

Possible Effects of Climate Warming on Selected Populations of Polar Bears (*Ursus maritimus*) in the Canadian Arctic

IAN STIRLING¹ and CLAIRE L. PARKINSON²

(Received 10 November 2005; accepted in revised form 25 January 2006)

ABSTRACT. Polar bears depend on sea ice for survival. Climate warming in the Arctic has caused significant declines in total cover and thickness of sea ice in the polar basin and progressively earlier breakup in some areas. Inuit hunters in the areas of four polar bear populations in the eastern Canadian Arctic (including Western Hudson Bay) have reported seeing more bears near settlements during the open-water period in recent years. In a fifth ecologically similar population, no changes have yet been reported by Inuit hunters. These observations, interpreted as evidence of increasing population size, have resulted in increases in hunting quotas. However, long-term data on the population size and body condition of polar bears in Western Hudson Bay, as well as population and harvest data from Baffin Bay, make it clear that those two populations at least are more likely to be declining, not increasing. While the ecological details vary in the regions occupied by the five different populations discussed in this paper, analysis of passive-microwave satellite imagery beginning in the late 1970s indicates that the sea ice is breaking up at progressively earlier dates, so that bears must fast for longer periods during the open-water season. Thus, at least part of the explanation for the appearance of more bears near coastal communities and hunting camps is likely that they are searching for alternative food sources in years when their stored body fat depots may be depleted before freeze-up, when they can return to the sea ice to hunt seals again. We hypothesize that, if the climate continues to warm as projected by the Intergovernmental Panel on Climate Change (IPCC), then polar bears in all five populations discussed in this paper will be increasingly food-stressed, and their numbers are likely to decline eventually, probably significantly so. As these populations decline, problem interactions between bears and humans will likely continue, and possibly increase, as the bears seek alternative food sources. Taken together, the data reported in this paper suggest that a precautionary approach be taken to the harvesting of polar bears and that the potential effects of climate warming be incorporated into planning for the management and conservation of this species throughout the Arctic.

Key words: climate warming, polar bear, *Ursus maritimus*, sea ice, Arctic

RÉSUMÉ. La survie des ours polaires dépend de la glace. Dans l'Arctique, le réchauffement climatique fait diminuer considérablement l'étendue et l'épaisseur de la glace de mer du bassin polaire et engendre une débâcle qui se produit progressivement plus tôt dans certaines régions. Ces dernières années, les chasseurs inuits des régions habitées par quatre populations d'ours polaire dans l'est de l'Arctique canadien (ce qui comprend l'ouest de la baie d'Hudson) ont signalé avoir aperçu une plus grande quantité d'ours près des agglomérations pendant la période des eaux libres. Au sein d'une cinquième population écologiquement semblable, les chasseurs inuits n'ont signalé aucun changement. Ces observations, interprétées comme des preuves de l'accroissement des populations, ont entraîné l'augmentation des quotas de chasse. Cependant, selon les données à long terme concernant l'effectif des populations et la condition physique des ours polaires de l'ouest de la baie d'Hudson, de même que les données concernant les populations et les captures de la baie de Baffin, il est clair que ces deux populations sont, à tout le moins, plus susceptibles de décliner et non pas d'augmenter. Bien que les conditions écologiques des régions visées par les cinq populations dont il est question dans cet article diffèrent, l'analyse de l'imagerie satellite à hyperfréquences passives de la fin des années 1970 laisse croire que la débâcle de la glace de mer se produit progressivement plus tôt, ce qui signifie que les ours doivent jeûner pendant plus longtemps au cours de la période des eaux libres. Par conséquent, la présence d'un plus grand nombre d'ours près des agglomérations de la côte et des camps de chasse s'explique donc en partie par le fait que les ours seraient à la recherche de sources de nourriture de rechange au cours des années où leurs dépôts de graisse s'épuisent avant la prise de la glace, moment auquel ils peuvent regagner la glace de mer pour recommencer à chasser les phoques. Notre hypothèse est la suivante : si le climat continue de se réchauffer, tel que projeté par le Groupe d'experts intergouvernemental sur l'évolution du climat (GIEC), les ours polaires des cinq populations dont il est question dans ce document ressentiront de plus en plus les effets de la privation d'aliments, ce qui engendrera leur déclin, probablement de manière considérable. Au fur et à mesure que ces populations chuteront, les interactions entre les ours et les êtres humains continueront vraisemblablement d'être problématiques, au point même de s'intensifier car les ours seront à la recherche de nouvelles sources de nourriture. Prises ensemble, les données précisées dans ce document laissent supposer qu'il y a lieu d'adopter des mesures de précaution en matière de capture des ours polaires et que les effets éventuels du réchauffement du climat devraient être intégrés à la planification de la gestion et de la conservation de cette espèce à la grandeur de l'Arctique.

