

DISTRIBUTION AND MIGRATION OF POLAR BEARS, PACIFIC WALRUSES AND GRAY WHALES DEPENDING ON ICE CONDITIONS IN THE RUSSIAN ARCTIC

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Abstract: This report presents a review of available data concerning the influence of ice cover on distribution, density and migration of three species of marine mammals inhabiting the Russian Arctic. Association of marine mammals with ice cover is as follows: (1) the polar bear is distributed in ice zone in the whole year, (2) the walrus is associated with the ice zone only in summer, and (3) the gray whale inhabits the southern area of the ice zone.

1. Introduction

This article is based on materials prepared for the project “Marine mammals” of the International Northern Sea Route Program (INSROP). The Program is designed to investigate the possibilities for commercial navigation through the North-East Passage. The area from Novaya Zemlya to the Bering Strait including the Kara, Laptev, East-Siberian and Chukchi seas (INSROP area) is involved in the Program. The three species show the various types of distribution and migration depending on ice conditions. In the present report, the unpublished data (long-term observations of marine mammals during ice patrol activity, activity of drifting stations “Severnyi Polus” and during some special research programs) were used occasionally to supplement the lack of published data to determine the association.

2. Polar Bear (*Ursus maritimus*)

Chemical analysis of skull samples obtained in different regions of the Russian Arctic (USPENSKI *et al.*, 1985) suggests three eco-geographical groups of polar bears: (1) western in the Barents and Kara seas; (2) central in the Laptev and East-Siberian seas; (3) eastern in the Chukchi and Bering seas. Analysis of long term observations of polar bears from drift stations “Severnyi Polus” and ice patrol not only supports the existence of these groups but also defines their separation more exactly.

Data collected by ice patrol indicate that in the central portion of the East-Siberian Sea there is a natural obstacle for marine mammals including polar bears migrating between the Laptev and Chukchi seas (BELIKOV *et al.*, 1982). This is the Ayonsk ice massif which consists of solid multiyear ice. However in years with favorable ice conditions, limited interaction between central and eastern groups is possible. So, the central portion of the East-Siberian Sea is the zone of division of two populations of

polar bears. The zone of division between central and western groups is not completely determined. According to satellite telemetry data such separation may be situated in the eastern or north-eastern portion of the Kara Sea near the Severnaya Zemlya archipelago (BELIKOV *et al.*, in press). We suppose that the above mentioned groups can be considered as populations (BELIKOV, 1992). In accordance with the typical habitats of these groups the following names for the populations are proposed: (1) Spitsbergen-Novozemelskaya (western group), (2) Laptev (central group), (3) Chukchi-Alaskan (eastern group).

Density of polar bears in their habitats is not even. This seems to be mainly caused by distribution of prey (ringed and bearded seals). At the same time with the spatial-temporal variation in polar bear distribution, there is a general decrease in polar bear density from the eastern and western areas toward the central part of the Russian Arctic (BELIKOV and GORBUNOV, 1991). The highest density of the other marine mammals, marine birds and fishes as well as the highest biomass of phyto- and zooplankton is also observed in the western and eastern regions.

On the other hand, a number of studies indicates that polar bear distribution has a strong dependence on ice conditions (AMSTRUP and DEMASTER, 1988; BELIKOV and GORBUNOV, 1991; GARNER *et al.*, 1990, 1994a, b, in press; GORBUNOV *et al.*, 1987; LARSEN, 1986; LENTFER, 1972; STIRLING *et al.*, 1984). Analysis of a data set on observations of polar bears and ice conditions at observation sites in the Kara, Laptev, East-Siberian and Chukchi seas (BELIKOV and GORBUNOV, 1991; GORBUNOV *et al.*, 1987) is summed up in the following distribution patterns:

- (1) In the Kara Sea in winter-spring time, bears are mostly observed in the south-western part of the sea and along the eastern coast of Novaya Zemlya, and relatively seldom on fast ice along the north-western coast of the Taimyr Peninsula. In winter time polar bears are often observed not far from such northern settlements as Amderma and Dikson. In spring 1994 during research on polar bears they were often observed along the edge of fast ice several hundred kilometres east of Dikson.
- (2) In the Laptev Sea and in the western portion of the East-Siberian Sea, density of the polar bear population increases in the area beyond the fast ice zone and in the marine area adjacent to the Severnaya Zemlya archipelago and to the north-eastern and eastern coasts of the Taimyr Peninsula as well as along the northern and north-eastern coast of Novosibirsk Islands.
- (3) In the eastern region (eastern portion of the East-Siberian Sea and the Chukchi Sea) in winter and spring, polar bears are mostly observed in the area of Wrangel and Gerald islands, in Long Strait, and in the southern portion of the Chukchi Sea. In years with hard ice conditions in the Chukchi Sea many polar bears move to the polynia situated north of Wrangel Island. In 1982–1984 registration of polar bear tracks during ice patrol was accomplished. It is found that tracks of polar bears are mostly observed in zones of shattered ice cover and beyond shore fast ice (zone of young ice).

