

TESTIMONY SUBMITTED

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TO THE

**SENATE ENVIRONMENT AND PUBLIC WORKS
COMMITTEE**

POLAR BEAR LISTING HEARING

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The National Wildlife Federation (NWF) appreciates this opportunity to testify before the Senate Environment and Public Works Committee on the issue of climate change and the conservation of polar bears. The National Wildlife Federation is America's largest wildlife conservation organization, representing more than 4 million members and supporters throughout the United States, including nearly 750,000 hunters and anglers. The National Wildlife Federation includes 48 affiliated state and territorial conservation organizations, which in turn support hundreds of local clubs across the nation. We are a non-partisan organization, and our membership mirrors the political diversity of Americans everywhere.

I am Doug Inkley, the National Wildlife Federation's Senior Scientist and a Certified Wildlife Biologist (by The Wildlife Society). I am responsible for helping to ensure that NWF's conservation policies are based on sound science. In this capacity I have been engaged in a diversity of fish and wildlife conservation issues including wetlands, endangered species, National Wildlife Refuges, conservation funding and many others. In the last decade my attention has increasingly turned to demonstrating the urgency of addressing climate change as the scientific evidence has grown exponentially and become virtually irrefutable. I have traveled from the Arctic to the equator to Antarctica. In all of these places, and in fact around the world, the effects of climate change on our natural resources are already evident.

Climate change is an enduring, significant, and complex problem facing humans and wildlife. It is now well established that the Earth has warmed over the past century, due mostly to the emissions of greenhouse gases from human activitiesⁱ, and that this warming has impacted wildlife and habitats in important ways^{ii,iii,iv}. More serious climate impacts on wildlife, including polar bears, are expected this century, especially if significant steps are not taken to reduce greenhouse gas emissions and to help wildlife cope with changing conditions.

This testimony first addresses the current state of the science on climate change and the influence of climate change on the Arctic ice cap, upon which the polar bear depends. This is followed by a review of the status of the polar bear and the merit of listing it as a threatened species. Finally, we conclude with mention of the implications of climate change for other species.

Collaborating in the preparation of this testimony were Dr. Doug Inkley, Dr. Amanda Staudt, Dr. Sterling Miller and John Kostyack, Esq. Dr. Inkley was the lead author in The Wildlife Society's technical review "Global Climate Change and Wildlife in North America." Dr. Staudt is NWF's Global Warming Scientist. She completed her Ph.D. at Harvard University in climatology and worked at the National Academy of Sciences prior to joining NWF. Dr. Miller is a renowned biologist who, before joining NWF, worked for the Alaska Department and Game and Fish as their grizzly bear biologist. Furthermore, Dr. Miller is the former President of the International Association for Bear Research and Management. All are the authors of peer-reviewed publications in their respective fields. Mr. Kostyack is an attorney and NWF's Executive Director for

Wildlife and Global Warming, with extensive experience in endangered species law and policy.

The Scientific Consensus on Climate Change

The Earth has warmed by about 1.4°F over the past century^v. This observed warming, along with other global climate changes, led the Intergovernmental Panel on Climate Change (IPCC) to state in its 2007 report that:

“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level”^{vi}

This conclusion, based on decades of peer-reviewed scientific research, is especially remarkable in that the IPCC report represents an unprecedented scientific collaboration by more than 2,500 scientists worldwide.

Fossil fuel burning, large-scale deforestation, and other human activities are responsible for most of the warming over the past century. These activities emit greenhouse gases, such as carbon dioxide (CO₂), to the atmosphere. The current levels of atmospheric CO₂ is 383 ppm^{vii}, higher than anytime in at least 650,000 years, during which the value did not exceed about 300 ppm.^{viii} For these and other reasons, the 2007 IPCC report concludes that there is:

“very high confidence (90%) that the global average net effect of human activities since 1750 has been one of warming.”

