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Polar Bears: Listing Under the Endangered Species Act

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Summary

On May 14, 2008, Interior Secretary Dirk Kempthorne announced the listing of polar bears as threatened under the Endangered Species Act (ESA; 16 U.S.C. § 1531 et seq.). The controversial decision highlights the intersection of two significant issues currently before Congress — climate change and species protection. Under the ESA, a listing decision must rest solely on the best available scientific information concerning the species. Habitat loss has been a major reason for many decisions to add species to the list — in this case, loss of Arctic sea ice. The listing itself was praised by some environmentalists, who nonetheless deplored interim protective regulations for the polar bear as being too weak. Other parties, who opposed the listing itself, argued that the science supporting listing was weak, but felt that the regulations mitigated some of the economic impacts of the listing.

Polar bears depend on Arctic sea ice, which most scientists acknowledge will be affected by climate change causing, at minimum, an earlier annual or seasonal thaw and a later freeze of coastal sea ice. Scientists generally agree that in recent decades, the observed extent of Arctic sea ice has declined significantly as the result of climate warming: annual ice break-up in many areas is occurring earlier and freeze-up later. Globally, less than one-third of the 19 known or recognized polar bear populations are declining, more than one-third are increasing or stable. The remaining one-third lack sufficient data to estimate population trends. Two polar bear populations occur within U.S. jurisdiction. There is considerable uncertainty in estimates of polar bear population numbers and trends as well as in our understanding of polar bear habitat.

Polar bears are affected by climate change, environmental contaminants, and subsistence and sport hunting. Arctic sea ice is experiencing a continuing decline that may not be reversed easily, and some models project that late summer (September) sea ice could even disappear completely by mid-century. Controversy exists over how great a threat the changing climate might be to polar bears and whether they might be able to adapt to these changing conditions.

Some point out that polar bears today are not coping with changing climate alone, but also face a host of other human-induced factors — including oil and gas exploration, shipping, contaminants, and reduced prey populations — that compound the threat to their continued existence. Three main groups of contaminants threaten polar bears — petroleum hydrocarbons, persistent organic pollutants, and heavy metals. The United States has allowed limited subsistence harvest of polar bears by Alaska Natives. In Canada, Native hunters are permitted to allocate a limited portion of the subsistence harvest to sport hunters. Under 1994 amendments to the Marine Mammal Protection Act (MMPA), U.S. citizens may obtain permits to import sport-harvested polar bear trophies from Canada. However, with ESA listing, polar bear populations are defined as depleted under MMPA, and therefore entry of these trophies is prohibited by MMPA.

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Polar Bears: Listing Under the Endangered Species Act

Acting under a court-ordered deadline, on May 14, 2008, Interior Secretary Dirk Kempthorne announced a decision to list the polar bear as threatened throughout its range, and to issue special interim final rules for its conservation. The decision to list the species under the Endangered Species Act (ESA; 16 U.S.C. §§ 1531 et seq.) highlights the intersection of two significant issues currently before Congress — climate change and species protection. Listing decisions must rest solely on the best available scientific understanding of the species. For this species, a major threat is loss of its primary habitat on the Arctic sea ice, an ecosystem that is changing rapidly.

Background

The polar bear, *Ursus maritimus*, is the largest terrestrial carnivore and a top predator, inhabiting circumpolar Arctic regions wherever sea ice is present for a substantial part of the year. Polar bears are well adapted to the Arctic, where ice thickness can increase or decrease rapidly as well as differ significantly from year to year and between regions.[1] Nineteen known or identified populations of polar bears are estimated to total 20,000 to 25,000 animals (**Figure 1**). Two of these populations occur within U.S. jurisdiction — the Southern Beaufort Sea population (shared about equally with Canada), estimated at 1,526 animals;[2] and the Chukchi/Bering Seas population (shared with Russia), estimated at about 2,000 animals.[3]

Robust data on polar bear populations are difficult to obtain. Globally, less than one-third of the world's 19 polar bear populations are known to be declining, and more than one-third are increasing or stable. In the remaining third, data are insufficient to estimate population trends and their status has not been assessed.[4] In the United States, the polar bear population shared with Canada in the Southern Beaufort Sea may be starting to decline. In the Chukchi Sea population, shared with the Russia, over-harvest on the Russian side is considered a problem. Elsewhere,

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[1] Seymour Laxon, Neil Peacock, and Doug Smith, "High Interannual Variability of Sea Ice Thickness in the Arctic Region," *Nature*, v. 425 (October 30, 2003): 947-950.

[2] E. V. Regehr, S. C. Amstrup, and I. Stirling, *Polar Bear Population Status in the Southern Beaufort Sea*, U.S. Geological Survey, Open File Report 1337 (2006).

[3] This population estimate, by the Polar Bear Specialist Group, has low statistical confidence, with no estimate of precision or bias. See *Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group*, Occasional Paper of the IUCN Species Survival Commission No. 32 (2006), available at [http://pbsg.npolar.no/docs/PBSG14proc.pdf]; hereafter referred to as "Polar Bear Specialist Group."

[4] Polar Bear Specialist Group, pp. 34-35.

studies suggest that polar bear numbers are declining in Western Hudson Bay;[5] a multi-year study, following local reports of more bears being seen in the northern parts of the population range, will determine if the observed decline is the result of a change in distribution or an actual reduction in abundance.[6] Simulations suggest that polar bear populations are also declining in Baffin Bay, Kane Basin, and Norwegian Bay. The status of polar bears in the Central Arctic Basin — where there are transient bears that normally reside in other regional populations — is unknown. Two of the most southerly polar bear populations, in Southern Hudson Bay[7] and Davis Strait,[8] show no evidence of population decline over the past two decades of decreasing sea ice.

Much of what is known about the polar bear populations and habitat is confined to regions close to shore that have been studied during long summer days, with little known about what happens on drifting sea ice far from shore, especially in winter when there is little or no daylight. Some observers urge caution in interpreting studies of sea ice change that are based primarily on surveys of nearshore regions, rather than the drifting sea ice environment in the Central Arctic Basin, where ice may be thickest. While the Central Arctic Basin currently is marginal habitat for small numbers of transient bears from other populations, changing climate could cause this area to become more important as a refugium for polar bears.

Polar Bear Life Cycle

The primary food of this large predator is the ringed seal (*Phoca hispida*). A polar bear may stalk a seal by waiting quietly for one to emerge from an opening in the ice that seals make to breathe or to climb out of the water to rest. Ringed seals have a circumpolar distribution and are associated with ice for birthing and molting in the spring. Much of ringed seal habitat (especially in offshore drifting sea ice) has not been surveyed, leading to much uncertainty regarding population size and status. Current estimates of the global population numbers for ringed seals range from 2 million to as many as 7 million animals. Other polar bear prey include bearded and harp seals, juvenile walrus, beluga whales, narwhal, fish, and seabirds and their eggs. Over most of their range, polar bears remain on the sea ice year-round or spend at most only short periods on land. In October and November, male polar bears, and females that are not pregnant, head out onto sea ice where they spend the winter.

