

Polar Bear Research on Wrangel Island and in the Central Arctic Basin

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This report summarizes preliminary results of polar bear research undertaken on Wrangel Island and in the Central Arctic Basin since the 14th IUCN/SSC PBSG meeting in Seattle in June 2005.

Polar bear research on Wrangel Island

Wrangel Island has been a Category Ia (IUCN classification) nature reserve since 1976. It includes Wrangel and Herald islands and the surrounding marine area, protecting both terrestrial and marine polar bear habitats. The nature reserve encompasses a total of 56,616 km², including 7,620 km² of land (7,608.7 km² on Wrangel Island; 11.3 km² on Herald Island) and 48,996 km² of marine area (11,543 km² of which is a “strict” nature reserve and 37,453 km² of which is a marine buffer zone). No changes in status or size of this protected natural area were made during 2005–2008.

Polar bear research on Wrangel Island has been ongoing since 1990 and includes two major parts: 1) monitoring of the local population during late summer-autumn periods, and 2) research on polar bear population and behavioural ecology. Monitoring focuses on basic population parameters: 1) the abundance and distribution of polar bears on Wrangel Island; 2) the demographic composition of bears during the ice-free season—thought to be a segment of the Chukchi-Alaskan population; and 3) physical condition. Research focuses on the processes and factors that may affect population dynamics and health. Objectives of the research are to document: 1) bear spatial distribution on the island, on-shore movements, and terrestrial habitat use; 2) changes in demographic structure during the ice-free seasons in relation to conditions of the season; 3) foraging activity and hunting behaviour; 4) social behaviour; 5) behaviour during encounters with

humans; 6) reaction to disturbances caused by human activities; and 7) changes in bear physical condition and mortality during the ice-free season.

Methods used were based on survey routes across the island and stationary observations at traditional sites of polar bear concentration, which are related to walrus haulout sites. The number, frequency, and length of survey routes, as well as the sites and duration of stationary observations depend on conditions of the season, and in particular on polar bear distribution and activity. The most common routes and three major points of stationary observations are shown in Fig. 1. Surveys were conducted on the island from mid-July through September, from 2005 to 2008. Approximately 2,500 km was traversed on all-terrain vehicles (ATV) every season.

The number of polar bears recorded on Wrangel Island during the late summer-autumn season in 2005–2008 varied from approximately 200 to 600 (Table 1). Demographic composition of stranded polar bears also varied over years (Table 2). Estimated proportions for 2006 are less detailed than for other years as there was a gap in systematic surveys during that year due to technical reasons. The lower proportion of adult males recorded in 2006 may be due to lack of surveys along the western coast of the island, where the number of adult males is usually higher. The actual proportion of adult females is thought to be higher, as females that are ready for denning at this time of year have already left for denning areas on inland slopes. These females are sleeping on slopes and can be observed only from a long distance; therefore, exact identification of the animal is usually impossible. Thus, a proportion of adult pregnant females may fall into the “lone unidentified adult bear” category. Young males may also be represented in this category, when observed from a long distance.

