SARAH PALIN
GOVERNOR
GOVERNOR@GOV.STATE.AK.US

P.O. BOX 110001
JUNEAU, ALASKA 99811-0001
(907) 465-3500
FAX (907) 465-3532
WWW.GOV.STATE.AK.US

STATE OF ALASKA
OFFICE OF THE GOVERNOR
JUNEAU

October 22, 2007

Supervisor
U.S. Fish and Wildlife Service
Marine Mammals Management Office
1011 East Tudor Road
Anchorage, Alaska 99503

RE: Response to September 7, 2007, USGS Polar Bear Reports

Dear Supervisor:

The State of Alaska re-affirms its previous opposition to any listing of polar bears under the Endangered Species Act (ESA). The nine U.S. Geological Survey (USGS) reports published September 7, 2007, and made available to the public for comment on September 20, 2007, reinforce our conclusion that there is insufficient information to justify a listing of the polar bear as threatened under the ESA at this time. We find nothing in the nine newly released USGS reports to support a determination that the currently healthy polar bear is ***likely*** to become an endangered species throughout all or significant portions of its range within the foreseeable future. Instead, the USGS reports make it clear that the 45 year mark arbitrarily designated by the service as representing the "foreseeable future" is pushing climate change models beyond their ability to produce reasonable approximations of likely conditions, acknowledging that because of natural variability "even a perfect representation of all climate system physics and dynamics" would not allow "detailed forecasts of climate change beyond about a decade." (DeWeaver, 2007). The USGS reports make it clear that nothing except highly speculative and uncertain climate change and ice modeling and equally or even more uncertain and speculative modeling of possible impacts on the species can be advanced to support a listing. Given the uncertainty inherent in the models we do not think that a listing decision should be based on climate modeling extending more than 10 years into the future. Anything beyond that point cannot reasonably be considered foreseeable.

At most, these reports can be argued to show that the species may become threatened at some point in the future and that its range may be reduced at its southern boundaries in the future. If this were the standard for listing, climate change modeling would require the listing of hundreds if not thousands of species throughout the United States; however this not the standard for listing. Under the ESA a species (or a distinct population segment of a species) may not be listed as threatened unless it is ***likely within the foreseeable future, throughout all or a significant portion of its range, to become endangered***. A species is not endangered until it is actually "in danger of extinction throughout all or a significant portion of its range."

The listing of a currently healthy species based entirely on highly speculative and uncertain climate and ice modeling and equally uncertain and speculative modeling of possible impacts on a species would be unprecedented. Such a listing, based entirely on modeling, could have severe repercussions both in Alaska and throughout the United States and could be expected to open the floodgates for thousands of listing petitions that would drain the Service's resources away from substantive research and conservation efforts. I urge you to carefully review the attached more detailed supplemental comments regarding the USGS reports and their relation to the proposed listing of the polar bear, as well as the detailed information the state submitted in April of this year.

Neither the 19 "subpopulations" of polar bears worldwide as described by the International Union for the Conservation of Nature and Natural Resources for research and management purposes, nor the 4 ecoregion "populations" described in the newly released USGS reports could reasonably be considered to represent distinct population segments. Because of ranging behavior (Aars et al. 2006, Amstrup 2004), particularly of male polar bears, and resulting gene flow, subpopulations may be neither distinct nor significant. Similarly, the ranging behavior of polar bears may prevent the modeled loss of summer habitat from the Southern extreme of its range from representing loss of a significant portion of the range of the polar bear even if the modeling was accepted as a reasonable projection of likely future conditions.

Like the information previously considered, the new USGS reports do not show any evidence that any of the "populations" of polar bears are not well managed through international agreements and the Marine Mammal Protection Act. Further, the USGS reports indicate that management actions could have little or no impact on the likelihood of continued presence of the polar bear throughout much of its range.

As a trustee of this resource, Alaska stands ready to assist the Service through this important decision. We are disappointed that the Service has not yet carried through with its prior commitment to accept assistance from the state in its peer and comment review processes. We share the goal of maintaining a healthy and well managed polar bear population, and recognize that climate change may eventually require more active management to preserve many species, including polar bears, at sustainable levels. However, at this time, as illustrated by the uncertainty associated with the USGS reports, a decision to list the species as threatened would be premature. Conservation goals can be better met through continued and expanded climate change and polar bear research and monitoring. We are deeply concerned that a listing of polar bears as threatened under the ESA could harm many of the existing and highly successful polar bear conservation measures currently in place under several international agreements and treaties and that it could result in the loss of other options that might be useful in assuring the continued sustainability of the species.

In addition to the concerns expressed above, we believe there is substantial disagreement regarding the sufficiency and accuracy of the available information, especially regarding the validity and predictive value of climate modeling, but also regarding population modeling based on modeled environmental changes. Given this, we do not believe that a one month comment period has been adequate to allow a thorough review of the USGS reports by appropriate experts, and we request that the Service extend its listing determination period for an additional 6 months to allow additional comment and more thorough consideration of the issues.

Sincerely,

Michael A. Nizich

Michael Nizich
Deputy Chief of Staff and
ESA Working Group Chair

cc: Dale Hall, Director, U.S. Fish and Wildlife Service
Mark Meyers, Director, U.S. Geological Service

Enclosure: Supplemental State of Alaska comments on proposed rule to list polar bears as threatened

SUPPLEMENTAL STATE OF ALASKA COMMENTS
PROPOSED RULE TO LIST POLAR BEARS AS THREATENED
(Federal Register / Vol. 72, No. 193 / Friday, October 5, 2007 / Proposed Rules 56979)

When the State of Alaska previously commented on the proposed listing of polar bears as threatened throughout all or a significant portion of their range, we questioned whether the U.S. Fish and Wildlife Service (USFWS) used the best available scientific and commercial data to demonstrate that sea ice will continue to recede throughout the foreseeable future (defined by the Service in their proposed rule as 45 years) as a result of climate change. As we stated in our earlier comments, we find a wide range of sea ice distribution and climate changes is predicted among climate models that significantly differs with the USFWS's conclusion of the likely timing and extent of sea ice recession. We urged the USFWS to review all available sea ice and climate change models, then use the best available science to formulate their conclusions. We detailed our recommendations regarding sea ice modeling in our previous comments. We do not believe the additional reports provided by the U.S. Geological Service (USGS) address our previously stated concerns nor that conclusions reached are based on the best available scientific and commercial data as required by 16 U.S.C. § 1533(b). Despite acknowledging that natural variability would preclude even a climate model containing a perfect representation of all climate system physics and dynamics "*would prevent detailed forecasts of climate change beyond about a decade*" (DeWeaver 2007, page 3) the USGS reports proceed to model to the previously designated 45 year horizon and even far beyond to the 100 year horizon and then further amplifies error and uncertainty by eliminating models that produce outlying results and using the selected climate change model outputs as inputs for similarly speculative ice modeling and then as inputs for biological modeling of impacts on polar bears.