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[5] I. Stirling and C. Parkinson, "Possible Effects of Climate Warming on Selected Populations of Polar Bears (*Ursus maritimus*) in the Canadian Arctic," *Arctic*, v. 59 (September 2006): 261-275.

[6] Government of Nunavut, Submission from the Government of Nunavut, Department of Environment to the Supervisor, U.S. FWS, April 6, 2007, Appendix A, p. 31. The study was to be completed in the fall of 2007; final results are not yet available.

[7] I. Stirling et al., "Polar Bear Distribution and Abundance on the Southwestern Hudson Bay Coast During the Open Water Season, in Relation to Population Trends and Annual Sea Ice Patterns," *Arctic*, v. 57 (March 2004): 15-26.

[8] Government of Nunavut, Submission from the Government of Nunavut, Department of Environment to the Supervisor, U.S. FWS, April 6, 2007, p.7.

Figure 1. Distribution of Polar Bear Populations Throughout the Circumpolar Basin

Source: Polar Bear Specialist Group, *Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group*, p. 33. SB = Southern Beaufort Sea, NB = Northern Beaufort Sea, VM = Viscount Melville, NW = Norwegian Bay, LS = Lancaster Sound, MC = McClintock Channel, GB = Gulf of Boothia, FB = Foxe Basin, WH = Western Hudson Bay, SH = Southern Hudson Bay, KB = Kane Basin, BB = Baffin Bay, DS = Davis Strait.

Pregnant females dig large dens in snow where they give birth and spend the winter.[9] Females seek denning sites either on the sea ice ("pelagic bears") or on mainland areas ("nearshore bears"); some individuals seem to prefer mainland sites. Both pelagic and nearshore individuals are known in all subpopulations studied.[10] Annual rates of population increase for polar bears may be as much as 5%, with

[9] U.S. Dept. of the Interior, Fish and Wildlife Service, "Polar Bear Fact Sheet," available at [http://www.fws.gov/home/feature/2006/polarbear.pdf], and "Polar Bear Questions and Answers," available at [http://www.fws.gov/home/feature/2006/PolarbearFAQ.pdf].

[10] Mette Mauritzen, Andrew E. Derocher, and Oystein Wiig, "Space-Use Strategies of Female Polar Bears in a Dynamic Sea Ice Habitat," *Canadian Journal of Zoology*, v. 79 (September 2001): 1704-1713.

mature females reproducing once every three years (commonly twins, more rarely triplets).[11] Large carnivorous mammals are generally considered to be most at risk of population declines and extinctions,[12] and the minimum viable total population of polar bears has been estimated at 4,961 adults.[13]

Effects of Climate Change.[14] Climate change is widely considered one of the most significant contemporary threats to biodiversity worldwide.[15] Studies by the U.S. Geological Survey (USGS) state that two-thirds of the world's polar bear population could be lost within 50 years.[16] A May 2002 report by the World Wildlife Fund raised public concern that polar bear populations are threatened by climate change.[17] Scientists have observed that, in recent decades, the extent of Arctic sea ice has declined significantly, and indicate that the reduction results from climate warming: annual ice break-up in many areas is occurring earlier and freeze-up later. Arctic sea ice is experiencing a continuing decline that, it is thought, may not easily be reversed,[18] and some models project that Arctic late summer (September) sea ice could disappear completely by mid-century.[19] In an analysis of

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[11] A. E. Derocher, "Polar Bear," In *Encyclopedia of the Arctic*, M. Nuttall, ed. (Routledge, 2005), v. 3, p. 1656-1658.

[12] M. Cardillo et al., "Multiple Causes of High Extinction Risk in Large Mammal Species," *Science*, v. 309, no. 5738 (August 19, 2005): 1239-1241.

[13] D. H. Reed et al., "Estimates of Minimum Viable Population Sizes for Vertebrates and Factors Influencing Those Estimates," *Biological Conservation*, v. 113, no. 1 (September 2003): 23-34. A *minimum viable population* is "the smallest-size interbreeding group of a particular species that can sustain itself over time; if the group becomes any smaller, it will fail to replace itself successfully and slowly die out." (*The Dictionary of Ecology and Environmental Science*, Henry Holt & Co., New York, 1993.) The measurement reflects especially a need for genetic diversity, and does not directly address major impacts of habitat loss, disease, etc.

[14] For background on climate change generally, see CRS Report RL33849, *Climate Change: Science and Policy Implications*, by Jane Leggett.

[15] C. D. Thomas et al., "Extinction Risk from Climate Change," *Nature*, v. 427, no. 6970 (January 8, 2004): 145-148; Arctic Climate Impact Assessment, *Impacts of a Warming Arctic: Arctic Climate Impact Assessment* (Cambridge University Press, 2005), 144 p.

[16] USGS studies are available at [http://www.usgs.gov/newsroom/special/polar%5Fbears/].

[17] Stefan Norris, Lynn Rosentrater, and Pal Martin Eid, *Polar Bears at Risk* (World Wildlife Fund, May 2002), available at [http://www.ngo.grida.no/wwfap/polarbears/risk/PolarBears AtRisk.pdf].

[18] R. W. Lindsay and J. Zhang, "The Thinning of the Arctic Sea Ice, 1988-2003: Have We Passed a Tipping Point?" *Journal of Climate*, v. 18, no. 22 (2005), pp. 4879-4894.

[19] Intergovernmental Panel on Climate Change, *Climate Change 2007: The Physical Science Basis*, Summary for Policymakers (Geneva, Switzerland: February 2007), 21 pp. This estimate is considered optimistic by some scientists, who argue that the Arctic could be ice-free in late summer in as soon as 30 years. For example, see Stroeve, J., M. M. Holland, W. Meier, T. Scambos, and M. Serreze (2007), Arctic sea ice decline: Faster than forecast, Geophys. Res. Lett., 34, L09501, doi:10.1029/2007GL029703. Available at [http://www.agu.org/journals/scripts/highlight.php?pid=2007GL029703&cls=edt].

climate models in light of Arctic ice conditions and polar bear impacts, USGS addressed the uncertainties in the models, but stated:

> Climate model simulations are in universal accord that greenhouse gas increases will cause Arctic sea ice cover to decline, with the greatest reductions occurring at the end of the summer melt season.... A further consistency in climate simulations is the uneven latitudinal distribution of global warming, which always has its greatest simulated impact in the high northern latitudes. This "polar amplification" and associated sea ice decline have been consistent climate simulation features at least since the early simulation of Manabe and Souffer (1980). Since Chapman and Walsh (1993), declines in Arctic sea ice, with the largest trends in September, have also been consistently reported in observations....[20]

