



Press release

Final allocation of polar bear quota for 2006

Based on the decision made by the Greenland Cabinet on fixing the quota for polar bears at 150 for 2006, the Minister for Fisheries and Hunting has determined, after consultation with the Association of Fishermen and Hunters (KNAPK) and the National Association of Local Authorities in Greenland (KANUKOKA), that the final distribution between the local authorities shall be as follows:

20. februar 2006
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Local authority	Quota 2006
Nanortalik	2
Qaqortoq	1
Narsaq	1
Paamiut	1
Nuuk	1
Maniitsoq	2
Sisimiut	2
Kangaatsiaq	2
Aasiaat	2
Qasigianniguit	1
Ilulissat	1
Qeqertarsuaq	2
Uummannaq	2
Upernavik	50
Qaanaaq	30
Ammassalik	20
Ittoqqortoormiit	30
Quota, total:	150

A new executive order on the protection and hunting of polar bears came into force on 15 October 2005. Some of the most important amendments to the new executive order are the introduction of quotas from 1 January 2006 and the protection of cubs (regardless of their age) and females accompanied by cubs. As previously, the period of protection is from 1 July to 31 August. However, in the local authorities of Ittoqqortoormiit and

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Ammassalik this period is from 1 August to 30 September,. The period of protection applies to all polar bears – also solitary males.

The local authorities that have been allocated a quota are to administer the issuance and distribution of numbered permits among the applicants. Only applicants holding a valid commercial hunting licence can obtain a permit to hunt polar bears. The local authorities should also control that the allocated municipal quotas are not exceeded.

After each hunt, the permit should be stamped by the local authority or settlement office, and no parts of the polar bear may be sold unless they are accompanied by a copy of the stamped permit, with the signature of the holder of the permit. At the same time as the permit is stamped, a completed catch report shall be submitted to the local authority or settlement office. A completed catch report shall be submitted to the local authority or settlement office, even if no parts of the polar bear are to be sold.

Finn Karlsen
Minister for Fisheries and Hunting

Table 2. Mean (and standard error [SE]) of natural (i.e., unharvested) survival parameters used in the assessment of risk for populations in Table 1, and best estimates of parameters of natural survival for populations modeled using RISKMAN. *It is to these rates that anticipated annual removal rate are added for simulation.*

Population	Males					Females				
	Survival estimates of unharvested bears					Survival estimates of unharvested bears				
	COY	1-4	5-20	>20		COY	1-4	5-20	>20	
LS ¹	0.634 (0.123)	0.838 (0.075)	0.974 (0.030)	0.715 (0.095)		0.750 (0.104)	0.898 (0.005)	0.946 (0.018)	0.771 (0.054)	
NW ¹	0.634 (0.123)	0.838 (0.075)	0.974 (0.030)	0.715 (0.095)		0.750 (0.104)	0.898 (0.005)	0.946 (0.018)	0.771 (0.054)	
KB	0.345 (0.200)	0.663 (0.197)	0.997 (0.026)	0.997 (0.026)		0.410 (0.200)	0.756 (0.159)	0.997 (0.026)	0.997 (0.026)	
BB	0.570 (0.094)	0.938 (0.045)	0.947 (0.022)	0.887 (0.060)		0.620 (0.095)	0.938 (0.042)	0.953 (0.020)	0.919 (0.050)	
VM	0.448 (0.216)	0.924 (0.109)	0.924 (0.109)	0.924 (0.109)		0.693 (0.183)	0.957 (0.028)	0.957 (0.028)	0.957 (0.028)	
FB ²	0.570 (0.094)	0.938 (0.045)	0.947 (0.022)	0.887 (0.060)		0.620 (0.095)	0.938 (0.042)	0.953 (0.020)	0.919 (0.050)	
GB	0.817 (0.201)	0.907 (0.084)	0.959 (0.039)	0.959 (0.039)		0.817 (0.201)	0.907 (0.084)	0.959 (0.039)	0.959 (0.039)	
MC	0.619 (0.151)	0.983 (0.034)	0.921 (0.046)	0.921 (0.046)		0.619 (0.151)	0.983 (0.034)	0.977 (0.033)	0.977 (0.033)	
SH ²	0.570 (0.094)	0.938 (0.045)	0.947 (0.022)	0.887 (0.060)		0.620 (0.095)	0.938 (0.042)	0.953 (0.020)	0.919 (0.050)	
WH ³	0.500 (0.033)	0.870 (0.026)	0.940 (0.010)	0.780 (0.023)		0.610 (0.028)	0.920 (0.020)	0.940 (0.008)	0.810 (0.020)	
DS ⁴	0.570 (0.094)	0.938 (0.045)	0.947 (0.022)	0.887 (0.060)		0.620 (0.095)	0.938 (0.042)	0.953 (0.020)	0.919 (0.050)	

¹ Survival estimates pooled for LS and NW (see text for LS and NW).

² Incorporates 1993-1998 BB data (Taylor et al. 2005b).

³ Based on survival rates provided by E. Regher (USGS, Alaska Science Centre, Anchorage, AK). Both cub and yearling survival rates are 0.50 for males and 0.610 for females; subadult survival (ages 2-4) from WH is 0.870.

⁴ Incorporates 1993-1998 BB data (Taylor et al. 2005b).

Table 3. Mean (and standard error [SE]) of reproductive parameters (standing age capture data) used in the assessment of risk for populations in Table 1, and best estimates of parameters to model FB, SH, WH, DS, NB, and SB.

