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Polar Bears: Proceedings of the Fourteenth Working Meeting

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Polar Bears

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Research on polar bear autumn aggregations on Chukotka, 1989–2004

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This report includes results of investigations on polar bear aggregations that formed on islands and the continental coast in the western part of the Chukchi Sea during autumn. Fieldwork was conducted on Wrangel and Herald islands in 1989–98 and on the arctic continental coast of Chukotka in 2002–04 (Figure 26). Data were collected from a motor boat and by direct observation in key areas inhabited by bears. Some additional information was obtained from the archives of the National Wrangel Island Reserve and from discussions with hunters from Chukotka coastal villages.

Wrangel Island

Visual surveys were conducted from August to November in two areas – on Blossom Cape and on the Somnitel'naya Spit (Figure 27). Polar bears were observed from a 12m high navigation watchtower close to the areas with the highest density of bears. From August to early October, surveys were conducted two times a day (in the morning and in the evening). As the day length shortened (usually after October 10), polar bears were observed once per day. Binoculars (12x40) were used to count all animals. Field of view varied with weather conditions reaching a maximum of 6km under ideal conditions. Each bear's activity (resting, feeding, moving, interacting) was documented along with the location of the animal (feeding grounds, snowdrifts, young ice, hummocks, etc.), sex, and relative age (adult, subadult) when possible using phenotypic characteristics and behaviour. When a family group was observed, the number and age of offspring was determined. The distribution of bears on the coast

Figure 26. Map of Chukotka with the various study areas (1 – 1989–98; 2 – 2002; 3 – 2003–04).

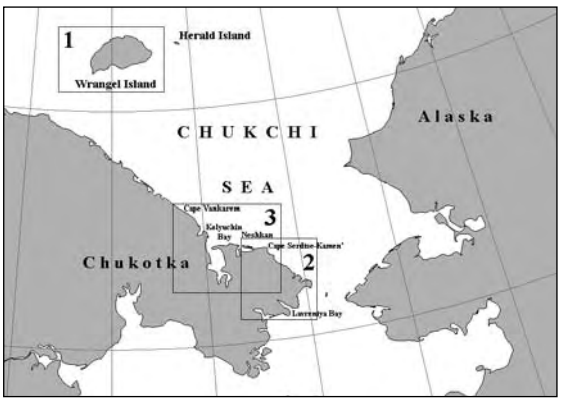


Figure 27. Study area on Wrangel Island, 1989–98.

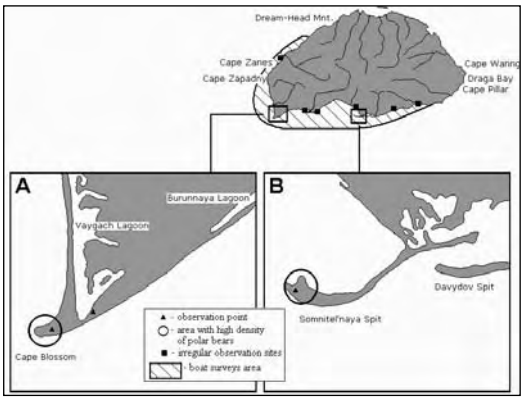


Figure 28. Ice edge positions with maximum open water in summer and autumn in the Wrangel Island area, 1989–1998 (the year is shown near the ice edge line; below the year is the number of Polar Bears in aggregations determined when the ice was in this position; the maximum number of Polar Bears in aggregations, observed during the whole season, is given in brackets).