However, links between climate-model predictions and threats to polar bears are characterized as tenuous by many scientists, who point to the limitations of correlational studies and the hypothetical nature of model-based predictions of environmental conditions decades into the future.[21]

Distribution patterns of some polar bear populations have changed in recent years. Greater numbers of bears are being found onshore near the Bering Sea,[22] and in some parts of Canada,[23] with Inuit hunters reporting more bears present on land during summer and fall.[24] There may be several reasons for the observed changes, including changes in sea ice; those who conduct population censuses of polar bears will need to be cautious in interpreting whether apparent population variations are indicative of changing habitat use (e.g., greater numbers of bears onshore) or actual changes in population abundance. Recent studies found that mid-latitude European

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[20] U.S. Department of the Interior, Geological Survey, "Uncertainty in Climate Model Projections of Arctic Sea Ice Decline: an Evaluation Relevant to Polar Bears," 2007, p. 21. Available at [http://www.usgs.gov/newsroom/special/polar_bears/docs/USGS_PolarBear_DeWeaver_GCM-Uncertainty.pdf].

[21] D. Berteaux et al., "Constraints to Projecting the Effects of Climate Change on Mammals," *Climate Research*, v. 32 (October 2006): 151-158; D. B. Botkin et al., "Forecasting the Effects of Global Warming on Biodiversity," *Bioscience*, v. 57 (March 2007): 227-236; C. J. Krebs and D. Berteaux, "Problems and Pitfalls in Relating Climate Variability to Population Dynamics," *Climate Research*, v. 32 (October 2006): 143-149; and M. G. Dyck, et al., "Polar Bears of Western Hudson Bay and Climate Change: Are Warming Spring Air Temperatures the 'Ultimate' Survival Control Factor?" September 2007, *Ecological Complexity*, v. 4, No. 3, p. 73-84.

[22] S. L. Schliebe, T. Evans, S. Miller, and J. Wilder, "Fall Distribution of Polar Bears along Northern Alaska Coastal Areas and Relationship to Pack Ice Position," in *Collection of Scientific Papers from the 4th International Conference of Marine Mammals of the Holarctic*, V. M. Belkovich, ed. (St. Petersburg, Russia: 2006), p. 559.

[23] E. K. Parks et al., "Seasonal and Annual Movement Patterns of Polar Bears on the Sea Ice of Hudson Bay," *Canadian Journal of Zoology*, v. 84, no. 9 (September 2006): 1281-1294.

[24] Unpublished reports in 2005 by M. Dowsley and M. Taylor, as cited in the FWS polar bear status assessment report. The polar bear status assessment document is available at [http://alaska.fws.gov/fisheries/mmm/polarbear/pdf/Polar_Bear_%20Status_Assessment.pdf].

populations of Arctic fox became extinct at the end of the Pleistocene and did not track the habitat when it shifted to the north, suggesting that some populations of Arctic species are unable to track decreases in habitat availability and may be vulnerable to increases in global temperatures.[25]

A loss of sea ice could affect survival and reproduction of polar bears by:

- shortening the season during which ice is available to serve as a platform for hunting ringed seals;[26]
- increasing the distance between the ice edge and land, thereby making it more difficult for nearshore female bears that prefer to den on land to reach preferred denning areas;
- reducing the availability of sea ice dens for gestating pelagic female bears;
- requiring nearshore bears to travel through fragmented sea ice and open water, which uses more energy than walking across stable ice formations;[27]
- reducing the availability and accessibility of ice-dependent prey, such as ringed seals, to nearshore populations;[28] and
- requiring nearshore bears to spend more time on land, thereby increasing the potential for adverse human-polar bear interactions.[29]

In addition to changing sea ice conditions, others have expressed concern that climate change could affect the integrity of polar bear den sites, as rain can destroy ice dens, exposing young polar bears to the elements prematurely.[30]

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[25] Love Dalen et al., "Ancient DNA Reveals Lack of Postglacial Habitat Tracking in the Arctic Fox," *Proceedings of the National Academy of Sciences of the United States of America*, v. 104, no. 16 (April 17, 2007): 6726-6729.

[26] For every week earlier the sea ice breaks up, bears come ashore 10 kilograms lighter in weight, on average. See Ian Stirling and A. E. Derocher, "Possible Impacts of Climatic Warming on Polar Bears," *Arctic*, v. 46 (1993): 240-245.

[27] Loss of sea ice forces polar bears to cross large expanses of water and increases risk of drowning. In 2004, scientists documented polar bears swimming as far as 60 miles offshore and observed 4 drowned bears. See C. Monnett and J. S. Gleason, "Observation of Mortality Associated with Extended Open-Water Swimming by Polar Bears in the Alaskan Beaufort Sea," *Polar Biology*, v. 29, no. 8 (July 2006): 681-687.

[28] I. Stirling and C. L. Parkinson, "Possible Effects of Climate Warming on Selected Populations of Polar Bears (*Ursus maritimus*) in the Canadian Arctic," *Arctic*, v. 59, no. 3 (September 2006): 261-275; S. H. Ferguson, I. Stirling, and P. McLoughlin, "Climate Change and Ringed Seal (*Phoca hispida*) Recruitment in Western Hudson Bay," *Marine Mammal Science*, v. 21, no. 1 (January 2005): 121-135.

[29] Marine Mammal Commission. *Annual Report to Congress, 2005* (Bethesda, MD: July 15, 2006), p. 52.

[30] Stefan Norris, Lynn Rosentrater, and Pal Martin Eid, *Polar Bears at Risk* (World Wildlife Fund, May 2002).

Although some scientists predict the extinction of polar bears under potential climate change scenarios, not all sea-ice changes would harm polar bears. For example, reduced sea ice thickness and coverage in far northern regions could improve polar bear habitat, by increasing the availability and accessibility of ice-dependent prey, such as ringed seals.[31] Others remind biologists that climate-related changes to a species' distribution may not necessarily lead to changes in abundance.[32]

Contaminants. Three main groups of contaminants are implicated as potentially threatening polar bears — petroleum hydrocarbons, persistent organic pollutants, and heavy metals. Moreover, climate change may alter contaminant pathways through increased precipitation, increasing the potential threat to polar bears.[33] Polar bears are particularly vulnerable to oil spills, because oil damages polar bear fur (decreasing the bears' ability to thermoregulate) and because of oil ingestion (poisoning) via grooming and/or eating contaminated prey.[34] Although elevated concentrations of some persistent organic pollutants have been discovered in polar bears, it has been difficult to determine what biological effects these chemicals might have on polar bears; weakened immune systems and reduced reproductive success are among the concerns.[35] Some persistent organic pollutants are endocrine disruptors and are thought to cause pseudo-hermaphrodism and aberrant genital morphology in polar bears.[36] Mercury is a particular concern because of its toxicity at low concentration, and its magnification and accumulation through the food web. However, polar bears appear able to demethylate (i.e., alter the chemical form and biological reactivity of) mercury and accumulate somewhat elevated levels of mercury without harm.[37]

Subsistence and Sport Harvest. The United States allows limited subsistence harvest of polar bears by Alaska Natives. According to FWS:

> The harvest levels in the Southern Beaufort Sea are managed at sustainable harvest levels under the Native to Native agreement between the Inupiat (Alaska)

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[31] A. E. Derocher, N. J. Lunn, and I. Stirling, "Polar Bears in a Warming Climate," *Integrative and Comparative Biology*, v. 44, no. 2 (April 2004): 163-176.

