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Information requested by the US Department of the Interior: recent biological data about polar bears in Greenland

As CITES Scientific Authority of Greenland, the Greenland Institute of Natural Resources (GINR) has been asked for help addressing the US request of information about biological data newly available regarding polar bears in Greenland.

Here, I present a summary of the progress in polar bear research and monitoring in Greenland by the GINR from October 2009 to June 2012. October 2009 is the last time when we were contacted by the US CITES authorities regarding polar bears.

Of the 19 recognised subpopulations of polar bears, five are shared with Greenland: Arctic Basin, East Greenland, Davis Strait, Baffin Bay and Kane Basin. In recent years, our primary research focus has been on the Baffin Bay subpopulation, shared by Nunavut (Canada) and West Greenland. This is because of interest in oil exploration and development, and because there is concern that the combined subsistence harvest for Greenland and Nunavut for the Baffin Bay and Kane Basin subpopulations may be too high. In addition to the work described below on Baffin Bay and Kane Basin, we have carried out analyses of satellite telemetry data from polar bears tagged in East Greenland in 2007 and 2008 (tracked through 2011), compared habitat use for East Greenland polar bears in the 1990s to today (2007-2011), and initiated the collection of biological samples from nearly all polar bears taken in Greenland. We have also been involved in publications by the University of Aarhus on contaminants in polar bears of East Greenland.

User's knowledge about polar bears in North West Greenland

A book based on interviews made in 2006 with 72 experienced Inuit hunters was published in English in 2011 (Born et al., 2011c). The book gives detailed descriptions of 588 subsistence catches from 1952 to 2005. The rationale for the study was the indication from hunting statistics that the catch of polar bears in Northwest Greenland had increased since the early 1990s. This change occurred simul-

taneously with marked changes in weather conditions and sea ice cover in Northwest Greenland. The information provided by Inuit polar bear hunters offered a detailed account of polar bear catch, polar bear biology, climate change, and the effect of these changes on both the species and the subsistence hunt. Hunters provided information about an increased occurrence of polar bears close to the coast. About 31% of the informants attributed this change to an increase in the number of polar bears, whereas 16% suggested that it was due to a decrease in sea ice cover. Beginning in the 1990s, the hunters noted marked environmental changes, including a decrease in sea ice cover and a warmer and more unpredictable weather. These changes have influenced both travelling and hunting activities in Northwest Greenland, where previous sled routes along glaciers and sea ice can no longer be used. With the increased open water, the boating season has been extended, resulting in an increase of the fraction of polar bears caught from boats, as compared to sleds. About 24% of the hunters observed physical changes in the polar bears, with animals thinner than in the past. This change was attributed either to increased competition or to impoverished access to food due to a decrease in sea ice. No informant suggested that polar bear foraging had changed.

Abundance estimate in Baffin Bay and Kane Basin

In 2009, the governments of Greenland, Nunavut and Canada signed a memorandum of understanding for the conservation and management of shared polar bear populations and created the Canada-Greenland Joint Commission on Polar Bear (Anonymous, 2009). A scientific working group established under this commission had as first task to evaluate the survey options for assessment of the Baffin Bay and Kane Basin polar bear populations (Born et al., 2011b). Based on this evaluation, it was decided to undertake an assessment based on genetic mark-recapture analyses of biopsies and samples from harvested bears. A working plan was endorsed by the Joint Commission in the summer 2011 (Born et al., 2011a). The aims of this assessment are:

- 1) To estimate the abundance and sex (and approximate age) composition of polar bears in Baffin Bay and Kane Basin
- 2) To compare a new estimate of abundance with those derived from previous study in-order to gain insight into population trends.
- 3) To estimate survival and reproductive parameters (to the extent possible) in-order to facilitate population viability analyses.
- 4) To evaluate polar bear distribution with respect to environmental variables, particularly ice conditions, topography and food availability/distribution.
- 5) To re-assess stock boundaries using satellite telemetry data from bears in Baffin Bay and Kane Basin tagged between 2009-2012.

Results generated by this research have the following potential applications:

- 1) The development of an updated status report including recommendations on sustainable harvest levels;
- 2) Informing land-use planning and environmental impact assessment processes within the geographic range of the subpopulation;
- 3) The mitigation of risks to public safety and reduction of human-bear conflicts through delineation of important polar bear habitats and the development of models to assess the effects of changes in habitat (in particular sea-ice) on polar bear distribution.