Population	Cub Litter size	4-yr-female litter-production rate	5-yr-female litter-production rate	6-yr-female litter-production rate	>6-yr-female litter-production rate	Proportion of male cubs
LS	1.688 (0.012)	0.000 (0)	0.107 (0.050)	0.312 (0.210)	0.954 (0.083)	0.531 (0.048)
NW	1.714 (0.081)	0.000 (0)	0.000 (0)	0.000 (0)	0.689 (0.534)	0.544 (0.066)
KB	1.667 (0.083)	0.000 (0)	0.000 (0)	0.357 (0.731)	0.478 (0.085)	0.426 (0.029)
BB	1.587 (0.073)	0.096 (0.120)	0.881 (0.398)	1.000 (0.167)	1.000 (0.167)	0.493 (0.029)
VM	1.640 (0.125)	0.000 (0)	0.623 (0.414)	0.872 (0.712)	0.872 (0.712)	0.535 (0.118)
FB ¹	1.587 (0.073)	0.096 (0.120)	0.881 (0.398)	1.000 (0.167)	1.000 (0.167)	0.493 (0.029)
GB	1.648 (0.098)	0.000 (0)	0.194 (0.178)	0.467 (0.168)	0.334 (0.300)	0.965 (0.091)
MC	1.680 (0.147)	0.000 (0)	0.111 (0.101)	0.191 (0.289)	0.604 (0.928)	0.545 (0.057)
SH ²	1.575 (0.116)	0.087 (0.202)	0.966 (0.821)	0.967 (0.022)	0.967 (0.022)	0.467 (0.086)
WH ²	1.540 (0.098)	0.000 (0)	0.257 (0.442)	0.950 (0.352)	0.950 (0.022)	0.490 (0.022)
DS ^{1,2}	1.587 (0.073)	0.096 (0.120)	0.881 (0.398)	1.000 (0.167)	1.000 (0.167)	0.493 (0.029)

¹Reproductive estimates from BB (Taylor et al. 2005).

²Best estimates for modeling exercise only (from standing age capture data).

Status of the Polar Bear

IUCN/SSC Polar Bear Specialist Group

Status and Distribution

Polar bears are not evenly distributed throughout the Arctic, nor do they comprise a single nomadic cosmopolitan population, but rather occur in 20 relatively discrete populations. The total number of polar bears worldwide is estimated to be 21,500-25,000. The following population summaries and Table 1, which summarises the current population estimates, harvest data, and provides a qualified status determination, are the result of discussions of the IUCN/SSC Polar Bear Specialist Group that were held in Nuuk, Greenland in June 2001 and based on the status reports and revisions given by each nation.

East Greenland

No inventories have been conducted in recent years to determine the size of the polar bear population in eastern Greenland. Although polar bears range widely along the entire coast of eastern Greenland, various studies have indicated that more or less resident groups of bears may occur within this range (Born 1995, Sandell *et al.* 2001). Although there is little evidence of a genetic difference between populations in the eastern Greenland and Svalbard – Franz Josef Land regions (Paetkau *et al.* 1999), satellite telemetry and movement of marked animals indicate that the exchange between these populations is minimal (Wiig 1995, Born *et al.* 1997).

From 1979-1998, the annual catch in eastern Greenland averaged 69 bears (range, 26-129 bears per year). However, an additional annual catch of about 8 bears taken in southwestern Greenland, south of 62° N, must be added (*i.e.*, 77 bears) to the catch statistics because polar bears arrive in SW Greenland with the drift ice that comes around the southern tip from eastern Greenland (Sandell *et al.* 2001).

Despite an increasing practice by hunters from Scoresby Sound in Central East Greenland to go further north to take polar bears during spring, there is no information to indicate an overall increase in hunting by East Greenlanders (Sandell *et al.* 2001). Based on harvest sampling in Scoresby Sound (A.

Rosing-Asvid, unpubl. data) and an interview survey in Scoresby Sound and Ammassalik municipalities (Sandell *et al.* 2001), the proportion of adult (=independent) female polar bears in the catch in eastern Greenland is estimated at 0.38.

Given the estimates of the proportion of adult females in the catch and an annual catch of about 80 bears (*i.e.*, East and SW Greenland combined), a minimum population of 2000 individuals would be needed to sustain this take. However, the actual number of animals in the exploited population is unknown.

During the last decades, the ice in the East Greenland area has diminished both in extent and thickness (*e.g.*, Parkinson 2000). Furthermore, polar bears in East Greenland have high body burdens of organic pollutants (Norstrom *et al.* 1998). In 1999, an instance of a pseudohermaphroditic female polar bear was found in East Greenland (Dietz *et al.* 2001), which may be related to the high levels of persistent organic pollutants (Wiig *et al.* 1998).

The effects of global warming and persistent organic pollutants on East Greenland polar bears have not been documented. However, with reference to what has been found in other parts of the Arctic (*e.g.*, Hudson Bay and Svalbard), these environmental changes cause concern about how polar bears in East Greenland may be negatively affected.

Barents Sea

The population size of the Barents Sea is unknown. The only population estimate was based on ship surveys and den counts in the early 1980s (Larsen 1972, 1986) and is too out-dated to be of use. Denning in this population occurs in both Svalbard and Franz Josef Land (Belikov and Matveev 1983, Larsen 1985). Both movement and population studies using telemetry and mark-recapture have been conducted in the western parts of the population at intervals beginning in the 1970s (Larsen 1972, 1986, Wiig 1995). Studies of movements using telemetry indicate that some polar bears associated with Svalbard are very restricted in

their movements but bears from the Barents Sea move widely between Svalbard and Franz Josef Land (Wiig 1995, Mauritzen *et al.* 2001). Population boundaries are based on satellite telemetry data (Mauritzen *et al.* in press) and the current boundaries represent a change from earlier reports. Extent of overlap between the Barents Sea and East Greenland populations is unknown but may be limited (Born *et al.* 1997). Gene flow from East Greenland to Franz Josef Land is high (Paetkau *et al.* 1999). It is possible that over harvest in NE Greenland has reduced the population density in the Greenland Sea but lack of research in this area precludes assessment. The Barents Sea population is currently unharvested with the exception of bears killed in defence of life and property (Gjertz and Persen 1987, Gjertz *et al.* 1993, 1995). The population associated was depleted by over-harvest but a total ban on hunting in 1973 in Norway and in 1956 in Russia allowed the population to increase (Larsen 1986, Prestrud and Stirling 1994). Trend information after the mid-1980s is lacking. High levels of PCBs have been detected in a sample of polar bears from this area, which raises the concern that industrial activity, and contaminants may cause environmental degradation (Skåre *et al.* 1994, Bernhoft *et al.* 1997, Norstrom *et al.* 1998) but recent studies suggest a decline and levelling of some pollutants (Henriksen *et al.* 2001). Heavy metal levels have been assessed but do not appear to present a threat (Norheim *et al.* 1992). Oil exploration in polar bear habitat may increase in the near future (Hansson *et al.* 1990). The natural history of this population is reasonably well known (Lønø 1970).