[32] C. J. Krebs and D. Berteaux, "Problems and Pitfalls in Relating Climate Variability to Population Dynamics," *Climate Research*, v. 32 (2006): 143-149.

[33] R. W. Macdonald, T. Harner, and J. Fyfe, "Recent Climate Change in the Arctic and Its Impact on Contaminant Pathways and Interpretation of Temporal Trend Data: Review Article," *Science of The Total Environment*, v. 342, no. 1-3 (April 1, 2005): 5-86.

[34] D. J. St. Aubin, "Physiologic and Toxic Effects on Polar Bears," in *Sea Mammals and Oil: Confronting the Risks*, J. R. Geraci and D. J. St. Aubin, eds. (New York, NY: Academic Press, Inc., 1990), p. 235-239; N. A. Oritsland, et al., *Effect of Crude Oil on Polar Bears*, Environmental Studies No. 24, Northern Affairs Program, Northern Environmental Protection Branch, Indian and Northern Affairs, Canada (1981), 268 pp.

[35] J. U. Skarre et al., "Ecological Risk Assessment of Persistent Organic Pollutants in the Arctic," *Toxicology*, v. 181-182 (2002): 193-197.

[36] C. M. Fossi and L. Marsili, "Effects of Endocrine Disruptors in Aquatic Mammals," *Pure and Applied Chemistry*, v. 75, nos. 11-12 (November-December 2003): 2235-2247.

[37] Arctic Monitoring and Assessment Programme, *AMAP Assessment 2002: Persistent Organic Pollutants in the Arctic* (Oslo, Norway: 2005), p. 123.

> and Inuvialuit (Canada) Agreement. The harvest levels in the Chukchi/Bering seas for the past 10-15 years (150-200 bears/year), which include the legal harvest in Alaska and an illegal harvest in Chukotka, Russia, are probably unsustainable. This harvest level is close to or greater than the harvest levels during the sport hunting era prior to 1972 (approximately 178 bears/year).[38]

There is particular concern for the Chukchi/Bering Seas population due to anecdotal evidence that unregulated harvest by Russian Natives on the Chukotka Peninsula may be reaching unsustainable levels.[39]

Some have suggested that habitat alteration from climate change may interact with subsistence and sport harvest to increase polar bear mortality. For example, they believe that large adult male bears, more likely to be targeted by hunters, could also be more at risk from the effect of climate change on prey availability since larger bears require greater amounts of food. Others counter that habitat conditions and prey availability for polar bears could improve as climate warms as a result of increased marine productivity in regions currently dominated by multi-year ice.[40] Also, male bears represent a threat to cubs and juvenile bears.[41] Consequently, any factor — such as sport and subsistence hunting (which often target adult males) — that reduces the population of adult males, may increase cub and juvenile survivorship and therefore may exert a positive influence should bears become nutritionally challenged in the future.

Canadian Non-Resident Sport Harvest.[42] Some argue that a well-regulated sport harvest, managed for conservation of the population, can provide strong incentives to conserve a species, and cite waterfowl conservation as an example of the beneficial effects of sport hunting. In the case of polar bears, big game hunters argue that the considerable money spent by hunters in northern Canada gives local people strong incentives to maintain healthy polar bear populations. In Canada, Native Inuit hunters are permitted to allocate a limited portion of the subsistence harvest to sport hunters.[43] Under 1994 amendments to the MMPA,[44] U.S. citizens may obtain permits to import sport-harvested polar bear trophies from Canada, if taken under quotas scientifically designed to ensure the maintenance of

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[38] Fish and Wildlife Service, Alaska Region. Available at [http://alaska.fws.gov/fisheries/mmm/polarbear/issues.htm].

[39] Marine Mammal Commission, *Annual Report to Congress, 2005* (Bethesda, MD: July 15, 2006), pp. 50-51.

[40] A. E. Derocher, N. J. Lunn, and I. Stirling, "Polar Bears in a Warming Climate," *Integrative and Comparative Biology*, v. 44 (June 2004): 163-176; I. Stirling and C. Parkinson, "Possible Effects of Climate Warming on Selected Populations of Polar Bears (*Ursus maritimus*) in the Canadian Arctic," *Arctic*, v. 59 (September 2006): 261-275.

[41] A. E. Derocher and O. Wiig, "Infanticide and Cannibalism of Juvenile Polar Bears (*Ursus maritimus*) in Svalbard," *Arctic*, v. 52 (September 1999): 302-310.

[42] Much of the material in this section was provided by Milton M. R. Freeman, Canadian Circumpolar Institute, University of Alberta, Edmonton.

[43] M. M. R. Freeman and G. W. Wenzel, "The Nature and Significance of Polar Bear Conservation Hunting in the Canadian Arctic," *Arctic*, v. 59, no. 1 (2006): 21-30.

[44] P.L. 103-238, §§4, 5; 16 U.S.C. § 1371(a)(1); 16 U.S.C. § 1374(c)(5).

the affected population at a sustainable level. The U.S. permit issuance fee for sport-hunted polar bear trophies is $1,000.[45]

Although each Canadian jurisdiction manages polar bears in its own territory, non-resident hunts (i.e., sport hunts) only occur in Nunavut and the Northwest Territories (NWT). Some of the regional polar bear populations in Nunavut and NWT are shared with other jurisdictions; harvest sharing is undertaken through inter-jurisdictional meetings and awareness of neighbors' hunting needs. The overall harvest quota for each jurisdiction is based on recommendations made by two federal-provincial-territorial polar bear committees (the Polar Bear Technical Committee and the Polar Bear Administrative Committee) made up of appropriate representatives of the relevant Canadian jurisdictions.