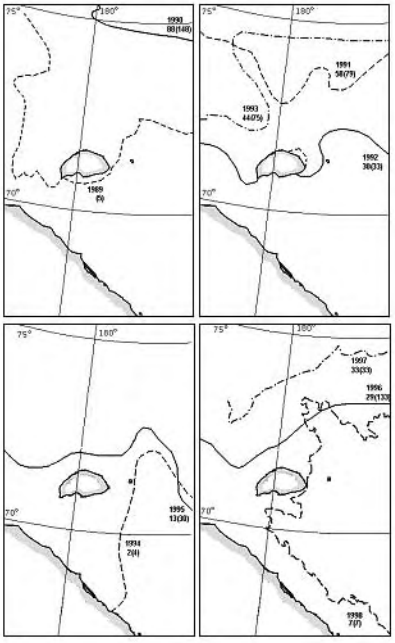
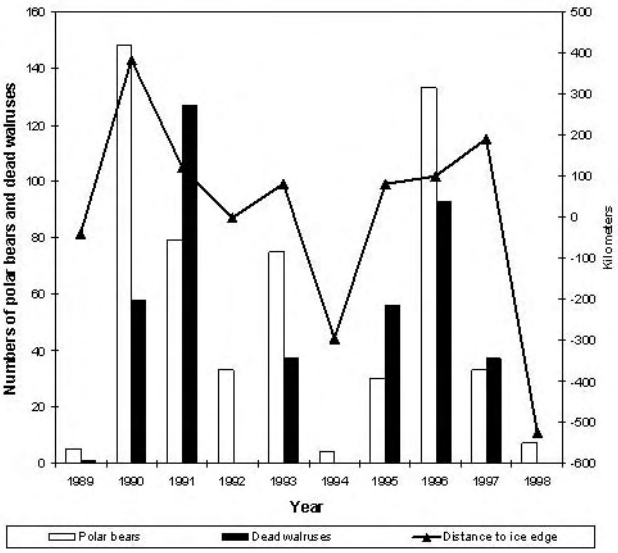


Table 25. Abundance of food available to polar bears on walrus haul-out sites on Wrangel Island, autumn 1989–1998 (combined data for Blossom Cape and the Somnitel'naya Spit)

Year	Number of Polar Bears	Number of polar bears before freeze-up	Number of walrus carcasses	Biomass, tons	Food/polar bear before freeze-up, tons	Quantity of food per polar bear (from the total numbers), tons
1989	5		1	0.54		0.108
1990	148	148	58	17.03	0.115	0.115
1991	79	79	127	44.77	0.567	0.567
1992	33		0	0		0.000
1993	75	75	37	14.98	0.200	0.200
1994	4		0	0		0.000
1995	30	13	56	19.89	1.530	0.663
1996	133	44	93	37.3	0.848	0.280
1997	33	31	37	8.19	0.264	0.248
1998	7		0	0		0.000
M_1	54.7		40.9	14.27		0.261
M_2	83	65	68	23.69	0.587	0.346

Key: M_1 – mean for the whole observation period, M_2 – mean for years in which walruses hauled out.

Figure 29. The number of polar bears in autumn aggregations on Wrangel Island, 1978–1998.



was observed during trips by boat and by land: occasional observations in other parts of the island were also used. The total sample combines data from 1989–98 and includes 549 days of counts and 8,580km of surveying. The sample includes observations from research assistants at the Wrangel Island State Reserve (116 days).

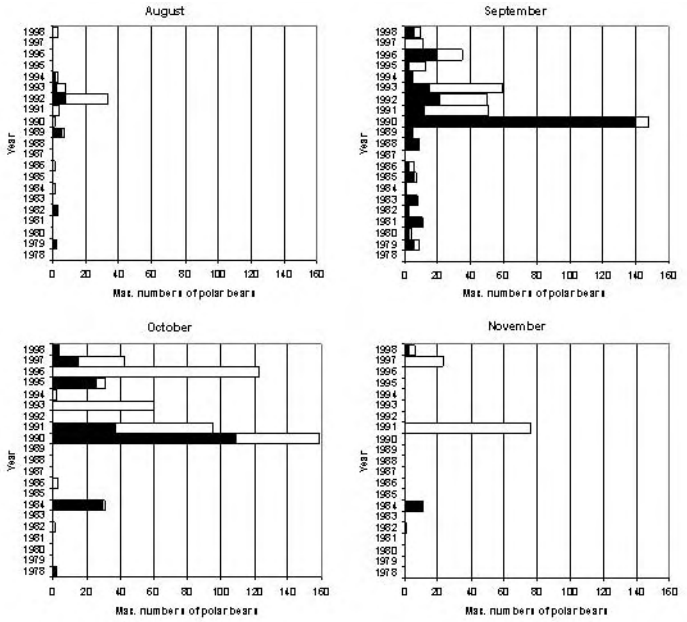
In the autumn seasons of 1990, 1991, 1993, 1995, 1996, and 1997 the ice edge was to the north and west at 80–380km from Wrangel Island (Figure 28). In those years, walruses used coastal haulout sites and were a food source for polar bears. The maximum number of bears was seen on Blossom Cape and Somnitel'naya Spit with the aggregations existing for the longest period. At the initial stage of concentration (late August–early September), 10–15 bears were present. polar bears fed on the remains of walruses which had died in previous years and hunted walruses on the coast. With the exception of 1995, walruses formed large haulouts on the Somnitel'naya Spit. When walruses were panicked, 24–104 were killed after they were crushed. The carcasses were the main factor attracting bears (Kochnev 2001a). The death of most walruses occurred in a short period (2–4 days). Following these mortality events, the concentration of bears rapidly increased and usually reached its peak in the second half of October. In the absence of walrus carcasses on Blossom Cape the number of polar bears gradually decreased.