Kara Sea

This population includes eastern portions of the Barents Sea, the Franz Josef Land archipelago, and the Kara Sea, including the Novaya Zemlya archipelago. The information for the Kara and Barents Seas in the vicinity of Franz Josef Land and Novaya Zemlya, is mainly based on aerial surveys and den counts (Parovshikov 1965, Belikov and Maeteev 1983, Uspenski 1989, Belikov *et al.* 1991, Belikov and Gorbunov 1991, Belikov 1993). Studies of movements, using telemetry, have been done throughout the area but data analyses to define the boundaries are incomplete. More extensive telemetry studies in the Svalbard area also suggest that the population associated with Svalbard could be regarded as geographically distinct (Wiig 1995). The population estimate should be regarded as

preliminary. Reported harvest activities have been limited to defence kills and a small but unknown number of illegal kills. The population is not thought to be impacted by current harvest levels. However, contaminant levels in rivers flowing into this area and recent information on nuclear and industrial waste disposal raise concerns about the possibility of environmental damage.

Laptev Sea

The Laptev population area includes the western half of the East Siberian Sea, the entire Laptev Sea, including the Novosibirsk and Severnaya Zemlya islands. Telemetry data from the East Siberian and the Chukchi seas support the eastern boundary (Belikov *et al.* 1998). Recent telemetry data from the Kara and Laptev seas indicate the western boundary is probably Severnaya Zemlya, but data analyses are incomplete. The estimate of population size for the Laptev Sea is based on aerial surveys and den counts (Kischinski 1969, Belikov and Randala 1987, Uspenski 1989, Belikov *et al.* 1991, Belikov and Gorbunov 1991, Belikov 1993) and should be regarded as preliminary. Reported harvest activities here are limited to defence kills and a small but unknown number of illegal kills. The current levels of harvest are not thought to be having a detrimental impact on the population.

Chukchi Sea

This population occupies the Chukchi Sea adjacent to Alaska and Russia. Co-operative studies between USA and Russia, using telemetry to study movements, have confirmed that polar bears in the area are widely distributed on the pack ice of the northern Bering, Chukchi, and eastern portions of the East Siberian seas (Garner *et al.* 1990, 1994, 1995). Based upon those telemetry data, the accepted western boundary of the population is near Chaunskaya Bay in northeastern Russia. The eastern boundary is Icy Cape, Alaska, which also is the accepted western boundary of the Southern Beaufort Sea population (Amstrup *et al.* 1986, Amstrup and DeMaster 1988, Garner *et al.* 1990, Amstrup *et al.* 1995). Estimates of the size of the population have been derived from observations of dens, and aerial surveys (Chelintsev 1977, Stishov 1991a,b, Stishov *et al.* 1991). Those estimates, however, are considered unreliable. Similarly, reliable estimates of population size based upon mark and recapture have not been available for this region. The Chukchi

population is believed to have increased after the level of harvest was reduced in 1972. However, the degree of increase and absolute numbers of animals remain a research challenge.

Legal harvesting activities are currently restricted to Inuit in Western Alaska and appear to be sustainable at current levels. However, recent reports of illegal harvest in Russia are cause for concern, particularly because the magnitude of this illegal kill is not known. Legal harvest rates have remained approximately constant, and polar bears appear to be abundant in the Chukchi Sea; however, the unknown rate of illegal take makes the stationary designation uncertain and tentative.

Recent analyses using new spatial modeling techniques suggest an altered view of the boundaries of this population. These analyses suggest that the polar bears occurring in the Chukchi Sea area, as currently defined, should be divided into two groups. These are the eastern portion of the previously described Chukchi sea population (hereafter called Eastern Chukchi [EC]) and the Western Chukchi Sea population. The WC group spends most of its time around Wrangel Island and the northern Chukchi coast. The EC spends most of its time along the northwestern coast of Alaska. This is a soft boundary, however. Proportional representation of WC bears increases while representation of EC bears decreases on a cline from east to west. The population data available for this region are too rudimentary to subdivide among these new putative groups. Also, the new methods for estimating population bounds have not yet been reviewed. Therefore, these new descriptions have not been included in this status report. When the new methods for defining population bounds have been reviewed and published, and after they have withstood tests of time and ongoing work, they will be incorporated into future status reports. Until then, we will retain the boundaries of this population as described above and as reported previously (Derocher *et al.* 1998).

Southern Beaufort Sea (SB)

The southern Beaufort Sea polar bear population is shared between Canada and Alaska. During the early 1980s, radio-collared polar bears were followed from the Canadian Beaufort Sea into the eastern Chukchi Sea of Alaska (Amstrup *et al.* 1986, Amstrup and DeMaster 1988). Telemetry data

combined with earlier returns of tagged individuals suggested that bears of the SBS comprised a single population with an eastern boundary between Paulatuk and Ballie Island, NWT, Canada, and a western boundary near Icy Cape, Alaska (Amstrup *et al.* 1986, Amstrup and DeMaster 1988, Stirling *et al.* 1988). Recognition that these animals are shared by Canada and Alaska prompted development of the "Polar Bear Management Agreement for the Southern Beaufort Sea" (Agreement). The Agreement, between the Inupiat hunters of Alaska and the Inuvialuit hunters of Canada, was ratified by both parties in 1988. The text of the Agreement included provisions to protect bears in dens and females with cubs, and stated that the annual sustainable harvest from the southern Beaufort Sea (SBS) polar bear population would be shared between the two jurisdictions. Harvest levels also were to be reviewed annually in light of the best scientific information available (Treseder and Carpenter 1989, Nageak *et al.* 1991).