The proposed rule bases its predictions of late summer ice-free timing on climate change information derived primarily from two reports cited in the 2006 Status Assessment. One is the 2001 report by the Intergovernmental Panel on Climate Changes (IPCC) and the other is the 2005 Arctic Climate Impact Assessment (ACIA). The disclaimers accompanying the models regarding their limitations of their predictive ability and cautioning their use for forecasting purposes were largely ignored.

The ACIA report supports this conclusion. "*The observational database for the Arctic is quite limited, with few long-term stations and a paucity of observations in general.*" ACIA Report p.36. "*Models continue to have significant limitations, such as in their representation of clouds, which lead to uncertainties in the magnitude and timing, as well as regional details, of predicted climate change.*" ACIA Report p.54.

The ACIA report further notes, "*Improvements in numerical modeling of potential changes in climate are needed, including the representation in climate models of key arctic processes such as ocean processes, permafrost–soil–vegetation interactions, important feedback processes, and* *extreme events. The development and use of very high-resolution coupled regional models that provide useful information to local experts and decision makers is also required."* ACIA Report p.1019.

The IPCC report cautions *"In addition, evaluating simulations of the Arctic is difficult because of the uncertainty of the observations. The few available observations are sparsely distributed in space and time and different data sets often differ considerably."* IPCC Report p.903. *"Coarse resolution in global models prevents the proper representation of local processes that are of global importance."* IPCC Report p.906.

The nine reports contracted by the USFWS to the USGS are fundamentally based upon the IPCC climate models referenced above. The USGS admits many of the shortcomings in climate modeling forecasts in a report by Dr. Eric DeWeaver titled "Uncertainty in Climate Model Projections of Arctic Sea Ice Decline: An Evaluation Relevant to Polar Bears." In this report the author stated, *"Like the real-world climate system, climate models and the sea ice models contained in them are quite complex, as in any discussion of their uncertainties."* He also points out that, *"A key point in the discussion is that the inherent climate sensitivity of sea ice leads inevitably to uncertainty in simulations of sea ice decline."* This statement is followed latter in his paper by, *"Uncertainties in sea ice model parameterizations and the inherent sensitivity of sea ice thermodynamics, combined with further uncertainties in atmosphere and ocean model construction, lead inevitably to errors in the simulation of Arctic sea ice."* He further stated, *"In assessing Arctic sea ice simulations, two prominent sources of uncertainty should be considered. First, uncertainties in the construction of climate models should be identified. While all models are constructed using the same physical laws, different approximations and simplifications are used in different models, and these differences lead to different sea ice simulation outcomes. Second, the degree of uncertainty due to unpredictable natural variability of the climate system should be examined. The atmosphere, ocean, and sea ice comprise a nonlinear chaotic system with a high level of natural variability unrelated to external climate forcing."*

We agree with these stated limitations and that there are areas of significant uncertainty in climate modeling. We also note that there are serious limitations to the data inputs for almost every variable considered in the models. Assumptions must be made regarding those variables that have no data. Not all climate forcing mechanisms were included in the climate models used as the basis for the USGS reports. Additionally, some of the forcing mechanisms such as future greenhouse gas emissions were estimated based upon untested assumptions. Also, other variables known to affect climate cycles, such as the Arctic Oscillation, solar activity (sun spots) and orbital effects were excluded from the climate models. These assumptions along with the many other assumptions necessary to run these models, significantly and adversely affect the validity and accuracy of the model outputs.

Prior comments by the State and other reviewers demonstrate that there is substantial disagreement regarding the accuracy and sufficiency of the data and modeling assumptions used to determine whether polar bears should be listed. Although we appreciate the additional 15-day extension to the comment period, we simply have not had sufficient time in the 30-day comment period provided to review these reports as thoroughly as they warrant. An adequate review will require commentary from a wide spectrum of disciplines including other polar bear experts, climatologists, and statisticians over a sufficient length of time to allow proper scientific debate and reciprocal discussion. This is substantiated in the newly released USGS reports when Amstup et al. (2007) reports:

> *"Due to time constraints, however, we were not able to seek and incorporate the input of multiple polar bear experts into out BN model. Therefore, the model presented here should be viewed as a first-generation "alpha" level prototype (Marcot et al. 2006). It captures and depicts judgment of one subject matter expert. It is therefore, in a general state, an expert system (Martin et al. 2005; McCann et al. 2006), but still must be vetted through other polar bear experts."*

We appreciate that the USGS had the draft reports peer reviewed. However, we are concerned that the reviewers selected may not have been representative of the broad opinions within the scientific community on these subjects. We feel that a more thorough peer review process over a sufficient length of time to allow proper scientific debate and reciprocal discussion is warranted given the significant policy implications of the listing decision being recommended.

Given their importance to ultimate projections of polar bear status, we are especially concerned with the review of the papers which are based on projections of sea ice based on climate change models. While it is generally agreed that Arctic temperatures are rising, the degree to which the future can be projected is less agreed upon. This is noted in the Arctic Climate Impact Assessment (2005) in which it is stated "*Many processes are still poorly understood and thus pose a challenge for climate models*". We suggest that a broader review of the projection and forecasting methodologies is warranted given the policy implications involved. Such a review should include specialists knowledgeable in variables such as solar activity and orbital effects on climate, both of which have been shown to affect long term climate cycles.

We also note that most evidence suggests that polar bears have evolved from brown bears between approximately 80,000 and 200,000 years ago. During this time, polar bears have experienced at least four periods of dramatic climate warming as warm, or warmer, than those projected in these reports. Polar bears have survived these climate shifts, suggesting that they found means to adapt to a changing environment. This is evidenced in the datasets gathered for the Hudson Bay polar bear populations. Over their entire history, polar bears have undoubtedly decreased and expanded their ranges and population levels in response to documented historic climate shifts. This suggests that they are much more adaptable than assumed in the various reports and will survive as a viable population within their natural range. Also, we note that the polar bear population is a worldwide population. While there are sub-units established for management purposes, there is no basis for future delineation of these units as separate DPS units. Thus, although there may be future declines in ranges and numbers between management units, this in itself would not justify a listing under the ESA.

