NATURAL RESOURCES DEFENSE COUNCIL

Statement of

Andrew E. Wetzler

Director, Endangered Species Project

Natural Resources Defense Council

Before the

Committee on Environment and Public Works

United States Senate

January 30, 2008

Introduction

Good morning Madam Chairman and Members of the Committee. My name is Andrew Wetzler and I am the Director of the Endangered Species Project for the Natural Resources Defense Council (NRDC). NRDC is a not-for-profit environmental advocacy organization with over 1 million members and activists served from offices in New York, Washington, D.C., Los Angeles, San Francisco, Chicago, and Beijing. NRDC's mission is to safeguard the Earth: its people, its plants and animals, and the natural systems on which all life depends. I thank the Committee for inviting me to testify today about threats and protections for the polar bear, one of the world's most spectacular and well-recognized animals.

Sadly, today polar bears stand on the brink of extinction. Threatened by a combination of factors ranging from toxic contamination to oil and gas pollution but, most importantly, global warming, polar bears are seeing the sea ice habitat on which they depend disappear at an alarming rate. There is now overwhelming scientific agreement that sea ice loss in the Arctic threatens polar bears with extinction. The International Union for the Conservation of Nature's Polar Bear Specialist Group has officially categorized the polar bear as a "vulnerable" species, defined as a species "facing a high risk of extinction in the wild."[1] Based on the "best scientific and commercial data available," the United States Fish and Wildlife Service has proposed classifying the polar bear as a threatened species under the federal Endangered Species Act, 16 U.S.C. §§ 1531, *et seq.*, and, after an extensive review, the United States Geological Survey has concluded

[1] IUCN (2001).

that two-thirds of the worlds polar bears, including all polar bears in Alaska, are likely to be extirpated by 2050.[2]

As grim as the situation facing polar bears is, it is not hopeless. Prompt action now to increase protection for polar bears throughout their range, combined with concerted action by Congress to control and reduce greenhouse gas emissions is needed if polar bears are to survive. Indeed, the best available science clearly indicates that future sea ice extent could be significantly affected by reductions in the emission of global warming pollution.[3] By stabilizing and gradually reducing carbon dioxide concentrations and significantly reducing concentrations of shorter-lived greenhouse gases, it should be possible to stabilize arctic sea ice extent and eventually allow for it to recover. While the situation confronting polar bears is critical, it is not too late if we act now.

It is thus particularly disturbing that the Fish and Wildlife Service has repeatedly delayed making a final decision about whether to protect polar bears under the Endangered Species Act. A formal petition to protect the polar bear was filed under the Endangered Species Act in February, 2005. Yet, despite the Endangered Species Act's clear requirement that the Fish and Wildlife Service make a final determination about the polar bear's status no later than two years after such a petition is filed, 16 U.S.C. § 1533(b), almost three years later the polar bear is still not protected. In January, the Fish and Wildlife Service announced that it would delay making a

[2] Amstrup et al. (2007).
[3] Durner et al. (2007).

final decision about whether to protect the polar bear for at least another month.[4] This announcement came on the heels of the U.S. Mineral Management Service's plans to lease 46,000 square miles of key polar bear habitat in the Chukchi Sea for oil and gas development, home to between 1,500 and 2,000 bears, on February 6, 2008.[5]

Global Warming Threatens the Polar Bear With Extinction

The Endangered Species Act requires that decisions to list a species as either "endangered" or "threatened" be made "solely on the basis of the best scientific and commercial data available." 16 U.S.C. § 1533(b)(1)(A). Even a cursory review of the available scientific literature leaves little doubt that polar bears are threatened by global warming.

Polar bears (*Ursus maritimus*) are pagophilic ("ice-loving") mammals whose preferred habitat is the annual sea ice over the continental shelf and inter-island archipelagoes of the Arctic basin. Polar bears are almost completely dependent on sea-ice for hunting and migrating, and also rely on sea-ice to find mates and, in some populations, to provide dens for pregnant females.[6] The current global population of polar bears is estimated to be between 20,000 and 25,000 individuals, divided into 19 sub-populations, all of which are located in the Arctic. Polar bear populations are not found outside of areas that have significant sea ice coverage for much of the year.

The greatest threat to polar bears is the effect of warming and sea ice declines on the availability

[4] Statement for Polar Bear Decision (January 7, 2008) (available at: http://www.fws.gov/news/NewsReleases/showNews.cfm?newsId=54D2A6BD-E928-94E6-6BA905F3F540B8F7)
[5] Lunn et al. (2002).
[6] Regehr et al. (2007); Derocher et al. (2004).

and abundance of polar bear's main prey, ringed seals (*Phoca hispida*) and bearded seals (*Erignathus barbatus*).[7] These seal species use sea-ice as resting places, haul-out sites, feeding grounds and habitat to raise their cubs. Changes in sea-ice will likely impact the availability and abundance of seals as prey for polar bears thereby reducing polar bear fat stores, resulting in longer fasting periods and decreasing successful reproductive rates. As three of the world's leading polar bear authorities concluded in 2004, when assessing the potential impact of widespread changes in sea ice on the polar bear: "anything that significantly changes the distribution, abundance, or even the existence of sea ice will have profound effects on polar bears."[8]

Based on ten climate models that have done the best job of simulating current ice conditions and are thus expected to do the best job of simulating future ice conditions, and using the Intergovernmental Panel on Climate Change ("IPCC") A1B "business as usual" scenario of future emissions, the U.S. Geological Survey (USGS) recently evaluated the future range-wide status of the polar bear.[9]

The USGS divided the range of the polar bear into four "ecoregions" based on major differences in current and projected sea ice conditions. (See Figure 1, below.) These ecoregions, which include all 19 polar bear subpopulations, are as follows:

[7] Derocher et al. (2004); Ferguson, et al (2005).
[8] Derocher, et al. (2004), p. 164.
[9] Amstrup, et al. (2007). In the A1B scenario, atmospheric carbon dioxide concentrations reach 717 parts per million by 2100.

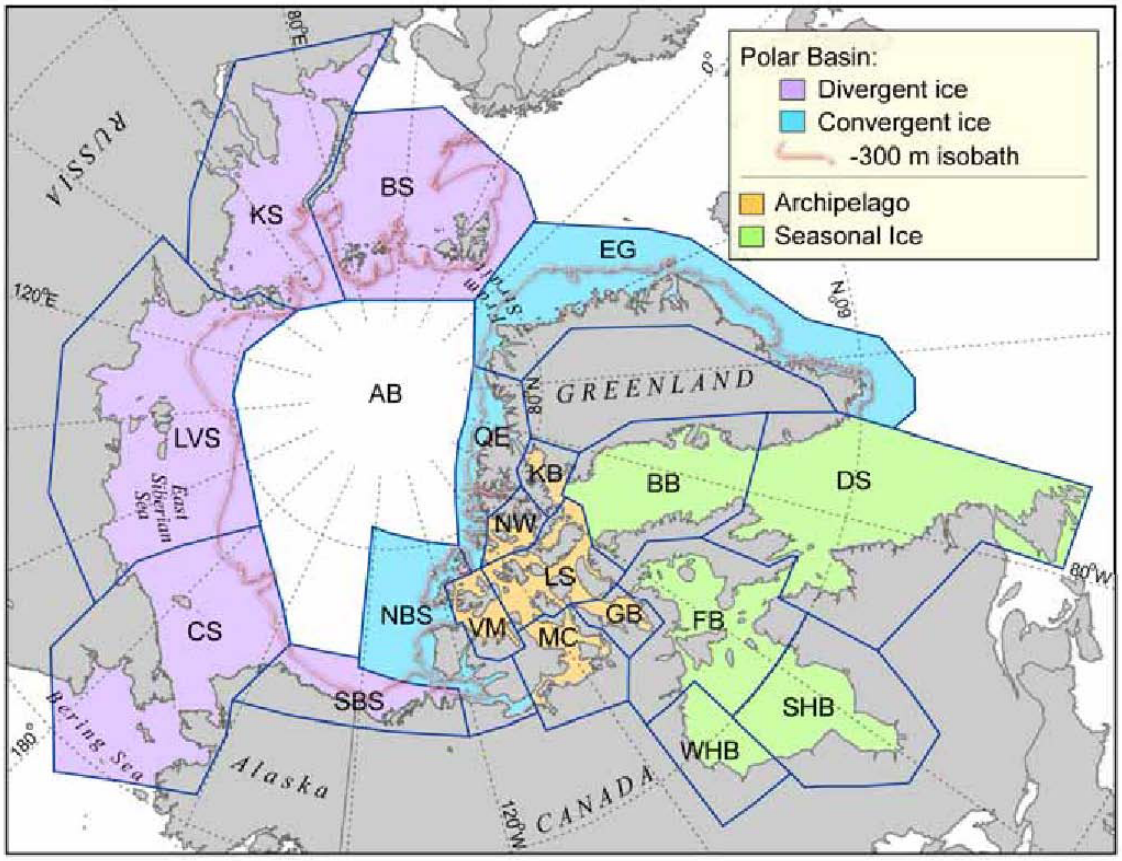
- *Seasonal Ice Ecoregion*, which includes Hudson Bay, and occurs mainly at the southern extreme of the polar bear range;

- *Archipelagic Ecoregion* of the Canadian Arctic;

- *Polar Basin Divergent Ecoregion*, where ice is formed and then drawn away from near-shore areas, especially during the summer minimum ice season; and

- *Polar Basin Convergent Ecoregion*, where sea ice formed elsewhere tends to collect against the shore.