The warming accelerated in recent decades as greenhouse gas emissions grew. The IPCC reported that 11 of the 12 years from 1995–2006 ranked among the 12 warmest years in the instrumental record of global surface temperature (since 1850). NASA data indicate that 2007 was tied for the second warmest on record^{ix}.

Scientists have explored many other factors, including the Earth’s orbit, variation in solar output, volcanic activity, and known periodic climatic cycles ranging from a few years (i.e. the El Niño/La Niña cycle) to decades (regular oscillations in the sun). Although all of these can, have, and will continue to influence the earth’s climate, none of them can account for the current rapid rise in temperatures. Simply put, the scientific evidence that the earth is being rapidly warmed by human-caused greenhouse gas emissions is overwhelming.

The IPCC report warns of more rapid warming in coming decades if we continue to use fossil fuels such as oil and coal as intensively as we do today. Global warming is accelerating because pollution is building up in the planet’s thin atmosphere at a faster rate as we use more and more fossil fuels. Moreover, we have not yet seen the full effects of the pollution we have already pumped into the air. By the end of this century, if we continue “business as usual” dependence on fossil fuels, the scientists’ consensus

'best estimate' is that temperatures will increase 7 degrees Fahrenheit above the changes we have already seen (with a range of 4 to 11 degrees, based on the report's 'Fossil-Intensive' emissions scenario).

Arctic Sea Ice

The Arctic is covered by a relatively thin layer of floating ice. This ice pack is in constant motion, drifting at the whim of ocean currents and prevailing winds. Influenced extensively by the seasons, sea ice expands greatly in area during the long, dark winters, and recedes during the summer in an annual cycle.

Sea ice is critical to the survival of polar bears because it provides the platform from which they can catch seals, their primary prey. So dependent are polar bears on sea ice, it is not surprising that wherever sea ice does not exist for significant portions of the year, there simply are no polar bears.

Through the use of satellites and other means, scientists have been able to accurately monitor the status and extent of Arctic sea ice for decades. In the Arctic Ocean, the area of summer sea ice declined 9.8 percent per decade since 1978, with a 32 percent thinning of the remaining ice from the 1960s and 1970s to the 1990s in some local areas. Significant areas of fast ice (connected to land and forming ice shelves) have broken up, including the 300-mile Ellesmere Ice Shelf along Ellesmere Island in northern Canada.

In the summer of 2007 scientists reported a record Arctic ice melt. The increase in ice melt over the long term (1979-2000) average was an area equivalent to the size of Alaska and Texas combined.^x The remaining ice was an incredible 39% below the long term average. These unexpected findings combined with recent ice melt data such as the previous record ice melt in 2005, necessitate that scientists adjust their models of summer sea ice decline. Instead of IPCC projections for the disappearance of late-summer sea ice by the latter part of the 21st century, scientists now believe this unprecedented event will occur much sooner. In contrast to a 2006 projection that summer sea ice in the Arctic may virtually disappear entirely by about 2040^{xi} one NASA scientist now projects a possible loss of summer sea ice by as early as 2012^{xii}.

Following the record Arctic summer ice melt in 2007, the 2008 winter was colder than the long-term average in some regions of the Arctic.^{xiii} These colder temperatures caused more new sea ice to form this winter than in each of the last three winters. Despite this welcome increase in winter ice, the sea-ice extent this winter is still 2.2% less than the long-term average. Furthermore, older or multi-year sea ice has continued to decline because of the long-term global warming trend and because of ice flowing out of the Arctic. Multi-year ice made up 50-60 percent of the winter Arctic ice as recently as the 1980s. This year (2008), multi-year ice has declined to less than 30 percent of the winter Arctic ice.

Climate Change and Polar Bears

To understand the importance of climate change to polar bears, we must first understand the polar bear's life history. As suggested by its scientific name (*Ursus maritimus*), the polar bear is actually a marine mammal that spends far more time at sea than it does on land. Polar bears are, in fact, classified as marine mammals under the Marine Mammal Protection Act.