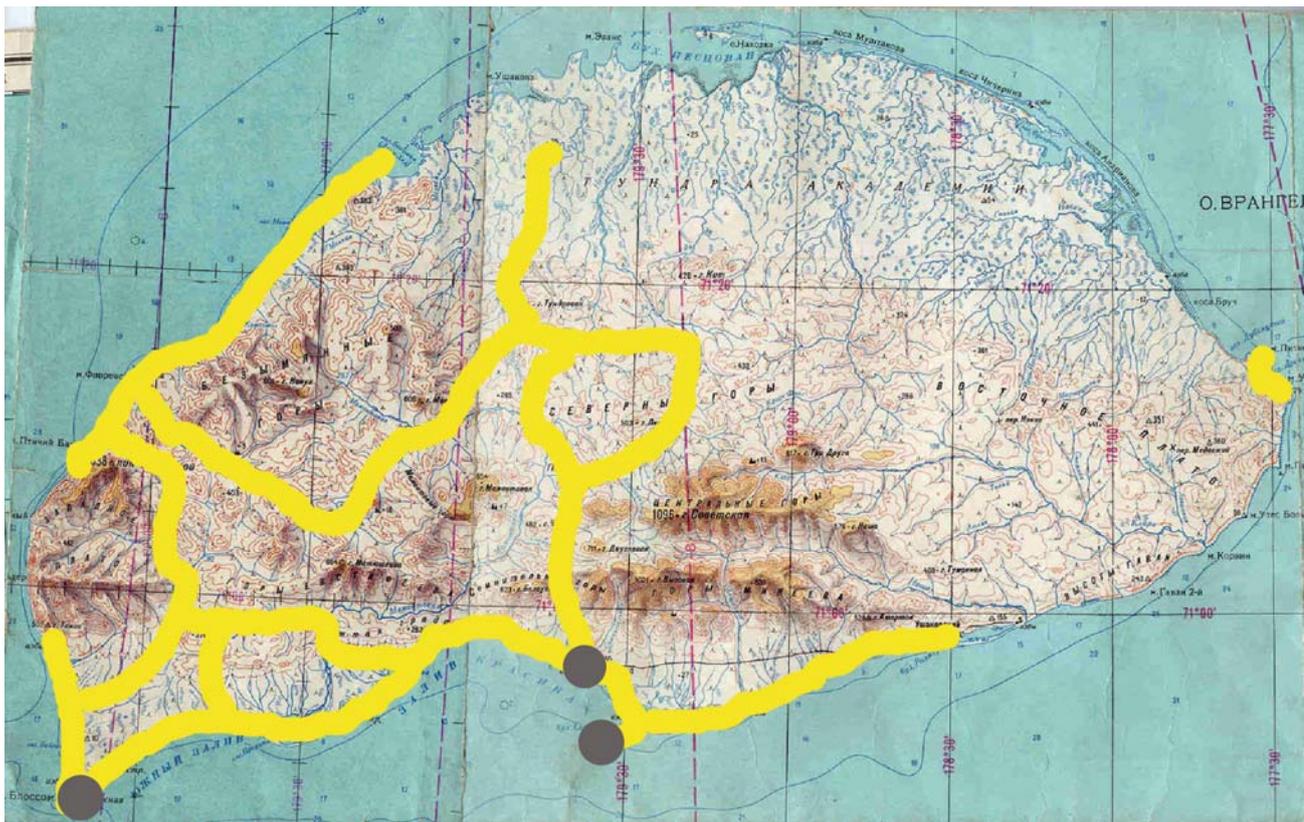


Fig. 1. Survey routes and points of stationary polar bear observations on Wrangel Island.

Table 1. Number of polar bears recorded on Wrangel Island, 2005–2008.

Year	Maximum number of bears in congregation at Cape Blossom at one time	Total polar bear count	Estimated number of bears
2005	18	104	150–200
2006	2	99	150–200
2007	11	391	550–600
2008	5	200	250–300

Table 2. Demographic composition (percentage of total) of polar bears on Wrangel Island during the ice-free period, 2005-2008.

Year	Adult male	Adult female	Females with COY	Females with yearlings	Females with 2-YR	Encumbered males with unidentified cubs	Adult bear (unknown sex)	COY	Yearlings	2-YR with adult female	Unidentified litter with adult female	Subadult	Total number of bears
2005	16.3	9.6	13.7	1.0	4.8	1.0	13.7	24.0	1.0	7.7	1.0	6.7	104
2006	2.9	5.8	9.7	7.8	3.9	0.0	36.9	15.5	8.7	5.8	0.0	2.9	99
2007	19.6	8.6	9.3	3.4	1.2	2.5	29.7	13.2	4.4	2.0	2.5	3.7	391
2008	15.5	5.5	13.0	2.0	2.5	0.5	13.5	23.5	2.5	3.0	0.5	18	200

The physical condition of polar bears on land on Wrangel Island during the ice-free season was estimated using a 5-point scale (Ovsyanikov 2006) in 2005 ($n = 87$), 2006 ($n = 61$), 2007 ($n = 239$), and 2008 ($n = 132$). The highest proportion of bears in poor physical condition was recorded in 2007 (4.6%), but this was lower than in the period 2001–2004, when the number of bears in poor condition varied from 6 to 15% (Ovsyanikov 2005). A detailed analysis of the dynamics of physical condition will be conducted in the future to compare within- and between-year variation of this parameter in relation to sea ice conditions and food availability. Preliminary results suggest that during the last 5 years foraging conditions for polar bears in the region of Wrangel Island improved and that the polar bear response to such an improvement was immediate.