Aggregation existence depended on food abundance as much as on rate of sea ice formation. The total biomass of dead walruses varied from 8 to 45 tons/per season (mean=23.7 tons/season) on both haulout sites (Table 25). The consumption of walrus meat, fat and viscera by bears was assessed by taking into account the maximum number of bears in the aggregations. In the seasons when walruses formed haulout sites, each bear had about 346kg of food. When predators reached their maximum density before the sea froze over and the level of walrus mortality was not high, the bears usually consumed all available food and left the coast as soon as ice consolidated. In 1995–96, the aggregations of polar bears before freeze-up were small and each animal could consume from 848 to 1,530kg of food. More bears appeared on the island after consolidated ice had formed and the total number of bears increased. In years when ice was constantly near the island, freeze-up did not noticeably influence bear numbers.

The relationships between the maximum number of polar bears in aggregations and the number of dead walruses, quantity of accessible food, and distance to the ice-edge were examined (Figure 29). The Spearman R correlation coefficient was calculated and in all three relationships a high correlation was found ($p < 0.05$). The relationship between the number of bears and distance to the ice-edge (Spearman rank order correlation $R = 0.823$) and the quantity of walrus carcasses ($R = 0.769$) were strong while the influence of walrus biomass was weaker ($R = 0.702$).

Historical data are inadequate to assess the temporal development of autumn bear aggregations on Wrangel Island. Some reports (Ognev 1931, Starokadomskii 1946) claim that in the beginning of the 20th century bears used to concentrate near walrus haulout sites if the sea did not freeze. The first period of the Island exploration (1926–33) was described in detail (Mineev 1935, 1946,

Figure 30. Relationship between the number of polar bears in autumn aggregations on Wrangel Island and food abundance and ice pattern in the Chukchi and East Siberian seas, 1989–1998.



Ushakov 1972). Harshening of the Chukchi sea ice conditions and absence of walruses on coastal haulout sites were common. Nevertheless, it was reported that one could meet polar bears in autumn (mainly in October) more frequently than during summer.

There is no information on the frequency of meeting polar bears on Wrangel Island in autumn 1934–59, the period of active hunting in the Soviet Arctic, which resulted in a decline in polar bear numbers. During this period, hunters lived on Blossom Cape and Somnitel'naya Spit all year. The anthropogenic disturbance was so strong that even when sea was clear of ice and walruses hauled out, bears did not aggregate in the vicinity of haulout sites.

After polar bear harvesting was prohibited in 1956 and Wrangel Island was designated as a reserve in 1960, bears regularly visited walrus haulout sites on Blossom Cape and on Somnitel'naya Spit. In periods when water surrounding Wrangel Island was free of ice and walruses hauled out, the number of bears left was usually very small. Bears began to concentrate on feeding grounds after the sea had frozen and animals from the consolidated pack ice had come (Velizhanin 1965, Fedoseev 1966, Kistchinsky and Uspensky 1973). Despite the high mortality of walruses in these years, when 245 animals on average died each season (Kochnev 2001a, Table 26), the aggregations of bears were less than 20–30 individuals and many unused carcasses were left for winter. In some years, bears on Blossom Cape continued to feed on walrus carcasses until May and formed aggregations of 4–10 animals (Kistchinsky and Uspensky 1973, Belikov and Kupriyanov 1977a,b).