The biopsy collection started in September 2011 and will continue through 2013, and builds upon satellite telemetry studies initiated by GINR in 2009 (see below). The assessment will finalise with the completion of final reports for Kane Basin and Baffin Bay in October 2014.

The assessment has several field components, including biopsy collection during fall and spring in Baffin Island (by Nunavut/Canada), biopsy collection during fall in Melville Bay (by GINR), satellite tagging and biopsy taking during spring in Eastern Baffin Bay (by GINR), satellite tagging and biopsy taking in Kane Basin (by Nunavut/Canada and GINR) and collecting samples from the harvest both in Nunavut and in Greenland. Funding has been secured for 2011 and 2012 and the fieldwork has been carried out as scheduled. The Greenland contribution for 2012 was funded mainly by the Danish Ministry of Environment. Applications for funding for 2013 and 2014 will be evaluated on a yearly basis.

Other studies in Northwest Greenland

Recent telemetry studies in West Greenland began in 2009, commissioned by the Bureau Minerals and Petroleum of Greenland for the assessment of environmental impact of hydrocarbon activities west of Disko Bay (Born et al., in press). Telemetry work continued during 2010, financed by the Danish Ministry of Environment as preparation for the population estimate mentioned above (Born and Laidre, 2010). In 2011, the BMP commissioned further telemetry studies in a program of environmental studies for assessment of the impact of oil and gas exploration and eventual development in Baffin Bay (Born et al., 2011d). In 2012, as part of the effort to estimate the abundance of polar bears in Baffin Bay and Kane Basin, and with funding from the Danish Ministry of Environment and the government of Canada, combined telemetry and biopsy-sampling operations were carried out in Melville Bay and Kane Basin. Since 2009, we have deployed satellite transmitters in 60 polar bears in Northwest Greenland (Laidre et al., 2012). As several transmitters are still transmitting, most analyses are still in progress.

Although final analysis are yet to be undertaken, the dataset collected during tagging has been included in a number of collaborative studies, including a comparison of body condition of polar bears handled by scientists in Davis Strait and Baffin Bay, in Canada and in Greenland, over the period between 1977 to 2010 (Rode et al., 2012). The study concluded that polar bears body condition has declined in concert with the decrease in sea ice habitat. The authors suggested declining body condition in Baffin Bay was a result of recent declines in sea ice habitat, while in Davis Strait, it could not be determined if high population density and/or sea ice loss was responsible for the declines in body condition.

Another collaborative study was undertaken together between Canada and Greenland. Using 10 additional years of harvest recovery data subsequent to the period of active marking of polar bears in Baffin Bay, updated estimates of annual survival were calculated (Peacock et al., *In press*). This analysis suggested a decline in survival of polar bears since the period of active marking (ending in 1997); with some of the decline in survival attributed to a decline in springtime ice concentration over the continental shelf of Baffin Island. The variance around the survival estimates was comparatively high because of the declining number of marks available, and therefore results must be interpreted with caution. The decline in the estimates of survival is consistent with population projections using harvest numbers and earlier vital rates, and consistent with an observed decline in the extent of sea ice habitat (Peacock et al., *In press*).

Finally, data collected from both male and female polar bears were used to make an inter-sex comparison of movements in Baffin Bay and East Greenland during the breeding season. This analysis showed significant differences in movement patterns, with females having more linear movements and larger ranges during the mating season, and males having tortuous movements that may allow for a high probability of encountering mates while avoiding competitive interactions (Laidre et al., *In review*).

Telemetry in East Greenland

As part of another study commissioned by the Bureau of Minerals and Petroleum within a series of studies for a strategic environmental impact assessment of hydrocarbon activities, GINR and collabo-

rators tagged 25 polar bears of the East Greenland subpopulation with satellite transmitters in 2007 and 2008 (Laidre et al., In press).

Overall, it was concluded that polar bears make extensive use of the offshore sea ice throughout the year. The bears show a clear preference for areas with dense sea ice and therefore shift their distribution north during the open water season to exploit areas where drift ice remains during summer. The polar bears may den widely scattered along the east coast of Greenland. However, the coastal areas between ca. 72° N and ca. 74° N and between ca. 78° N and ca. 81° N are important maternity denning areas. None of the tagged animals moved south of 65° N, lending circumstantial support to the hypothesis that there may be two separate subpopulations in Northeast and Southeast Greenland.