Litter size was estimated during the late summer-autumn period, 2005–2008, for litters of all age categories (Fig. 3). In addition, in 2005 and 2007, spring surveys were conducted on the island to estimate polar bear activity during the period of female emergence from maternal dens. Systematic spring maternal den surveys were ended on Wrangel Island in 1997, due to concerns regarding den disturbance. However, in spring 2007 a single den survey session was conducted on the island; a group of two observers counted maternal dens at Cape Warring from March 16 through May 1. In 2009, a survey on spring polar bear activity on the island was conducted from March 26 through April 6. These spring surveys were limited to ground observations at only one location each year: in 2007 at Cape Warring and in 2009 at Thomas mount. Surveys were conducted by foot along the periphery of denning areas to avoid disturbance to family groups. In addition to observations at denning areas, snowmobile surveys were conducted along river valleys inland, and along the southern and western coasts of the island to count tracks of polar bear families heading towards the sea ice.

During spring surveys in 2007 at Cape Warring, 7 maternal dens were located, 5 bear families observed, and a total of 39 family groups recorded leaving the island (by both tracks and animals sightings). In 2009 at Thomas Mount, we found only 1 maternal den, whereas in the early 1990s we recorded from 5–8 dens/yr within the same area. In 2009, a total of 24 family groups

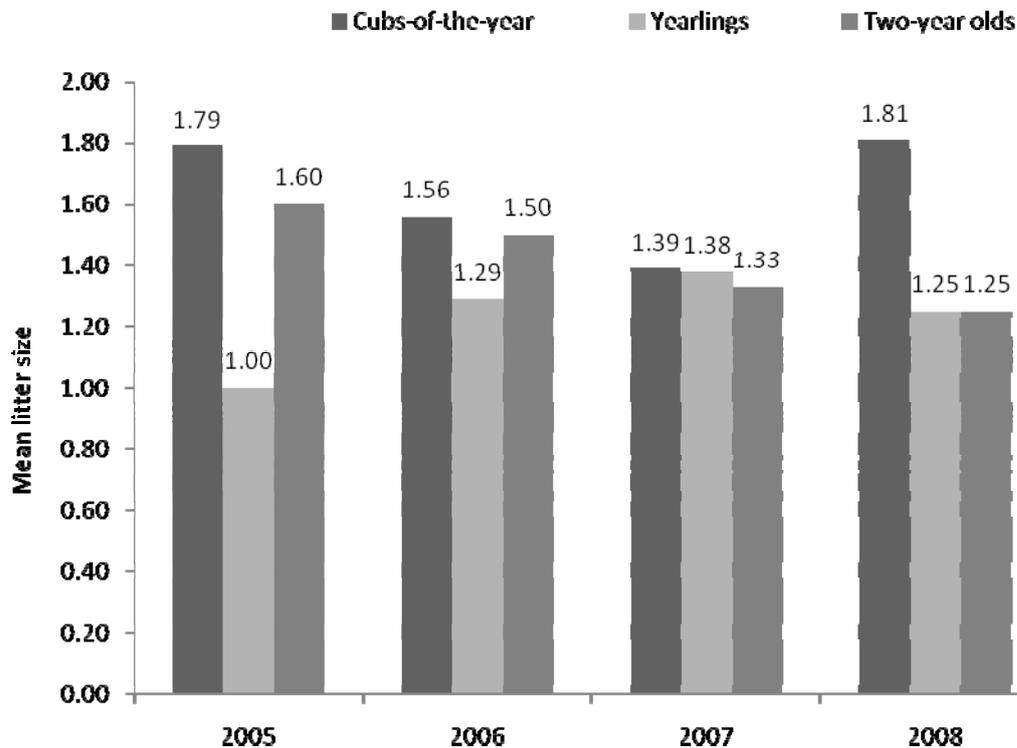


Fig. 3. Mean litter size during the autumn on Wrangel Island, 2005-2008.

were recorded leaving the island (5 observed, 19 by tracks) during the 2-week survey period.