Under ESA, the Secretary is required to take into account foreign polar bear conservation programs, including hunting programs involving non-local (including U.S.) hunters. These programs, through carefully controlled sport hunting, can play a role in providing incentives to conserve a species, as well as funding conservation programs for the hunted species and its habitat. Before polar bears were listed under ESA, a provision of the MMPA allowed the importation of sport trophy polar bear artifacts and skins from regulated hunts in Canada. However, an ESA listing as "threatened" triggers an automatic designation as a "depleted" species under the MMPA, and therefore prevents U.S. citizens from importing polar bear products into the United States, due to a violation of the MMPA. Such an import ban, effectively stopping U.S. participation in the Canadian conservation-based hunting programs, would, according to some observers, end the financial assistance derived from the sport hunt, possibly reduce community support for a sustainable harvest, and perhaps compromise successful community-based conservation programs.[46]

Economic Impacts. The NWT and Nunavut governments charge non-resident hunters (i.e., U.S. or other non-Canadian resident) a Can$750 trophy fee plus a Can$50 tag fee.[47] In addition, the local outfitter charges for his/her services and, as part of that service, hires guides and assistants, provides transportation (dogs and skidoos), food, and camping gear, and may provide locally made caribou/wolf skin clothing (or this can be custom-made and purchased) and accommodations in the community if bad weather prevents leaving on the hunt. In addition, government license fees benefit communities indirectly by supporting polar bear research and monitoring. For example, Nunavut spends about Can$1 million annually on polar bear research and monitoring.

The federal government collects a 6% goods and services tax (GST) on all goods and services (except food and certain other exempt items) purchased in Canada. These monies go to the federal government. Almost all the rest of the money that enters the local community circulates in the community — even the

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[45] MMPA, §104(c)(5)(B).

[46] M. M. R. Freeman and G. W. Wenzel, "The Nature and Significance of Polar Bear Conservation Hunting in the Canadian Arctic," *Arctic*, v. 59, no. 1 (2006): 21-30.

[47] In June 2008, Can$1.00 was equal to US$1.0021.

purchase of supplies from the local cooperative store results in a dividend paid to co-op members (i.e., virtually all community households). The disbursement of cash varies from community to community, but in each case, more than 90% is disbursed and circulates locally. In 2001, the 74 outfitted hunts in Nunavut were reported to have generated Can$1.221 million, a figure significantly higher than that derived annually from all other tourist/private visitor activities.[48]

Other U.S. Laws, Agreements, and Treaties

Besides ESA, polar bears are protected and managed under other domestic laws and several international agreements. Because the primary habitat of the polar bear is sea ice and this species is evolutionarily adapted to life at sea, it is managed as a marine mammal. In the United States, polar bears are protected under the MMPA, with the Fish and Wildlife Service (FWS) in the Department of the Interior as the federal management agency. Marginal benefits are also provided by the Outer Continental Shelf Lands Act (43 U.S.C. §§ 1331-1356) and the Coastal Zone Management Act (16 U.S.C. §§ 1451-1464). The Alaska Nanuuq Commission, a Native organization representing villages in northern and northwestern Alaska, has a co-management agreement with the FWS to provide input on matters related to the conservation and sustainable use of polar bears.[49]

Internationally, the multilateral 1973 Agreement on the Conservation of Polar Bears[50] and the 2000 bilateral Agreement Between the Government of the United States of America and the Government of the Russian Federation on the Conservation and Management of the Alaska-Chukotka Polar Bear Population[51] provide a basis for cooperation on polar bear management, though over-harvest on the Russian side is thought to have reduced this population. Alaska and Canada exercise joint cross-border management through the Inuvialuit-Inupiat Polar Bear Management Agreement for the Southern Beaufort Sea.[52] The International Union for the Conservation of Nature (IUCN) classifies the polar bear as *vulnerable* on the IUCN Red List of Threatened Species. The IUCN classification of *vulnerable* represents a judgment that the species is facing a high risk of extinction in the wild.[53]

In addition, polar bears are listed on Appendix II of the Convention on International Trade in Endangered Species of Fauna and Flora (CITES). Appendix II lists species not necessarily threatened with extinction but requiring controlled

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[48] This Can$1.2 million is a minimal figure, as the Wenzel and Bourgouin study focused exclusively on the polar bear hunt; some hunters also hunt for a muskox, caribou, wolf, or grizzly bear, incurring additional costs when extending the stay in the community for these additional hunts.

[49] See [http://www.nanuuq.info/index.html].

[50] Parties to this agreement are Canada, Denmark, Norway, the Russian Federation, and the United States. See [http://sedac.ciesin.org/entri/texts/polar.bears.1973.html].

[51] See [http://alaska.fws.gov/media/pbsigning/agreement.html].

[52] See [http://pubs.aina.ucalgary.ca/arctic/Arctic55-4-362.pdf].

[53] This assessment is based on a suspected population decline of more than 30% within three generations (45 years) due to decline in area of occupancy, extent of occurrence, and habitat quality.

trade to prevent population declines, as well as other species whose body parts are difficult to distinguish by visual inspection (the so-called "look-alike" problem, in this case in controlling trade in bear gall bladders).[54] ESA implements CITES provisions domestically. As such, ESA affords protection to endangered species and wildlife of global concern. To complement CITES, ESA specifically prohibits interstate and foreign commerce in ESA-listed species. FWS agents and inspectors work to control any illegal trade and international movement of ESA-listed species, since some species found in other countries may be brought into the United States by activities that could threaten their long-term survival. International provisions of ESA are applicable to activities within U.S. jurisdiction, as well as activities by U.S. citizens anywhere, including the high seas.

The Listing Decision: Continuing Controversy

On May 14, 2008, in response to a court-ordered deadline, Interior Secretary Kempthorne announced a decision to list polar bears as threatened under the ESA.[55] The listing decision itself was supported by environmental groups and various scientific societies; others, including the state of Alaska, opposed it, arguing that the science supporting listing was weak. (See discussion below.) In addition, the Secretary announced special rules under § 4(d) of ESA to address how the agency will handle the consultation that federal agencies must carry out for actions which "may affect" listed species and how the prohibitions on takings under ESA's § 9 may be limited. Here, the situation was reversed: environmental groups decried the rules, saying that they violated the ESA, and did not sufficiently address recovery of the species; opponents of listing felt that the special rules would lessen the economic impact of listing, would help prevent the ESA being used as a lever to force action on global climate change, and might allow northern economic development greater freedom. (See discussion below.) Legal challenges both to the listing and to the special rules were announced shortly after the announcement of the decision.[56] The actions leading to the listing are described below, and followed by an analysis of controversies concerning the listing itself and the special rule.

Protection Efforts

On February 17, 2005, FWS received a petition from the Center for Biological Diversity requesting that FWS list the polar bear as threatened under ESA throughout

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[54] For additional background on CITES, see CRS Report RL32751, *The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): Background and Issues*, by Pervaze A. Sheikh and M. Lynne Corn.

