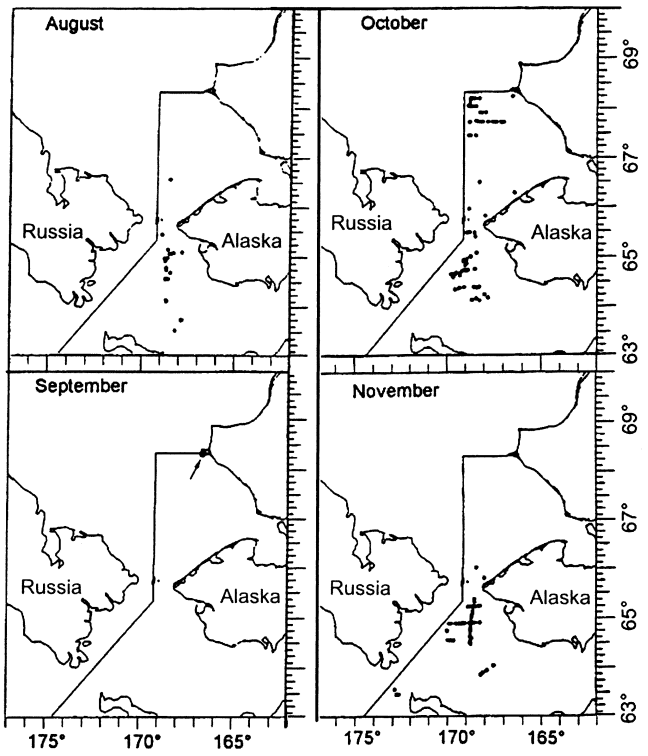

Fig. 4. Distribution scattergram depicting 176 sightings of 488 gray whales, 1980-1989: 28 sightings of 46 whales in August; 6 sightings of 28 whales in September (denoted by arrow); 82 sightings of 251 whales in October; 60 sightings of 163 whales in November. Each symbol represents one sighting of one or more whales. There were two sightings in August to the southeast of St. Lawrence Island (*ca* 63°N, 169°W).

Table 2

Monthly summary of gray whale sightings per number of whales August-November 1980-1989. * = no survey effort during this time period.

Year	August	September	October	November	Total
1980	*	*	44/125	60/163	104/288
1981	28/46	*	*	*	28/46
1983	*	*	3/7	*	3/7
1986	*	0	*	*	0
1987	*	6/28	*	*	6/28
1989	*	*	35/119	*	35/119
Total	28/46	6/28	82/251	60/163	176/488

did not show any concerted movement in any one direction. Therefore, whales seen feeding were not considered to be actively migrating and swim direction analyses excluded feeding whales. Consequently, there were insufficient data on swim direction collected to warrant analysis. One calf was seen in the study area, south of Point Hope in September 1987 (Clarke *et al*., 1989).

DISCUSSION

Gray whales in the southern Chukchi Sea and northern Bering Sea of Alaska in late summer and early autumn have not been extensively studied for several reasons. The southern Chukchi and northern Bering seas are not important areas of offshore oil exploration and development, a factor greatly influencing the degree of interest and funding available for biological studies in the region. Additionally, unlike bowhead whales (*Balaena mysticetus*) which are actively hunted by Alaskan Eskimos, gray whales make only a minor contribution to native subsistence in a few US communities (Marquette and Braham, 1982; Krupnik, 1987). Thus, the incentive in the USA to support research on sustainable yields for gray whales is not as great as for bowhead whales. Finally, the California-Chukotka gray whale stock was removed from the Endangered Species List in June 1995 after having recovered to, or bypassed, pre-exploitation size (Breiwick *et al*., 1988). Gray whales therefore do not receive the same scientific and financial consideration shown to other, more critically endangered, whale populations such as the bowhead whale or the North Atlantic right whale (*Eubalaena glacialis*).