Figure 1--Polar Bear Habitat Ecoregions
(*Source*: Amstrup et al. (2007), Figure 1)



Based on this modeling, USGS concluded that polar bears will completely disappear from the Seasonal and Divergent Ice Ecoregions by the middle of this century. Polar bears may survive in the Archipelago Ecoregion and portions of the Convergent Ice Ecoregion through the end of this century, however, even in these regions, the probability of extinction by century's end is still extremely high: over 40% in the Archipelago Ecoregion and over 70% in the Convergent Ice Ecoregion, under any of the sea ice projections. Table 1, below, expresses the most likely outcome for polar bear populations in each region in a forty-five and one hundred year time-frame.

Table 1--Most Likely Modeled Outcome of the Four Polar Bear Ecoregions
(*Source*: Amstrup et al. (2007) (Table 8)).

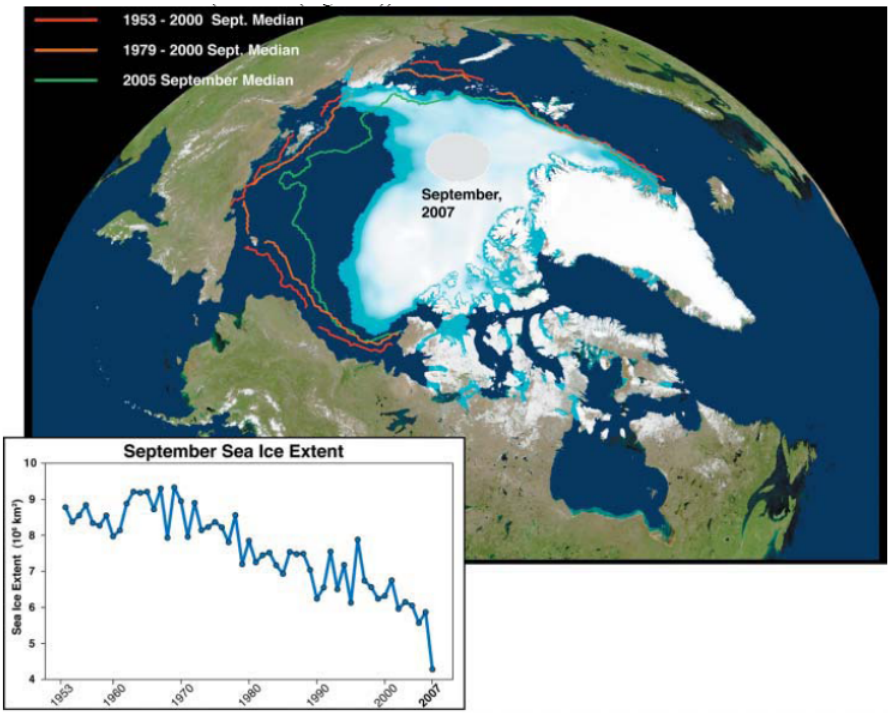
Ecoregion	Time Period	Most Likely Outcome	Probability of Extinction
Seasonal Ice	Year 45	**EXTINCT**	77.19%
	Year 100	**EXTINCT**	88.15%
Divergent Ice	Year 45	**EXTINCT**	80.33%
	Year 100	**EXTINCT**	83.89%
Convergent Ice	Year 45	**EXTINCT**	35.06%
	Year 100	**EXTINCT**	77.30%
Archipelago	Year 45	SMALLER	10.56%
	Year 100	**EXTINCT**	41.07%

When assessing these predictions it is extremely important to bear in mind that the USGS's projections must be viewed as conservative, as the actual *observed rate of sea ice loss has*

exceeded these models predictions. This is noted throughout the USGS report (*e.g.* Amstrup et al. (2007), pp. 34, 36).

Indeed, as shown in Figure 2, after the USGS report was released, scientists reported that a new record summer sea ice minimum had been reached in 2007. The new reported record low of 1.59 million square miles is far less than the previous record low of 2.05 million square miles and 50% lower than conditions in the 1950s to the 1970s.[10] The 2007 record low is also 1 million square miles—an area approximately six times the size of California—less than the long-term average minimum of 2.60 million square miles.[11]

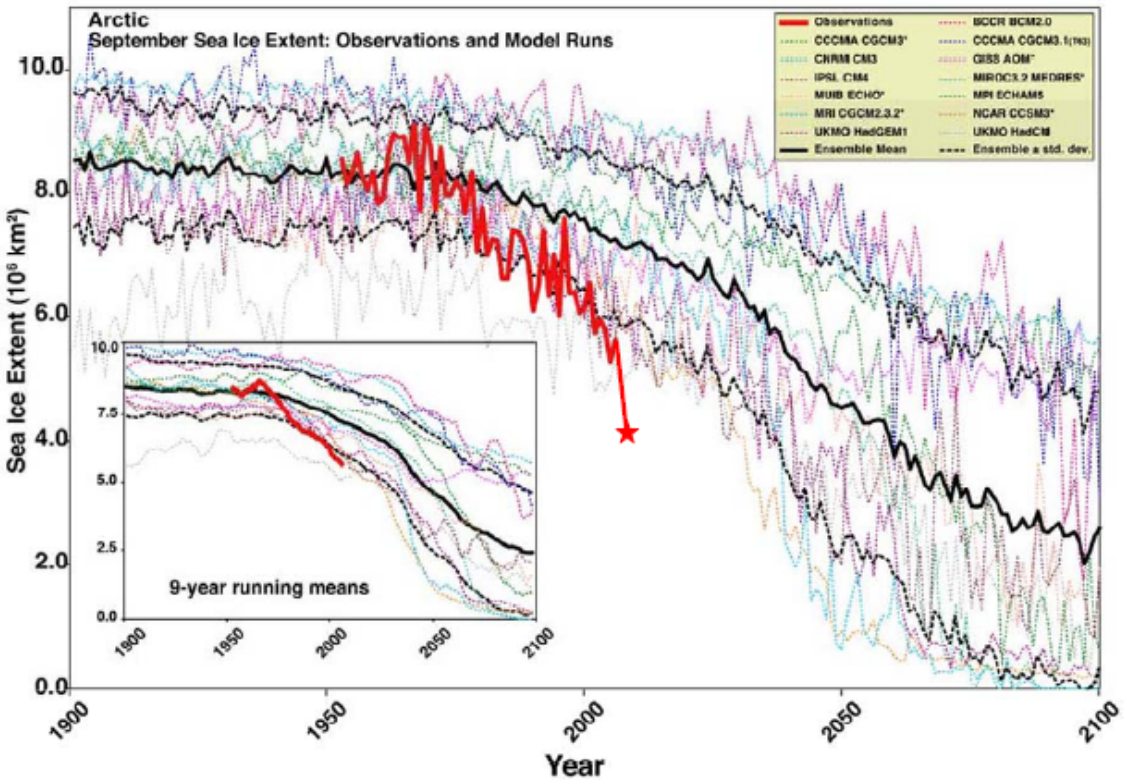
Figure 2--Sea ice concentration for September 2007, along with median extent from1953 to 2000 (red curve), from 1979 to 2000 (orange curve), and for September 2005 (green curve). September ice extent time series from 1953 to 2007 is shown at the bottom.
(*Source*: Stroeve et al. (2008) (Figure 1)).