Polar bears evolved from brown (grizzly) bears (*Ursus arctos horribilis*), a terrestrial species that still lives on land adjacent to the Arctic oceans. The terrestrial habitat for brown bears is marginal in these extreme northern latitudes and this is reflected in these populations having the lowest densities (1-2 bears/1000 km²) and among the lowest reproductive rates of any brown bear population in the world. Perhaps because conditions were so marginal on land, some brown bears began to forage out on the sea ice and learned how to kill the abundant seals that utilize the arctic ice cap. Over the course of time, these evolved into polar bears that are highly specialized in their foraging habits, relying almost exclusively in most areas on seals for food. The diet of brown bears includes a wide variety of foods from berries to caribou calves. Generalist species such as the brown bear are more adaptable to changes in their environment because when one food becomes scarce, they can shift to other foods. On the other hand, specialized species such as the polar bear are highly vulnerable to changes in their environment because they lack other species to shift to for food. This specialization makes polar bears much more vulnerable to extinction than the brown bears from which they derived.

Superbly adapted to its icy habitats, the polar bear's primary hunting technique is to capture seals when they surface at a breathing hole in the ice. Polar bears also capture seals by sniffing out their snow-covered pupping dens in the ice before seal pups are mature enough to swim. Because seals are much better swimmers, polar bears are unable to take them in open water. The polar bear's dependence on Arctic ice is obvious.

In marked contrast to black bears and brown bears which hibernate during the winter because their food sources are unavailable, most polar bears are active year-round because they are able to hunt for seals on the ice all year. The only polar bears that den during the winter are pregnant females; they den so that they can give birth to their tiny cubs in a secure environment unexposed to the severe arctic winter. These females emerge from their dens in the spring when their cubs are large enough to survive. Male, non-pregnant female, and subadult polar bears do not den and continue to hunt for seals all winter.

This pattern is somewhat different in the areas at the southern limit of the polar bear's range, such as Hudson Bay. In these areas the ice is not available for polar bears to forage for seals during the summer. As a consequence, they are confined to land for the summer. With little opportunity to catch prey, they may go months essentially without eating, until the ice freezes in the fall and they can commence hunting for seals again.

The population of polar bears worldwide is estimated at 20,000 to 25,000 and changes in population abundance associated with climate change have not been documented so far for most populations. In 2005, of the 13 polar bear populations along Canada and Greenland, one was reported to be increasing, five were declining, and two were severely depleted from over-harvesting but being managed to increase the population. The remaining five were reported as stable. However, already there is evidence of the impact of climate change on polar bears via the decline in ice.

In just 20 years the ice-free period in Hudson Bay has increased by an average 20 days, leaving nearly three weeks less time each year for the bears to hunt for seals on the ice. The ice is freezing later in the fall, but it is the earlier breakup of the ice in the spring that is particularly problematic for polar bears in these southern areas. This is because spring is the time when seals give birth to their pups and polar bears rely on this relative abundance of food for the bulk of their annual nutrition, and to see them through the long summer when they cannot hunt. As a result, polar bears in western areas of Hudson Bay are on average skinnier and have lower reproductive rates than when the ice persisted throughout the seals birthing period. As average bear weight has dropped by 15%, reproduction has declined, and the population is down more than 20%.^{xiv} The impact of climate change on polar bears in these southern latitudes foreshadows what will happen as the sea ice continues to decline in more northern latitudes.

