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# INTERACTIONS BETWEEN POLAR BEARS AND OVERWINTERING WALRUSES IN THE CENTRAL CANADIAN HIGH ARCTIC

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**Abstract:** There are few records of predation by polar bears (*Ursus maritimus*) on walruses (*Odobenus rosmarus*), although their distributions overlap extensively. During the late winter and early spring from 1981 through 1989, we recorded interactions between polar bears and walruses in the central Canadian High Arctic, where walrus movements are severely restricted in the winter by limited areas of open water for breathing and haulout holes. Predatory behaviour of bears and anti-predator behaviour of walruses were observed. We found evidence that polar bears made wounding but non-fatal attacks on 3 walruses, killed 3 walruses, and probably killed 4 others. One walrus was frozen out of its breathing hole and vulnerable to predation. Although the vulnerability of walruses to polar bear predation would vary with habitats and seasons, it is clear that polar bears are important predators of walruses in the central Canadian High Arctic in late winter-early spring.

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Walrus and polar bear distributions overlap in a variety of habitats and seasons including the floe edge or drifting pack ice throughout the year in some areas, terrestrial haulouts where all the ice has melted in the summer, and polynyas of variable sizes during the winter. The vulnerability of walruses to predation by polar bears may vary significantly among these shared habitats, but there are few confirmed reports of predation (Perry 1966, Kiliaan and Stirling 1978) and little quantitative information about the nature and magnitude of the predation. Most of the observations of interactions between polar bears and walruses have been made at terrestrial or ice-edge haulouts or in pack ice.

Polar bears are powerful predators, capable of taking large prey such as bearded seals (*Erignathus barbatus*) (Stirling and Archibald 1977) and belugas (*Delphinapterus leucas*) (Lowry et al. 1987), but walruses are the largest of the polar bear's possible prey, and they are able to use their tusks for defence. Loughrey (1959) felt there was little doubt polar bears prey on calves and subadults, but found factual accounts scarce. Fay (1982) stated that he knew of no confirmed records of predation by bears on walruses. He concluded that contact between polar bears and walruses occurred mainly in summer and that only younger walruses are really vulnerable to predation. Although Fay (1985) listed predation by polar bears as 1 of 3 primary causes of mortality among walrus calves (along with predation by killer whales [*Orcinus orca*] and crushing), he noted that Mansfield (1958) has calculated that total mortality of walrus calves is low compared to other pinnipeds. It is hard to assess if this predation would be significant to the population.

In the central Canadian High Arctic, small groups of walruses winter in polynyas, including a group of 50-100 walruses at the Dundas Polynya at Cape Collins (Fig. 1) on the northeastern tip of Dundas Island (Stirling et al. 1981). Open water where walruses can breathe and feed