[10] NSIDC 2007a,b; Stroeve et al. (2008).
[11] NSIDC 2007a,b.

This record low is far below that predicted by any of the ten climate models used by the USGS. Moreover, as illustrated by Figure 3, below, the 2007 minimum sea ice extent is below that predicted by the ensemble mean of the Stroeve et al. (2007) models for 2050. In other words, *there was less ice in the Arctic in 2007 than over half of the climate models predicted for 2050.*[12] Leading sea ice researchers now believe that the Arctic could be completely ice free in the summer as early as 2030.[13]

Figure 3--Actual Observed Sea Ice Extent (in Red) Compared to Model Projections
(*Source*: After DeWeaver (2007); Stroeve et al. 2007.)



[12] It is also worth noting that the carbon dioxide concentrations cited for these scenarios in 2100 are just the level projected to be attained in that year, not the level at which CO2 concentrations would be stabilized. Indeed, under all of these scenarios CO2 concentrations would continue to rise indefinitely after 2100.

[13] Stroeve et al. (2008).

The effects of the decline of sea ice can already be seen in many polar bear populations around the world, and are particularly pronounced in the Western Hudson Bay, the polar bear's southern-most population.

Over the past two decades the condition of adult polar bears in the Hudson Bay has deteriorated and this has been reflected in the reproductive cycle of females and in total population levels. In 1987 there were 1,194 polar bears in the Western Hudson Bay. In 2004 only 935 were recorded, a drop of 22%.[14] This decline is reflective of reduced breeding success and lower survival of senescent-adult polar bears (less than 20 years in age) and can be attributed to a combination of overharvest and "increased natural mortality associated with earlier sea ice breakup." [15] Scientists now predict that "more northerly polar bear populations will experience declines in demographic parameters similar to those observed in western Hudson Bay" in light of the "long term and severe" forecasts of ice break up in the Arctic.[16]

And, in fact, the Western Hudson Bay population is not the only one that is already suffering from the effects of climate change. The Southern Beaufort Sea population is now also classified by the Polar Bear Specialist Group as declining.[17] In addition to an overall population decline, the Southern Beaufort Sea population has experienced statistically significant declines in cub survival, cub skull size, and adult male weight and skull size—the same types of declines observed in Western Hudson Bay prior to the decline of that population.[18] Other signs of poor

[14] Aars et al. (2006).
[15] Regehr et al. (2007), p. 2681.
[16] *Id.*, p. 2681.
[17] Aars et al. (2006).
[18] Regehr et al. (2007).

nutrition have been recorded in the Southern Beaufort Sea, where multiple female polar bears and their young have starved to death.[19]

There are also indications that adult male polar bears may be turning to cannibalism as a means to supplement their diet. Amstrup (2006) reports three instances of intraspecific predation and cannibalism of polar bears in the Beaufort Sea, including the unprecedented killing of a parturient female in her maternal den. The authors hypothesize that these killings—which are the first reported in 24 years of research on polar bears in the southern Beaufort Sea and 34 years in northwestern Canada—may be caused by nutritional stress due to longer ice-free seasons. A similar incident was recently reported among polar bears on Phippsøya, in Norway's Svalbard Islands.[20]

The retreat of sea ice may also result in significant behavior changes in polar bears, some of which put bears at increased risk of mortality. Most female polar bears, for example, exhibit a preference for den locations that are on land. As sea-ice extent declines, and hence the sea-ice edge moves northwards, polar bears will have to travel greater distances, and expend more energy, to reach their preferred den areas or they will have to change den locations. Sometimes this can have catastrophic consequences. For example, in Alaska's Southern Beaufort Sea, survey results reported by the Minerals Management Service reveal that in September 2004 at least four polar bears, and up to twenty-seven, drowned off the north coast of Alaska where the sea-ice retreated a record 160 miles from the coast.[21] As an alternative to traveling long

[19] Regehr et al. (2006).
[20] Stone and Derocher (2007).
[21] Monnett et al. (2005).

distances, some female polar bears may choose to leave the ice at break-up and summer in the location of their den. Although this avoids additional energy expended during travel, it will instead require an additional fasting period because females will leave the sea-ice feeding grounds earlier than preferred, possibly resulting in fasting of up to eight months.[22]

Some polar bear populations also den in snow and changes in the proportion of precipitation falling as snow compared to rain will affect such denning behavior. The Arctic Council and the International Arctic Science Committee reports that den collapses due to increased frequency and intensity of spring rains has already occurred in some cases, resulting in the death of some females and their cubs.[23] In addition to an increase in unseasonable rains, global warming is expected to increase the frequency, extent, and season for fires in Arctic regions which, in turn, may significantly reduce availability of suitable denning habitat on land.[24]

In short, global warming thus poses an immediate, accelerating, and mortal threat to polar bear populations around the world.

Other threats to polar bears

As polar bear populations continue to be affected by the loss, retreat, and earlier break up of sea ice, it is extremely important to minimize other stresses on the population. In particular continued and expanded oil and gas exploration and development, toxic contamination and, in

[22] Derocher et al. (2004).
[23] ACIA (2004).
[24] Richardson (2007).

some populations, over-harvesting are all additional sources of disruption, injury, and mortality to polar bears. Some of these threats are expected to be exacerbated by global warming.

Oil and Gas Exploration

Oil and gas exploration can have a significant effect on polar bear populations. Oil and gas activities can alter important onshore and offshore polar bear habitat and is often accompanied by air traffic, vessel traffic and other supporting infrastructure. A large oil spill could have catastrophic consequences for polar bear populations. In addition, anthropogenic noise pollution, generated by seismic exploration and oil and gas development activities, may also have a negative effect on polar bears. Denning polar bears, for example, are likely to be susceptible to disturbance from activities related to oil and gas exploration and development. Noise disturbance from seismic activities of oil exploration as well as ground and air transportation can be heard within 300 meters of dens.[25] A recent study of auditory evoked potentials found that polar bears hear acutely across an unexpectedly wide frequency range and, on this basis, the authors expressed caution over the introduction of noise into their environment.[26] Exposure to noise from drilling and vehicles may cause bears to abandon their dens.[27] In other circumstances, den disturbance has been linked to lower birth weight in female cubs.[28]

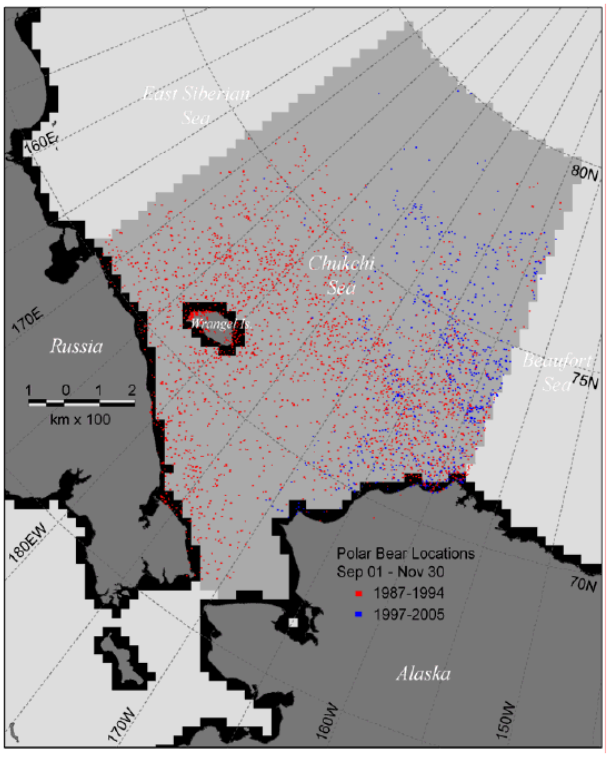
Of particular concern is pending Lease Sale 193 in the Chukchi Sea. Polar bears in the Chukchi Sea are thought to number between 1,500 and 2,000 individuals (although much about the population still remains uncertain). Lease Sale 193 would open up 46,000 square miles of polar

[25] Blix and Lentfer (1992).
[26] Nacthingall (2007).
[27] Amstrup (1993); Linnell et al. (2000).
[28] Lunn et al. (2004).