[55] Listing: 73 *Fed. Reg*. 28211-28303, May 15, 2008; 50 C.F.R. § 17.11(h). Special rule: 73 *Fed. Reg*. 28305-28318, May 15, 2008; 50 C.F.R. § 17.40(q).

[56] See "Alaska will try to block polar bear listing", available at [http://www.eenews.net/Greenwire/2008/05/22/3]; "Polar Bear Listing Opens Door to New Lawsuits", available at [http://www.sciencemag.org]; and "Groups take polar bear listing back to court", available at [http://www.eenews.net/Greenwire/2008/05/20/1/].

its range and that it designate critical habitat for this species.[57] The Natural Resources Defense Council and Greenpeace, Inc., joined as petitioners on July 5, 2005. On December 15, 2005, the petitioners filed a complaint in federal court, challenging FWS's failure to issue a 90-day finding on the petition. On February 7, 2006, FWS announced a finding that the petition presented substantial scientific information indicating that listing the polar bear might be warranted, and subsequently announced the initiation of a formal status review.[58] Under ESA, the Secretary of the Interior was to decide whether to list polar bears based solely on the best available scientific and commercial (i.e., trade) information,[59] after an extensive series of procedural steps to ensure public participation and the collection of relevant information.

As in other listing decisions, the polar bear decision was to consider information relating to five factors: habitat destruction, overutilization, disease or predation, inadequacy of other regulatory mechanisms, and other natural or manmade factors.[60] At this point in the ESA process, the Secretary *may not* consider the economic effects that listing may have. The listing determination is the only place in ESA where economic considerations are expressly forbidden; such considerations may enter in other stages, including critical habitat designation.

Economic factors cannot be taken into account at this stage because Congress directed that ESA listing be fundamentally a scientific question: is the continued existence of the species threatened or endangered? With the listing of a species under ESA, federal agencies are required to ensure that anything the federal government authorizes, funds, or carries out that is likely to affect the species or its habitat will not jeopardize the survival of the species or destroy or adversely modify its designated critical habitat.

In a settlement agreement to the 2005 lawsuit by environmental groups, approved on July 5, 2006, FWS agreed to submit a 12-month finding on the petition by December 27, 2006. On January 9, 2007, FWS announced its 12-month finding on the petition — concluding that, after a review of scientific and commercial information, listing the polar bear as a threatened species under ESA was warranted

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[57] A species may be designated as either endangered or threatened, depending on the severity of its decline and threats to its continued survival. The prohibitions and penalties of ESA apply to those species listed as endangered. FWS extends the same prohibitions to threatened species as well unless, under § 4(d) of ESA, the Secretary promulgates special regulations to address the plight of species listed as threatened. Protections and recovery measures for a particular threatened species can be tailored to particular situations. 50 C.F.R. § 17.31 also affords threatened species for which a special rule has not been promulgated the same protections as endangered species. For additional background on ESA as well as regulatory procedures under this act, see CRS Report RL31654, *The Endangered Species Act: A Primer*, by M. Lynne Corn, Eugene H. Buck, and Pamela Baldwin.

[58] 71 *Fed. Reg.* 6745 (February 9, 2006). Information on the status of the polar bear was solicited from the public in this notice and again in 71 *Fed. Reg.* 28653 (May 17, 2006).

[59] 16 U.S.C. § 1533(b)(1)(A).

[60] 16 U.S.C. § 1533(a)(1).

— and formally proposed such listing.[61] This proposed rule did not designate critical habitat for the polar bear. A 90-day period (through April 9, 2007) was announced to receive data and comments, with requests for a public hearing accepted for 45 days (through February 23, 2007). A decision on whether to list polar bears was due from FWS in early January 2008. However, FWS announced on January 7, 2008, that this decision was delayed and would be finalized "within the next month."[62] Some suggested that the delay in listing the polar bear was beneficial to proceeding unimpeded with the Mineral Management Service's Chukchi Sea Planning Area Oil & Gas Lease Sale 193 on February 6, 2008, in Anchorage, Alaska.[63] The Administration held that an ESA listing would have no effect on the lease sale, since polar bears were already considered in the lease sale, due to their protected status under the MMPA.[64]

After additional delays in announcing a listing decision, on March 10, 2008, the Natural Resources Defense Council, Greenpeace, and the Center for Biological Diversity filed a lawsuit in U.S. District Court in San Francisco, seeking to compel FWS to issue a final decision immediately on whether to list polar bears as a threatened species. On April 28, 2008, Judge Claudia Wilken of the U.S. District Court, Northern District of California, ruled that the final decision on listing must be published in the *Federal Register* no later than May 15, 2008. Secretary Kempthorne issued the decision to list the species on May 14.[65] Provisions of the decision are discussed below.

Internationally, in late April 2008, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) announced a status assessment of the polar bear in Canada as a species of "special concern," with a more detailed official report scheduled for release in August 2008. After the August COSEWIC report is received, Canada's Environment Minister, John Baird, will issue a statement outlining how the Government of Canada will proceed toward a decision on polar bear listing under Canada's Species at Risk Act.[66] In addition, the multilateral 1973 Agreement on the Conservation of Polar Bears, signed by the United States and the other four circumpolar nations, offered some protection from over-harvest, although

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[61] 72 *Fed. Reg.* 1064-1099 (January 9, 2007). The polar bear status assessment document is available at [http://alaska.fws.gov/fisheries/mmm/polarbear/pdf/Polar_Bear_%20Status_Assessment.pdf].

[62] News release at [http://www.fws.gov/news/NewsReleases/showNews.cfm?newsId=54D2A6BD-E928-94E6-6BA905F3F540B8F7].

[63] "Bush Administration Set to Offer Chukchi Sea to Oil Industry," *AlaskaWild Update*, no. 272 (January 10, 2008) at [http://www.alaskawild.org/alaskawild-update-272-january-10-2008/#more-472].

[64] "Bush admin seeks 10 more weeks for polar bear decision", by Allison Winter. *Greenwire*, April 14, 2008. Available at [http://www.eenews.net/Greenwire/print/2008/04/18/4].

[65] Center for Biological Diversity v. Kempthorne, No. C-08-1339, 2008 Westlaw 1902703 (N.D. Cal. Apr. 28, 2008)

[66] See [http://www.ec.gc.ca/default.asp?lang=En&n=714D9AAE-1&news=A4C9B4A9-BB66-423E-94A7-CDC313368213].

the Polar Bear Status assessment noted that over-harvest continues in some areas, and the agreement lacks provisions for the protection of habitats critical to the species.[67]

On May 8, 2008, Secretary Kempthorne signed a Memorandum of Understanding (MOU) with Canadian Environment Minister John Baird on the conservation of polar bears. Canada is thought to host about two-thirds of the world population of polar bears. The MOU, which is not binding, reflects the two countries' agreement on management of the populations whose ranges cross the boundaries of the two countries.