The average litter size in spring was 1.90 ($n = 39$) in 2007 and 2.17 ($n = 24$) in 2009. Spring litter size for cubs-of-the-year was higher than recorded during autumn. However, in 2008, it was the highest recorded during the autumn for the last decade. In spring 2009 the number of family groups leaving the island was at least 4 times lower than for the same time period and the same area as in the early 1990s; however, average litter size was the highest recorded on the island since early 1990s (Ovsyanikov 1993, 2006). In other words, fewer females were denning on the island during recent years compared to the 1990s, but those few that were denning were in relatively good condition and produced larger litters on average. This may reflect an improvement in foraging opportunities in the region of Wrangel Island during the last few years (perhaps due to better ice conditions during the spring-early summer hunting season) or an immediate response of polar bears to local improvement in food availability. More

detailed analysis in relation to ice dynamics and further monitoring is needed to assess these hypotheses.

Alternative food resources are available for polar bears on Wrangel Island during the ice-free period. Since the summer of 2005 I recorded feeding on, or attempts to hunt, the following prey: walrus (*Odobenus rosmarus*; both alive and washed up carcasses), grey whale (*Eschrichtius robustus*) carcasses, Arctic cod (*Boreogadus saida*) carcasses, dead and alive salmon in lagoons, moulting snow geese (*Chen caerulescens*), lemmings, reindeer (*Rangifer tarandus*) carcasses, musk oxen (*Ovibos moschatus*) carcasses (a few unsuccessful attempts to chase or follow musk oxen were observed as well), washed up marine invertebrates (shellfish) and other carrion, such as dead birds, and Arctic fox (*Vulpes lagopus*) carcasses.

Large gatherings of polar bears on shore (coastal aggregations) were not observed on the island during the last 5 years. The multi-year accumulation of old walrus skins and bones at the spit of Cape Blossom, known as “field of bones”,

which was a strong attraction for polar bears that concentrated there even in the absence of walrus haulouts, no longer exists. Beginning in 2004, the “field of bones” has been gradually washed out by late-autumn storms, and the last portion of walrus remains was washed out in autumn 2007. Since this attraction has disappeared, polar bears do not show any preference for Cape Blossom. All local polar bear gatherings (lesser aggregations) were recorded on the island only in relation to walrus haulouts or whale carcasses, and did not exist long after the available food was finished.

The most usual activity pattern during the ice-free period is the alternation between sleeping and slow walking along the coast or inland in search of food. When encountering humans on the coast, polar bears escape into the sea, and swim out to sea or along the shore some distance (from a few tens of meters to a few kilometres), wait for humans to pass, and then come ashore again. The same escape tactic is observed when polar bears are disturbed by an ATV or any other vehicle: escape into the sea, wait for the vehicle to pass, and get back onto land. Since the beginning of our research in 1990, we have never observed a bear leaving the island for the open sea before ice is visible from the coast. As soon as the ice returns from the north or the surrounding sea is frozen to the stage where it can support a walking or crawling bear, the majority of bears leave the land for the ice and in 2–3 days almost all bears are out on the ice hunting. Most polar bears leave areas with intensive ATV traffic (often near base camp, for instance) moving to more remote parts of the coast where they are not disturbed.

Polar bear survey in the Central Arctic Basin in 2005 and 2007

Two polar bear surveys were conducted in the Central Arctic Basin (CAB) from the expedition research ship “Academic Fedorov” in 2005 and 2007. The 2005 survey was conducted northward from Wrangel Island on both sides of the 180° meridian, up to 79°15′ N. The second expedition in 2007 sailed from Franz Joseph Land to the North Pole and back. On both surveys observations were carried out from the bridge 24 hours a day (by N. Ovsyanikov, the ice surveying team, and marine officers on duty). For each polar bear sighting, the observer on duty recorded the

number of animals (including cubs), their position (coordinates), type of ice, bear physical condition, sex (when possible), and activity.

In 2005, 18 bears were seen on sea ice north of Wrangel Island, 12 of which were observed north of the edge of continental shelf (above 75° N), including 8 bears north of 77° N. Ten of the bears were in 4 family groups, including 3 family groups observed north of the continental shelf. One female with 2 two-yr-old cubs (all with a fat index of 4) were at 77° 04.10′ N, 178° 26.50′ W. One female and 1 cub-of-the-year (fat index, 4) were recorded feeding on a killed seal at 78°50.20′ N, 177° 27.40′ W (sea depth at this position was 1500 m). All bears observed in 2005 were in good physical condition: 16.7% were of average healthy body index (3); 83.3% were fat (9 with a fat index of 4, one with a fat index of 5). In addition, 7 polar bear track lines (lone bears) were recorded north of 75° N (i.e., north of the edge of continental shelf).