Ice conditions in the sites of track observations are characterized by the following data (GORBUNOV *et al.*, 1987): Most (51%) tracks were observed in the zone of channels covered with young ice. A large number of tracks is registered for hummocked one-year

ice, probably housing seals' lairs. There were a few (13%) tracks on the relatively flat one-year ice, but almost no tracks on old ice. There was a very low density of polar bear tracks in the vast fast ice zone of the East-Siberian Sea, eastern portion of the Laptev Sea and in the south-eastern portion of the Kara Sea. Bears and their tracks were mostly observed on the fast ice along the coast of Chukchi Peninsula and on the edge of fast ice in the Yugorski Shar Strait (the Kara Sea).

In the beginning of summer in the eastern region, bears can often be observed not far from Wrangel and Herald islands, in Long Strait and in the southern portion of the Chukchi Sea. In summer, following the retreating ice edge, bears are distributed along the edge in the northern portion of the Chukchi Sea (GARNER *et al.*, 1994b) and are rarely observed on the islands and on the mainland coast. Bears appear to be on the islands during seasonal migration and breeding in spring and autumn. There is a strong correlation between ice conditions and number of bears visiting Wrangel Island in summer and autumn. The high density of polar bears on the island is usually conditioned by the presence of non-dispersed ice along the coastline (LUTSUK, 1978). Sometimes ice can be removed by strong wind. In such cases many bears stay on the island. In 1990–1992 up to 140 animals stayed in the south-western part of Wrangel Island (Cape Blossom) under these circumstances (OVSIANIKOV, 1993).

Only data obtained by ice patrol show distribution patterns for polar bears in the Laptev and East-Siberian seas. In summer time polar bears may occasionally be observed in the northern portion of the Laptev Sea and in central and eastern portions of the East-Siberian Sea, which can be explained by the large retreat of the ice edge in the Laptev Sea and in the western portion of the East-Siberian Sea (Novosibirsk Islands region). In autumn and the beginning of winter, polar bear distribution patterns are the same as in summer. In the Kara Sea bears are present all year around. In summer and autumn many bears can be met on the coast of Novaya Zemlya. Polar bears in the Russian Arctic spend most of the year in the pelagic zone. They can stay for a while on land in case of abundance of food or unusual ice conditions. For example, distribution patterns of polar bears in the Canadian Arctic differ from that in the Chukchi Sea (GARNER *et al.*, 1994b). In the Canadian Arctic bears stay on the shore fast ice in winter and spring. In summer some of them stay on the coast; the others move to ice-covered bays (DEROCHER and STIRLING, 1990).

Seasonal migrations of polar bears in the Russian Arctic depend strictly on seasonal changes of ice conditions (BELIKOV and GORBUNOV, 1991; BELIKOV, 1993), especially in the Chukchi and Bering seas (GARNER *et al.*, 1990, 1994a,b). In spring, bears occupying the northern portion of the Bering Sea begin to move to the Chukchi Sea. In summer they continue to migrate north. Following the retreating ice edge, bears move to the Arctic basin (BELIKOV *et al.*, 1984; BELIKOV and GORBUNOV, 1991; GARNER *et al.*, 1990). In years when ice cover is more dispersed than usual, polar bear migration is more intensive, because of the quick melting of the ice cover. Some bears in spring and summer move to the north-western part of the Chukchi Sea, others- to central and north-eastern parts of the sea and then to the western Beaufort Sea (GARNER *et al.*, 1990). Data from radio tracking show that the Chukchi-Alaskan population of polar bears occupies a vast area including the Chukchi Sea, eastern portion of the East-Siberian Sea and the most western part of the Beaufort Sea (GARNER and KNICK, 1991;