A principal assumption of the Agreement was that polar bears harvested within the region identified came from one SBS population. Early estimates suggested the size of this population was approximately 1800, although uneven sampling was known to compromise the precision of that estimate (Amstrup 1985, Amstrup *et al.* 1986, Amstrup and DeMaster 1988).

Research incorporating mark and recapture and radio-telemetry has continued on a nearly annual basis through the present time. Recent analyses using new spatial modeling techniques have altered our view of the bounds and size of this population. These analyses suggest that the polar bears occurring in the SBS area, as currently defined, should be divided into two groups. These are the eastern portion of the previously described Chukchi sea population (hereafter called Eastern Chukchi [EC]) and the SBS population. The SBS and the EC populations comprise most of the bears from this region. The boundary between these groups occurs near Lonely, which is approximately 140 km east of Barrow Alaska on the Beaufort Sea coast. This is a soft boundary, however. Proportional representation of EC bears increases while representation of SBS bears decreases on a cline from east to west.

Concurrent with recognition of possible new boundaries are new population estimating techniques suggesting the total numbers of bears in this region

are higher than previously thought (Amstrup *et al.* 2001, McDonald and Amstrup 2001). Although the new population sizes have been published, the new methods for estimating population bounds have not yet been reviewed. Therefore, the region to which the new estimate applies is still under investigation. The revised population descriptions and estimates, therefore, are not incorporated into this status report. If completed analyses and subsequent reviews substantiate the above population definitions, they will be incorporated into subsequent status reports. For purposes of this report, however, we will continue to use the previously published bounds and size estimates for the SBS population.

Northern Beaufort Sea (NB)

Studies of movements and population estimates of polar bears in the eastern Beaufort Sea have been conducted using telemetry and mark-recapture at intervals since the early-1970s (Stirling *et al.* 1975, 1988, DeMaster *et al.* 1980, Lunn *et al.* 1995). As a result, it was realised that there were separate populations in the North and South Beaufort Sea areas and not a single population as was suspected initially (Stirling *et al.* 1988, Taylor and Lee 1995, Amstrup 1995, Bethke *et al.* 1996). The density of polar bears using the multi-year ice of the northernmost area was lower than it was further south. The population estimate of 1200 (Stirling *et al.* 1988) is believed to be unbiased and the current harvest appears to be within sustainable limits.

Queen Elizabeth (QE)

The Queen Elizabeth population is a geographic catch-all population to account for the remainder of northern Canada. Polar bears occur at low densities here, but systematic inventory studies have not been done. This area is characterised by heavy multi-year ice, except for a recurring lead system that runs along the Queen Elizabeth Islands from the northeastern Beaufort Sea to northern Greenland. Perhaps 200 polar bears are resident in this area, and others are known to move through the area or use it for a portion of the year (Durner and Amstrup 1995, Lunn *et al.* 1995). This population is unharvested except for an occasional defence kill. Given the low numbers and low rate of reproduction that is likely, even a small amount of incidental take could cause population depletion if visitation to this remote area becomes more common.

Viscount Melville Sound (VM)

A five-year study of movements and population size, using telemetry and mark-recapture, was completed in 1992 (Messier *et al.* 1992, 1994). Population boundaries were based on the observed movements of female polar bears with satellite radio collars and movements of bears tagged in and out of the study area (Bethke *et al.* 1996, Taylor *et al.* 2001). The population estimate of 230 is accurate with a 14% CV (M.K. Taylor, unpubl. data). Because this population occupies such a large geographic area, it was thought to be more abundant and productive at the time the original quotas were allocated in the mid-1970s. However, this area is characterised by heavy multi-year ice and low densities of ringed seals (Kingsley *et al.* 1985) and the productivity and density of polar bears was lower than was initially expected. Consequently, quotas were reduced and a five-year moratorium on hunting began in 1994/95. Hunting resumed in 1999/2000 with a quota of 4. While it is expected that only males will be taken, a kill of one female per year will be allowed.

Norwegian Bay (NW)

The Norwegian Bay population is bounded by heavy multi-year ice to the west, islands to the north, east, and west and polynyas to the south (Stirling 1980, 1997, Taylor *et al.* 2001). From data collected during mark-recapture studies, and from satellite tracking of adult female polar bears, it appears that most of the polar bears in this population are concentrated along the coastal tide cracks and ridges along the north, east, and southern boundaries (Taylor *et al.* 2001). The preponderance of heavy multi-year ice through most of the central and western areas has resulted in low densities of ringed seals (Kingsley *et al.* 1985) and, consequently, low densities of polar bears. Based on preliminary data, the current estimate for this population is 100 (M.K. Taylor, unpubl. data). The estimate of population size is currently under revision based on the analysis of mark-recapture data collected during an inventory of Canadian High Arctic populations (1993-97).

The harvest quota for this population was reduced to four (three males and one female) in 1996 and appears to be sustainable.

Lancaster Sound (LS)

The central and western portion of the area occupied by the Lancaster Sound population of polar bears is characterised by high biological productivity and high densities of ringed seals and polar bears (Schweinsburg *et al.* 1982, Stirling *et al.* 1984, Kingsley *et al.* 1985, Welch *et al.* 1992). The western third of this region (eastern Viscount Melville Sound) is dominated by heavy multi-year ice and apparently low biological productivity, as evidenced by low densities of ringed seals (Kingsley *et al.* 1985). In the spring and summer, densities of polar bears in the western third of the area occupied by the Lancaster Sound population are low but, as break-up occurs, polar bears move west to summer on the multi-year pack. Recent information on the movements of adult female polar bears monitored by satellite radio collars, and mark-recapture data from past years, has shown that this population is distinct from the adjoining Viscount Melville Sound, M'Clintock Channel, Gulf of Boothia, Baffin Bay and Norwegian Bay populations (Taylor *et al.* 2001). The current estimate of 1700 is based on a preliminary analysis of both historical and current mark-recapture data, which compares favourably with a previous estimate of 1675 that included Norwegian Bay (Stirling *et al.* 1984), and was considered to be conservative. The estimate of population size is currently under revision based on the analysis of mark-recapture data collected during an inventory of Canadian High Arctic populations (1993-97).