With respect to the newly released reports, the USGS projects extinction of polar bears by the end of the 21st century based on complex and uncertain assumptions and with a posited causal chain as follows: (1) global warming will occur throughout the 21st century; (2) this will both reduce the extent of and thin the summer sea ice throughout this period; (3) polar bears will obtain less food by hunting from the sea ice platform than they do now; (4) polar bears, unlike their ancestors, will not adapt to environmental changes and emigrate or obtain adequate supplementary food using other means or from other expanding food sources; (5) natality rates will fall below replacement levels and the bear population will decline. Further, the entire listing process is based on the assumptions that (6) the early designation of polar bears as a threatened species prior to development of any real population problems will mitigate or solve the problem and will not have serious detrimental effects; and (7) there are no other intervening policies that could produce better outcomes than a decision to list the species prior to the development of population problems. In short, this is an extremely complex line of reasoning, based on unsupported conjecture, for a complex situation. Because errors tend to cascade in such a complex line of reasoning, proper forecasting procedures must be used at each stage. A failure at any one stage would lead to the conclusion that the resulting forecasts lack validity and that it would therefore be improper to use the forecasts as the basis for any policy changes. Given that scientific forecasting methodology has been researched and published on since the 1930s, it seems imperative that this body of knowledge be incorporated in such an important forecasting effort. We provide an assessment of the forecasting methodologies used as part of comments.

Given the uncertainty associated with forecasting, we also question the use of 45 years as a legitimate horizon for the forecasting the "foreseeable future" of polar bears. We feel a shorter time frame is warranted given the stated uncertainty. We are confident that although the range and abundance of polar bears may change, polar bears will not likely become an endangered species throughout all or a significant portion of their natural range within the "foreseeable future."

It is unfortunate that the State was not offered an opportunity to directly participate in the development and review of these reports before their publication. While we understand the need for independence on the part of the USGS, we were told that the State would have an opportunity to comment on these analyses as they were developed. As a trustee of the State's resources, we have considerable expertise that could have provided value to these analyses.

Until a more through review occurs and the state's comments are fully addressed, the State continues to strongly oppose any listing under the ESA of the polar bear as threatened in all or significant portions of its range. The State stands by its earlier conclusion that polar bears are abundant, stable, and unthreatened by direct human activity. We continue to maintain that the 19 "subpopulations" of polar bears worldwide as described by the IUCN for research and management purposes are well managed through international agreements and the Marine Mammal Protection Act. We also continue to question the use of a listing under the ESA by the petitioner to address global issues such as climate change and carbon emissions. The State is deeply concerned that listing this species would harm many of the existing and highly successful polar bear conservation measures currently in place under several international agreements and treaties.

The State of Alaska comments on the newly released USGS studies are organized as follows: 1) review of forecasting methods 2) specific comments on the newly released USGS reports, and 3) additional existing regulatory mechanisms currently in place for conservation of polar bears. These comments should be considered as an addendum to our previously submitted comments.

Review of forecasting methodologies used in the USGS reports

As indicated above, the usefulness of forecasts contained within the USGS reports depend upon the validity of the following causal chain: (1) global warming will occur throughout the 21st century; (2) this will both reduce the extent of and thin the summer sea ice throughout this period; (3) polar bears will obtain less food by hunting from the sea ice platform than they do now; (4) polar bears, unlike their ancestors, will not adapt to environmental changes and emigrate or obtain adequate supplementary food using other means or from other expanding food sources; (5) natality rates will fall below replacement levels and the bear population will decline. Further, forecasts in support of a threatened listing under the ESA must assume that; (6) the early designation of polar bears as a threatened species prior to development of any real population problems will mitigate or solve the problem and will not have serious detrimental effects; and (7) there are no other intervening policies that could produce better outcomes than a decision to list the species prior to the development of population problems.

Errors tend to increase exponentially in a complex causal chain such as this, so it is important to use proper forecasting procedures. Failing to use proper procedures at any one stage would mean that the resulting forecasts lacked validity, in which case it would be improper to use the forecasts as the basis for any policy changes. The methods used in two of the USGS reports (Amstrup et al. 2007; Hunter et al. 2007) were evaluated against evidence-based forecasting principles that represent a distillation of 70 years of research on forecasting (Armstrong 2001). An audit of these two reports indicated that a substantial number of these forecasting principles were violated. Tables outlining the audit results of these reports are available upon request. A summary of significant findings follows.

Long-term forecasts require enormous amounts of valid and reliable data. Accurately forecasting climate change and sea ice conditions would require 40 to 100 years of historical data on which to base extrapolations. In order to forecast using causal methods, it is necessary to have reliable data over sufficiently long periods for all variables to have varied relative to each other on a large number of occasions. The Hunter et al. report clearly violates this principle with its reliance on five years of data with unknown measurement errors. We are not convinced that the capture data on which they rely could be regarded as representative samples of bears in the southern Beaufort Sea given the vast area involved and difficulties in spotting and capturing the bears. Moreover, bears wander over long distances and do not respect administrative boundaries (Amstrup et al. 2004). The validity of the data is likely to be compromised further by imposing a speculative demographic model on the raw capture-recapture data (Amstrup et al. 2001; Regehr et al. 2006).

Simple methods are superior to complex methods for situations that involve complexity and uncertainty. Complex methods mistake random fluctuations and measurement error, "noise," for important changes. The authors violate this principle by employing elaborate statistical methods for their forecasts. Complex methods also obscure assumptions and make errors hard to find. Complexity cannot substitute for accuracy.

The reports also violate the forecasting principle of being conservative where there is significant uncertainty. Forecasts should be conservative when a situation is unstable or complex or when there is uncertainty. Being conservative means moving forecasts towards "no change" or, in cases that exhibit a well established long-term trend and where there is no reason to expect the trend to change, being conservative means moving forecasts toward the trend line. A long-term trend is one that has been evident over a period that is much longer than the period being forecast. We note that conservatism is a fundamental principle in forecasting.

It is also unclear why the authors chose the forecasting methods that they did. They provided no evidence as to why the methodologies they used might be appropriate. The authors appear not to have been aware of the published methods that have been developed for such situations. As a consequence, the methods the authors adopted for this important problem are speculative.

We note also that regional changes add to uncertainty. For example, Antarctic ice extent has been growing at the same time that sea and air temperatures have been increasing (e.g. Zhang 2007) while depth averaged oceanic temperatures around the southeastern Bering Sea have been undergoing relative cooling in 2006 (Richter-Menge et al. 2007). Despite the warming of local air temperature by 1.6±0.6°C, there was no sharp decline in the area over the continental shelf of the Canadian Beaufort Sea that was covered in ice for the 36 years from 1968 to 2003 (Melling et al. 2005).