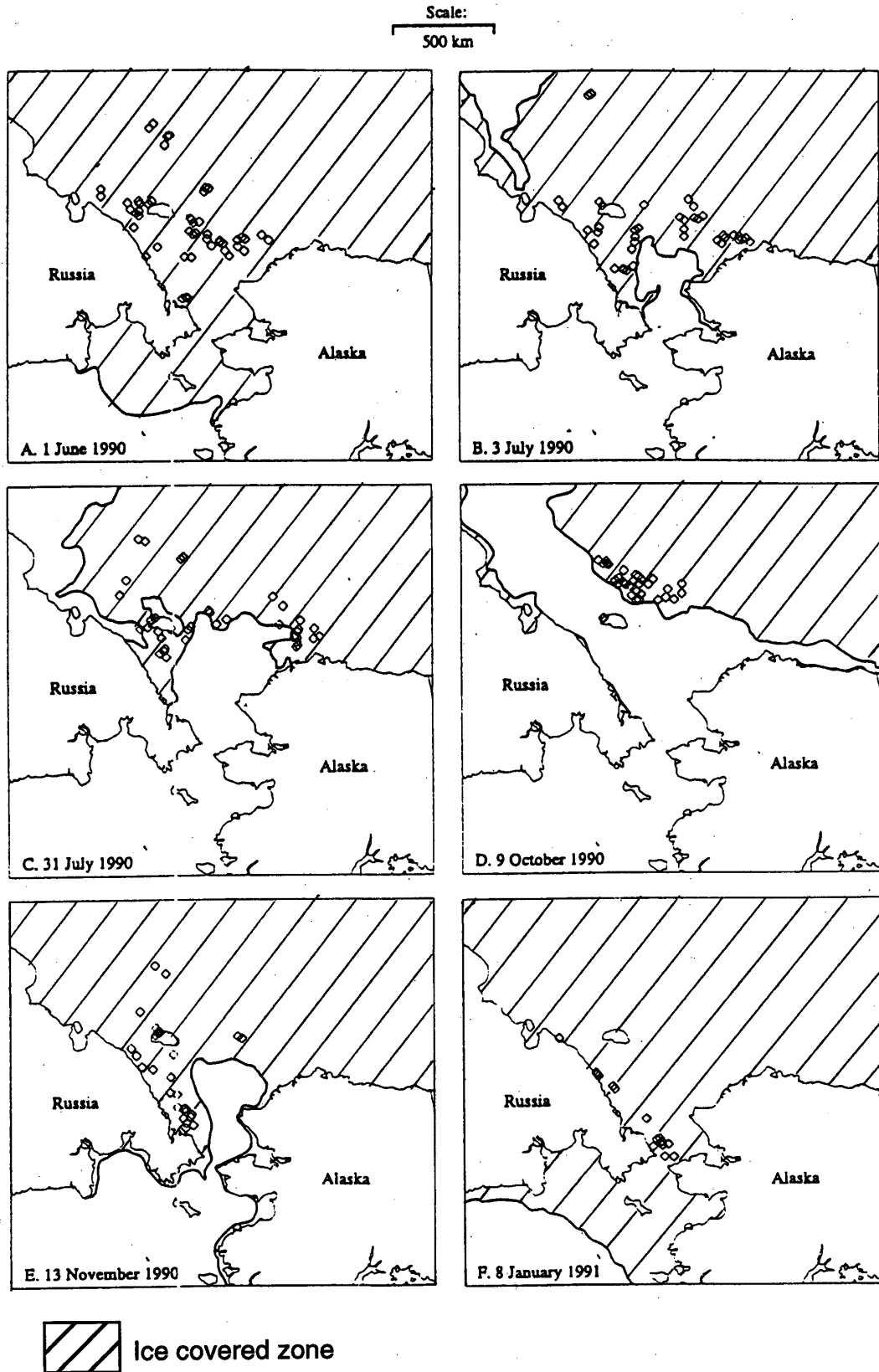


Fig. 1. Distribution of marked female polar bears (squares) relative to ice-edge (heavy line) on selected dates (From GARNER et al. in press).

GARNER *et al.*, 1990, 1994a,b). Migrations of polar bears may be contrary to the major drift of ice or coincide with it. The area occupied by collared females varies in the Bering and Chukchi seas from 150000 to 350000 sq. km (GARNER *et al.*, 1990), in the Beaufort Sea—from 10000 to 270000 sq. km (AMSTRUP, 1986), in the Canadian Arctic archipelago from 2500 to 23000 sq. km (SCHWEINSBURG and LEE, 1982).