bear habitat in the Chukchi Sea to oil and gas development. As can be seen from Figure 4 and Figure 5, below, polar bears are widely distributed throughout the Chukchi Sea, as are polar bear denning sites.[29]

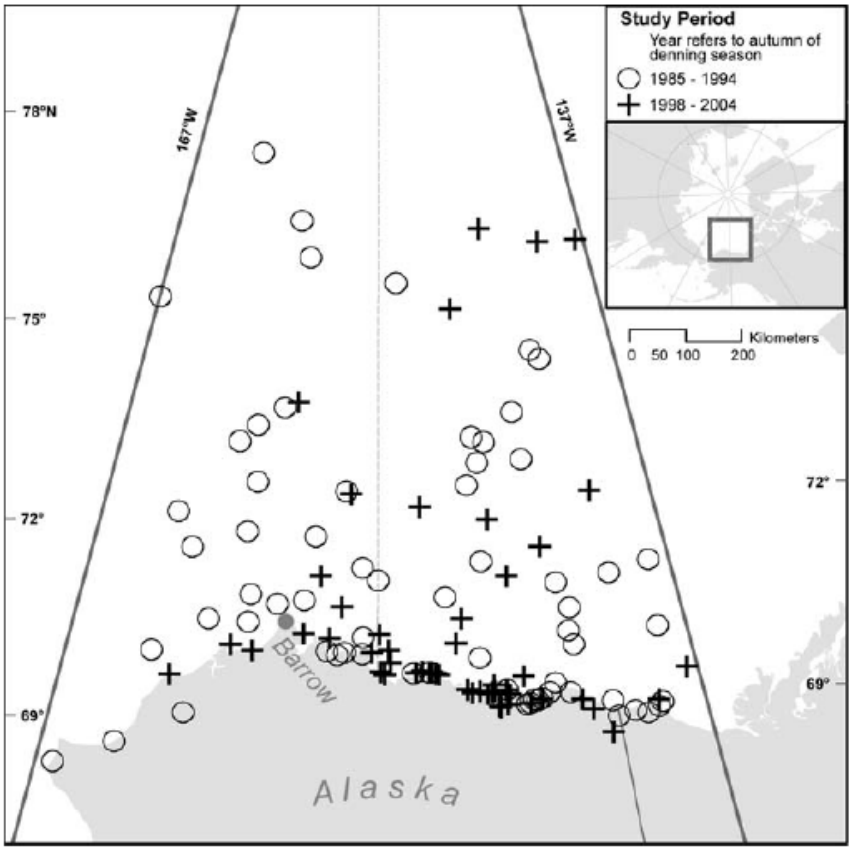
Figure 4--Chuckchi Sea polar bear distribution
(*Source*: Durner et al (2007))

Figure 1. Boundary of the full Chukchi Sea study area (intermediate gray) as defined by a 25 km x 25 km rasterized polygon that encompassed offshore (>25 km) waters between 170°E–156°W and 66°N–80°N. Dot symbols denote all polar bear satellite relocations within 170°E–156°W and 66°N–80°N that were collected during the autumn months (September–November), mostly from an early-vintage field study (1987–1994) of the Chukchi Sea bear population (red), and exclusively from a recent-vintage field study (1997–2005) of the Beaufort Sea bear population (blue).



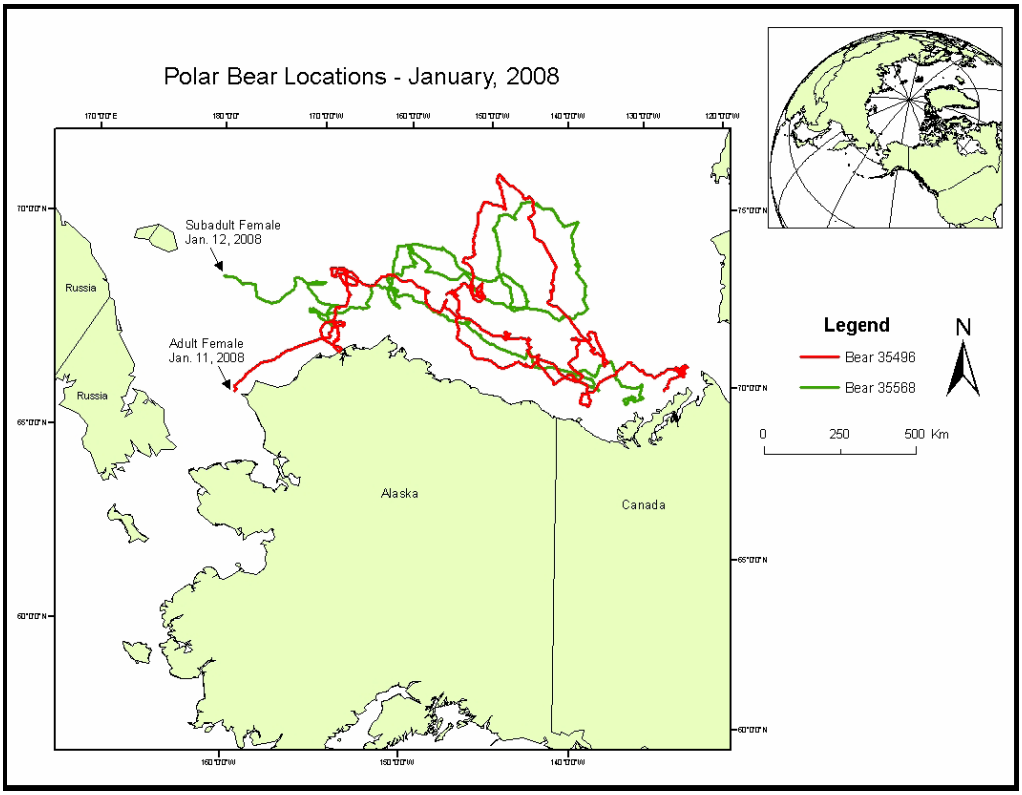
[29] Fischbach et al. (2007).

Figure 5--Distribution of polar bear den entrance locations
(*Source*: Fischbach et al. (2007))



As illustrated in Figure 5, there has been an apparent shift in denning locations in response to changing sea ice stability and the lengthening of the Arctic melt season. Significantly, researchers are also beginning to observe large scale polar bear movements, including the movement of bears from the Canadian portion of the Southern Beaufort Sea population into the Chukchi Sea (see Figure 6, below). As conditions in the Southern Beaufort Sea decline, the Chukchi Sea's habitat may become increasingly important.

Figure 6--Selected Locations of Bears 35496 and 35568 through 12 January 2008
(*Source*: Andrew Derocher, unpubl. data.)



In addition to the risks that accompany any oil development, Lease Sale 193 also poses an unacceptable risk of a large oil spill. The Mineral Management Service's Final Environmental Impact Statement for Chukchi Sea Planning Area Oil and Gas Lease Sale 193 and Seismic Surveying Activities (FEIS) estimates that there is at least a 40%, and as much as a 54%, chance of a large spill if the sale areas are developed.[30] Bears who come in contact with oil generally attempt to clean themselves, ingesting the oil, which can be fatal.

[30] Minerals Management Service (2007), p. IV-2; Table A.1-27.

Toxic Contamination

In addition to threats from global warming and oil and gas development, the polar bear, as one of the Arctic's apex predators, is particularly vulnerable to biocontamination from a range of substances, including persistent organic pollutants (or "POPs") and heavy metals. Its vulnerability is exacerbated by certain aspects of its biology, such as its long annual fast, which tends to elevate its toxicity levels at a time when the animal is under greatest stress. Moreover, global warming stands to create new pathways for concentration of pollutants in the region, with the remobilization of toxics from melting permafrost and the rise of industrial activity as the climate warms.

In general, pollutant levels in the Arctic remain high and in some cases are increasing. Sampling taken from 1996 to 2002 indicates that regional concentrations of certain chlorinated hydrocarbon contaminants (CHCs) did not decline as might have been expected in response to reduced production.[31] Based on their CHC loads, the East Greenland and Svalbard polar bear populations are at greatest risk of health effects.[32] Perfluorochemicals (PFOS), whose world-wide circulation was only recently discovered, are considered important contaminants in Greenland, with biomagnification of PFOS observed in the polar bear populations there and in South Hudson Bay.[33] Some perfluorochemicals are reported to have rapidly increased in the Canadian Arctic as well[34] and have been found in significant concentrations in polar bears of the Beaufort and Chukchi Seas, though at lower levels than in North Atlantic populations.[35]

[31] Verreault et al. (2005a)
[32] *Id*.
[33] Bossi et al. (2005), Smithwick et al. (2005).
[34] Braune et al. (2005); see also Prevedouros et al. (2005).
[35] Kannan et al. (2005), Smithwick et al. (2005).