The prediction intervals provided by the authors are a statistical artifact of the methods they used and there is no evidence that outcomes (the SB polar bear population decades into the future) are likely to fall within the range of forecast population levels they provide. Prediction intervals are properly estimated from the relationship between previous forecasts and outcomes or by using holdout data with which to generate forecasts and then comparing the relationship. Prediction intervals (PIs) should typically increase rapidly over the forecast horizon, yet the authors ignored this principle.

In order to assess meaningful PIs, it helps to think of diverse possible outcomes. The authors did not appear to consider, for example, the possibility that polar bears might adapt well to terrestrial life over summer months by finding alternative food sources (such as is the case for the Southern Hudson Bay population) or as a consequence of ringed seals also adopting the same low-ice summer habitats or by successfully congregating in smaller summer ice hunting platforms. Considering these and other possible outcomes would have likely led them to be less confident (provide wider prediction intervals) about a bad outcome for bears. Extending this exercise to the forecasts of climate and summer ice extent would have widened them still further.

Finally, the situation regarding polar bears in the Arctic is complex and there is much uncertainty. For example, the authors associated warm temperatures with lower polar bear survival rates, yet cold temperatures have also been associated with bad outcomes, as this quote illustrates: "*Abnormally heavy ice covered much of the eastern Beaufort Sea during the winter of 1973-1974. This resulted in major declines in numbers and productivity of polar bears and ringed seals in 1975*" (Amstrup et al. 1986, p. 249).

Specific comments on newly released USGS reports

Ice Modeling (report by DeWeaver 2007).

This report examines the uncertainty in climate model projections of arctic sea ice declines. While we agree with the author that the "*same factors that make Arctic sea ice susceptible to rapid loss under global warming also make sea ice difficult to simulate,*" we also agree that "*Uncertainties in climate simulation necessitate the use of ensembles of simulations from several models, from which the range of possible outcomes can be appreciated,*" Given this, we are perplexed by the failure of the author to define the full range of possible outcomes, choosing instead to use only "middle-of-the-road" ice simulation models. We suggest, given the significance these simulations have on modeling the status of polar bear across their range, that "extreme" simulations cannot reasonably be discarded and must be used to define the full range of possible outcomes. This would allow the simulation of all possible outcomes in the population forecasting models. It would also acknowledge the uncertainty inherent in ice modeling. Such an approach is supported by Green and Armstrong (2007) who state that "*Public policy makers owe it the people who would be affected by their policies to base them on scientific forecasts. Advocates of policy change have a similar obligation. We hope that in the future, climate scientists with diverse views will embrace forecasting principles and will collaborate with forecasting experts in order to provide policy makers with scientific forecasts of climate.*"

The authors project ice conditions through the year 2100. We note that the uncertainty of the projection of Arctic climate change, is as the authors note, "*relatively high.*" The report goes on to state that "*Inherent unpredictability would prevent us from issuing detailed forecasts of climate change beyond about a decade.*" We agree and conclude that a better projection would look out only a decade instead of a century.

The author also points out that the issue is summer ice and not winter ice, which exists six months of the year and is not projected to decrease significantly. Thus, the issue is the amount of ice melt in the summer. The report goes on, however, to state that there is high uncertainty associated with the projections of summer sea ice. Thus, we question the reliability of summer ice projections, especially those made past a decade out.

The report also fails to adequately incorporate other variables known to affect climate cycles, such as the Arctic Oscillation, solar activity (sun spots) and orbital effects, all of which have been shown to affect long term climate cycles.

Other reports also call into question the conclusions reached by the author. A recent Oasis Environmental report was prepared for the Alaska Department of Environmental Conservation entitled "*North Slope Nearshore and Offshore Breakup Study Literature Search and Analysis of Conditions and Dates*" dated July 15, 2006. This report includes information obtained from satellite photo archives maintained by the United States Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA), industry and consultant reports, government-sponsored research programs, and recent studies into the potential impacts of climate change on Arctic sea ice. The report notes that "*the comparison made with older data sources in the example table would seem to indicate that the summer open water period has increased by 10-20 days from the 1960s to the 1990s. This may not be a real result. The difference could be a combination of the greatly improved quality of ice reporting over the past few decades, and differences in interpretation of open water, or the distinction between ice free and open water ice that can result in variable season lengths.* The report also notes "*…there is no doubt that over the past five years, satellite sensors have mapped a dramatic reduction in summer ice extent….the general consensus is that while summer ice conditions could change significantly over times scales of a few decades, mostly in terms of distance from shore to pack ice edge, the general timing of freeze up and breakup, as well as the extent and thickness of the fast ice zone, are unlikely to change to a great extent.*

Population Stress Factors (reports by Bergen et al. 2007; Durner et al. 2007).

These reports predict stresses on polar bear populations due to declining availability of sea ice. The Durner et al. 2007 and Bergen et al, 2007 papers suggest that polar bears will have to travel longer distances between ice habitats and denning habitats as sea ice retreats greater amounts. This will place greater energetic demands on polar bears and that this in turn *could* affect pregnant bears and bears with dependent cubs, and ultimately affect reproductive fitness and population recruitment thereby affecting annual polar bear survival rates. The study assumes that bear movement will be limited to the "good" habitat with over 50 percent ice concentration, apparently assigning no habitat value to lower ice concentrations.

However, the data presented within several of the USGS reports to substantiate these inferences is conflicting. The paper by Regehr et al. 2007 examines the relationship between the number of ice-free days and various population stress factors. Although they show a significant relationship between the number of ice-free days and breeding probabilities of females without cubs, there is no significant relationship between the number of ice-free days and survival rates of subadult males and all females or between the number of ice-free days and the survival of adult males. In summary, the authors have provided some evidence supporting a lower natality with increased number of ice-free days, but that is the only relationship where they have any such evidence. Reproductive rates are only one part of the calculation of survival rates.

Rode et al. (2007) also examines the influence of ice on several population stress factors. Again, conflicting data are presented. The variable "*Ice*" was not related to COY (cub of the year) per female in spring or fall; nor was it related to mean body mass or BCI (body condition index) of adult male and female polar bears in the SB population. *Ice* was also not related to length, skull size, mass or BCI of sub-adult females. Nor did the author observe a declining trend in cub mass or skull size.