Radio tracking of polar bear females collared in spring on Wrangel Island (GARNER *et al.*, 1994b; Fig. 1) shows that in the beginning of summer animals occur in the southern Chukchi Sea and stay there and in the more northern portion of the sea (from Kolyuchinskaya inlet to the Bering Strait) until ice begins to retreat north. By this time the majority of bears occupies an area along the ice edge. When the ice-forming process begins in the northern Chukchi Sea, polar bears move back south and south-east. Some of them migrate to the northern Bering Sea. In years with strong north winds, ice from the Chukchi Sea can be pushed into the Bering Sea. In such years bears on the ice are moved far to the south, up to the Kamchatka Peninsula (SHUBNIKOVA, 1978). Bears have to move back across the Chukotka Peninsula. Mostly such animals die. In the Kara, Laptev and East-Siberian seas migrations of polar bears correlate with seasonal changing ice conditions. However, migration routes there are not so extensive as in the eastern region. The probable reason is that ice often stays in the seas all year around. It can be illustrated by data on radiotracking 5 female polar bears in the eastern Kara Sea and in the region of the Severnaya Zemlya archipelago (BELIKOV *et al.*, 1995).

3. Pacific Walrus (*Odobenus rosmarus divergens*)

The area of the population includes the eastern East-Siberian Sea, Chukchi Sea and the northern portion of the Bering Sea. Walruses occur as far north as near the pole. The western limit of the area is situated in the region of Chaunskaya Bay in the East-Siberian Sea. Near the northern coast of Alaska walruses occur up to Cape Barrow. The summer distribution of walruses in the Chukchi Sea depends strictly on ice conditions. In years with hard ice conditions, distribution to the west is limited by Long Strait, and to the north by 70–71°N. If ice conditions are light, walruses move into the East-Siberian Sea, and can reach 74°N (FEDOSEEV, 1979; BELIKOV *et al.*, 1984). Walruses can not stay on solid ice cover, and that is why in years with hard ice conditions some feeding grounds are not available to them. Walruses prefer shattered ice and areas with permanent polynias. FEDOSEEV (1979) supposes that the existence of such polynias is one of the important factors influencing the formation of different populations of walruses in the Arctic.

Pacific walruses migrate big distances annually (GOLTISOV, 1968; KOSYGIN, 1975; KIBALCHICH, 1982; BELIKOV *et al.*, 1984; MYMRIN *et al.*, 1988; FEDOSEEV, 1990). Walruses winter in the shallow zone in the northern Bering Sea. In April–May they begin to move north, appearing near the southern and eastern coasts of the Chukotka Peninsula. Mass migration of walruses through the Bering Strait continues until the end of May–beginning of June. After that the majority of the stock move into the western Chukchi Sea and eastern East-Siberian Sea. The other walruses migrate east along the northern coast of Alaska. In years with favorable ice conditions some walruses can