Concentrations of Polybrominated diphenyl ethers (PBDEs) have for the first time been reported in Alaskan bears.[36] In addition, according to the Arctic Monitoring and Assessment Programme ("AMAP"), the region as a whole remains highly vulnerable to the effects of radionuclides.[37]

Several recent studies provide further indication of the health impacts of contaminants. Some congeners have been shown to significantly affect lymphocyte production in polar bears, leaving the animals susceptible to infection.[38] On the basis of that study and others, a number of Canadian and Norwegian researchers have concluded that organochlorines could already be having population-level impacts on the species.[39] A separate study on East Greenlandic polar bears correlated liver inflammation with long-term exposure to organohalogens, such as PBDEs, which have also been linked to renal lesions.[40]

Additional research that has emerged, particularly on brominated flame retardants like PBDEs, which are rising in the Arctic due to long-range transport from western Europe, eastern North America, and other industrial regions.[41] Studies have demonstrated slow biodegradation[42] and high biomagnification[43] of certain PBDEs in a number of polar bear subpopulations, and a study of the food web in the Norwegian Arctic indicates that some congeners already exceed detection thresholds even in zooplankton and biomagnify specifically through the trophic system.[44] PBDEs and other organohalogens were shown to adversely affect the male and female genitalia

[36] Kannan et al. (2005).
[37] AMAP (2004).
[38] Lie et al. (2004); see also AMAP (2005).
[39] Fisk et al. (2005).
[40] Sonne et al. (2005).
[41] de Wit et al. (2006).
[42] Dietz et al. (2007).
[43] Muir et al. (2006).
[44] Sørmo et al. (2006).

of East Greenland polar bears, reducing their size and robustness and potentially compromising reproduction in these animals.[45] The past year also saw further evidence on the health impacts of other contaminants. Organochlorines, for example, were found to alter hormone production in both male and female polar bears; modeling indicates that even low levels of chronic exposure to these chemicals can impair the reproduction and immune system function of their offspring.[46]

Of particular note is the possible increase in global mercury deposition, despite emission reductions adopted in the 1980s by North America and Europe.[47] Rising concentrations in the Northwest Atlantic and other parts of the Arctic have been attributed to long-range transport from Asia, which now accounts for roughly half of the world's mercury pollution.[48] Concentrations are substantially higher in the Canadian Arctic than elsewhere, and there is strong evidence that levels in Canadian polar bears have increased substantially since the beginning of the industrial age.[49] The higher levels that have been reported in the Canadian Arctic may be due, in part, to global warming.[50] Indeed, the increased precipitation that climate change is expected to bring is likely to make the Arctic a more effective trap for heavy metals.[51] While mercury concentrations have declined in East Greenlandic polar bears, consistent with emission reductions from European coal plants, levels remain about 11 times higher than the pre-industrial baseline.[52]

[45] Sonne et al. (2006b).
[46] Ropstad et al. (2007).
[47] AMAP (2005).
[48] Dietz et al. (2006).
[49] Braune et al. (2005).
[50] Braune et al. (2005).
[51] Macdonald et al. (2005).
[52] Dietz et al. (2006).

I would note that this Committee is now considering important legislation, the Mercury Export Ban Act of 2007, which will help stem global mercury pollution, by banning the export of elemental mercury from the United States. Elemental mercury is still used in a number of commercial products and industrial processes worldwide. While the US has become increasingly vigilant about managing mercury within its borders, much of our mercury is sold on the global market, where it is used in highly polluting industries, mainly in developing countries. Because mercury is a global pollutant, mercury emitted in those countries can travel around the world, and end up in Arctic waters and fish and wildlife, including polar bears. By preventing the sale of United States mercury overseas, the Mercury Export Ban Act of 2007 will help limit the US contribution to the overall global mercury contaminant pool. I urge the committee to consider and pass this important legislation as quickly as possible.

Overharvest

While sports hunting of polar bears is currently prohibited in the United States, Russia, and Norway, some polar bear populations are subject to unsustainable harvest levels either as the result of poaching (as is the case in Russia) or hunting practices (as is the case in Greenland and some parts of Canada). Over-harvest of polar bears thus has a concentrated, but potentially severe, effect on several polar bear populations, some of which have already been classified as "declining" by the Polar Bear Specialist Group.[53]

Poaching of polar bears in the Russian Federation continues to be a serious problem. In 2002, for example, experts estimate that poachers took between 250 and 300 bears on the north coast of

[53] Aars et al. (2006).

Chukotka.[54] Poaching may be exacerbated by receding sea ice, which forces polar bears onto shore early. And more polar bear skins and other commercial products are being advertised on web sites than ever before.[55] However, the Agreement between the United States of America and the Russian Federation on the Conservation and Management of the Alaska-Chukotka Polar Bear Population, which was recently ratified by the U.S. Senate, is an important tool whose implementation may help to alleviate illegal harvest of polar bears in Russia.

In Canada and Greenland, the levels of legal harvest of some polar bear populations are far too high and, in and of themselves, may threaten the continued existence of these populations. For example, despite the scientific evidence, discussed above, that the western Hudson Bay population is experiencing severe declines, the Fish and Wildlife Service has noted that, while this population has a maximum sustained yield of only 44 bears, Canada allows 62 bears to be removed from the western Hudson Bay.[56] A recent study also concluded that selective harvest of male polar bears by sports hunters could lead to a "sudden and rapid reproductive collapse" due to a combination of reduced population density and altered female-to-male ratios.[57] Moreover, receding sea ice, caused by global warming, may bring more polar bears in contact with people, increasing hunting opportunities and potentially leading to misperceptions of polar bear abundance.[58]

[54] Ovsiyanikov (2003).
[55] *Id*.
[56] 72 Fed. Reg. at 1084.
[57] Molnár et al (2008).
[58] Stirling and Parkinson (2006).

When discussing hunting, it is important to emphasize, however, *that protecting the polar bear under the Endangered Species Act will not affect subsistence harvest by native Alaskans*. Section 9(e) of the Endangered Species Act provides that the Act's prohibition against "taking" a listed species does not apply to Alaskan Natives (or non-native residents of Native villages) if such taking is primarily for subsistence purposes. 16 U.S.C. § 1539(e). The Act also exempts "authentic native article of crafts and clothing" produced from listed species. Id. Significantly, the Marine Mammal Protection Act, which *already* regulates native harvest of polar bears in Alaska, contains a nearly identical provision. See 16 U.S.C. § 1371(b) ("Exemptions for Alaskan natives").

Prompt Action is Needed to Save the Polar Bear

Congress Must Pass Legislation to Control Global Warming Pollution

The situation facing polar bears is undeniably grim. But it is not hopeless. The USGS Reports illustrate this very point. As discusses above, in its reports the USGS considered several scenarios developed by the IPCC in implementing its models. These scenarios indicate that arctic sea ice conditions during the coming century will be sensitive to future emission levels. Scientists have noted, for example, that the ensemble-mean summer minimum sea ice extent is reduced by 65% in the highest emission scenario considered (A2) and by 45.8% in the lowest scenario considered (B1), thus suggesting that reducing global warming emissions can substantially affect future reductions of sea ice in polar bear habitat.[59] In fact, the USGS reports themselves note that:

[59] DeWeaver (2007); Zhang and Walsh (2006).

> "Differences between the A1B and B1 scenarios (for the CCSM3 model) in timing and relative magnitude of projected sea ice extent are remarkably similar to the inverse of their imposed CO2 loadings…"[60]

The U.S. government as well as many other governments and independent researchers have developed climate mitigation scenarios that would stabilize greenhouse gas concentrations well below the levels considered in the scenarios used by the USGS reports. For example, the U.S. Climate Change Technology Program Strategic Plan (DOE/PI-0005, 2006: 35) considers a "Very High Constraint" scenario in which total radiative forcing from greenhouse gases is stabilized at less than 3.5 W/m2, corresponding to stabilizing CO2 concentrations at approximately 450 parts per million (ppm). The Union of Concerned Scientists recently reviewed scenarios designed to limit total global warming to no more than 2 degrees Celsius, concluding that this is feasible if the United States reduces its emissions by 4 percent per year starting in 2010, assuming other countries also take appropriate action.[61] Finally, Dr. James Hansen, Director of NASA's Goddard Institute for Space Studies, has proposed an "alternative" scenario aimed at keeping additional global warming well below 1 degree Celsius.[62] His recent review of current trends concludes that it is still possible to achieve this objective.[63] Thus, by stabilizing and gradually reducing CO2 concentrations while significantly reducing concentrations of shorter-lived greenhouse gases, it should be possible to stabilize arctic sea ice extent and eventually allow for it to recover. This observation is particularly important given the possibility that some polar bear refugia may continue to exist in the Arctic through the end of the century.