Also, Regehr et al. (2006) have shown that past changes in sea ice have not yet been associated with actual changes in the size of the SB polar bear population. This is important in that Regehr et al. (2007) have demonstrated (refer to Figure 3) that the SB polar bear population has endured years with longer ice-free periods than what was used to project declines in survival rates for this population.

Finally, time limitations/constraints on travel in the Bergen et al. paper are based on 5 GCM models. Such a limitation limits the scope of the analysis and relevant findings. A broader use of GCM models would have bracketed all potential outcomes, albeit with a result of considerable uncertainty.

In conclusion, although there are hypothetical survival rate implications due to increased numbers of ice-free days, these have neither been substantiated nor observed on a broad basis in the actual recorded data.

Population Modeling (Regehr et al. 2007; Hunter et al. 2007; Rode et al. 2007; Stirling et al 2007; Obbard et al 2007)

1. Southern Beaufort Sea Population (Regehr et al. 2007; Hunter et al. 2007; Rode et al. 2007).

These three papers assess impacts to the Southern Beaufort Sea polar bear population in relation to changing sea ice conditions. Overall, the papers suggest that population stress factors on Southern Beaufort Sea (SBS) polar bears will be negatively impacted by retreating sea ice. These papers form the foundation of the modeling effort by Amstrup et al. 2007. We question several of the conclusions of these reports.

a) Regehr et al. 2007

As stated in section 2, we question the assumption that the number of ice-free days negatively affect several key population factors. Although a significant relationship between the number of ice-free days and breeding probability of females without cubs is demonstrated, there is no significant relationship between the number of ice-free days and survival rates of subadult males and all females or between the number of ice-free days and the survival of adult males. In summary, the authors have provided some evidence supporting a lower natality with increased number of ice-free days, but that is the only relationship where they have presented such evidence. Thus, several of the assumptions that lead to extrapolations of population survival rates are invalid.

Several technical issues also need to be addressed. First, the models use bootstrap confidence intervals that have been trimmed of 'outliers'. Having a significant number of bootstrap replicates as outliers (impossible probabilities) is an indication of bias in the estimated probability. Simply culling these inconvenient results gives an overly optimistic outlook on the accuracy of the estimated probability. Estimated bias calculated from the complete set of bootstrap replicates should be reported for each statistic. The second issue involves the effect of emigration on accuracy. No arguments are needed unless survival rates are significantly low, and then any argument must be based on the fates of all bears with transmitters. It is not enough to say that 53% of test subjects were in the sampling area. Where were the others? The argument of no late-study emigration is weakened considerably if large numbers of test subjects cannot be found at all.

We also question the statement in the conclusions that there is an increasing trend in the number of ice-free days in the SB region. There is no such trend evident in Figure 3 of their report. This is also evident in Figure 4 in Rode et al. (2007) which shows a non-significant trend in percent days with >50% ice. As we discussed in our earlier comments, there is significant variability associated with ice modeling predictions.

Finally, projections of survival rates in Figure 6 are based on point estimates as expressed in Figure 5. The uncertainty in these point estimates is ignored. Also, logistic functions like those displayed in Figure 6 are extrapolations, not fitted curves. The implication is there has been experimentation or observation that leads to the depicted curve, when in fact it is entirely speculation. The actual rate of the decline in the curve could vary significantly. In fact, there is evidence that the curve may turn down at either a less steep rate or at a later deflection point. Figure 5 depicts historical occurrences of ice-free days much higher than those used to generate Figure 6. We note that polar bear populations are currently stable (Regehr et al. 2006) and have endured these seasons of higher ice-free periods. We also note that the polar bear has survived through prior periods as warm or warmer than model projections over the next century.

Given such issues we question the author's conclusions that polar bear survival rates will be significantly impacted as a result of increased occurrences of ice-free days.

b) Hunter et al. 2007

The authors present a demographic analysis of the SB polar bear population. The analysis is based upon the assumptions presented in the Regehr et al. (2007) paper to construct a stochastic model to deterministically project polar bear population trends.

The finding that the SB population will decline as a result of increasing number of ice-free days, defined by less than 50 percent ice concentration, is driven by the increased occurrence in number of ice-free days and the reduced population survivals concluded by Regehr et al. (2007). As we discussed above, there are serious questions regarding the validity of both of these assumptions. Breeding age assumptions also raise significant questions regarding the validity of the results. While polar bears were assumed to enter the breeding population at age 5, female polar bears have been known to breed at age 4 and males may breed as early as age 3 (Matt Cronin, personal communication[1]). As such, we question the validity of the results of the model projections based on these assumptions.

The authors show that in a stochastic environment in which good and bad years occur at the same frequency since 1979 the SB population will only decline at a rate of 1 percent, suggesting relative population stability. We agree in that the SB population over this same 20 year period has been stable (Regehr et al. 2006). We also note that during the period between 1986 and 2006 about one-third of all the observed number of ice-free days resulted in "bad" years.

b) Rode et al. 2007

Rode et al (2007) examines the influence of ice on several population stress factors. They conclude that the duration of ice significantly affects several population factors. However, conflicting data are presented. The variable "*Ice*" was not related to COY (cub of the year) per female in spring or fall; nor was it related to mean body mass or BCI (body condition index) of adult male and female polar bears in the SB population. *Ice* was also not related to length, skull size, mass or BCI of sub-adult females. Nor did the author observe a declining trend in cub mass or skull size.

2. Northern Beaufort Sea Population (Stirling et al. 2007).

This paper assesses the population status of the NB population polar bears. The report concludes that this population is increasing. We do not have any comments on this report.

3. Hudson Bay Population (Obbard et al. 2007).

This paper assesses the population status of the polar bears in the Hudson Bay area. The paper concludes that if sea ice patterns (i.e., earlier melt and later freeze) continues, the Southern Hudson Bay (SH) population will begin to decline. However, there is direct evidence that this population is relatively stable. Abundance in the SH

[1] Matt Cronin, personal communication 10/17/2007, (907) 227-1753

population was unchanged between 2 sampling events separated by about 20 years (1984-86 vs. 2003-05). Also, survival rates of subadults and adult males and females between two sampling events were not statistically different. This occurred during a period when breakup occurred 5-8 days earlier per decade in the area, suggesting that the SH polar bear population has not been negatively impacted to date by changing climate. This is further substantiated in that there was no clear association between survival and COY (cub of the year) body condition, average body condition for the age class, or extent of ice cover in their modeling.