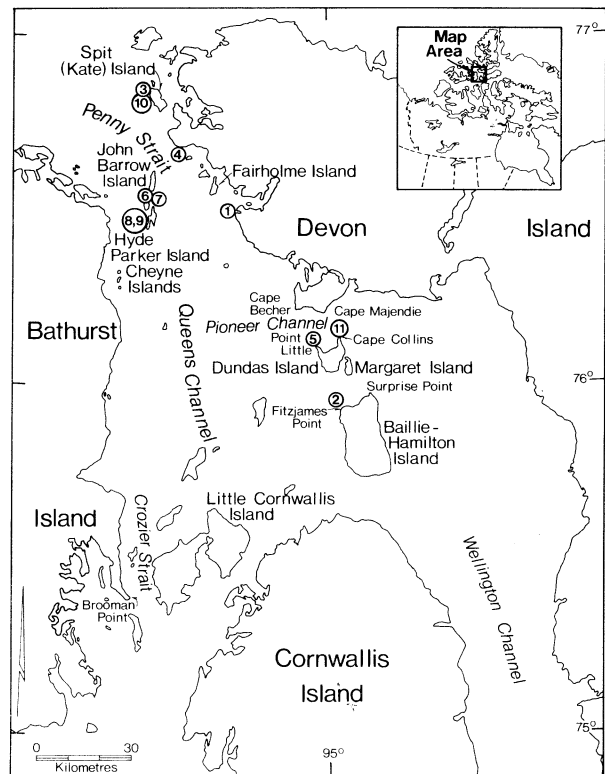


Fig. 1. Kills or attacks by polar bears on walruses in the Penny Strait and Queens Channel area from 1981 through 1988: 1) 10 Apr 1981, confirmed kill of young adult, found partially eaten, tusks <30 cm; 2) 3 Apr 1982, confirmed kill, 1 large bear pulling adult walrus (length 247 cm) from hole, 2 walruses hauled out nearby; 3) 26 Apr 1983, evidence of attack but not kill; 4) 12 Apr 1984, young adult female frozen out >2 days, not killed, tusks ~20 cm; 5) 19 Mar 1985, possible attack, blood around hole; 6) and 7) 30 Mar 1985, old kill of 1 adult and 1 yearling walrus, carcasses dismembered, adult female polar bear and 2-year cub feeding on them; 8) 30 Mar 1985, confirmed fresh kill of young female walrus, tusks 10 cm, 2 adult bears feeding; 9) 11 Apr 1985, possible attack, blood near hole, bear tracks windblown; 10) 21 Apr 1986, kill of young walrus, length 185 cm, tusks 3.8 cm; 11) 23 Apr 1987, adult male carcass (length >275 cm, tusks 33 cm) at tide crack, probably killed by a polar bear, scavenged by many bears.

during the winter is maintained there and at several other locations in eastern Penny Strait by strong tidal currents (Topham et al. 1983). In addition, multiyear floes that become grounded in shallow water in the late summer throughout this region will remain frozen in place through the winter. These floes are rocked by tidal currents and winds, creating a border of weaker broken ice where walrus are also able to breathe and haul out. The walrus may remain at these floes for weeks or months at a time (Stirling et al. 1981: Fig. 3).

On 2 occasions, Kiliaan and Stirling (1978) found lone walrus, one an adult, the other almost 2-years-old, that had been attacked and killed by a polar bear at a haulout hole. They also reported a kill by Inuit of a walrus at a frozen-over hole, and an observation of an adult walrus that had been attacked by a polar bear but survived. From these observations, they suggested that walrus overwintering in areas with restricted breathing and haulout sites might be more vulnerable to predation, and that predation by polar bears might be more frequent than previously seemed apparent. This paper presents observations of predation by polar bears on both young and adult walrus in a polynya area during the late winter and early spring.

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## METHODS

We conducted studies of the biological importance of the Dundas Polynya to overwintering marine mammals in the late winter and early spring from 1981 through 1989. Our observations concentrated on walrus and polar bears and to a lesser extent on ringed seals (*Phoca hispida*) and bearded seals.

We were able to observe polar bears and walrus up to 6 km away almost continually during daylight hours. Visibility was occasionally obscured by poor weather, but it was rarely <2 km. The animals appeared undisturbed by our presence in a hut at the top of a 90-m cliff

overlooking the polynya. On an opportunistic basis, we recorded the hunting behaviour of polar bears, occasional interactions between polar bears and walrus, and the behaviour of walrus while hauled out and vulnerable to predation.

We used a helicopter to survey Penny Strait and Queens Channel also. On each survey, we followed the same general route north from the Dundas Polynya along the western coast of Devon Island and returned via the middle of Penny Strait and Queens Channel past Hyde Parker Island, the Cheyne Islands, and the northern end of Baillie-Hamilton Island (Fig. 1). The exact route varied within and among years, depending on the distribution of walrus, changes in ice conditions, and prevailing weather conditions. Surveys were conducted 2-6 times each year at approximately 2-week intervals between mid-March and early May and covered a distance of 150-400 km. We flew between about 1000 and 2000 hrs EST, at an altitude of about 70 m and an airspeed of about 100 km/hr. The surveys were primarily to map walrus and polynya distribution and record the underwater vocalizations of walrus and seals for another study, but we also noted all polar bears, polar bear tracks (and an estimation of their freshness), and any indications of interactions between polar bears and walrus. When a walrus carcass was found, ice conditions and presence of bears were noted. When possible, measurements and photographs were taken, and a tooth was collected for age determination.