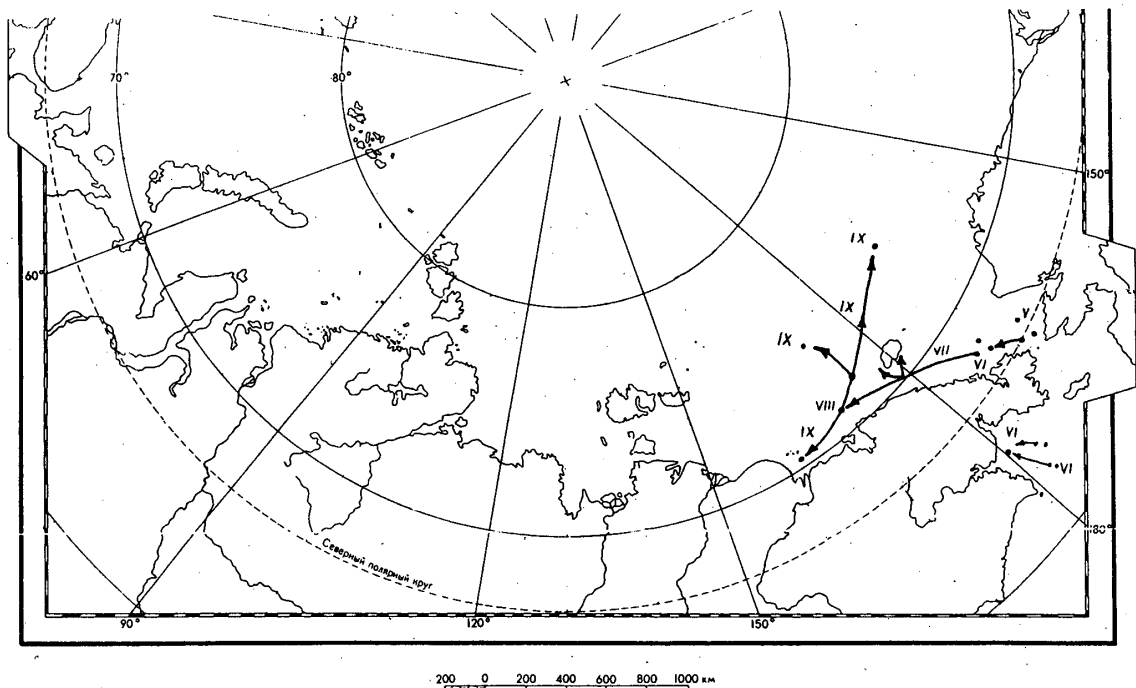


Fig. 2. Migration routes of walrus of Pacific population in the Chukchi and East-Siberian seas (Roman numerals-months) (From BELIKOV *et al.*, 1984).

reach Wrangel Island up to the end of July. Also walrus move west along the coast to Billings Cape. At the end of August–beginning of September, walrus are observed moving north and north-east of Wrangel Island. Data from ice reconnaissance show that walrus migrating to feeding grounds do not move far from the coastline. They reach an area north of Wrangel Island through Longa Strait rounding the island from the west (Fig. 2). The migration pattern can change depending on ice conditions forming in spring-summer time.

In years with hard ice conditions when the western portion of the Chukchi Sea is covered by ice for a long time, the majority of walrus move into the eastern Chukchi Sea to the Alaskan coast. In the second half of summer some of them return to the western part of the sea. In years with poor ice cover walrus migrate in the western and eastern Chukchi Sea at the same time (FEDOSEEV, 1990). In autumn walrus migrate in two directions: from the region of Shalourov Island (the East-Siberian Sea) and the most western portion of the Chukchi Sea they move south-east; from regions west and south of Wrangel Island they move through Long Strait to Cape Vankarem and then east to the Bering Strait (FEDOSEEV, 1982). Migrating walrus move along the coast line. If there is no ice, they stay for a while on the coast (temporary haul-outs). Migration continues until November, when walrus appear in the Bering Sea. An area of water free of ice appears at the end of June–July in the Chukchi Sea around Wrangel and Herald islands. Walrus females with juveniles and some subadult males concentrate there on the ice edge (FAY, 1982; KIBALCHICH, 1986; SADOVOV, 1986). In summer and the beginning of autumn in the Chukchi Sea, walrus mostly inhabit the region of Wrangel Island and Herald Island and Long Strait; in the East-Siberian Sea—the eastern part of the sea from Long Strait to Chaunskaya Inlet (KRYLOV, 1962; KIBALCHICH, 1978; BELIKOV *et al.*, 1984, FEDOSEEV, 1962, 1985, 1990). In September–

October, if most of the Chukchi Sea is free of ice, walruses aggregate in the region of Wrangel Island and in Long Strait ($66^{\circ}22'-71^{\circ}07'N$ and $176^{\circ}30'-179^{\circ}58'W$) (KRYLOV, 1962; FAY, 1982). In such years big walrus haul-outs are situated on Cape Blossom and the Spit Somnitelnaya of Wrangel Island (KOCHNEV, 1991).

A comparison of two seasons (1985 and 1990) shows a variation in the number of walruses on the haul-outs depending on ice conditions. According to an autumn air-survey in 1985 (FEDOSEEV, 1985; GILBERT, 1989), aggregations of Pacific walruses were observed in the following areas:

- Marine area in the East-Siberian Sea along the coastline from Cape Shelagski to Nolda Inlet;
- Long Strait, mostly its southern part from Pilgen Inlet to Cape Schmidt and east of it.

There were no important groups of walrus south of Wrangel Island. Such a distribution pattern is not typical for this period and it was caused by hard ice conditions. The following haul-outs were observed on the northern coast of Chukotka Peninsula: Cape Serdse-Kamen (5454 walruses), Cape Inkgur (876), Inchounskaya Inlet (1037). Two haul-outs were registered on the eastern coast of the Peninsula: Cape Dezhnev (842), Nunyamo (5945) (FEDOSEEV, 1985).