Data from a subset of 18 polar bears tagged in 2007 and 2008, which transmitted from March 2007 to March 2010, were compared to equivalent satellite tracking data collected in the 1990s (Laidre et al., *In prep.*). Analyses focused on resource selection models contrasting present day (2007-2010) habitat availability, habitat selection, and denning behavior past (1993-1997) polar bear availability and selection. The study concluded that female bears in the 2000s used an area with less sea ice coverage and were closer to open water habitat than in the 1990s. Polar bear females in the later period moved more and showed a larger seasonal variation in their movement patterns than in the earlier period.

Contaminants in East Greenland

The University of Aarhus has lead several cooperative studies that document high levels of contaminants in the polar bears of East Greenland (Jaspers et al., 2010; Bechshøft et al., 2011; Dietz et al., 2011; McKinney et al., 2011; Rigét et al., 2011; Routti et al., 2011; Sonne et al., 2011; Bechshøft et al., 2012; Sonne et al., 2012).

Polar bears in Nuuk

Before 2009, polar bears were a rare occurrence in central southwest Greenland, with approximately one observation per decade in the area around Nuuk. However, between April 2009 and June 2012, seven polar bears have been shot in the proximity of Nuuk. These include 3 legal harvests, one illegal take, and the killing of 3 problem bears by Wildlife officers (a mother-cub pair and a single male). Biological samples have been obtained for five of these bears, and there are photographs of all of them. Stomach samples and photographs indicate that at least 4 of the bears fed on seals short before dying. Two of the bears had empty stomachs but were not undernourished and only one bear looked thin (judging for photographs).

These polar bears are likely a mixture of animals from the Davis Strait population (arriving in years when the sea ice in the Davis Strait approaches Nuuk) and bears from the East Greenland population, as indicated by repeated sightings along the coast as bears move northwards from the southernmost parts of Greenland. The reason for the increased sightings in Nuuk could be a consequence of increased population size in Davis Strait (Obbard et al., 2010), and the introduction of quotas in Southern Greenland (Ugarte, 2012). In addition, sea ice habitat in both areas has changed over the past several decades and shifts in habitat availability could place more bears on land in areas they did not used to occur when sea ice was available. Polar bears in Southern Greenland are connected through the sea ice drifting from the Northeast coast to the Southeast coast of Greenland. If catches prior to the introduction of quotas in 2006 are regarded as a proxy for the number of polar bears in the area, between 1 and 20 polar bears may occur in SW Greenland during a single year (Rosing-Asvid, 2002; Born, *In press*). The current quota of 4 bears for Southern Greenland results often in a surplus of bears, of which some move north along the coast.

Biological advice

GINR updated its management advice to the Government of Greenland in 2010 (Born, 2010). The advice was that the combined catches from Canada and Greenland are probably unsustainable for the subpopulations of Kane Basin and Baffin Bay, and that population declines could be avoided by reducing catches to 1-2 polar bears per year in Kane Basin and 90 polar bears per year in Baffin Bay. The recommended catch levels refer to the total combined removals from Greenland and Nunavut.

Catch levels were not mentioned in the advice for the Davis Strait subpopulation, since the population was considered as “not reduced” by the Polar Bear Specialist Group in 2009. The catch in this subpopulation has not been considered a problem by the IUCN/Polar bear Specialist Group and the vast majority of the harvest is taken in Canada.

There are no abundance estimates for the subpopulation of East Greenland, and therefore GINR was unable to provide advice for catch levels in this population.

For all populations it was stressed that current abundance estimates are largely outdated or have uncertainties (or are completely absent in the case of East Greenland), and that a documented reduction of the sea ice habitat may be detrimental for polar bears.

Concluding remarks

As it can be seen from the summary of ongoing studies presented here, there are several analyses being carried out at the moment, and we are in the middle of a major population census in Baffin and Kane Basin. We expect that the knowledge about the status of polar bears in Greenland will be significantly improved in the next 2-3 years. Greenland at this moment do not have enough new information to re-evaluate the status of polar bears in relation to CITES, and that is why the NDF issued in 2007 has not been updated (Born and Ugarte, 2007). We will be better prepared to reassess polar bears in 2014-15, when the ongoing studies have been completed.

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