## RESULTS AND DISCUSSION

### Sightings of Polar Bears

Polar bears den, hunt and feed on seals, and mate in the study area (Stirling et al. 1984), and bears of all age- and sex-classes were seen on the ice adjacent to the polynya where the walrus haul out to rest. Polar bears hunted along pressure ridges and small refrozen cracks in the area for the subnivean breathing holes and birth lairs of ringed and bearded seals. Bears also searched along the edges of the main polynya and smaller areas of open water and investigated the breathing holes used by walrus, their haulout sites, and the hauled-out walrus themselves.

In most years, bears were observed every 2-4 days at Cape Collins (Table 1), but there were some periods when none were seen for several weeks. There were undoubtedly some bears present in the area that were not seen. There was no obvious trend in numbers or correlations among months or years and the number of bears recorded. The variation in numbers of bears seen among years was also independent of the number of walrus present or the

Table 1. Number of days of observation at the Dundas Polynya at Cape Collins and number of polar bears seen.

Year	Month	Days of observation	Bears seen	Minimum bears/day
1981	Apr	25	9	0.36
1982	Apr	19	5	0.26
1983	Apr	19	4	0.21
1984	Apr	23	1	0.04
1985	Mar	20	6	0.30
	Apr	13	2	0.15
1986	Apr	26	14	0.54
1987	Feb	6	1	0.17
	Mar	31	21	0.68
	Apr	30	10	0.33
	May	20	5	0.25
1988	Feb	17	27	1.59
	Mar	31	4	0.13
	Apr	30	12	0.40
	May	9	0	0
1989	Feb	20	3	0.15
	Mar	31	0	0
	Apr	26	1	0.04

size of the polynya (unpubl. data). Although there was a walrus carcass immediately below the hut in 1987, and bears scavenged there regularly, we saw them no more often that year than in 1988. It is likely that the number of bears seen at the Dundas Polynya is affected more by seal densities in nearby areas such as Wellington Channel, which has high ringed seal densities (Kingsley et al. 1985), than by ice conditions or walrus numbers in the Pioneer Channel.

### Sightings and Behaviour of Walruses

The presence of walruses in and adjacent to the Dundas Polynya was confirmed by continual underwater vocalizations heard on our monitoring and recording equipment. Walruses were also heard or seen throughout eastern Penny Strait and Queens Channel on most helicopter surveys. Even in mid-February, some walruses hauled out on most days when winds were light, and after early April, over 60 animals, scattered in many small groups, were counted several times from the observation hut on sunny calm days.

All walruses we approached on the sea ice or observed from the hut or the helicopter were within a metre of their haulout holes, often with their hind limbs (more frequently than their forelimbs) partially in the water. The

ice at the edge of the breathing holes is smooth and slippery from the movements of water and animals, and is often thin enough to bend and slope into the water beneath the weight of 1 walrus. In these circumstances, a slight movement by a walrus allows it to slide into the water.

Females and calves usually hauled out in groups of 4 or more, were more vigilant than all-male groups, and were easily disturbed. We sometimes saw them rush into the water even when we could see no cause for the disturbance. In groups of females and young, the calves were as near, or nearer, the water than the adults. Although calves often slept, the females remained alert.

In contrast, adult male walruses were much less easily disturbed when hauled out and more reluctant to enter the water. People or bears could often approach to within a few metres. When approached closely, large male walruses often backed into the water slowly, ready to fight with their tusks if necessary.

Bears are able to use rough ice for cover to get close to a walrus before charging, which could be particularly dangerous to subadult animals that are less capable of fending off a bear. Smaller walruses hauled up alone often entered the water head-first shortly after a human, or in some observed instances, a bear, was detected. If several male walruses were hauled out together, the largest males tended to lie furthest from the hole, with the subadults nearest. The subadults were more restless and possibly more observant of predators. The combination of being watchful and nearest the water probably increased their chances of escaping safely from a charging bear that must first face the tusks of the larger male walruses.