M'Clintock Channel (MC)

The current population boundaries are based on recovery of tagged bears and movements of adult females with satellite radio-collars in adjacent areas (Taylor and Lee 1995, Taylor *et al.* 2001). These boundaries appear to be a consequence of large islands to the east and west, the mainland to the south, and the heavy multi-year ice in Viscount Melville Sound to the north. A six-year mark-recapture population study covered most of this area in the mid-1970s (Furnell and Schweinsburg 1984). Subsequently, a population estimate of 900 was derived from the data collected within the boundaries proposed for the M'Clintock Channel population, as part of a study conducted over a larger area of the Central Arctic (Furnell and Schweinsburg 1984). More recently, local hunters suggested 900 might be too high so the Canadian Polar Bear Technical Committee accepted a recommendation to reduce the estimate to 700.

Following the completion of a mark-recapture inventory in spring 2000, preliminary population estimates were calculated that varied from 238 to 399, depending on whether or not estimates of natural mortality were included and on whether capture data from different years were pooled or treated separately. In February 2001, the Canadian Polar Bear Technical Committee reviewed these estimates and recommended the most conservative estimate of 240, pending a more detailed analysis of the capture data. This analysis has been completed (J. Laake and M.K. Taylor, unpubl. data); the best current estimate is 350 (367, SE=191, 95% asymmetrical CI=141-958).

The Government of Nunavut has recommended the implementation of a moratorium on hunting for the 2001/2002 hunting season.

Gulf of Boothia (GB)

The population boundaries are based on both movements of tagged bears, movements of adult females with satellite radio-collars in adjacent areas, and interpretations by local Inuit hunters of how local conditions influence the movements of polar bears in the area (Stirling *et al.* 1978, Taylor and Lee 1995, Taylor *et al.* 2001). An initial population estimate of 333 was derived from the data collected within the boundaries proposed for the Gulf of Boothia population, as part of a study conducted over a larger area of the Central Arctic (Furnell and Schweinsburg 1984). Although population data from this area are limited, local hunters report that numbers have remained constant or increased. The Canadian Polar Bear Technical Committee agreed to an increase in the population estimate from 333 to 900, on an interim basis pending completion of satellite tracking and mark-recapture studies, based on recognition that the central and eastern portions of the area were not sampled in the earlier study and the beliefs of local Inuit hunters about polar bear abundance in the area. The status was listed as stationary (Table 1), but this designation should be regarded as uncertain and tentative. A satellite telemetry study of movements and a mark-recapture population inventory began in 1998.

Foxe Basin (FB)

Based on 12 years of mark-recapture studies, a limited amount of tracking of female bears with

conventional radios, and satellite tracking of adult females in western Hudson Bay, the Foxe Basin population appears to occur in Foxe Basin, northern Hudson Bay, and the western end of Hudson Strait (Taylor and Lee 1995). The current estimate of 2300 (SE=350) was developed in 1996 (M.K. Taylor, unpubl. data) from a mark-recapture program based on tetracycline biomarkers (Taylor and Lee 1994). During the ice-free season, polar bears were concentrated on Southampton Island and along the Wager Bay coast. However, significant numbers of bears were also encountered on the islands and coastal regions throughout the Foxe Basin area. The marking effort was conducted during the ice-free season, and distributed throughout the entire area. The population estimate is believed to be accurate. The previous harvest quotas are believed to have reduced the population from about 3000 in the early 1970s to about 2300 (15% CV) in 1996. The Nunavut harvest quota for this population has been revised to levels that will permit slow recovery of this population, provided that the kill in Québec does not increase. Co-management discussions with Québec are ongoing.

Western Hudson Bay (WH)

The distribution, abundance, and population boundaries of this population have been the subject of research programs since the late 1960s (Stirling *et al.* 1977, Derocher and Stirling 1995, Lunn *et al.* 1997, Taylor and Lee 1995). Over 80% of the adult population is marked and there are extensive records from mark-recapture studies and the return of tags from bears killed by Inuit hunters. This population appears to be geographically segregated during the open-water season, although it mixes with those of Southern Hudson Bay and Foxe Basin on the Hudson Bay sea ice during the winter and spring (Stirling *et al.* 1977, Derocher and Stirling 1990, Stirling and Derocher 1993, Taylor and Lee 1995). The size of this population was estimated to be 1200 in autumn 1995 (Lunn *et al.* 1997), and the current harvest is believed to be sustainable. The harvest sex ratio of 2 males per female has resulted in a population composition that is 58% female and 42% male (Derocher *et al.* 1997).

Over the past two decades, the condition of adult male and female bears and the proportion of independent yearling bears caught during the open water season have declined significantly (Derocher and Stirling 1992, Stirling and Lunn 1997, Stirling *et*

al. 1999). Over the same period of time, the date of break-up of the sea-ice in western Hudson Bay has advanced by two weeks (Stirling *et al.* 1999), which is probably due to spring air temperatures in the region warming at a rate of 0.2-0.3° C per decade since 1950 (Skinner *et al.* 1998). Stirling *et al.* (1999) documented that the timing of break-up was positively correlated with the condition of adult females (*i.e.*, the earlier the break-up the poorer the condition of the bears) and suggested that the declines in the various parameters measured in the polar bears have resulted from the trend toward earlier break-up, which in turn appears to be due to the long-term warming trend in spring temperatures.