¹ Canadian Wildlife Service, 5320 122 Street, Edmonton, Alberta T6H 3S5, Canada; ian.stirling@ec.gc.ca

² NASA Goddard Space Flight Center, Cryospheric Sciences Branch/Code 614.1, Greenbelt, Maryland 20771, U.S.A.

Mots clés : réchauffement climatique, ours polaire, *Ursus maritimus*, glace de mer, Arctique

Traduit pour la revue *Arctic* par Nicole Giguère.

INTRODUCTION

Polar bears (*Ursus maritimus*) are distributed throughout the ice-covered waters of the circumpolar Arctic in 20 relatively discrete subpopulations (Lunn et al., 2002a). Initially, and until recently, scientists considered harvesting to be the principal threat to polar bear populations because of their low reproductive rate. In response to unregulated harvesting throughout most of the polar bear's circumpolar range in the 1960s, the five nations with polar bears in their jurisdictions negotiated the Agreement on the Conservation of Polar Bears, signed in Oslo, Norway in 1973 (Stirling, 1988: Appendix I; Prestrud and Stirling, 1994). Article II of the Agreement states: "Each Contracting Party shall take appropriate action to protect the ecosystems of which polar bears are a part, with special attention to habitat components such as denning and feeding sites and migration patterns, and shall manage polar bear populations in accordance with sound conservation practices based on the best available scientific data." In Canada, "sound conservation practices" has been interpreted to include sustainable hunting by aboriginal people, regulated through an annual quota, usually estimated from the results of a scientifically conducted (mark-recapture) population assessment. In Nunavut and the Northwest Territories, a high priority is also placed on incorporating Inuit hunters' "traditional knowledge" of wildlife, as well as scientific knowledge, into decision making about wildlife management practices (GNWT, 2005).

In February 2005, the Department of Environment of the Government of Nunavut, Canada, announced an overall increase in polar bear quotas in the Territory of 28.5%, varying from 0% to 64% between different subpopulations. For the majority of populations in which the quotas were increased, the estimates of population size, and the sustainable quotas from them, were determined on the basis of scientific studies (mark-recapture, survival rates, and reproductive rates). However, in four populations—Western Hudson Bay, Foxe Basin, Baffin Bay, and Davis Strait (Fig. 1)—Inuit traditional knowledge was the primary information source that influenced the quota increase. More specifically, Inuit hunters in these four populations had reported seeing more bears in recent years around settlements, hunting camps, and sometimes locations where they had not (or only rarely) been seen before, resulting in an increase in threats to human life and damage to property. Most of these bears were seen along or near the coast during the open-water season in fall. In those regions, the increased number of bears seen was interpreted as evidence that the populations were growing, and this conclusion greatly influenced the decision to increase the annual quotas (Table 1). The figures on previous and current

harvest quotas for Canada and Greenland listed in Table 1 are summarized from Derocher et al. (1998), Lunn et al. (2002a), and Aars et al. (in press).

SUMMARY

There are five polar bear populations in the Canadian Arctic (including two shared with Greenland) in which the whole population must fast on shore for several months because all the sea ice in the area melts completely. In four of these populations (Western Hudson Bay, Foxe Basin, Baffin Bay, and Davis Strait), residents of coastal settlements have reported seeing more polar bears and having more problem bear encounters during the open-water season, particularly in the fall. In those areas, the increased numbers of sightings have been interpreted as indicative of an increase in population size, with the result that quotas for Inuit hunters were increased. However, in Western Hudson Bay, the decline in population size, condition, and survival of young as a consequence of earlier breakup of the sea ice brought about by climate warming have all been well documented (Stirling et al., 1999; Gagnon and Gough, 2005; Regehr et al., 2005; I. Stirling and N.J. Lunn, unpub. data). In Baffin Bay, the available data suggest that the population is being overharvested, so the reason for seeing more polar bears is unlikely to be an increase in population size. We suggest that the increase in numbers of sightings of polar bears in Foxe Basin and Davis Strait may also be influenced by factors related to earlier breakup of the sea ice. In Davis Strait and Western Hudson Bay, preliminary information suggests that populations of seals preyed upon by polar bears may also be affected by changes in the sea ice due to climate warming. We hypothesize that, if the climate continues to warm as projected by the IPCC, then polar bears in all five populations discussed in this paper will be stressed and are likely to decline in numbers, probably significantly so. As these populations decline, there will likely also be continuing, possibly increasing, numbers of problem interactions between bears and humans as the bears seek alternative food sources. Taken together, the data and concepts reported in this paper suggest that a precautionary approach be taken to the harvesting of polar bears and that the potential effects of climate warming be incorporated into planning for the management and conservation of this species throughout the Arctic.