[60] Durner, et al (2007), p. 16. See also Holland et al. (2006) (finding that periods of rapid decline in arctic sea ice are less likely under the B1 scenario than under the A1B or A2 scenarios).
[61] Luers et al. (2007).
[62] Hansen, et al (2000).
[63] Hansen and Sato (2007).

In order to accomplish this goal, it is crucial for Congress to enact comprehensive legislation to reduce global warming pollution. The Lieberman-Warner Climate Security Act of 2008 is one of the strongest global warming bills currently being considered by Congress and I would like to thank Senator Boxer and other members of the Committee for their leadership in both strengthening and moving this bill through the Committee last year. NRDC urges you to move the Lieberman-Warner bill to the Senate floor as soon as possible and we stand ready to assist you to help further strengthen the bill. NRDC will also work to prevent any amendments from passing that would weaken the emission limits, which will make it much more challenging to stablalize atmospheric concentrations of C02 at a level that is sufficient to save the polar bear and the thousands of other species that are threatened by global warming.

Protecting the Polar Bear Under the Endangered Species Act Will Help Save the Species

Protecting the polar bear under the Endangered Species Act will also provide crucial long and short-term protections to the species. Listing the polar bear under the Endangered Species Act will have the following immediate benefits.

First, once a species is listed as threatened or endangered, federal agencies must ensure, through a process known a "consultations" with the Fish and Wildlife Service, that any action they authorize, fund, or carry out will not "jeopardize the continued existence" of the species or "result in the destruction or adverse modification" of that habitat. 16 U.S.C. § 1536(a)(2). While the Section 7(a)(2) duty not to "jeopardize the continued existence" of listed species helps

to ensure their survival, the critical habitat duty allows these species to recover so that they may eventually be delisted.[64]

The consultation process, which can be informal or formal in nature, almost never stops projects from going forward.[65] That is because the Fish and Wildlife Service is required to provide federal agencies with a list of "reasonable and prudent measures" that can be implemented to reduce the impact of proposed federal actions and allow the action to proceed. 16 U.S.C. § 1536(b)(4). Thus, in practice, the consultation process will provide an important safety net for polar bears, by requiring federal agencies to implement additional safeguards to the species, while allowing them to go forward. Significantly, this consultation requirement will apply to many of the threats facing polar bears, from toxic pollution, to oil and gas development, and, most importantly, sources of global warming pollution that require a federal permit.

Second, the Fish and Wildlife Service will be required to designate "critical habitat" for the polar bear. 16 U.S.C. § 1533(a)(3)(A)(i). Critical habitat is defined in Section 3 of the ESA as:

> (i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the [Endangered Species Act], on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it was listed....upon a determination by the Secretary that such areas are essential for the conservation of the species."

---

[64] *See Gifford Pinchot Task Force v. U.S. Fish and Wildlife Serv.*, 378 F.3d 1059 (9th Cir. 2004); *Sierra Club v. U.S. Fish and Wildlife Serv.*, 245 F.3d 434 (5th Cir. 2001).

[65] According the Endangered Species Coaliton, a study by the Fish and Wildlife Service found that between 1987 and 1992 the consultation process only resulted in the cancellation of .05% of proposed federal actions. *See* Endangered Species Coalition, "ESA Agency Action Facts" (available at: http://www.stopextinction.org/site/c.epIQKXOBJsG/b.861809/k.C6E0/ESA__Agency_Actions.htm)

16 U.S.C. § 1532(5)(A). As discussed above, designating critical habitat will provide additional protections to essential polar bear habitat, including both onshore habitat used for maternal denning and sea ice habitat used for most of the bears' essential biological functions.

Third, protecting the polar bear under the Endangered Species Act will impose a prohibition against any individual "taking" of a polar bear without a permit. It should be noted, however, that, while the Endangered Species Act prohibits the "take" of a species listed as endangered, this same prohibition does not apply to threatened species, except by regulation. 16 U.S.C. § 1533(d). Thus, under certain circumstances, the Service may issue regulations under Section 4(d) of the ESA (these regulations are generally referred to as "special rules") that authorize activities that result in the take of threatened species that could not be authorized for endangered species. While NRDC believes that the scientific evidence now warrants an "endangered" rather than a "threatened" listing, it is important to note that if the Fish and Wildlife Service does list the polar bear as a threatened species, that designation will provide the agency with the ability to modify the Endangered Species Act's taking requirements for the species. Given this Administration's history of undercutting environmental protections, particularly when it comes to the energy industry, we would urge that any such regulations be subject to vigilant oversight by this Committee.

Fourth, protecting the polar bear under the Endangered Species Act will require the Fish and Wildlife Service to prepare a "recovery plan" for the polar bear. Recovery plans are required to include (1) "site specific management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species"; (2) "objective, measurable criteria" for

determining a species to be recovered; and (3) "estimates of the time required" to carry out the recovery plan. 16 U.S.C. § 1533(f)(1)(B). Preparing a recovery plan for the polar bear will not only be of enormous benefit to the species, by forcing the Fish and Wildlife Service to precisely confront the various threats that it faces and put the species on the road to recovery, but it will also force the Bush Administration to deal directly and quantifiably with the climate change science in a way it has mostly resisted to date.

Finally, listing the polar bear under the Endangered Species Act will be a powerful acknowledgement of the toll that global warming is taking not just on polar bears, but on the entire Arctic ecosystem and, indeed, on wildlife around the world. Polar bears may be the first species listed under the Endangered Species Act principally because of global warming, but if we do not act soon to stabilize and reduce greenhouse gas emissions, they will be far from the last.

The Fish and Wildlife Service's History of Delays in Protecting Polar Bears

Given the overwhelming evidence that polar bears are facing extinction because of global warming, the need for prompt action to protect the polar bear, and the many benefits that Endangered Species Act protections would provide, it is particularly dismaying that the Fish and Wildlife Service has continually sought to delay making a final decision about whether to list polar bears.

The Endangered Species Act allows "any person" to petition the Secretary of the Interior or Secretary of Commerce to list a species as either "endangered" or "threatened." 16 U.S.C. §

1533(a). An "endangered species" is defined as any species "which is in danger of extinction throughout all or a significant portion of its range." 16 U.S.C. § 1532(6). A "threatened species" is defined as any species "which is likely to become an endangered species within the foreseeable future." 16 U.S.C. § 1532(20).

When making listing determinations, the Service must consider five statutory listing criteria: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (e) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; or (5) other natural or manmade factors affecting its continued existence. 16 U.S.C. § 1533(a)(1). If a species meets the definition of threatened or endangered because it is imperiled by any one or more of these five factors, the Service must list the species. 16 U.S.C. § 1533(1). The Service must base all listing determinations "solely on the basis of the best scientific and commercial data available." Id. at § 1533(b)(1)(A).

On February 16, 2005, the Center for Biological Diversity petitioned the Fish and Wildlife Service to list the polar bear as a threatened species. The Petition was principally based on the threat that global warming poses to the polar bear's sea ice habitat, but also discussed ongoing threats from toxic contamination, oil and gas development, and overhunting. NRDC and Greenpeace USA formally joined the petition in July 2005.

After a petition to list a species is filed, the Fish and Wildlife Service (acting on behalf of the Secretary) has ninety days to make an initial finding whether the petition presents "substantial

scientific or commercial information indicating that the petitioned action may be warranted" (this is known as a "90-day finding"). 16 U.S.C. § 1533(b). If the Service answers this question in the affirmative, it has twelve months from the date the petition was filed to decide whether to grant the petition and, if so, issue a proposed rule listing the species (known as a "12-month finding"). Id.