Despite the lack of empirical support, the authors jump to a conclusion that there will be future declines, based largely on assumptions regarding the nearby western Hudson Bay polar bear populations. However, the conclusion that warming spring temperatures are affecting the survival of polar bears in western Hudson Bay has also been challenged by Dyck et al. (2007, in prep.). They showed that spring air temperatures around the Hudson Bay basin for the period 1932-2002 showed no significant warming trends and are more likely identified with the large-amplitude, natural climatic variability that is characteristic of the Arctic. As such, they argue that the Hudson Bay populations of polar bears have not been negatively impacted by warming temperatures and that predictions of polar bear extinctions from this area are highly premature.

Other studies suggest that polar bears adapt to changing climate conditions by changing their food sources. When on land, polar bears have been shown to opportunistically feed on marine algae, terrestrial vegetation, and various birds and other vertebrates (Russell 1975, Derocher et al. 1993). They have also been documented to attempt to prey on caribou (Brook and Richardson 2002). Additionally, polar bears have been observed foraging on whale and walrus carcasses along the Alaska and Russian coastlines (Charlie Johnson, personal communication[2]). This suggests that polar bear can endure periods of warming.

Range-wide population forecasting (Armstrup et al 2007)

This report forecasts the population status of polar bears through the 21st century in four population units based on ice habitat use characteristics: the polar basin divergent ice ecosystem unit (DI), the polar basin convergent ice ecosystem unit (CI), the Archipelago ecosystem unit (CA), and the seasonal ice ecosystem unit (SI). The reports use two models to project the future status of polar bears within each ecosystem unit: a carrying capacity and a Bayesian network (BN) model. The report concludes that the world's total population of polar bears will be reduced by about two-thirds by mid-century and will likely be completely extirpated within the DI and SI ecosystems during this period. We question the validity of these conclusions based on several factors.

---

[2] Charlie Johnson, Executive Director, Nannuk Commission, testimony before the U.S. Arctic Research Commission, October 8, 2007; (907) 443-5044.

First, any model is only as good as the assumptions it is built upon. We have raised serious questions regarding the validity of the assumptions used to predict survival rates of polar bears based on the duration of ice (refer to our comments above). We also question the selective use of ice models. The authors note that uses of global climate change models (GCMs) possess wide margins of uncertainty and that the magnitude and distribution of such errors are unknown. Finally, we question the validity of model inputs that have not had the benefit of input by multiple experts. This last fact was even acknowledged by the author with his statement:

> *"Due to time constraints, however, we were not able to seek and incorporate the input of multiple polar bear experts into out BN model. Therefore, the model presented here should be viewed as a first-generation "alpha" level prototype (Marcot et al. 2006). It captures and depicts judgment of one subject matter expert. It is therefore, in a general state, an expert system (Martin et al. 2005; McCann et al. 2006), but still must be vetted through other polar bear experts."*

We question the credibility of the projected outcomes from the BN model. An analysis using a single person to provide prior probability distributions on parameters is not scientifically appropriate. The ideal behind BN analysis is that the likelihood will wash out the effect of the priors thereby providing a relatively objective posterior distribution of probabilities. In this analysis the priors are a product of one person's opinions and there is no likelihood coming from newly collected data (those data would come from the future). While probability distributions can be calculated for posteriors, such probability distributions would never capture the true uncertainty in the analysis. Based on this, we question the validity of the conclusions based on the BN model outputs.

We also question the conclusions of extinction to be overstatements of the results. At most the author might be able to support the proposition that population abundance will dwindle because of shrinking habitat. This finding alone would be logical and worrisome. However, it does not substantiate the conclusion that the world's total population of polar bears will be reduced by about two-thirds by mid-century and is likely to be completely extirpated within the divergent ice and seasonal ice ecosystems.

We also question the assumption that polar bears will not adapt to a changing environment. We note that polar bears have evolved from brown bears between 80,000 to 200,000 years ago. During this time polar bears have experienced periods of dramatic climate shifts as large, or larger, than those projected in these reports. Polar bears have survived these climate shifts suggesting that they found means to adapt to a changing environment. They have likely shrunk and expanded their ranges and population levels in response to such climate shifts and may have changed or significantly supplemented their prey base on other expanding prey populations during prior warming periods. This suggests that they are much more adaptable than assumed in the various reports.

Regarding each summary conclusion we provide the following comments:

1. *Polar bear populations in the Polar Basin Divergent and Seasonal Ice ecogregions will most likely be extirpated by mid century.*

   This conclusion does not follow from the results obtained from using the 'carrying capacity' model, which are that carrying capacity in these two ecoregions is reduced 32-48% by the end of the century given the <u>greatest</u> loss in sea-ice coverage by the 10 GCMs. These reductions are troubling, but are far from reductions needed to cause extinction. We remain skeptical of the results of the 'BN' model because they are essentially based on the opinion of a single biologist.

2. *Polar bear populations in the Archipelago Ecoregion appear likely to persist through the middle of the century.*

   Judging from the results of the 'carrying capacity' model, this population of bears should persist well beyond. The maximum reduction in carrying capacity for this region is 24% by the end of the century. Again, priors for influential parameters in the BN model are based on the opinion of a single biologist. Since likelihoods cannot be calculated without data collected in the future, current projections by the BN model are projections based on prior probability distributions, that is, distributions based on the opinion of a single person.

3. *Polar bears in the Polar Basin Convergent Ecoregion may persist through mid-century, but they most probably be extirpated at and beyond year 75.*

   The aggregate projection across all 10 GCMs used in this analysis is <u>no reduction in carrying capacity</u> in this region by the end of the century. We can only assume that the conclusion of extinction would come from the 'BN' (Table 7 notwithstanding) - a model based solely on the opinion of the senior author to this report.

4. *A declining habitat base … was the overriding factor in forecasts of declining numbers and distribution of polar bears.*

   The idea that carrying capacity and abundance will shrink with shrinking habitat is intuitively appealing. However, one is left to question how such a relationship has been empirically established when abundance of polar bears has been poorly estimated.

5. *Other factors … could result in additional population stress on polar bears, are likely to exacerbate effects of habitat loss.*

   Other factors could, but are they likely? The likelihood of these other factors occurring again rests on the opinion of one person and his interpretation of past studies. We note that the likelihood of Factor B (over-utilization or over-hunting), Factor D (disease and predation), and Factor E (other human impacts) occurring is the speculation by a single biologist. We also note that the likelihood of polar bear adaptation and range expansion of other prey species in response to climate change as an offsetting factor appears to have been ignored or discounted.

6. *Management of localized human activities (such as hunting …) qualitatively increased the probability of persistence of polar bears (at least through mid-century in Archipelago and Convergent ecoregions).*

   Again, the results are the outcome of one person's opinion. An interesting question arises here. Why would 'control' of hunting affect persistence of bears in two ecoregions instead of all regions? (see conclusion 7).