Some of the best habitat for polar bears in the Arctic Ocean is fast ice (attached to shore) or ice that can be reached with a short swim from land. Because these relatively shallow water areas on the continental shelf are more productive than deeper ocean waters further offshore, they provide abundant prey for seals. However, as the ice cap shrinks and moves further and further from the shore, the remaining ice is over the deeper less-productive areas. There is already evidence that ringed seal populations are declining as the ice retreats from shallow, productive coastal areas. Receding ice can affect polar bears by both reducing populations of its primary prey and requiring polar bears to swim great distances from shore to ice. Although the bears are excellent swimmers, this crossing becomes increasingly hazardous as the distance increases and as waves become higher due to the longer fetch for winds across the land/sea ice gap. In the Beaufort Sea off Alaska's northern coast, fewer cubs are now surviving beyond their first year, which is probably a consequence of reduced food available to their mothers and increased risk of mortality from drowning and other threats. The number of cubs has dropped more than 50% from 61 cubs per 100 adult females from 1967 through 1989 to just 25 cubs per 100 adult females from 1990 through 2006.^{xv}

New studies released in September 2007 by the U.S. Geological Survey reveal that the rapid decline in summer sea ice poses a very serious threat to the polar bear^{xvi}. These studies led government scientists to the conservative conclusion that fully two-thirds of the world's polar bears, including all polar bears in the United States, will disappear by 2050, due to ice loss. The retreat of ice 300 to 500 miles off the coast by 2050, if it occurs as projected, will be just too far for polar bears to swim.

Listing of the Polar Bear as a Threatened Species under ESA

The Endangered Species Act (ESA), enacted in 1973, is the nation's primary tool for conserving imperiled plants and animals. It imposes a duty on the Secretaries of Interior and Commerce to list a species as threatened if, based on five criteria, it is found to be at risk of becoming endangered in the foreseeable future; a species is considered endangered if it is at risk of becoming extinct in the foreseeable future^{xvii}. The five applicable criteria are threats to the species' habitat, disease or predation, overuse, inadequate legal protection and "other natural or man-made factors."

Listing decisions must be made based on the best available scientific data available and are to be made "without reference to possible economic or other impacts of such determination^{xviii}." In other words, the decision is to be based purely on the scientifically-determined status and trends of the species and threats to the species and its habitat, not on the political or economic consequences of the listing.

Once a species is listed, the ESA requires that the Service designate or identify "critical habitat" that is essential to the conservation of that species, and it requires that all federal agencies ensure that the actions they permit, fund, or carry out do not destroy or adversely modify this habitat. The Service is required to designate this critical habitat within one year of listing. Any proponent of a federal project must consult with the Service to ensure that the project does not "jeopardize" the existence of the species in the wild or adversely modify its critical habitat. If the Service finds that a proposed federal project will jeopardize a species or adversely modify its critical habitat, the agency project proponent and the Service must work to design an alternative approach to the project that avoids violating the ESA. It is very rare for a project to be terminated or withdrawn due to jeopardy.

The ESA's ultimate goal is to recover threatened and endangered species to the point where they no longer need the law's protections. After a species is listed, the Service is required to develop a recovery plan, which must provide objective, measurable criteria that, if satisfied, would lead to recovery of the species. In essence, it provides a blueprint for federal, state, tribal and private cooperation in the conservation of a listed species and its habitat.

The process of listing the polar bear was initiated on February 17, 2005 when the Center for Biological Diversity first petitioned the U.S. Fish and Wildlife Service to list the polar bear as a threatened species under the ESA. Subsequently, and facing a court-imposed deadline, the Service proposed on January 9, 2007 to list the species as threatened^{xix}. The Service was required by the ESA to issue a final listing decision twelve months thereafter, a deadline that the Service missed nearly three months ago.

The scientific basis for listing the polar bear as a threatened species is overwhelming, as presented in the Service's proposal to list the species. Although seemingly far from the disturbance of mankind, loss of habitat --the rapid decline in Arctic ice-- from climate change is the primary threat to the polar bear. As noted by Secretary of the Interior Dirk Kempthorne, "we are concerned that the polar bears' habitat may literally be melting^{xx}."

Listing the polar bear as threatened under the Endangered Species Act will provide the polar bear with the legal protections it will need if it is to survive climate change. While the continued rapid decline in Arctic ice seems inevitable for the foreseeable future, immediate action to list the species will provide the means for the Service to develop needed plans and implement actions to reduce other threats to the polar bear. These threats include oil and gas development.