As is typically the case, however, we received no official response (other than an acknowledgement of receipt) to our Petition. Accordingly, on December 15, 2005, the Center for Biological Diversity, NRDC, and Greenpeace sued the Fish and Wildlife Service for failing to respond to the Petition within the time required by the ESA.[66] In response to the lawsuit, the Service issued a positive 90-day finding on February 9, 2007, and initiated a status review of the species. NRDC and the other petitioners, and numerous conservation groups, filed comments with the Fish and Wildlife Service during a public comment period that followed this finding. The parties also entered into a Settlement Agreement and Consent Decree that required the Service to make a preliminary decision about whether to propose the polar bear for protection under the ESA by the end of the year.

On December 27, 2006, the Fish and Wildlife Service issued a proposed rule to list the polar bear as a threatened species under the ESA, which was published in the *Federal Register* on January 9, 2007.[67] The proposed rule triggered another public comment period, which the Fish and Wildlife Service subsequently reopened twice, once to allow for the official submission of new

[66] *Center for Biological Diversity v. Kempthorne*, Civ. 05-5191 JSW (N. Dist. Cal. Dec. 15 2005) (Complaint).
[67] Proposal to List the Polar Bear as a Threatened Species, 72 Fed. Reg. 1064-1099 (Jan. 9, 2007).

information and once to allow public comment on the USGS studies discussed above. During these various public comment periods over 600,000 people submitted comments to the Fish and Wildlife Service, the overwhelming majority supporting the listing of the polar bear. Almost 400,000 of these comments were submitted by NRDC members and activists.

The Endangered Species Act requires that "[w]ithin the one-year period beginning on the date on which" a proposed rule to list a species is published in the Federal Register, the Fish and Wildlife Service must either issue a final rule listing the species or withdraw it's proposed rule." 16 U.S.C. 1533(b)(6)(A). The Fish and Wildlife Service may extend this mandatory deadline for six months if it finds that there is "a substantial disagreement regarding the sufficiency or accuracy of the available data relevant to the determination." 16 U.S.C. §1536(b)(6)(B)(i). Thus, in the absence of such a substantial disagreement, the Fish and Wildlife Service was required to make a final decision about whether to protect the polar bear under the Endangered Species Act no later than January 9th, 2008.

On January on January 7, 2008, the Fish and Wildlife Service announced that the listing decision would be delayed.[68] While the agency did not give a firm date for publication of the final listing determination, it stated that it "expected" to make a final decision "within the next month." The Fish and Wildlife Service did not claim that there was any substantial disagreement justifying a delay of the final listing determination.

[68] Statement for Polar Bear Decision (January 7, 2008) (available at http://www.fws.gov/news/NewsReleases/showNews.cfm?newsId=54D2A6BD-E928-94E6-6BA905F3F540B8F7)

It is worth noting, however, that a delay of a month is precisely long enough to allow the Minerals Management Service to proceed with Lease Sale 193 in the Chukchi Sea. Despite this, however, the Mineral Management Service has refused to delay Lease Sale 193. NRDC believes that it is thus incumbent upon Congress to ensure that the Department of Interior withdraw its Record of Decisions on Lease Sale 193 and that the sale not be allowed to proceed until the Mineral Management Service fully accounts for the risk that it poses to the Chukchi Sea polar bear population under the Endangered Species Act, including any impacts that oil and gas development would have on polar bear critical habitat.

Thank you for this opportunity to address the Committee on the conservation of polar bears.

Literature Cited

Aars, J., N.J. Lunn, and A.E. Derocher. 2006. *Polar Bears: Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 20-24 June 2005, Seattle, Washington, USA*. IUCN, Gland, Switzerland and Cambridge, UK.

ACIA. 2004. *Impacts of a Warming Arctic: Arctic Climate Impact Assessment.* Cambridge University Press.

AMAP. 2005. AMAP Assessment 2002: *Heavy Metals in the Arctic*. Available at: www.amap.no.

AMAP. 2004. AMAP Assessment 2002. *Radioactivity in the Arctic*. Available at: www.amap.no.

Amstrup, S.C., B.G. Marcot, and D.C. Douglas. 2007. *Forecasting the Range-wide Status of Polar Bears at Selected Times in the 21st Century*. U.S. Geological Survey, Reston, Virginia, USA

Amstrup, S. C. 1993. Human disturbances of denning polar bears in Alaska. *Arctic*, 46:246-250.

Bossi, R., F.F. Riget, R. Dietz, C. Sonne, P. Fauser, M. Dam and K. Vorkamp. 2005. Preliminary screening of perfluorooctane sulfonate (PFOS) and other fluorochemicals in fish, birds and marine mammals from Greenland and the Faroe Islands. *Environmental Pollution*, 136:323-329.

Blix, A. S. and J. W. Lentfer. 1992. Noise and vibration levels in artificial polar bear dens as related to selected petroleum exploration and developmental activities. *Arctic*, 45:20-24.

Braune, B.M., P.M. Outridge, A.T. Fisk, D.C.G. Muir, P.A. Helm, K. Hobbs, P.F. Hoekstra, Z.A. Kuzyk, M. Kwan, R.J. Letcher, W.L. Lockhart, R.J. Norstrom and G.A. Stern and I. Stirling. 2005. Persistent organic pollutants and mercury in marine biota of the Canadian Arctic: An overview of spatial and temporal trends. *Science of the Total Environment*, 351-352, 4-56.

Dietz, R., F. Riget, E.W. Born, C. Sonne, P. Grandjean, M. Kirkegaard, M.T. Olsen, G. Asmund, A. Renzonin, H. Baagøe and C. Andreasen. 2006. Trends in mercury in hair of Greenlandic polar bears (Ursus maritimus) during 1892-2001. *Environmental Science & Technology*, 40:1120-1125.

Dietz, R., F.F. Rigét, C. Sonne, R.J. Letcher, S. Backus, E.W. Born, M. Kirkegaard, and D.C.G. Muir. 2007. Age and seasonal variability of polybrominated diphenyl ethers in free-ranging East Greenland polar bears (Ursus maritimus). *Environmental Pollution*, 146:166-173.

Derocher, A.E., N.J. Lunn, and I. Stirling. 2004. Polar bears in a warming climate. *Integrated Comparative Biology*, 44:163-176.

Durner, G.M., et al. 2007. *Predicting the future distribution of polar bear habitat in the polar basin from resource selection functions applied to 21st century general circulation model projections of sea ice*. U.S. Geological Survey Administrative Report. U.S. Geological Survey, Reston, VA.

DeWeaver, E. 2007. *Uncertainty in climate model projections of Arctic sea ice decline: an evaluation relevant to polar bears*. U.S. Geological Survey, Reston, Virginia, USA.

de Wit, C.A., M. Alaee, and D.C.G. Muir. 2006. Levels and trends of brominated flame retardants in the Arctic. *Chemosphere*, 64:209-233.

Ferguson, S. H., I. Sterling and P. McLaughlin. 2005. Climate change and ringed seal (Phoca hispida) recruitment in western Hudson Bay. Marine Mammal Science 21: 121-135

Fischbach, A.S., S. C. Amstrup and D. C. Douglas. 2007. Landward and eastward shift of Alaskan polar bear denning associated with recent sea ice changes. *Polar Biol.*, 30:1395–1405

Fisk, A.T. C.A. de Wit, M. Wayland, Z.Z. Kuzyk, N. Burgess, R. Letcher, B. Braune, R. Norstrom, S.P. Blum, C. Sandau, E. Lie, H.J.S. Larsen, J.U. Skaare and D.C.G. Muir. 2005. Assessment of the toxicological significance of anthropogenic contaminants in Canadian arctic wildlife. *Science of the Total Environment*, 351-352, 57-93.

Hansen, J., Sato M., Ruedy R., Lacis A. and Oinas V. 2000. Global warming in the 21st century: an alternative scenario. *Proc. Natl. Acad. Sci.* 97:9875-9880.

Hansen, J., M. Sato, P. Kharecha, G. Russell, D.W. Lea, and M. Siddall. 2007. Climate Change and Trace Gases. *Phil. Trans. R. Soc. A*, 3651925–1954 doi:10.1098/rsta.2007.2052.

Holland, M. et al. 2006. Future abrupt reductions in the summer Arctic sea ice. *Geo. Res. Let.* 33:L23503.