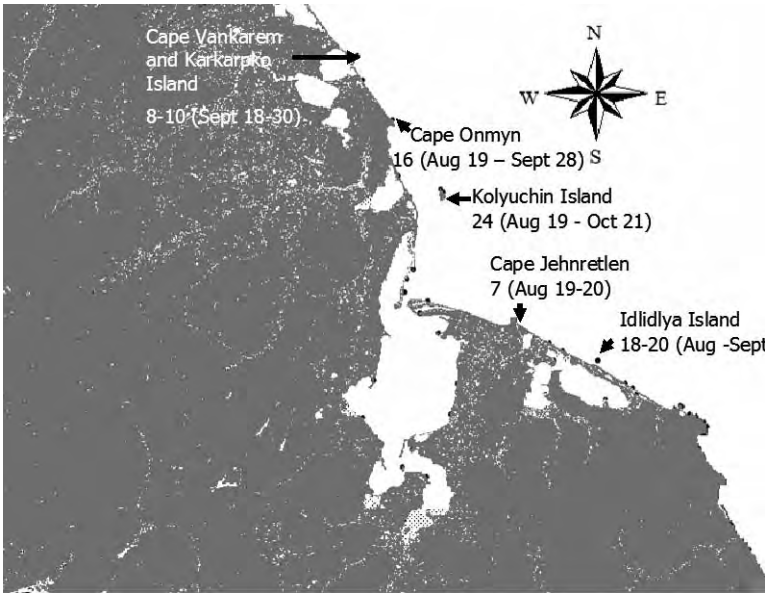
From 1976, when the Wrangel Island State Reserve was organized, the frequency of ecological observations increased. However, large aggregations of bears were still not reported (Figure 30). In the 1980s, small groups of bears were regularly observed in September, even when the ice covered the sea near the island and walruses hauled out and died on the land rarely (Kochnev 2001a, Table 26). In the course of that decade, bears usually fed on old dry skins and other remains of walruses that had died in the 1960–70s on Blossom Cape. The largest aggregations of polar bears were observed on Blossom Cape in September 1981 (11 animals), and in October and November, 1984 (30 and 10 animals respectively). In the Somnitel'naya Spit area, researchers did not note more than three animals simultaneously.

The large aggregations of polar bears in the vicinity of walrus haulout sites observed regularly on Wrangel Island in the 1990s were the result of protection measures and changes in the sea ice. The correlation between bear numbers and remoteness of ice edge indicates that the concentration of bears depends on ice patterns in the Chukchi and East Siberian seas. The same ice conditions force walruses to haul out, thus the remoteness of the ice edge influences walrus numbers and mortality rate

Table 26. Autumn conditions and food resources for polar bears on Wrangel Island, 1960–1999

Decade	No. seasons with the Chukchi Sea free of ice	No. seasons that walruses hauled out	Mean no. dead walruses/decade	Mean (per decade) peak no. polar bears in aggregations
1960–69	5	5	318 (n=1)	8–20
1970–79	4	6	191.5 (lim 0-574, n=6)	5.5 (lim 2-9, n=2)
1980–89	1	3	0.4 (lim 0-1, n=3)	7.7 (lim 0-30, n=10)
1990–99	7	7	68 (lim 37-127, n=6)	54.7 (lim 4-140, n=9)

Figure 31. Study area on the Chukotka coast (2003–2004) and the location of the largest aggregations of polar bears in summer and autumn of 2003.



(Kochnev 1999, 2004). Additional factors influence the formation of bear aggregations and the number of animals in groups: the speed of ice break-up in summer and the distribution of bears and their prey in surrounding waters when the ice edge moves north. The arrival of bears, searching for food, in large numbers on the coast after sea freezing (October–November) is apparently caused by their unsuccessful hunting of seals near the edge of the pack ice the previous month.