The polar bear, and in fact the entire Arctic ecosystem, face serious threats from the development of oil and gas in the Arctic. One need look only as far as the March 24, 1989, grounding of the Exxon Valdez and subsequent spill of over 11 million gallons of crude oil to understand the potential impacts of oil spills in the Arctic. Nearly 20 years later oil can still be found and some species have yet to fully recover.^{xxi}

A large oil spill in the Chukchi Sea or other polar bear habitat would be extremely difficult to clean up due to both the remote location and rough seas. Such a spill could have long-term effects on the polar bear food chain (zooplankton and phytoplankton, shellfish and other invertebrates, and seals^{xxii}), thereby affecting overall food availability. More directly, polar bears would be imperiled by hypothermia from oil destroying the insulating qualities of their thick fur, which is essential for maintaining body temperature in their frigid environment. When soiled by oil, polar bears are also prone to the toxic effects of oil ingestion from grooming.

Another concern is the potential impact of offshore platforms and the greatly increased human activities associated with oil and gas development. Polar bears and their prey may avoid newly developed areas that would otherwise be suitable habitat. Female polar bears are particularly threatened by disturbance when denning.^{xxiii}

Listing of the polar bear would engage the Service in evaluating oil and gas development plans and their potential harm to polar bears. Through mandatory ESA consultations, the Service would identify methods of eliminating or minimizing such harmful impacts. Unfortunately, delay in the listing decision has raised suspicions that the Bush Administration was seeking to avoid scrutiny of oil and gas leases in polar bear habitat under the Endangered Species Act when it proceeded to sell oil and gas leases in the Chukchi Sea on February 6, 2008.

The recovery plan for the polar bear must address all the stressors to the polar bear, including both oil and gas development within its habitat, as well as climate change, the leading threat to the species' existence. Because the solutions to climate change are far beyond the expertise of the Service, the Service will need to enlist the assistance of other agencies. Funding must also be provided under the ESA to enable additional research and monitoring of polar bears and the seals they hunt. This is especially important in the Chukchi Sea where relatively little is known about the polar bear population and the sea ice is both retreating and thinning.

Ultimately, the survival of the polar bear will require more than just U.S. action under the ESA: it will require global action by all the nations of the world to reduce the emissions of greenhouse gases that are causing the climate to warm. Delay in listing the polar bear

as a threatened species only puts the polar bear at greater risk, makes the challenge of recovery more difficult, and continues to deny the reality of climate change and its wide-ranging impacts.

Climate Change and Wildlife

Unfortunately, the challenges facing the polar bear are only the tip of the iceberg — a sign of the cascade of species that will likely become imperiled from climate change. In its 2007 report, the IPCC stated that 20-30% of plant and animal species worldwide are “likely to be at increased risk of extinction if increases in average global temperatures exceed 2.2-4.0° F (converted from °C) above current levels.” Further temperature increases would imperil even more species.

Already, species are being listed under the ESA because of imperilment from climate change. In 2007 the National Oceanic & Atmospheric Administration listed elkhorn and staghorn coral as the first species ‘threatened’ in part because of global warming. Just last week the National Marine Fisheries Service (NMFS) announced they will undertake a status review of the ribbon seal in response to a petition to list it as a threatened species^{xxiv}. NMFS will also review the status of bearded, spotted and ringed seals for possible listing, because like the ribbon seal, they are also affected by changes in Arctic ice conditions.

Unfortunately, the evidence is accumulating every day that climate change is already affecting us in our own backyards. In northwestern Minnesota, a moose population prone to heat stress has declined from several thousand to fewer than 100 animals. In the West, critical snowpack that supplies cold water for trout streams is declining, leaving fish, anglers and these ecosystems potentially high and dry. The forest landscape is being noticeably changed by unprecedented fires and insect infestations intensified by global warming. As sea levels rise, coastal wetlands and the rich habitat provided there are being submerged.