IUCN/SSC Polar Bear Specialist Group. 2001. *Population Status Reviews, 13th Meeting, Nuuk, Greenland* (available at: http://pbsg.npolar.no/).

Kannan, K., S.H. Yun and T.J. Evans. 2005. Chlorinated, brominated, and perfluorinated contaminants in livers of polar bears from Alaska. *Environmental Science & Technology* 39:9057-9063.

Lie, E., H.J.S. Larsen, S. Larsen, G.M. Johansen, A.E. Derocher, N.J. Lunn, R.J. Norstrum, O. Wüg and J.U. Skaare. 2005. Does high organochlorine (OC) exposure impair the resistance to infection in polar bears (Ursus maritimus)? Part II: Possible effect of Ocs on mitogen- and antigen-induced lymphocyte proliferation. *Journal of Toxicology and Environmental Health*, 68:457-484.

Linnell, J.D.C., J.E. Swenson, R. Andersen, B. Brain .2000. How vulnerable are denning bears to disturbance? *Wildlife Society Bulletin*, 28: 400-413.

Luers, A.L., M. D. Mastrandrea, K. Hayhoe, and P. C. Frumhoff. 2007. How to Avoid Dangerous Climate Change A Target for U.S. Emissions Reductions. Available at http://www.ucsusa.org/assets/documents/global_warming/emissions-target-report.pdf.

Lunn, N.J., Schliebe, S. and Born, E.W. (eds.). 2002. Polar Bears. *Proceedings of the Thirteenth Working Meeting of the IUCN/SSC Polar Bear Specialist Group*. IUCN, Gland, Switzerland and Cambridge, UK.

Macdonald, R.W., T. Harner and J. Fyfe. 2005. Recent climate change in the Arctic and its impact on contaminant pathways and interpretation of temporal trend data. *Science of the Total Environment*, 342:5-86.

Minerals Management Service. 2007. *Final Environmental Impact Statement for Chukchi Sea Planning Area Oil and Gas Lease Sale 193 and Seismic Surveying Activities*. OCS EIS/EA MMS 2007-026. Available at: http://www.mms.gov/alaska/ref/EIS%20EA/Chukchi_feis_Sale193/feis_193.htm.

Molnár, P.K., A. E. Derocher, M. A. Lewis, and M.K. Taylor. 2008. Modeling the mating system of polar bears: a mechanistic approach to the Allee effect. *Proc. R. Soc. B*, 275:217–226.

Monnett, C. and J.S. Gleason. 2006. Observations of mortality associated with extended open water swimming by polar bears in the Alaskan Beaufort Sea. *Polar Biology*, 29(8):861-687.

Muir, D.C.G., S. Backus, A.E. Derocher, R. Dietz, T.J. Evans, G.W. Gabrielsen, J. Nagy, R.J. Norstrom, C. Sonne, I. Stirling, M.K. Taylor, and R.J. Letcher. 2006. Brominated flame retardants in polar bears (Ursus maritimus) from Alaska, the Canadian Arctic, East Greenland, and Svalbard. *Environmental Science & Technology*, 40:449-455.

Nachtigall, P.E., A.Y. Supin, M. Amundin, B. Röken, T. Møller, T. Aran Mooney, K.A. Taylor, and M. Yuen .2007. Polar bear Ursus maritimus hearing measured with auditory evoked potentials. *Journal of Experimental Biology*, 210:1116-1122.

National Snow and Ice Data Center (NSIDC). 2007a. Arctic Sea Ice News Fall 2007. Available at: http://www.nsidc.org/news/press/2007_seaiceminimum/20070810_index.html.

National Snow and Ice Data Center (NSIDC). 2007b. Arctic Sea Ice Shatters All Previous Record Lows. Available at http://www.nsidc.org/news/press/2007_seaiceminimum/20071001_pressrelease.html.

Ovsyanikov, N. 2003. Dark times for Chukotka polar bears. *WWF Arctic Bulletin*, 2.03:13–14.

Prevedouros, K., I.T. Cousins, R.C. Buck and S.H. Korzeniowski .2006. Sources, Fate and Transport of Perfluorocarboxylates. *Environmental Science & Technology*, 40:32-44.

Richardson, E., Stirling, I., and Kochtubajda, B. 2007. The effects of forest fires on polar bear maternity denning habitat in western Hudson Bay. *Polar Biol*, 30:369-378.

Regehr et al. 2006. *Polar bear populations status in the Southern Beaufort Sea*. U.S. Geological Survey Open-File Report 2006-1337.

Regehr et al. 2007. Effects of earlier sea ice breakup on survival and population size of polar bears in Western Hudson Bay. *Journal of Wildlife Management*, 71(8):2673-2683.

Smithwick, M., S.A. Mabury, K.R. Solomon, C. Somme, J.W. Martin, E.W. Born, R. Dietz, A.E. Derocher, R.J. Letcher, T.J. Evans, G.W. Gabrielsen, J. Nagy, I. Stirling, M.K. Taylor and D.C.G. Muir. 2005. Circumpolar study of perfluoroalkyl contaminants in polar bears (Ursus maritimus). *Environmental Science & Technology*, 39:5517-5523.

Smithwick, M., R.J. Norstrom, S.A. Mabury, K. Solomon, T.J. Evans, I. Stirling, M.K. Taylor, and D.C.G. Muir. 2006. Temporal Trends of Perfluoroalkyl Contaminants in Polar Bears (Ursus maritimus) from Two Locations in the North American Arctic, 1972-2002. *Environmental Science & Technology*, 40:1139-43.

Somme, C., R. Dietz, P.S. Leifsson, E.W. Born, R.J. Letcher, M. Kirkegaard, D.C.G. Muir, F.F. Riget and L. Hyldsrup. 2005. Do organohalogen contaminants contribute to histopathology in liver from East Greenland polar bears (Ursus maritimus)? *Environmental Health Perspectives,* 113:1569-1574.

Sonne, C., R. Dietz, P.S. Leifsson, E.W. Born, M. Kirkegaard, R.J. Letcher, D.C.G. Muir, F.F. Riget, and L. Hyldstrup (2006a). Are Organohalogen Contaminants a Cofactor in the Development of Renal Lesions in East Greenland Polar Bears (Ursus maritimus). *Environmental Toxicology & Chemistry*, 25:1551-57.

Sonne, C., P.S. Leifsson, R. Dietz, E.W. Born, R.J. Letcher, L. Hyldstrup, F.F. Riget, M. Kirkegaard, and D.C.G. Muir. 2006b. Xenoendocrine pollutants may reduce size of sexual organs in East Greenland polar bears (Ursus maritimus). *Environmental Science & Technology*, 40:5668-5674.

Sørmo, E.G., M.P. Salmer, B.M. Jenssen, H. Hop, K. Bæk, K.M. Kovacs, C. Lydersen, S. Falk-Petersen, G.W. Gabrielsen, E. Lie, and J.U. Skaare. 2006. Biomagnification of polybrominated diphenyl ether and hexabromocyclododecane flame retardants in the polar bear food chain in Svalbard, Norway. *Environmental Toxicology & Chemistry*, 25:2502-2511.

Stirling, I. and Parkinson, C.L. 2006. Possible Effects of Climate Warming on Selected Populations of Polar Bears (Ursus maritimus) in the Canadian Arctic. *Arctic,* 59:261–275

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.

Stroeve, J. et al. 2008. Arctic sea ice extent plummets in 2007. *Eos* 89:13-20.

Stone, I.R. and A.E. Derocher. 2007. An incident of polar bear infanticide and cannibalism on Phippsøya, Svalbard. *Polar Record* 43. 171-173.

Verreault, J., D.C.G. Muir, R.J. Norstrom, I. Stirling, A.T. Fisk, G.W. Gabrielsen, A.E. Derocher, T.J. Evans, R. Dietz, C. Sonne, G.M. Sandala, W. Gebbink, F.F. Riget, E.W. Born, M.K. Taylor, J. Nagy and R.J. Letcher .2005a.. Chlorinated hydrocarbon contaminants and metabolites in polar bears (Ursus maritimus) from Alaska, Canada, East Greenland, and Svalbard: 1996-2002. *Science of the Total Environment*, 351-352, 369-390.

Zhang, X., J.E. Walsh. 2006. Toward a seasonally ice-covered Arctic Ocean: Scenarios from the IPCC AR4 model simulations. *J. Climate*, 19: 1730-1747.