In 2007, in the western sector of the CAB, 7 polar bears were sighted, and 61 polar bear track lines were recorded along both legs of the route. As in 2005, all bears were in good physical condition: 85.7% were fat (5 bears of each sex) or very fat (1 adult female), and only one bear was in category 3 (average). A particularly high concentration of tracks was recorded between 82° 25.30′ N and 82° 22.00′ N. One female, with a condition index of 4, was observed at the North Pole. Based on her behaviour, she was not simply transiting through the area near the North Pole (Fig. 4). During both surveys, all bears recorded in CAB were observed on fields of substantial ice.

During both surveys in CAB all sightings of seals were recorded. In 2005, ringed seals (*Pusa hispida*) were recorded at all parts of the route across ice north of Wrangel Island—from 75° through 79°15′ N. In 2007 ringed seals were recorded up to the North Pole (Fig. 5.)

The long-term observational study on polar bear behavioural ecology on Wrangel Island may provide essential information for understanding how polar bears respond or may respond in the future to global environmental change. I suggest that processes observed on Wrangel Island may illustrate a strategy for polar bears to survive ice-free seasons in coastal ecosystems. When the Arctic pack ice recedes northward beyond the edge of the continental shelf during the summer



Fig. 4. Adult female polar bear recorded at the North Pole, August 1–2, 2007. (Photo credit: S. Khvorostov).

season, bears that hunt on the remaining ice fields in the marginal zone south from the edge of the main pack ice are forced ashore as this marginal ice splits from the main pack and melts. These bears are stranded on land where they conserve energy accumulated during the spring hunting season and may exploit alternative food resources. Under certain circumstances, such as were observed on Wrangel Island in 2007 (Ovsyanikov and Menyushina 2008, Ovsyanikov *et al.*, 2008), resources available in coastal ecosystems may be so abundant that polar bears are able to feed on them more successfully than while hunting on the sea ice. Bears that stay on the main pack ice while it is receding move to the CAB where they spend the summer. Our observations in 2005 and 2007 suggest that ringed seals also move to the CAB with the receding pack ice, thus providing opportunities for polar bears to hunt in habitats that were not optimal during normal ice conditions in the Arctic. During the winter-spring-early summer season, when marine areas in the continental shelf zone are covered by annual ice, polar bears return to these areas to forage on the rich resources of this most productive marine zone. As the ice melts during summer, this cycle repeats.

Based on this descriptive model, I speculate

that the same strategy may have helped polar bears to survive periods of interglacial global warming during the Pleistocene epoch. This strategy possibly could be modified in different geographic areas by variations in local conditions. However, an understanding of the behavioural response of polar bears to various factors may not only explain the drivers in observed processes, but also predict potential scenarios for population trends under various conditions.

Based on our current understanding of polar bear behaviour and processes in this local population, the actual and potential reactions of the species to global environmental change, if current trends continue, may be summarized as follows: 1) Decrease of polar bear numbers, some populations may disappear; 2) Global redistribution of polar bears, seasonal shift of some bears from continental shelf zone into CAB; 3) Increase of gene flow between some populations; 4) Seasonal geographic isolation of some populations; 5) Extended periods of stranding on land and a switch to a terrestrial lifestyle; 6) Seasonal switch to alternative food resources; 7) Forced maternity denning on drifting pack ice in CAB (for females that cannot return to land in time for hibernation); 8) Increased social interaction during periods of stranding; and 9)

Increased nutritional stress in terrestrial habitats and the probability of cannibalism.

Some of these reactions are confirmed by observations during recent years. For example, the Chukchi-Alaskan population now apparently splits every year into four seasonally isolated parts: Wrangel, Chukotka, Alaska, and CAB. Some of the hypotheses presented could be tested in

further research. Under current environmental trends, further research and monitoring of polar bear populations in different sectors of the Arctic is critically important for understanding ongoing processes, drivers, and trends for defining major threats and implementing the appropriate conservation measures.