7. *Management of localized human activities (such as hunting …) did not appear to change probability of extinction in the (Divergent and Seasonal Ice ecoregions).*

   (See comment on conclusion 6).

8. *… to qualitatively alter outcomes projected by our models …, future sea ice would have to be far more extensive than is projected by even conservative GCMs.*

   Outcomes of the carrying capacity models (not the authors' conclusions, but the actual outcomes) are persistence of bear populations across all four ecoregions, albeit at reduced abundance in three of the regions. Given the relationship between carrying capacity and sea-ice coverage, the latter would have to increase to restore carrying capacity to levels presumed in 2007 for the three regions with reduced carrying capacity. We note that projections from 5 of 10 GCMs show ice coverage higher than in 2007 (3 GCMs) or about the same (2 GCMs) (see report Figure 15).

We feel a better approach to project polar bear status would be based on rethinking the carrying capacity model and projecting it over at most a 10 to 20 year period. As we stated earlier, we suggest dropping the use of GCMs in favor of a time series model. No GCM need be chosen, so there would be no controversy on this point. Forecasts would be empirically based with a concomitant variance that would completely capture the uncertainty in the projection. A Bayesian network time-series model could be used to provide a probability distribution for the forecast. Next, quantify the relationship between quality and quantity of sea-ice coverage and bear density. That relationship could also be expressed using a Bayesian model and included with the time-series model in a hierarchical framework. The result would be a posterior probability distribution on carrying capacity projected into the future. Non-informative priors could be used to remove subjectivity. Results would not be dependent on one person's opinion. All uncertainty would be captured in these posteriors. The relationship between sea-ice coverage and bear density could be based on the work by Regehr et al. 2007. We suggest that the relationship between number of ice-free days in the spring and natality would be a good place to start. A problem with this approach is that the time-series model would provide poor forecasts with quite a bit of uncertainty. Figure 3 in Regehr et al. 2007 shows quite a bit of variation and not much trend. However, such uncertainty would lead to more realistic and objective prognostications concerning changes in density and probabilities of extinction.

References

Aars, J., Lunn, N.J. and Derocher, A.E. (2006) Polar bears – Proceedings of the 14th Working Meeting of the IUCN/SSC polar bear specialists group, 20-24 June 2005, Seattle, Washington, USA. Occasional Paper of the IUCN Species Survival Commission No. 32. IUCN, Cambridge, UK.

Amstrup, S.A, Marcot, B.G., and Douglas, D.C. (2007). Forecasting the Rangewide Status of Polar Bears at Selected Times in the 21st Century. USGS Alaska Science Center, Anchorage, Administrative Report.

Amstrup, S.C., McDonald, T.L. and Durner, G.M. (2004). Using satellite radiotelemetry data to delineate and manage wildlife populations. Wildlife Society Bulletin, 32, 661-679.

Amstrup, S.C., McDonald, T.L. and Stirling, I. (2001). Polar bears in the Beaufort Sea: A 30-year mark-recapture case history. Journal of Agricultural, Biological, and Environmental Statistics, 6, 221-234.

Amstrup, S.C., Stirling, I. and Lentfer, J.W. (1986). Past and present status of polar bears in Alaska. *Wildlife Society Bulletin*, *14*, 241-254.

Armstrong, J.S. (2001). *Principles of Forecasting: A Handbook for Researchers and Practitioners*. Kluwer Academic Publishers.

Bergen, S., Durner, G.M., Douglas, D.C. and Amstrup, S.C. (2007). Predicting movements of female polar bears between summer sea ice foraging habitats and terrestrial denning habitat of Alaska in the 21st century: proposed methodology and pilot assessment. USGS Alaska Science Center, Anchorage, Administrative Report.

Brook, R.K. and Richardson, E.S. (2002). Observations of polar bear predatory behavior towards caribou. Arctic 55:193-196.

Derocher, A.E., Andriashek, D. and Stirling I. (1993). Terrestrial foraging by polar bears during the ice-free period in western Hudson Bay. Arctic 46:251-254.

DeWeaver, E. (2007). Uncertainty in climate model projections of Arctic sea ice decline: An evaluation relevant to polar bears. USGS Alaska Science Center, Anchorage, Administrative Report.

Durner, G.M., Douglas, D.C. Nielson, R.M. Amstrup, S.C. and McDonald, T.L. (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. USGS Alaska Science Center, Anchorage, Administrative Report.

Dyck, M.G., Soon, W., Baydack, R.K., Legates, D.R., Baliunas, S., Ball, T.F., and Hancock, L.O. (2007). Polar bears of western Hudson Bay and climate change: Are warming spring air temperatures the "ultimate" survival control factor? *Ecological Complexity*, 4, 73-84.

Green, K.C. and Armstrong, J.S. (2007), "Global Warming: Forecasts by Scientists versus Scientific Forecasts," *Energy and Environment* (forthcoming)

Hunter, C.M., Caswell, H., Runge, M.C., Amstrup, S.C., Regehr, E.V. and Stirling I. (2007). Polar Bears in the Southern Beaufort Sea II: Demography and Population Growth in Relation to Sea Ice Conditions. USGS Alaska Science Center, Anchorage, Administrative Report.

Melling, H., Riedel, D.A., and Gedalof, Z. (2005). Trends in the draft and extent of seasonal pack ice, Canadian Beaufort Sea. *Geophysical Research Letters*, 32, L24501, doi:10.1029/2005GL024483.

Obbard, M.E., McDonald, T.L. Howe, E.J. Regehr, E.V. and Richardson, E.S. (2007). Trends in Abundance and Survival for Polar Bears from Southern Hudson Bay, Canada, 1984-2005. USGS Alaska Science Center, Anchorage, Administrative Report.

Regehr, E.V., Hunter, C.M. Caswell, H. Amstrup, S.C. and Stirling, I. (2007). Polar Bears in the Southern Beaufort Sea I: Survival and Breeding in Relation to Sea Ice Conditions, 2001-2006. USGS Alaska Science Center, Anchorage, Administrative Report.

Regehr, E.V., S.C. Amstrup, and I. Stirling (2006). Polar Bear Population Status in the Southern Beaufort Sea. USGS Open-File Report 2006-1337, 20p.

Richter-Menge, J. and Coauthors (2007). State of the climate in 2006: Arctic. *Bulletin of the American Meteorological Society*, 88, S62-S71.