Southern Hudson Bay (SH)

The population boundaries are based on the observed movements of marked bears, and telemetry studies (Jonkel *et al.* 1976, Kolenosky *et al.* 1992, Kolenosky and Prevett 1983, Stirling and Derocher 1993, Taylor and Lee 1995). Ongoing research using satellite-collared bears is aimed at refining the boundaries of this population (M. Obbard, M.K. Taylor and F. Messier, unpubl. data). The estimate of population numbers comes from a three-year (1984-1986) mark-recapture study, conducted mainly along the Ontario coastline (Kolenosky *et al.* 1992). This study and the more recent telemetry data have documented seasonal fidelity to the Ontario coast during the ice-free season, and intermixing with the Western Hudson Bay and Foxe Basin populations during the months when the bay is frozen over. In 1988, a population-modelling workshop resulted in the Canadian Polar Bear Technical Committee increasing the calculated population estimate from 763 to 1000 because portions of the eastern and western coastal areas were not included in the area sampled. Additionally, the area away from the coast may have been under-sampled due to the difficulty of locating polar bears inland in the boreal forest. Thus some classes of bears, especially pregnant females and females with cubs, may have been under-sampled. The estimate of 1000 is considered conservative, and the total harvest by Nunavut, Ontario, and Québec appears to be sustainable. Discussions between these jurisdictions on co-management and cooperative research are ongoing.

Kane Basin (KB)

Based on the movements of adult females with satellite radios and recaptures of tagged animals, the boundaries of the Kane Basin population are the North Water Polynya to the south, and Greenland and Ellesmere Island to the west, north, and east (Taylor *et al.* 2001). Polar bears in Kane Basin do not differ genetically from those in Baffin Bay (Paetkau *et al.* 1999). Prior to 1997, this population was essentially unharvested in Canadian territory because of its distance from Grise Fiord, the closest Canadian community and because conditions for travel there are typically difficult. However, this population has occasionally been harvested by hunters from Grise Fiord since 1997 and continues to be harvested on the Greenland side of Kane Basin. In some years, Greenland hunters have also harvested polar bears in western Kane Basin and Smith Sound (Rosing-Asvid and Born 1990, 1995).

Few polar bears were encountered by researchers along the Greenland coast 1994 through 1997, possibly because of intense harvest pressure there. Based on preliminary data from ongoing research (see Lancaster Sound summary), the population estimate of 200 would support a total cumulative harvest of eight per year at two males per female (M.K. Taylor, unpubl. data). The current best estimate of the Greenland kill is 10 per year (Born 2001), which is not sustainable. However, the actual number being taken by Greenland hunters is uncertain (Born 2001) and must be validated. The Canadian quota for this population is 5 and if Canadian Inuit continue to harvest from this area, over-harvest and population depletion could occur. Although the habitat appears suitable for polar bears on both the Greenland and Canadian sides of Kane Basin, the densities of polar bears on the Greenland (harvested) side were much lower than on the Canadian (unharvested) side; suggesting that this population may have been larger in past years, and could be managed for increase. Co-management discussions between Greenland and Canada are continuing, and Greenland has indicated its intention to move to a quota system.

Baffin Bay (BB)

Based on the movements of adult females with satellite radios and recaptures of tagged animals, the Baffin Bay population is bounded by the North Water Polynya to the north, Greenland to the east, and Baffin Island to the west (Taylor and Lee 1995, Taylor *et al.* 2001). A distinct southern boundary at

Cape Dyer, Baffin Island is evident from the movements of tagged bears (Stirling *et al.* 1980) and recent movement data from polar bears monitored by satellite telemetry (Taylor *et al.* 2001). A study of micro-satellite variation did not reveal any genetic differences between polar bears in Baffin Bay and Kane Basin, although Baffin Bay bears differed significantly from Davis Strait and Lancaster Sound bears (Paetkau *et al.* 1999). An initial population estimate of 300-600 bears was based on mark-recapture data collected in spring (1984-1989) in which the capture effort was restricted to shore-fast ice and the floe edge off northeast Baffin Island (R.E. Schweinsburg and L.J. Lee, unpubl. data). However, recent work has shown that an unknown proportion of the population is typically offshore during the spring and, therefore, unavailable for capture. A second study (1993-1997) was done in September and October, when all polar bears were ashore in summer retreat areas on Bylot and Baffin islands. The mark-recapture sampling in 1995 was compromised by an unexpected autumn outflow of multi-year ice from Lancaster Sound, Jones Sound, and the polar basin. This resulted in an unknown fraction of the polar bears from Baffin Bay remaining on the offshore pack ice where they were unavailable. A preliminary estimate of 2200 is based only on the 1993-1995 data and believed to be conservative (M.K. Taylor, unpubl. data). The estimate of population size is currently under revision based on the analysis of mark-recapture data collected during an inventory of Canadian High Arctic populations (1993-97).

This population is shared with Greenland, which does not limit the number of polar bears harvested. Based on the preliminary population estimate and the most recent harvest information (Born 2001), it appears the population may be over-harvested. Better information on population numbers and validation of the Greenland harvest data are required to clarify the status of this population. Co-management discussions between Greenland and Canada are ongoing, and Greenland has indicated its intention to move to a quota system.

Davis Strait (DS)

Based on the movements made by tagged animals and, more recently, of adult females with satellite radios, this population has been determined to occur in the Labrador Sea, eastern Hudson Strait, Davis Strait south of Cape Dyer, and an as yet

undetermined portion of south-west Greenland (Stirling and Kiliaan 1980, Stirling *et al.* 1980, Taylor and Lee 1995, Taylor *et al.* 2001). A genetic study (Paetkau *et al.* 1999) showed significant differences between bears from Davis Strait and both Baffin Bay and Foxe Basin. The initial population estimate of 900 (Stirling *et al.* 1980) was based on a subjective correction from the original mark recapture calculation of 726, which was felt to be too low because of possible bias in the sampling. In 1993, this estimate was increased to 1400 by the Canadian Polar Bear Technical Committee to account for the realisation that the bias in sampling caused by the inability of researchers to survey the extensive area of offshore pack ice was greater than had previously been thought and to account for additional scientific information (I. Stirling and M.K. Taylor, unpubl. data) and traditional knowledge, which suggest that the population has increased over the last 20 years. The principal justification for this adjustment is the observation that the annual harvest has been sustained for the last 20 years, non-quantitative observations continue to suggest the population has increased, and there are no data to suggest the population has been detrimentally impacted by the ongoing harvest. The population estimate of 1400 was selected because that is the minimum number of animals required to sustain the observed harvest.