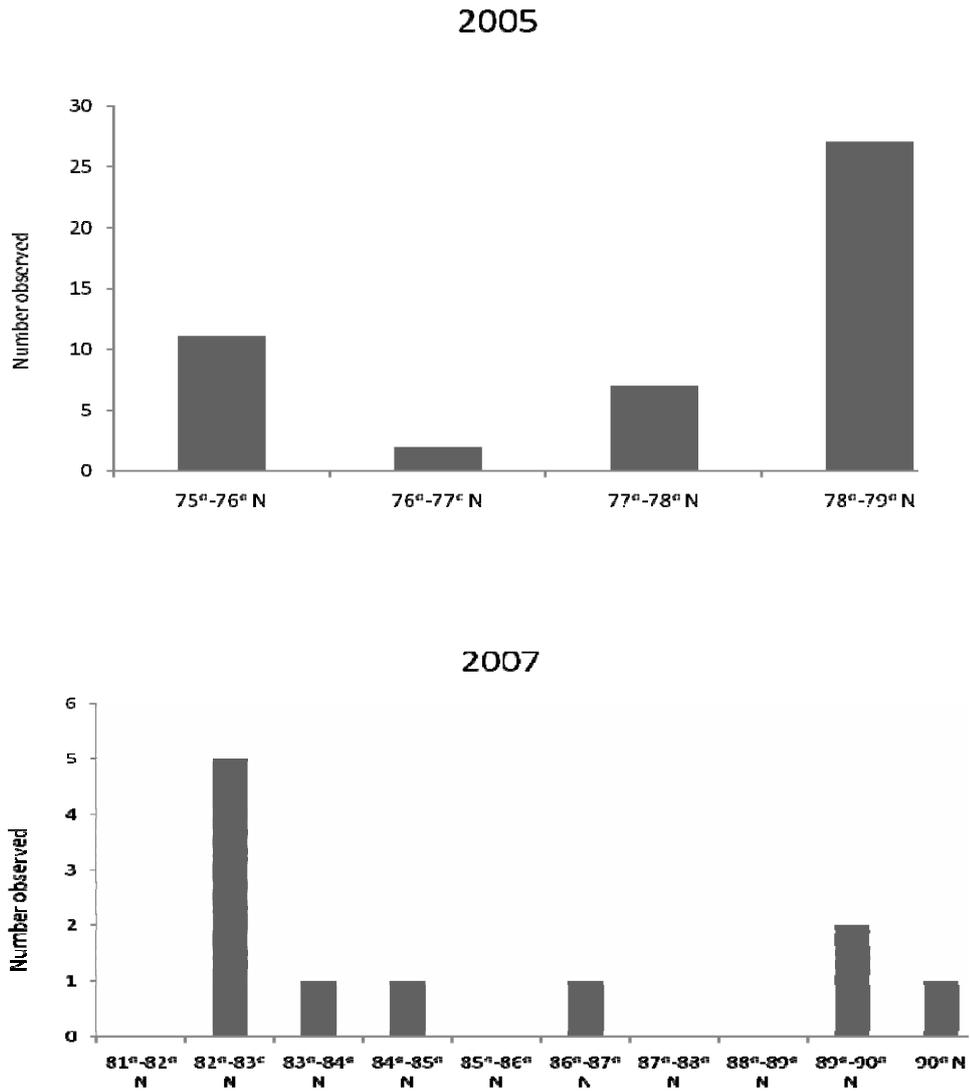


Fig. 5. Observations of ringed seals (*Pusa hispida*) in the Central Arctic Basin, 2005 and 2007.

References

- Ovsyanikov, N.G. 1993. Number, distribution and demographic structure of polar bears in the Wrangel Island region during the autumn season. Pages 12-41 In *Bears of Russia and adjacent countries—status of populations. Part 2*, Moscow, 1993. (In Russian)
- Ovsyanikov, N.G. 2006. Current research and conservation of polar bears on Wrangel Island. Pages 167-171 In Aars, J., Lunn, N.J. and Derocher, A.E. (eds.). *Polar Bears: Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 20–25 June 2005, Seattle, WA, USA*. IUCN, Gland, Switzerland and Cambridge, UK.
- Ovsyanikov, N.G. and Menyushina, I.E. 2008. Specifics of Polar Bears Surviving an Ice Free Season on Wrangel Island in 2007. Pages 407-412 In *Marine Mammals of the Holarctic*. Odessa, Russia.
- Ovsyanikov, N.G., Menyushina, I.E. and Bezrukov, A.V. 2008. Unusual Pacific walrus mortality at Wrangel Island in 2007. Pages 413-416 In *Marine Mammals of the Holarctic*. Odessa, Russia.