Special Rules for a Threatened Species

Under the ESA, an endangered species is entitled to a well-defined set of protections spelled out in § 4 and § 9 of the act. For threatened species, such as the polar bear, § 4(d) allows FWS to write special rules tailored very specifically to a species; these rules are generally less restrictive than those applying to endangered species. The polar bear is the 64th threatened species with such rules.[68]

For polar bears, many fear — or hope — that a threatened status will enhance efforts to address global climate change, or to restrict oil and gas development in the Arctic, since the effects of climate change or energy development could be argued to affect this species. Before the listing, some groups voiced their intention to file lawsuits to effect limits on greenhouse gases (GHGs) or Arctic energy development.[69] The groups supporting such suits argued that a cited purpose of the ESA was to "provide a means whereby the ecosystems on which endangered species and threatened species depend may be conserved" (16 U.S.C. § 1531(b)) and therefore such an effort was an appropriate means of conserving this species — as well as others that may be listed in the future due to climate change. Opponents of listing, or at least of using polar bear protection as a means of addressing the larger questions of climate change and Arctic energy development, held that the ESA constitutes essentially a blunt and unwieldy instrument for policies best set through existing or new legislation.[70]

A focus on protecting polar bears from the effects of global climate change in some of the lawsuits already announced is ESA's requirement under § 7 that federal agencies, carrying out actions which "may affect" a listed species, must consult with

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[67] FWS polar bear status assessment report, pp. 131-132. The polar bear status assessment document is available at [http://alaska.fws.gov/fisheries/mmm/polarbear/pdf/Polar_Bear_%20Status_Assessment.pdf].

[68] Listing: 73 *Fed. Reg*. 28211-28303, May 15, 2008; 50 C.F.R. § 17.11(h). Special rule: 73 *Fed. Reg*. 28305-28318, May 15, 2008; 50 C.F.R. § 17.40(q).

[69] For example, see Katie Howell, "Enviro groups seek to further climate, oil and gas agendas with polar bear listing." Energy and Environment Daily, May 15, 2008. Available at [http://www.eenews.net/EEDaily/print/2008/05/15/1].

[70] "The Threatened Polar Bear", editorial, *Washington Post*, May 15, 2008, p. A14. Available at [http://www.washingtonpost.com/wp-dyn/content/article/2008/05/14/AR2008051403241.html].

FWS on the actions.[71] FWS then issues a *biological opinion* (BiOp) that analyzes the action, and assesses whether it might jeopardize the species or adversely modify designated critical habitat. If jeopardy or adverse modification would occur, FWS offers reasonable and prudent alternatives within the authority of the action agency, that would permit the action to go forward without jeopardy or adverse modification.[72] Key questions in the FWS consultation process are the severity of the effects of the proposed action, and the number of polar bears that would be affected. These requirements are in the statute, and adoption of a special rule under § 4(d) cannot modify them. Critics of the special rule argue that polar bear conservation cannot be addressed without addressing climate change, since loss of Arctic sea ice is acknowledged as one of the chief threats to the species. Opponents of addressing climate change in efforts to recover the polar bear hold that the ESA was not intended to serve as a lever for addressing climate change, and that in any case, FWS is not equipped to handle the myriad consultations that would result.

The discussion of the special rule for polar bears addresses a variety of other issues, as well as consultation under §7 and takings under § 9.[73] These issues include subsistence handicrafts, international imports and exports, imports of sport-hunted trophies, takes in self-defense, incidental takes during fishing and other legitimate activities, and interaction with military activities. The discussion below focuses on takings and consultation, which have received the widest attention since issuance of the special rule.

What Is a Take? The term "take" under the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[74] (Harassment and harm are further defined by regulation at 50 C.F.R. § 17.3.) Taking is prohibited under 16 U.S.C. § 1538. There has been controversy over the extent to which the prohibition on taking may include habitat modification. A 1995 Supreme Court decision[75] held that the inclusion of significant habitat modification was a reasonable interpretation of the term "harm" in the law.

Under the special rule (50C.F.R. § 17.40(q)(2)) issued by Secretary Kempthorne on May 14, the take prohibitions that would normally apply to a threatened species do not

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[71] "Polar Bear Listing Opens Door to New Lawsuits", available at [http://www.sciencemag.org]; and "Groups take polar bear listing back to court", available at [http://www.eenews.net/Greenwire/2008/05/20/1/].

[72] In the very rare case that no reasonable and prudent alternative within the authority of the action agency can be found, the action agency has three options: to abandon the action, to seek a formal exemption under §7 of the ESA, or to proceed and risk a citizen suit under the broad provisions of § 11(g).

[73] 73. Fed. Reg. 28305-28318. May 15, 2008.

[74] 16 U.S.C. § 1532.

[75] Babbitt v. Sweet Home Chapter of Communities for a Great Oregon, 515 U.S. 687 (1995) ("Sweet Home"). See CRS Report 95-778 A, *Habitat Modification and the Endangered Species Act: The Sweet Home Decision*, by Pamela Baldwin.

> ... apply to any activity conducted in a manner that is consistent with the requirements of [MMPA] and [CITES], provided that the person carrying out the activity has complied with all of the terms and conditions that apply to that activity under the provisions of the MMPA and CITES and their implementing regulations.

The Secretary's stated at the press conference announcing the decision that "polar bears are already protected under the Marine Mammal Protection Act, which has more stringent protections for polar bears than the Endangered Species Act does.... If an activity is permissible under the stricter standards imposed by the [MMPA], it is also permissible under the [ESA] with respect to the polar bear."[76]

Under § 9(a)(1)(G) of ESA, takings of threatened species which "violate any regulation pertaining to ... any threatened species" are illegal. Some environmental groups filed notice of an intent to sue, claiming that limiting ESA's protections against takings to no more than those available under the MMPA was illegal and that "take" under ESA offers more habitat protection than MMPA.[77]

Consultation Under Section 7. In a consultation, FWS must determine whether the agency's actions would jeopardize the continued existence of the species, or adversely modify habitat that has been designated as critical. An agency *action* is defined in 50 C.F.R. § 402.02 as "all activities and programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The same provision includes, as examples of such actions, "the promulgation of regulations," the "granting of leases, easements, and rights-of-way," and "actions directly or indirectly causing modifications to the land, water, or air." Under §7, as the special rule notes,

> ...the determination of whether consultation is triggered is narrow; that is, the focus of the effect analysis is on the discrete effect of the proposed agency action.... [The] Federal agency evaluates whether consultation is necessary by analyzing what will happen to the listed species or critical habitat 'with and without' the proposed action.