Stirling (1984) observed 20 or more walruses give a coordinated threat display to a young adult female polar bear that had been hunting along the edge of the Dundas Polynya and scaring hauled-out walruses into the water. The walruses swam rapidly toward the bear and a few larger individuals at the front of the group slapped the water with their hind flippers and made sufficient noise to frighten the bear from the area.

All these observations suggest that predation by polar bears on walruses, or at least the threat of it, occurs frequently enough that walruses have evolved behavioural responses to reduce the risk. However, unlike the other northern ice-inhabiting seals, which defecate predominantly in the water, possibly to reduce their scent around a breathing hole (Stirling 1977), walruses often defecate on the ice surface. Possibly this indicates polar bears are not as serious a threat to walruses as they are to the smaller phocids.

### Evidence of Predation

Between 1981 and 1989, we found evidence of 10 walrus carcasses that we believe were wounded or killed by polar bears (Fig. 1). The date of death is known only for the kill at site 2 where the bear was observed killing a large adult male walrus and pulling it from its haulout hole (D. Grant, pers. commun.). All the other carcasses were frozen and partially eaten when found. Wind-blown snow often obscured the bear tracks in the area, making it difficult to reconstruct the attack, but the presence of bear claw marks, blood smears, and scratching marks made by walrus flippers indicated an interaction had occurred. In 2 cases, the haulout hole near the carcass was still unfrozen, suggesting the walrus was killed on the ice before they could escape, and that freezing-out was not a factor. There was blood soaked into the snow beneath the head of the adult male found dead in February 1987 at the shoreline tidal cracks below our camp (site 11), suggesting that a bear killed him, though possibly only after the ice shifted and he was frozen out. At 6 of 7 sites of kills or probable kills, polar bears were feeding on the carcass when it was sighted, but we did not know if they were predators or scavengers.

Although walrus hit each other on the neck and shoulder with their tusks when fighting, they are protected by a thick skin. Most wounds are superficial and bleeding is limited. At site 3, there was no carcass, but from the tracks we determined a bear had stalked the walrus from a distance, using a ridge of rough ice to conceal itself until it was close enough to charge the walrus as it lay by its haulout hole at the edge of a frozen-in multiyear floe. There was blood sprayed on the snow at 3 separate breathing holes around the edge of the floe in a pattern that probably resulted from the blood being mixed with expired air from the nostrils. We suspect the bear had time to hit the walrus on the head with a paw, or bite it on the face or nose, before the walrus escaped into the water. The bear's tracks went to all 3 holes, suggesting that it tried unsuccessfully to capture the walrus for some time after the initial attempt, possibly because the wounded animal kept resurfacing at different holes to breathe. We also found unusual amounts of blood that appeared to be from wounding attacks at breathing holes at sites 5 and 9, but it was difficult to interpret what had happened because most of the tracks were covered by drifted snow.

In spring 1976, T. Eley (Alas. Dep. Fish and Game, Fairbanks, unpubl. data) tracked polar bears as part of a study on polar bear predation. He recorded 1 kill of a young yearling walrus by a polar bear at Cape Lisburne, Alaska. On 13 June 1987, about 60 km northeast of Point

Barrow, Alaska, K. Frost (pers. commun.) observed a large male polar bear dragging a medium-sized adult male walrus, with approximately 25-cm tusks, out of the water at the edge of a floe. The walrus was bleeding profusely, indicating it had just been killed. It had apparently been alone at the edge of a floe in an area of broken ice, and was farther east than walrus normally occur in that region.

### Vulnerability to Predation

Certain aspects of the sea ice habitat in the central Canadian High Arctic may make walrus more vulnerable than they are in the pack ice. In particular, breathing and haulout holes are often small, prone to freezing over, and probably more difficult for several animals to escape through quickly. Also, the high relief of multiyear floes or of active pressure ice near polynyas gives good cover for stalking bears.