According to an autumn air-survey in 1990 (FEDOSEEV, 1992), four haul-outs have appeared on the northern coast of Chukotka Peninsula: Inchoun, Cape Inkgur, Koluchin Island and Cape Serdse-Kamen. A total of about 21000 walruses were counted there. On Wrangel Island, four haul-outs, including a new one on Cape Gavai, were found. The total number of walruses was 112848 animals. On small Herald Island (60 km of Wrangel Island) 300 walruses were counted. A haul-out (1267 animals) was registered on Cape Dezhnev. In the drift ice zone of the Chukchi Sea, about 13000 walruses were counted in autumn 1990. The highest density was observed between $160^{\circ}W$ and $166^{\circ}W$. A considerable number of walruses was observed north of the north-eastern coast of the Chukotka Peninsula. In Long Strait walruses occupied the area near Wrangel Island. There were few walruses west of the island. A high density of walruses was observed in the marine area along the mainland coast west of Cape Schmidt and near Kolyuchi Island and Cape Serdse-Kamen. It should be noted that ice conditions in 1990 were quite different from those in 1985 (previous survey). There was a minimum ice cover in 1990 and the ice edge retreated as far north as $74-75^{\circ}N$. Almost all of the Chukchi Sea and the eastern East-Siberian Sea were free of ice. In 1991-1992 ice conditions were similar to the above mentioned. At the end of summer-autumn, the ice edge was situated far north of Wrangel Island, and apparently forced walrus females with calves to stay on the ground on the southern coastline of the island.

Pacific walruses spend winter in the ice covered northern Bering Sea. Just a small number of them winter in the Chukchi and East-Siberian seas. They stay in the polynia north of Wrangel Island and in a permanent crack near the entrance to Chaunskaya Bay (KUDRIAVTSEV, 1979; BELIKOV *et al.*, 1984, 1989). In winter, small groups of walruses were observed during some years in the south-eastern portion of the Bering Sea. They usually stay among channels and leads (BELIKOV *et al.*, 1986).

4. Gray Whale (*Eschrichtius robustus*)

The eastern part of the Russian Arctic is inhabited only by the Chukchi-Californian population of gray whale. Gray whales of the Chukchi-Californian population spend winter and give birth in waters off California. In February they begin to migrate north along the western coast of America. Whales move to the Beaufort, Chukchi and Bering seas—primary feeding grounds (BLOKHIN, 1984; WYNNE, 1992). The first migrating gray whales appear near the eastern coast of the Chukotka Peninsula (in the region of Cape Chaplin) in the last ten days of May. For example, in 1984 they were observed for the first time on May 26. The majority of migrating whales moves north along the south-eastern coast of Chukotka in June (BLOKHIN, 1986). In autumn whales migrate back by the same route.

Gray whales inhabit the Chukchi Sea from the end of May to the beginning of November (BLOKHIN, 1984; POPOV, 1990; SLEPTSOV, 1965). The greatest number of whales occupy the Chukchi Sea in August–September (TOMILIN, 1962). The northern and western limits of the habitat are determined in summer by the edge of the drift ice (Fig. 3). Whales have been met in the eastern portion of the East-Siberian Sea, in Long Strait, and as far north as Wrangel Island. From June gray whales occupy the whole Chukchi Sea, concentrating in sites with high density of the main prey—benthic crustaceans. In some years in this region up to 1500–2000 gray whales have been observed. Results of a census accomplished in 1986 indicate that more than half of the population feed in the Chukchi Sea (BLOKHIN, 1984; POPOV, 1990). In August 1986 in the Chukchi Sea in the marine area (6275 sq. miles) limited on the north by 68°30'N, on