For some actions (e.g., plants that would be inundated in a new reservoir, or nests that would be removed in a timber sale), the affected area is obvious. In other cases, including effects on a species or its habitat some distance away, FWS must consider the effects caused by the action under consultation that are "reasonably certain to occur" (50 C.F.R. § 402.02).

Some argue that all power plant emissions should be considered when dealing with the impacts of climate change on polar ice. In discussing the breadth of the consultation requirement vis-a-vis emission of GHGs, the special rule states that the need for a causal connection between the federal action and an effect on polar bears

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[76] Secretary Kempthorne's remarks at press conference of May 14, 2008. Available at [http://www.fws.gov/home/feature/2008/polarbear012308/pdf/press-conference-remarks.pdf].

[77] See "Environmental Groups Seek Full Protection for Polar Bear", available at [http://www.biologicaldiversity.org/news/press_releases/2008/polar-bear-05-20-2008.html].

"narrows section 7 consultation requirements to listed species and critical habitat in the 'action area' rather than to all listed species or all designated critical habitats." This interpretation, according to the special rule, avoids the possibility that every agency action that would produce greenhouse gases would result in consultation.

While this provision in the special rule could limit the number of consultations regarding polar bears, it is less clear that it would limit their breadth. For example, if an agency were issuing permits relating to emissions of GHG at a specific site, the rule's discussion states

> There is currently no way to determine how the emissions from a specific project under consultation both influence climate change and then subsequently affect specific listed species or critical habitat, including polar bears. As we now understand them, the best scientific data currently available does [sic.] not draw a causal connection between GHG emissions resulting from a specific Federal action and effects on listed species or critical habitat by climate change, nor are there sufficient data to establish the required causal connection to the level of reasonable certainty between an action's resulting emissions and effect on species or critical habitat.

The rule suggests that the action agency need not consult on the permit on the grounds that the causal link between the agency's action and an effect on polar bears is too weak. However, if the agency were developing regulations that applied to emissions for *all* such sites or emitters, one might argue that implementation of the regulations "may affect" polar bears and their habitat. Consultation would appear to be necessary in that case, since the causal link between regulations for all of the permitted GHG emissions and effects on polar bears might be stronger.

In addition, while the causal connection between emissions of a single GHG source and polar bear habitat loss is currently tenuous or *de minimus*, according to "the best scientific data currently available," what might happen if scientific analysis and improved data were to make that causal chain stronger? If that link were forged in the future, then consultation might be needed, even if the special rule is unchanged.

Controversies

Supporters of increased protection for polar bears argue that polar bears are the most iconic Arctic species, representing the Arctic as lions represent Africa. They further assert that it would be irresponsible to let the polar bear become extinct as a result of human action, and would be a terrible blow to the psyche of humankind. However, some critics suggest that listing polar bears as threatened is premature, with this species being used as a "poster child" for the evils of climate change by the popular press in recognition of polar bears' charismatic appeal. Some believe that other species, such as the less-glamorous walrus, could be facing similar or greater immediate risk.[78]

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[78] "Ice Dwellers Are Finding Less Ice to Dwell On," by Natalie Angier. *New York Times*, (continued...)

Some scientists also point out that, since polar bears have survived at least two major warming periods over the last 10,000 years, including the intense warming event that ended the Last Glacial Maximum about 8,000 to 9,000 years ago (when temperatures were believed to have been much warmer than now), polar bears and other Arctic mammals could be capable of adjusting, adapting, and coping with the current climatic change. At the end of the last Ice Age, the Northern Hemisphere entered an extended period of rapid warming, with temperatures in Arctic regions eventually reaching levels several degrees warmer than today. At that time, the sea ice above North America is known to have retreated substantially, allowing Arctic species such as bowhead whales and walrus to move northward into areas of the Canadian Arctic that they cannot reach today. The Mid-Holocene Warm Period peaked about 11,000-9,000 years ago near Alaska and about 8,000-5,000 years ago near Greenland and Northern Europe. In both areas, temperatures rose rapidly 10-15° Celsius (18-27°F) to a point significantly warmer than present (about 2.5° Celsius warmer (4.5°F); but less than the temperatures projected by the Intergovernmental Panel on Climate Change for 2100), and about 5-10° Celsius (9-18°F) of that warming took place within 30 years or less.[79]

Another significant but shorter warm period occurred about 1,000 years ago, when Arctic temperatures were slightly warmer than today. This warming also triggered sea ice reductions in Arctic regions and was accompanied by significant reductions in Greenland glaciers, creating so much arable land that Viking settlers established farms on the west coast of Greenland that were occupied for about 400 years.[80]

There is no evidence to suggest that ice in the Arctic Basin disappeared entirely during either of these warm periods, which were of equal or greater warming than predicted by the Intergovernmental Panel on Climate Change's climate-warming models, nor did any ice-dependent species become extinct.[81] Polar bears and their primary prey existed before the last Ice Age, and significant populations of them remain today. The tight association of polar bears and their prey species with moving sea ice may give them a flexibility that land-based carnivores do not have.

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[78] (...continued)
May 20, 2008, available at [http://www.nytimes.com/2008/05/20/science/20count.html?_r=1&ref=science&oref=slogin].

[79] D. S. Kaufman et al., "Holocene Thermal Maximum in the Western Arctic (0-180 Degrees W," *Quaternary Science Reviews*, v. 23, nos. 18-19 (October 2004): 2059-2060; Arthur S. Dyke, et al., "The Late Wisconsinan and Holocene Record of Walrus (*Odobenus rosmarus*) from North America: A Review with New Data from Arctic and Atlantic Canada," *Arctic*, v. 52, no. 2 (June 1999): 160-181; Arthur S. Dyke and James M. Savelle, "Holocene History of the Bering Sea Bowhead Whale (*Balaena mysticetus*) in its Beaufort Sea Summer Grounds off Southwestern Victoria Island, Western Canadian Arctic," *Quaternary Research*, v. 55 (2001): 371-379.

[80] Willie Soon and Sallie Baliunas, "Proxy Climatic and Environmental Changes of the Past 1000 Years," *Climate Research*, v. 23 (January 31, 2003): 89-110.

[81] D. B. Botkin et al., "Forecasting the Effects of Global Warming on Biodiversity," *Bioscience*, v. 57 (March 2007): 227-236.

Critics, however, counter that polar bears today are not coping with changing climate alone, but also face a host of other human-induced factors — including shipping, oil and gas exploration, contaminants, and reduced prey populations — that compound the threat to their continued existence.[82]

[82] A. Shi, A. M. Bell, and J. L. Kerby, "Two Stressors are Far Deadlier Than One," *Trends in Ecology and Evolution*, v. 19 (2004): 274-276.