Between freeze-up and break-up, movements of walrus in our study area are restricted because of the paucity of breathing holes and the small size of polynyas. The dependence on grounded small multiyear floes to breathe by and haul out on (e.g., Stirling et al. 1981; Fig. 3) could markedly reduce movements during the winter, especially in years when there are few floes present. This reduced ability to move elsewhere could make walrus vulnerable to a high degree of harassment by polar bears. For example, on 24 April 1980, I. Stirling and T.G. Smith (pers. commun.) found a subadult male walrus, with 20-cm tusks, hauled out beside an open breathing hole at the edge of a small (5-m diameter) iceberg frozen into the annual ice. The walrus was covered with frost and ice, suggesting it had been hauled out for several days. The walrus could have been stranded there; no other walrus, breathing holes, or open cracks were found in the area.

Walrus that haul out to rest and sleep adjacent to small breathing holes also increase their vulnerability to predation because of the possibility of the hole being closed by ice movement, or freezing over in cold weather. One dead walrus found by Kiliaan and Stirling (1978) had blood on the surface of her haulout hole, suggesting she may have been killed by a polar bear after her hole had frozen over. In April 1981, M. Taylor (pers. commun.) found a subadult walrus carcass, with about 10-cm tusks, about 20 km south of Maxwell Bay on the south coast of Devon Island. There was no open water nearby and it appeared the animal had been killed by a polar bear after it became stranded. The adult female first observed at site 4 (Fig. 1) on 12 April 1984 was in an area of thin but unbroken ice near shore. We back-tracked her in a nearly

straight line for more than 6 km offshore without reaching the beginning of her trail. In that distance, we counted 10 spots where she had rested long enough to melt a depression into the ice, suggesting she had travelled across the ice for at least 1 and possibly more days. She did not move farther and was at the same site near shore the following day, still apparently healthy and making defending lunges at us with her tusks. When that area was next searched 25 April, the only open water within 10 km was a 500-m diameter polynya within 1 km of where she was last seen. This polynya recurs at the same location each year and it is possible she knew the area or detected the thinner ice. We found no sign of blood or other evidence she had been attacked while frozen out.

Most authors suggest polar bears prey on young walrus only (Loughrey 1959, Fay 1985). This results, at least in part, from the perception that polar bears cannot kill large walrus, or do so only with great difficulty. This impression is reinforced by anecdotal suggestions that a large walrus may occasionally kill an attacking polar bear (Freuchen 1935, Kiliaan and Stirling 1978). However, the relationship between the weight of a solitary predator and the maximum size of prey regularly killed predicts a 400-kg adult male polar bear should be able to kill prey in excess of 600 kg (Earle 1987). That would include adult walrus. The 2 adult male walrus observed being dragged from the water (Fig. 1, site 2; K. Frost, pers. commun.) were both killed by single large, probably male, polar bears. Presumed adult male polar bears have also been recorded killing and hauling from the water adult belugas weighing over 600 kg (Lowry et al. 1987) and adult female narwhals (*Monodon monoceros*) (Smith and Sjare 1990). We suggest female polar bears with cubs and subadult bears seen feeding on walrus carcasses were only scavenging. Polar bears are opportunistic hunters, however, and we have observed bears of all age- and sex-classes stalk walrus; a subadult or young adult bear would attempt to kill a walrus if the conditions were right.

Although walrus may not be killed frequently, the energetic return to a bear from killing one might justify the amount of time spent unsuccessfully investigating and stalking hauled-out animals. A carcass could be fed upon for a protracted period by a large bear even when scavenged by other bears. For example, the carcass below our observation hut was already partially eaten when we occupied the camp on 23 February 1987, but bears continued to feed on it until late April.

From our observations at the Dundas Polynya (Table 1), it seems possible a walrus could see a polar bear every few days throughout the winter. We have no data for com-

parison, but we suspect this is a higher encounter rate than occurs in the pack ice. Part of the reason the relationship is not better documented is that most areas where the 2 species overlap are generally inaccessible, so encounters are simply not recorded. Polar bears are often sighted near aggregations of walrus in the ice front of the Chukchi Sea during mid-summer and early autumn surveys (J.J. Burns, pers. commun.) but there are few data on kills. Although encounter and predation rates likely vary among different habitats, we suggest that polar bears are important predators of walrus in our study area. The data also suggest that subadult walrus are most vulnerable, but that large male bears are capable of also killing adult male walrus. Polar bears may also kill more walrus in pack ice situations than has been reported previously.

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