Consequently, most information available concerning gray whales in and adjacent to the study area comes from incidental sightings made during research targeting other species. The data suggest that the southern Chukchi Sea supports relatively high gray whale densities throughout the late summer and autumn. Large gray whale aggregations were described from aerial and shipboard surveys both along the northern coast and offshore of the Chukotka Peninsula (Fig. 5). Soviet researchers conducting aerial surveys in August and October 1973 reported the highest densities of gray whales nearshore north of the Chukotka Peninsula between Cape Dezhneva (East Cape) and *ca* 175°W. Large aggregations were also located offshore at 68°N, 169°05'W (Zimushko and Ivashin, 1980; Berzin, 1984). Likewise, in late September and early October 1975, aggregations were located offshore north of Cape Serdtse-Kamen and north of Cape Dezhneva. During joint Soviet-American research cruises, large groups of gray whales were seen in October 1979 (>250) and October 1980 (>580) north of Cape Serdtse-Kamen (Berzin, 1984) as well as nearshore along the northern Chukotka coast (Miller *et al*., 1985). Large aggregations were again reported along the coast and north of the Chukotka Peninsula in August and September 1982, with scattered sightings near Point Hope (Berzin, 1984; Miller *et al*., 1985). Similarly, Blokhin (2003) counted 1,450 gray whales in a broad area north of the Chukotka Peninsula in August 1986. Joint Japanese-Russian-American oceanographic cruises in September-early October 1992-1994 documented gray whale aggregations north of the Strait and nearshore along the northern Chukotka coast (George, 1992; Moore, 1993). These data, combined with the gray whale sightings reported here in the southern Chukchi Sea in October 1989, indicate that the southern Chukchi Sea is an important gray whale habitat throughout late summer and autumn.

Incidental sightings data for the northern Bering Sea lead to more ambiguous conclusions. Gray whale aggregations are routinely reported along the southern Chukotka coast between Cape Dezhneva and Provideniya in association with Soviet whaling (Fig. 5; Zimushko and Ivashin, 1980; Berzin, 1984; Miller *et al*., 1986; Blokhin, 2003). Whales were seen there as late as November in 1984 and 1987 (Blokhin, 1990). In addition, Blokhin (1990) noted that large numbers of gray whales occupy Mechigmen Bay (Mechigmenskiy Zaliv) from August to October in some years. Aggregations of gray whales were also reported offshore between St Lawrence Island and Bering Strait in September-October 1975 (Zimushko and Ivashin, 1980) and in November 1980 (Fig. 4), but these waters have rarely been surveyed in the autumn. Additional incidental data include five sightings of an unspecified number of whales near St Lawrence Island in September-October 1958-1981 (Braham, 1984), two gray whales in northwest Norton Sound in September 1982 (Leatherwood *et al*., 1983) and scattered sightings of a few gray whales north of St Lawrence Island in December 1984 (Kibal'chich *et al*., 1986). Gray whales were observed

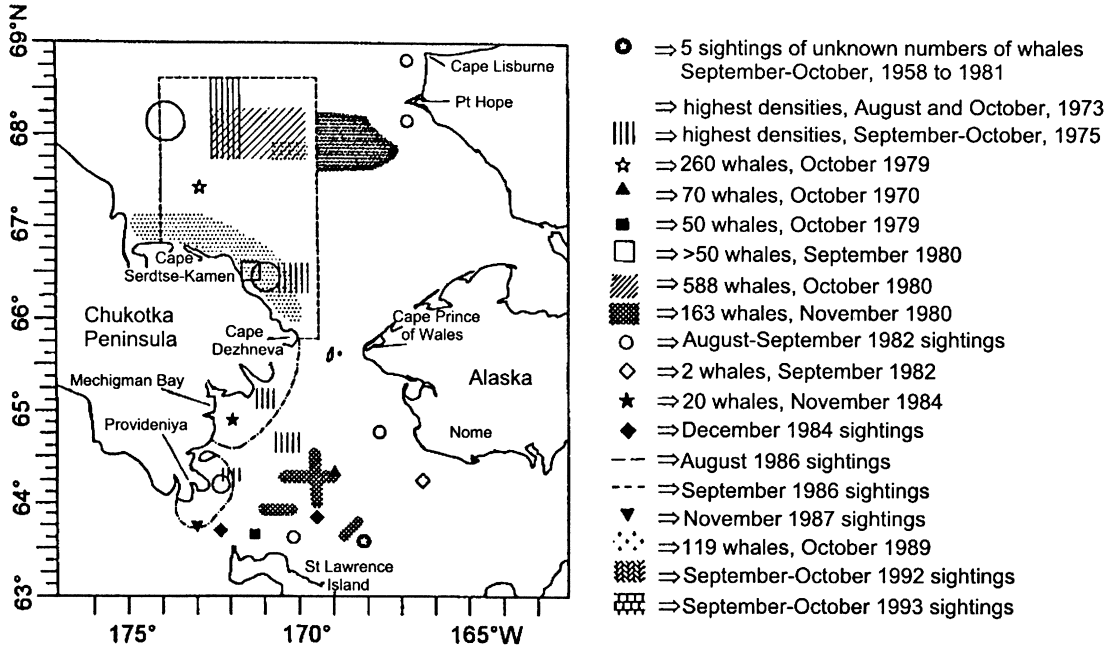

Fig. 5. Gray whale sightings and high density areas in or adjacent to the study area, 1958-93.

during the joint Japanese-Russian-American oceanographic cruises in late September and early October 1992 and early October 1993 south of the Strait (George, 1992; Moore, 1993).