Chukotka Arctic coast

Observation routes and stationary counts of polar bears took place from August 1 to September 2 in 2002 in the coastal waters from Lavrentya Bay (Bering Strait) up to Neshkan village (Chukchi Sea); from July 19 to October 30 in 2003 from Vankarem Cape to Kolyuchin Bay (Chukchi Sea); from August 13 to November 4 in 2004 in the coastal waters of the Chukchi Sea from Serdtse-Kamen' Cape to Kolyuchin Island (Figures 26 and 30). Land-based observations were made on Kolyuchin Island in 2003–04 using the same methods as on Wrangel Island. The total survey route was 1,906km.

In 2002, only one polar bear was encountered (August 26) on the coast between the Chegitun' River mouth and Inkigur Cape. As reported by hunters, bears began to visit the area near Vankarem Cape after the sea had frozen (end of October–beginning of November). Bears formed small feeding aggregations near walrus carcasses on the haulout sites of Karkarpko Island and Vankarem Cape. The same situation was observed in 2004. In the absence of ice cover in our study area during August, September and October single bears were met only twice (at the end of August in the vicinity of Nutepel'men village and at the end of September near Vankarem

Cape). Bears started to visit walrus haulout sites on Karkarpko Island and Vankarem Cape in the first 10 days of November, i.e. 1–1.5 weeks after the ice had reached the coast.

The situation was different in 2003. On August 20, up to 18 bears of different sex and age were counted along the coastline of Kolyuchin Island. About 20 bears lived on the Island until the end of September. The maximum number of bears (24) was noted on September 6. The aggregation could have been larger if natives did not hunt there. On Kolyuchin Island and area, on the continental coast, not less than 17 polar bears were killed at the end of August and September. As the reports of native people suggested, from 7 up to 20 bears concentrated in five coastal areas in autumn 2003 (Figure 7). The aggregation of animals on Kolyuchin Island persisted until freeze-up (late October), though some animals began to leave the island in early October.

Autumn and summer seasons of all three years (2002–04) were characterized by similar ice and open water conditions in the Chukchi Sea. Walruses formed large haulouts on the arctic coast of Chukotka in all years. At the same time, the dynamics of ice break-up varied each summer. In 2002 and 2004, the ice edge moved to the north and the majority of polar bears followed it. In July and in early August 2003, the ice conditions were close to average: the central part of the Chukchi Sea was ice free, while a strip of half-consolidated ice moved along the Chukotka coast – from the East Siberian Sea through Long Strait down to the Bering Strait. From August 11–18, however, a strong storm, accompanied by northern winds, broke up the coastal ice fields. polar bears that lived there, moved onto the coast and became isolated from the main ice.

Discussion

Large regular aggregations of polar bears were observed in the vicinity of walrus haulout sites on Wrangel Island in autumn 1990. The dramatic increase in the aggregations and the number of bears was connected to altered ice conditions in the Chukchi Sea and the eastern part of the East Siberian Sea and was related to walrus mortality (Table 2). The same ice situation was typical of the 1960–70s when walrus mortality was even higher. However, in those years, bears began to concentrate in areas with haulout sites only after freeze-up and they were not as abundant. These patterns could be explained by the high level of anthropogenic disturbance (the reserve was not organized yet) and by the low numbers of animals in the population.

On the arctic coast of Chukotka, in the same sea ice and feeding conditions as on Wrangel Island, the aggregations of polar bears near walrus haulout sites were not as regular and included smaller numbers of animals. The geographical position of Wrangel Island makes it unique: this isolated structure is the only large land area in the vast range of polar bears in the Chukchi Sea subpopulation (Chukotka-Alaska).

Bears feeding on whales and pinniped carcasses along the Chukotka coast in November–April have been noted repeatedly since the mid 1970s (Smirnoff 1983, Stashkevich 1986). However, in the last 10–15 years, the number of such observations has increased (Kochnev *et al.* 2003). Thus, polar bears began visiting coastal haulout sites more frequently in November and December and when carcasses were abundant, they formed large aggregations. The observations in 2003 suggest that certain patterns of ice break-up cause bear concentrations on the coast even at the end of summer and polar bears head for walrus haulout sites, both actual and potential. In 2003, walruses hauled out on Vankarem and Onmyn Capes, Karkarpko and Kolyuchin Islands (Figure 31). Although Jehnretlen Cape and Idlidlya Island were not visited by walrus in 2003, animals used them for rest during autumn migrations. If hunting was not so intense and the level of anthropogenic disturbance was not so high, the regularity of bear concentrations in these areas of the continental coast, the duration of their existence and the number of animals in them could be similar to Wrangel Island.