Clarification of the status of this population will require a population inventory conducted during the open water season, and more reliable (*i.e.*, systematically validated) harvest information from Greenland. Within Canada, this population is harvested by Inuit from Nunavut, Québec, and Labrador. Co-management discussions between Greenland and Canada are continuing, and Greenland has indicated its intention to move to a quota system.

Arctic Basin

The Arctic Basin population is a geographic catch-all to account for polar bears that may be resident in areas of the circumpolar arctic that occur outside of the territorial jurisdictions of the polar nations. Polar bears probably occur at very low densities here, although no systematic surveys have been conducted. Seven polar bears were handled during a joint US-Canada scientific oceanographic voyage across the Arctic Basin in 1994. It is probable that bears from neighbouring populations move through

the Arctic Basin or use it for a portion of the year (*e.g.*, Durner and Amstrup 1995, Lunn *et al.* 1995).

Management Uncertainties

Anthropogenic and natural changes in arctic environments as well as new recognition of the shortcomings of our knowledge are increasing the uncertainties of polar bear management. Higher temperatures and erratic weather fluctuations, apparent symptoms of Global Climate change, are increasing across the range of polar bears. Following the predictions of climate modelers, such changes have been most prevalent in Arctic regions (Stirling and Derocher 1993, Stirling and Lunn 1997), and already have altered local and global sea-ice conditions (Gloersen and Campbell 1991, Vinnikov *et al.* 1999). Because changes in sea-ice are known to alter polar bear numbers and productivity (Stirling and Lunn 1997, Stirling *et al.* 1999), effects of global climate changes can only increase future uncertainty and may increase risks to the welfare of polar bear populations. Uncertainty about effects on polar bears of climate change must be included in future management and conservation plans.

Persistent organic pollutants, which reach Arctic regions via long-range transportation, also increase uncertainty for the welfare of polar bears. The effects of pollutants on polar bears are only partially understood. Levels of such pollutants in some polar bear populations, however, are already sufficiently high that they may interfere with hormone regulation, immune system function, and possibly reproduction (Wiig *et al.* 1998, Bernhoft *et al.* 2000, Skaare *et al.* 2000, Henriksen *et al.* 2001, Skaare *et al.* 2001). Population level impacts on polar bears are unknown, at present, but reproductive and survival rates may be affected, and management uncertainty is sure to increase.

Further, although our understanding of polar bear population dynamics constantly improves, new analysis methods (Lebreton *et al.* 1992, Amstrup *et al.* 2001, McDonald and Amstrup 2001) suggest estimates of population parameters and numbers are more uncertain than (and in some cases different from) those used to generate this status report (Taylor *et al.* 1987). Additionally, computer simulations (*e.g.*, Taylor *et al.* 2000, 2001) suggest harvesting polar bear populations at or near maximum sustained yield is accompanied by greater risks than previously believed.

Some new information is not yet reviewed. Other results are too recent to have withstood the tests of time or to be fully understood. Hence, possible ramifications were not included in the current status report. Nonetheless, we recognize that the suggested uncertainties in the balance between current harvest opportunities and risks to future population security must be incorporated into future status reports. More importantly, even in advance of future reports, managers must consider the entire range of cumulative but uncertain threats to polar bears including the many uncertainties and shortcomings of knowledge regarding population dynamics. Management models must become more proactive and adaptive, and cumulative uncertainty may require more conservative management regimes.

The International Polar Bear Agreement

In the early 1960s, great concern was expressed about the increasing harvest of polar bears. In 1965, representatives from the five "polar bear countries" met in Fairbanks, Alaska to discuss protection of polar bears. At the time that this first international meeting was convened, there was little management in effect except for the USSR, where polar bear hunting was prohibited in 1956 (Prestrud and Stirling 1994). At this meeting the following points were agreed upon:

1. The polar bear is an international circumpolar resource.
2. Each country should take whatever steps are necessary to conserve the polar bear until the results of more precise research findings can be applied.
3. Cubs, and females accompanied by cubs, should be protected throughout the year.
4. Each nation should, to the best of their ability, conduct research programs on polar bears within its territory.
5. Each nation should exchange information freely, and the IUCN should function to facilitate such exchange.
6. Further international meetings should be called when urgent problems or new scientific information warrants international consideration.
7. The results of the First International Scientific Meeting on the Polar Bear should be published.

Following the first international meeting on polar bear conservation, the IUCN Polar Bear

Specialist Group (PBSG) was formed to coordinate research and management of polar bears on an international basis. In addition, this group took on the role of developing and negotiating the *Agreement on the Conservation of Polar Bears and Their Habitat* (the Agreement). That Agreement (Appendix 1) was signed in Oslo, Norway in May 1973 and came into effect for a 5-year trial period in May 1976. The Agreement was unanimously confirmed for an indefinite period in January 1981.

Article VII of the Agreement stipulates that: "The Contracting parties shall conduct national research programs on polar bears, particularly research relating to the conservation and management of the species. They shall as appropriate coordinate such research with the research carried out by other Parties, consult with other Parties on management of migrating polar bear populations, and exchange information on research and management programs, research results, and data on bears taken." To meet the conditions of Article VII of the Agreement, the IUCN PBSG meets every 3-5 years.

The Agreement did not provide for protection of female polar bears accompanied by cubs or for the cubs themselves. Annex E to the Agreement drew attention to the need for this protection (Appendix 2). In 1997, the PBSG reviewed Annex E and reaffirmed the need for special protection measures for adult females (Appendix 2), but noted that the occasional take of cubs for cultural and nutritional purposes by subsistence users did not present a conservation concern.

The Importance of the Agreement

A primary goal of the Agreement was to limit the hunting of polar bears to sustainable levels. Because so many management changes had already been put in place during the period when the Agreement was being negotiated, there was little detectable impact immediately following it being signed and ratified (Prestrud and Stirling 1994). However, there is no doubt that the knowledge that the Agreement was being negotiated, and was likely to be successful, was a significant stimulus (Fikkan *et al.* 1993). The Alaskan harvest rate was reduced by 50% following the MMPA in 1972.