Describing patterns of gray whale abundance and migration based on the available data is difficult owing to the lack of consistent and comparable survey effort, but some trends are worth noting. Gray whales have been seen in the northern Bering Sea as late as November and December (see Figs 4 and 5), by which time others will have reached the coasts of Oregon and California on their southbound migration (Herzing and Mate, 1984; Graham, 1990). The onset of the southbound migration from the southern Chukchi and northern Bering Seas is probably influenced by ice conditions. Rugh (1984) noted that the 1977 southbound migration past Unimak Pass was 10-11 days earlier than that in 1978, when ice conditions were far lighter and the ice front was much further north. Overall, ice front advances could be correlated with differences in median whale migration dates during 1977-9, although year-to-year variations in ice conditions were far greater than in whale migration dates (Rugh, 1984). Likewise, Graham (1990) estimated the peak migration date past San Clemente Island during the 1988/1989 southbound migration (14 January) to be six days earlier than that of the 1986/1987 migration (20 January) and five days later than that of the 1987/1988 migration (9 January); 1986 and 1987 were both considered light ice years, while 1988 was a heavy ice year in the Alaskan Arctic (Moore and Clarke, 1990). Blokhin (1990) also suggested that gray whales are probably present along the coastline of the Russian Far East, including the Chukotka Peninsula, into December, depending on the prevailing ice conditions. Therefore, while ice cover probably influences gray whale distribution and migration timing in the southern Chukchi and northern Bering Seas, the extent of the influence is unknown.

Gray whales return annually to particular regions in the southern Chukchi and northern Bering Seas which are apparently rich feeding grounds for adult whales (Clarke *et al.*, 1989; Blokhin, 2003) and/or weaning areas (Yablokov and Bogoslovskaya, 1984; Moore *et al.*, 1986b). The size segregation observed off Chukotka may be related to differential prey availability. Stoker (1990) suggests that smaller whales feed on smaller amphipods commonly found inshore, while larger whales feed further offshore on larger amphipods. Estimates of standing benthic stocks in various regions of the northern Bering and Chukchi Seas indicate that gray whales take advantage of those areas where the benthic community biomass is most dense, such as the Chirikov basin south of St Lawrence Island. Areas where gray whales are usually not seen feeding, such as north of St Lawrence Island, are often characterised by benthic communities dominated by species not preferred by gray whales (Stoker, 1990). Blokhin (2003) reported that preliminary hydrobiological results indicated that the area between Cape Serdtse-Kamen and Cape Dezhneva had the highest measured biomass of prey preferred by gray whales (62% of the total measured benthic biomass). This area was where the greatest proportion of whales (57%) was seen. However, it was pointed out that the occurrence of whales did not always coincide with areas of high benthic concentration and it was consequently suggested that gray whales probably graze from area to area. The lack of gray whale sightings in Kotzebue and Norton sounds may be due to the lack of preferred prey in those areas. Such sounds typically contain brackish water, which support prey species ingested by anadromous fishes rather than mysticete whales (Cooney, 1981). Additionally, Frost and Lowry (1988) report that crangonid shrimp, a preferred food for spotted seals and white whales but not gray whales (Nerini, 1984), are abundant in Kotzebue Sound.

The information presented here is of limited significance due to the circumstances under which it was collected, as it does not lend itself to the testing of hypotheses on gray whale abundance, migration patterns and behaviour. There has been no additional dedicated research on gray whales in the northern Bering and southern Chukchi Seas since 1989. Aerial surveys dedicated to determining gray whale distribution and relative abundance in this area were flown for one week in summer 2002 (Moore *et al.*, 2002). Results from that limited effort suggest that the northern Bering Sea may no longer be a primary feeding ground. Information on

gray whales in this area will probably continue to result from incidental sightings by researchers on projects targeting other species or with other primary interests. Despite this, the material presented here provides some additional insights into gray whale natural history in a geographic area that is not well known.

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