The concentration of bears on walrus haulout sites of Wrangel Island is somewhat unique. Aggregations of this kind, forming in summer and autumn, are nowadays known only in the southern part of polar bears' natural habitat (Hudson and James Bays in Canada). After the ice breaks up, the whole subpopulation comes to the coast. However, the density of predators is not as high as on Wrangel Island: bears are scattered along the coast and further inland, because food resources are equally scattered (Latour 1981, Derocher and Stirling 1990a,b). Abundance of food, concentrated in small coastal areas of Wrangel Island, promotes the formation of aggregations. Aggregations with similar density can appear near food resources such as dead whales (belugas, sperm whales, grey and bowhead whales). Indeed, they were noted repeatedly on the Chukotka and in other arctic regions (Smirnoff 1983, Stashkevich 1986, Larsen 1986, Kalxdorf 1997, Derocher *et al.* 2002, Kochnev *et al.* 2003). However, the appearance (place and time) of whale carcasses cannot be predicted, while walrus haulout sites usually form in traditional areas of the coast

when the larger part of the Chukchi sea is clear of ice (Kochnev 1999).

When ice conditions prevent polar bears hunting seals, walrus haulouts are an important food resource in autumn and early winter. The regularity and predictability of walrus arrival allows bears to head for the coastal haulout sites when they move on ice and land near the coast in summer and autumn. Abundance of food, long-term aggregation existence and number of animals in aggregations can cause high levels of intraspecific interactions (Kochnev 2001b, 2002, Ovsyanikov 2005). Thus, taking into account the regular nature of such aggregations, one can conclude that they play an important role in forming and supporting connections between individual animals. These situations allow opportunities to look at the social structure of bears in the subpopulation from a different viewpoint.

The problem of global climatic warming is widely discussed nowadays and a lot of attention is drawn to the possible influence of arctic warming on the survival of the polar bear as species (Stirling and Derocher 1993). The subpopulation of Hudson Bay is the most vulnerable to climatic changes, because bears have to wait through the long period (3–4 months) of ice absence on land, when they practically do not feed (Stirling *et al.* 1999). The Chukchi Sea (Chukotka-Alaska) subpopulation occupies a more northern habitat area and is less vulnerable to warming. Our investigations on Wrangel Island have shown that the polar bear is a very plastic animal: it can rapidly change its way of life, spatial distribution and behaviour according to new ecological conditions.

Comparing the situation in 1980s and 1990s, one can easily trace the changing Chukchi Sea ice conditions (Table 2). This process is still ongoing. From 1999 to 2004 bears continued to form large aggregations on the Wrangel Island coast, although walrus numbers and mortality rates on haulout sites decreased (Ovsyanikov 2005, I.P. Oleynikov, L.L. Bove, V.V. Baranyuk, G.N. Kaurgin, personal communications).

If the process of warming lasts for a long time and feeding conditions near the ice edge in summer and autumn are not satisfactory, the life cycle of the Chukchi Sea subpopulation could shift to a similar one to the Hudson Bay subpopulation. In the absence of ice, the majority of bears will move to land and spread out over the islands and continental coast of the Chukchi and East Siberian seas. Nevertheless, feeding conditions in the north are better than in the Hudson Bay area. From 10 to 13 walrus haulout sites usually function in summer and autumn on the arctic coast of Chukotka (Gilbert *et al.* 1992, Kochnev 2004). In addition not less than 7–8 dead whales are thrown on land from the sea every year (Kochnev 1998).

On the American side of the Chukchi Sea walrus haulout sites are rare but on the Beaufort Sea coast in recent years, bears form feeding aggregations in places where bowhead whales have been butchered on land (see Schliebe *et al.* this volume). Thus the pattern of behaviour observed in the 1990s on Wrangel Island, when animals formed coastal aggregations near the food source, may spread over the whole coast of the Chukchi Sea and alter the life cycle of the subpopulation if arctic warming continues and is irreversible.

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