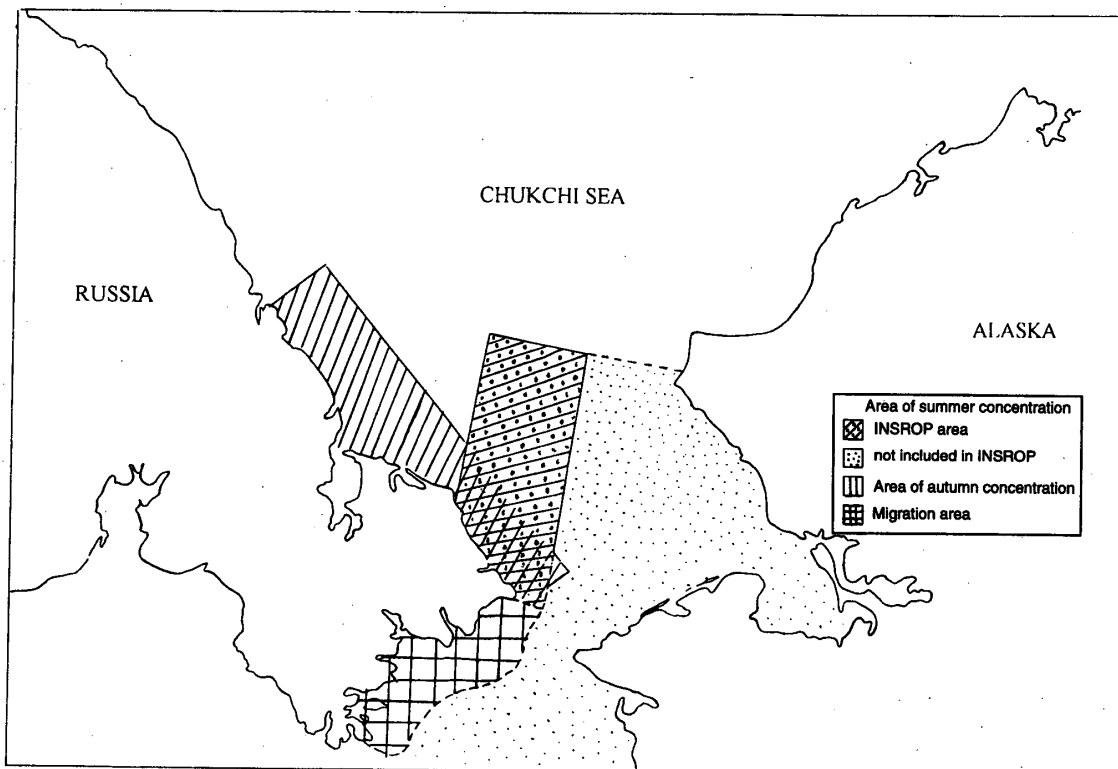


Fig. 3. Gray whale. Areas of concentration.

the west—by 173°30'W, and on the east—by 169°W 1450 gray whales were counted. The total number of gray whales occupying the research area (about 11000 sq. miles) in July—August 1986 was estimated to be 5500 animals. During this period the whales move slowly and feed intensively (BLOKHIN, 1988). KIM and OLIVER (1989) have concluded that stomach contents, feeding excavations, feeding behavior, mud plumes, and distribution of gray whales clearly indicate that the southern Chukchi Sea and especially the northern Bering Sea constitute the primary feeding grounds for this species.

BLOKHIN (1988) reports that in the second half of August numerous juvenile gray whales stay in the southern portion of the Chukchi Sea, aggregating in big groups. Considerable aggregations of gray whales appear near the northern coast of the Chukchi Peninsula in autumn before migration. In 1980 the joint Soviet—American expedition to study cetaceans in Arctic seas was accomplished. From September 18 to November 15 the western Chukchi Sea, the eastern East-Siberian Sea and the northern Bering Sea were observed. Big groups of gray whales were observed in the Chukchi Sea in the region of Dvukh Pilotov Cape, and lesser groups — near Cape Schmidt, and in the area with co-ordinates 67°40'—68°15'N and 164°40'—172°10'W. During four days of surveying, 588 whales were counted there. A total of about 2000 gray whales were observed in the region (POPOV, 1990).

The gray whale is a benthic-feeding whale, dredging through mud and using the baleen to filter out bottom-dwelling amphipods and crustaceans. The gray whale rarely feeds in the wintering grounds (WYNNE, 1992). The life of gray whales is closely associated with coastal waters, lagoons and shallows. During autumn and spring migrations they move along the coastline (up to 30 km) (BLOKHIN, 1984).

5. Conclusion

Basing on observational data three types of connection of marine animals with ice cover in the Russian Arctic can be determined. The first one (strict) is typical for the polar bear. This species is dependent on dynamics and character of ice cover the whole year round. The second type of connection is shown by the example of the Pacific walrus. In summer time ice cover determines distribution of these animals and occurrence of coastal haul outs. Walruses can use ice-floes as platforms for rest. The gray whale depends on marine areas free of ice. These whales appear to extend their habitats to the north only when sea ice retreats.

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