Other examples include:

- The Pacific coast marine ecosystem is being dramatically affected by climate change. Zooplankton – the base of the marine food web – have declined 70% there, putting virtually every marine species in that ecosystem at risk. Fish larvae have declined by 50%, and seabirds have declined by 30% in less than 30 years.
- Amphibians around the world are already declining due primarily to disease that may be associated with climate change.
- As an indicator of what could happen to many species, 80% of historical populations of the Edith’s checkerspot butterfly in the southern end of the species’ range in California and Mexico have disappeared due to the combined effects of climate change and habitat fragmentation.

Projections for future effects to wildlife species due to climate change are also foreboding:

- Scientists believe that a majority of coral reefs around the world will face extensive coral bleaching within the next 20-40 years if climate changes continues unabated.
- The breeding habitats of many Arctic shorebirds and waterfowl are expected to decline by up to 50% based on global temperature increases of about 1.1 degrees Fahrenheit.
- Nearly 50% of critical salt marsh and 84% of tidal flats along the coast of Florida could be lost with just a 15-inch rise in sea level.
- The prairie pothole region of the northern Great Plains, which annually produces 50% or more of the continent's waterfowl, is threatened with a dramatic loss of critical wetlands as temperatures rises and soil moisture declines.
- In the Apalachicola Bay of Florida, crabs, shrimp, oysters and flounder may be unable to survive past this century due to rising temperatures making the area unsuitable for them.
- Invasive species problems will be exacerbated as habitat disturbance from climate change enhances invasive species' ability to 'out-compete' native populations. As the freeze zone moves northward with climate change, invasive species such as fire ants are also expected to move northward.

Climate change will also affect humans in a multitude of ways because of the many services from our natural resources that we are dependent upon. These include water, wood, food and much more. Unless climate change is addressed, we can expect major disruptions to the supply of these essential natural resources.

Conclusion

The U.S. Fish and Wildlife Service is obligated by the Endangered Species Act to quickly move forward to list the polar bear as a threatened species. With this action they can then develop a recovery plan and thereby improve the prospects of the polar bear. It would be a shame if the only polar bears our grandchildren will ever see are behind bars or merely pictures in a book, rather than roaming free on the Arctic ice pack that is essential to their survival.

Looking more broadly at the plight of the polar bear and all wildlife, National Wildlife Federation believes that Congress must act swiftly to pass comprehensive global warming legislation that tackles global warming at the root cause: emissions of greenhouse gases. Last month nearly 700 hunting and fishing organizations across the nation joined with National Wildlife Federation to urge Congress to pass legislation that reduces greenhouse gas emissions by 2% annually and provides dedicated funding to fish and wildlife impacted by climate change (Attachment A). In January more than 600 biological scientists made a similar request to Congress (Attachment B).

National Wildlife Federation applauds the leadership of many members of the Senate Environment and Public Works Committee for reporting a comprehensive climate bill out of committee for the first time ever. The Climate Security Act (S. 2191) is a good starting point for action by the full Senate to pass legislation that reduces emissions by two percent annually, provides dedicated funding to protect fish, wildlife and ecosystems impacted by climate change, and ensures fair treatment of consumers, particularly low-income families. The National Wildlife Federation urges Congress to debate, strengthen and pass this measure.

Thank you, again, for this opportunity to testify and for your attention to climate change. There is no more important conservation issue for our children's future than global warming.

Attachment A (separate document) Hunter/Angler's Letter to Congress 2/12/2008

Attachment B (separate document) Scientists' Letter to Congress 1/29/2008

ⁱ IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment. Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A.(eds.)]. IPCC, Geneva, Switzerland, 104 pp.

Climate Change 2007 - The Physical Science Basis

Contribution of Working Group I to the Fourth Assessment Report of the IPCC
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Climate Change 2007 - Mitigation of Climate Change

Contribution of Working Group III to the Fourth Assessment Report of the IPCC
(978 0521 88011-4 Hardback; 978 0521 70598-1 Paperback)

ⁱⁱ Parmesan, C. 2006. Ecological and evolutionary responses to recent climate change. *Annual Review of Ecology, Evolution, and Systematics* 37:637-669.