To date, the Agreement has been the most important single influence on the development of

internationally coordinated management and research programs which have ensured the survival of polar bears (Prestrud and Stirling 1994). The Agreement is not enforceable by law in any of the countries that have signed it, a weakness that has been identified in previous reviews of international wildlife law. It has been successful in bringing the harvest of polar bears within sustainable limits for most populations, while still facilitating harvest by local people. Most of the original habitat of polar bears is still intact (although not protected) and uninhabited. The polar bear is the only bear, and probably one of the only large carnivores that still occurs throughout most of its original range.

The IUCN Polar Bear Specialist Group

The work of the PBSG has always been important to the Agreement. Initially, membership was limited to government biologists working on polar bears because one of the principal tasks was negotiation of the Agreement. After the Agreement was signed, "Invited Specialists" were included to facilitate the input of experts in fields like population dynamics and physiology. One of the reasons the PBSG has been so successful is that members have been appointed by government agencies and have usually been polar bear specialists as well. Because governments have been more directly involved in the work of this Specialist Group, they have also had a vested interest in its success. Consequently, the people going to meetings have had a fair amount of authority to make decisions and commitments.

The PBSG has no regulatory function and the main function is to promote cooperation between jurisdictions that share polar bear populations, facilitate communication on current research and management, and monitor compliance with the agreement. The PBSG is not an open forum for public participation; it is a technical group that meets to discuss technical matters that relate to the Agreement. The deliberations and resolutions adopted by the PBSG are available to the public as are the published proceedings of the meetings. They have been published in the IUCN Occasional Papers Series of the IUCN Species Survival Commission (SSC).

One strength of the group has always been its small size. Because of the relationship of the PBSG to the Agreement, membership must reflect not only technical expertise in polar bear research and

management, but also equal representation of the nations signatory to the Agreement. For this reason, each nation is entitled to designate three full members. However, in matters that require a vote (e.g., elections and resolutions), each member nation is allowed only one vote. Each nation is at liberty to independently determine their process for casting a single vote. Only government-appointed members may vote. Government appointed members are chosen by their respective governments.

In addition to government-appointed members, the chairman may, as per IUCN guidelines for membership in Specialist Groups, appoint five full members so long as they qualify as polar bear specialists. Full members appointed by the chair and government appointed members constitute the membership of the PBSG between meetings. The chair-appointed members are considered members until the election of a new chairman, which occurs at the end of each meeting. In this way the number of members of the PBSG will not exceed 20.

A third category titled: "Invited Specialists" is recognized. These individuals are not considered full members, but are invited to participate in a given meeting or parts of the meeting as designated by the Chairman.

These guidelines are intended to maintain the integrity of the PBSG as a small working group of technical specialists on polar bears while still ensuring that it is responsible to the governments signatory to the Agreement, the IUCN, and the international conservation community.

Conservation Action Plan for Polar Bears

The PBSG considers the Agreement to be an action plan for the conservation of polar bears. In 1999, the PBSG published a review of the Agreement and how it has worked for the conservation of polar bears (IUCN Polar Bear Specialist Group 1999).

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Table 1. Summary of polar bear population status as determined by both historical harvest (1995-96 to 1999-00) levels and current management practices. The percent females statistic excludes bears of unknown sex, and natural deaths are not included.

Population	Number	Certainty of Estimate	Monitoring of Harvest and Other Removals	% Females in Kill	Sustainable Kill ¹	Mean Annual Kill	Environmental Concerns ²	Status ³
East Greenland	2000	unknown	fair	38	unknown	80	P, W	?
Barents Sea	2000-5000	poor (1982)	poor		na	Norway - 2	P, W	?
Kara Sea	unknown	unknown			na	Russia - ?		
Laptev Sea	800-1200	unknown	poor		na	unknown	P, I	?
Chukchi Sea	2000+	poor (1997)	US - good	US - 35	86+	unknown	P	?
			Russia - poor	Russia - ?		US - 76	W, I	S?
Southern Beaufort Sea	1800	good (2001)	good	33	81	Russia - ?	W, I	I
Northern Beaufort Sea	1200	good (1987)	good	33	54		W	I
Queen Elizabeth	200	unknown			9?	0	P	S?
Viscount Melville Sound	230	fair (1992)	good	25	4	4		S
Norwegian Bay	100	fair (1979)	good	32	4	4	W	S ^a
Lancaster Sound	1700	fair (1996)	good	25	77	76	W	S ^a
M'Clintock Channel	350	fair (2001)	good	26	11	24	W	S?
Gulf of Boothia	900	poor (1986)	good	40	34	37		S ^a
Foxe Basin	2300	good (1996)	good	36	97	90	W	S ^a
Western Hudson Bay	1200	good (1997)	good	35	52	49	W	S ^a
Southern Hudson Bay	1000	fair (1986)	good	36	41	45		S
Kane Basin	200	fair (1996)	fair	32	9	10		S
Baffin Bay	2200	fair (1996)	fair	36	93	139		D
Davis Strait	1400	fair (1996)	fair	38	56	63	W	D?
Arctic Basin	unknown	unknown	none		na			?
Total estimate for world population size: 21,500 - 25,000								

¹ Except for Viscount Melville Sound, sustainable harvest is based on population estimate (N), estimated rates of birth and death, and harvest sex ratio (Taylor *et al.* 1987);

$$\text{Sustainable harvest} = \frac{N \bullet 0.015}{\text{Proportion of harvest that was female}}$$

Proportion of harvest that was female is the greater of the actual value or 0.33. Unpublished modeling indicates a sex ratio of 2 males:1 female is sustainable, although mean age and abundance of males will be reduced at maximum sustainable yield. Harvest data (Lee and Taylor, 1994) indicate that selection of males can be achieved

² I - industrial development current or proposed; P - evidence of pollutants in bear tissues; W - evidence global warming effects on sea ice or populations

³ D - decreasing; I - increasing; S - stationary; S^a - stationary, population managed with a flexible quota system in which any over-harvest in a one year results in a fully compensatory reduction to the following year's quota; ? - indicated trend uncertain

Fig. 1. Distribution of polar bear populations throughout the circumpolar basin