ⁱⁱⁱ Inkley, D.B., M.G. Anderson, A.R. Blaustein, V.R. Burkett, B. Felzer, B. Griffith, J. Price and T.L. Root. 2004. Global climate change and wildlife in North America. *Wildlife Society Technical Review* 04-2. The Wildlife Society, Bethesda, Maryland, USA.

^{iv} Root, T.L., J.T. Price, K.R. Hall, S.H. Schneider, C. Rosenzweig, and J.A. Pounds. 2003. Fingerprints of global warming on animals and plants. *Nature* 421:57-60.

^v See endnote i

^{vi} <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf>, pg 5

^{vii} NOAA. 2007. Available at: <http://www.esrl.noaa.gov/gmd/ccgg/trends>.

^{viii} Siegenthaler, U., T. F. Stocker, E. Monnin, D. Lüthi, J. Schwander, B. Stauffer, D. Raynaud, J.-M. Barnola, H. Fischer, V. Masson-Delmotte, and J. Jouzel. 2005. Stable Carbon Cycle-Climate Relationship during the Late Pleistocene. *Science* 310(5752)1313-1317.

^{ix} <http://data.giss.nasa.gov/gistemp/>

^x http://nsidc.org/news/press/2007_seaiceminimum/20071001_pressrelease.html

^{xi} The University Corporation for Atmospheric Research, *Abrupt Ice Retreat Could Produce Ice-Free Arctic Summers by 2040* <http://www.ucar.edu/news/releases/2006/arctic.shtml> (Dec. 11, 2006).

^{xii} Sea ice may be gone by 2012, scientist says. Dramatic rise in Arctic melting prompts worry

Associated Press. Wednesday, December 12, 2007

^{xiii} http://www.nasa.gov/topics/earth/features/seaiice_conditions_feature.html

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- ^{xiv} Harden, Blaine. "Experts Predict Polar Bear Decline Global Warming Is Melting Their Ice Pack Habitat." *Washington Post* (July 7, 2005) <http://www.washingtonpost.com/>
- ^{xv} Regehr, E.V., Amstrup, S.C. and Stirling, I., *Polar Bear Population Status in the Southern Beaufort Sea*. U.S. Geological Survey, Open-File Report 2006-1337 <http://pubs.usgs.gov/of/2006/1337/pdf/ofr20061337.pdf> (2006)
- ^{xvi} http://www.usgs.gov/newsroom/special/polar_bears/
- ^{xvii} 50 C.F.R. § 424.11(b).
- ^{xviii} See previous endnote
- ^{xix} Endangered and Threatened Wildlife and Plants; 12-Month Petition Finding and Proposed Rule to List Polar Bear (*Ursus maritimus*) as Threatened Throughout Its Range, 72 Fed. Reg. 1064 (Jan. 9, 2007).
- ^{xx} December 27, 2006 DOI Press Release "Interior Secretary Kempthorne Announces Proposal to List Polar Bears as Threatened Under Endangered Species Act"
- ^{xxi} ExxonValdez Oil Spill Trustees Council. November 2006. Update on Injured Resources and Services 2006. Anchorage. www.evostc.state.ak.us/Universal/Documents/Publications/2006IRSUpdate.pdf
- ^{xxii} St. Aubin, D.J., 1990, Psychological and toxic effects on pinnipeds, in *Sea Mammals and Oil: Confronting the Risks*, Geraci and J.R. and St. Aubin, D.J. (Eds.). Academic Press, New York , 103-107 and 235-240.
- ^{xxiii} U.S. Fish and Wildlife Service. 1995. Habitat conservation strategy for polar bears in Alaska. Marine Mammals Management, Anchorage, Alaska. 232pp.
- ^{xxiv} <http://www.fakr.noaa.gov/newsreleases/2008/ribbonseal032608.pdf>