Rode, K.D., Amstrup, S.C. and Regehr, E.V. (2007) Polar bears in the Southern Beaufort Sea III: stature, mass, and cub recruitment in relationship to time and sea ice extent between 1982 and 2006. USGS Alaska Science Center, Anchorage, Administrative Report.

Russel, R.H. (1975) Food habits of polar bears of James Bay and southwest Hudson Bay in summer and autumn. Arctic 28:117-129.

Stirling, I., McDonald, T.L. Richardson, E.S. and Regehr, E.V. (2007). Polar bear population status in the northern Beaufort Sea. USGS Alaska Science Center, Anchorage, Administrative Report.

Zhang, J. (2007). Increasing Antarctic sea ice under warming atmospheric and oceanic conditions. *Journal of Climate*, 20, 2515-2529.

Additional Regulatory Oversight Information not previously Provided

Amstrup et al. (2007) makes assumptions regarding potential effects of various types of human impact on polar bears. These assumptions are largely based on an understanding of the impact these human activities have on polar bear survival. We provide the following information to help the authors further test their assumptions regarding impacts of human activities on polar bear.

Following is an overview of the Alaska Department of Environmental Conservation's (ADEC) environmental monitoring and permitting in the Arctic. The Alaska Department of Environmental Conservation's agency mission involves the permitting and authorization of actions relating to oil and gas development, oil spill prevention and response, pollutant discharges and other activities affecting the waters of the Arctic. The information is broken down into the following categories:

- Oil spill prevention and response
- Discharges to the waters of Arctic
- Industrial wastewater discharges
- Contaminated sites
- Water Quality Monitoring and Assessment

Oil Spill Prevention and Response

ADEC's Spill Prevention and Response Division's activities are specifically focused on oil spill prevention and assurance of adequate oil spill response. ADEC focuses its resources on the consequences of an oil spill, rather than predicting the probability of an oil spill occurring. It is the specific responsibility of ADEC to ensure that the environmental consequences of a discharge can be mitigated to a degree protective of human health and the environment by requiring regulated operators to be prepared to respond to and clean up oil spills under typical environmental conditions. Each facility or operation is required to have a oil discharge prevention and contingency plan under 18 AAC 75.400 – 18 AAC 75.420 and meet applicable requirements of 18 AAC 75.425 – 18 AAC 75.495. Requirements are complex and vary somewhat among between different types of facilities and operations, but they generally require demonstration of immediate availability of response equipment and operators and the ability to clean up spills to open water within 72 hours. Plan approvals are subject to multidisciplinary review, often with input from the Alaska Department of Fish and Game, and are subject to oversight by the U.S. EPA.

A search of the ADEC oil spill database revealed a total of seven oil spills during the period 1995 - 2005, six in the Beaufort Sea and one in the Chukchi Sea, primarily from oil production and exploration activities. There appears to be a seasonal increase in the number of spills during the January through April timeframe. This could be the result of increased exploration activity during the winter. 93% of the reported spills on the North Slope were from transportation facilities. This category includes pipelines that carry crude oil and other substances to the production facilities and on to the Trans Alaska Pipeline System. 54% of the total number of spills involved noncrude oil, followed by hazardous substances at 33% and crude oil at 13%. All spills were cleaned up to the department's satisfaction.

In May 2007, the Minerals Management Service (MMS) produced a final EIS for Oil and Gas Lease Sale 193 in the Chukchi Sea Planning Area. An oil spill risk assessment was produced as part of that effort. The risk assessment indicated that the proposed action in the lease sale (oil and gas development) would result in a 16% chance of one or more platform-based spills, a 22% chance of one or more pipeline spills, and a 35% chance of one or more spills total over the life of the project for the Alternative IV, Corridor II development. The Alternative IV, Corridor II development was the one supported by the Governor in a recent letter to the Secretary of the Interior on Lease Sale 193. Any development of these alternatives would be subject to oil discharge prevention and contingency planning requirements outlined above.

Discharges to the waters of the Arctic

According to the Lease Sale 193 EIS, "*the general water quality of the Alaska Arctic region OCS is relatively pristine due to the remoteness, harsh but active ecological system, and limited presence of human (anthropogenic) inputs. Most detectable pollutants occur at very low levels in arctic waters and do not pose an ecological risk to marine organisms.*"

Industrial Wastewater Discharges

Much of the higher strength effluent produced on the North Slope can be transported and deep injected to Class 1 Underground Injection Control (UIC) wells under the EPA's Safe Drinking Water Act jurisdiction. Therefore, drilling wastes, some domestic wastes, and other effluents avoid discharge to surface marine or fresh water. This includes mobile facilities (cat trains, exploration facilities) that can transport wastes on the road system (ice road) to an approved injection facility. Arctic oil and gas wastewater discharges are mainly permitted through the EPA's NPDES Arctic General Permit. The January 24, 2006 *EPA Ocean Discharge Criteria Evaluation of the Arctic NPDES General Permit* report provides critical baseline information and updates regarding water quality issues in the Beaufort and Chukchi Seas. The report identifies biologically sensitive areas and discusses the seasonal distribution of marine mammals, including polar bears in the biological resources section. The biological resources section also discusses polar bear critical areas or habitats in detail.

The EPA's NPDES Arctic General Permit also includes data on existing approved mixing zones, the parameters in the mixing zones, as well as effluent water quality data. ADEC issued a Certificate of Reasonable Assurance (401 Certification) for this EPA permit. Water quality parameters of concern in ADEC's certification were

- Hydrocarbons from drilling operations
- Increased sediment loading from drilling operations
- Increased metals loading from drilling muds
- Residues from drill cuttings accumulating in areas that do not have high currents that would encourage dispersal

At present, the following oil and gas facilities are located in or adjacent to Arctic waters:

- BP Exploration Northstar Facility
- BP Endicott Satellite Island
- Pioneer Oooguruk
- BP Milne Point (Kuparuk River)
- Prudhoe Bay (BP and various others)
- Conoco Phillips Kuparuk

There is currently only one other project in the development and permitting stage:

- BP Liberty Project (drilled from the Endicott Satellite Island site)

Neither ADEC or ADFG has any reason to believe that discharges from these facilities are having any significant impacts on polar bears or that they will do so in the future.

Contaminated Sites

The ADEC Contaminated Sites database contains information on only three sites adjacent to Arctic waters:

- Camp Lonely Landfill – Nuiqsut, AK
- Collinson Point Intermediate DEW Line Station – Kaktovik, AK
- Saint Lawrence Island – Formerly Used Defense Sites

Neither ADEC or ADFG has any reason to believe that contaminants from these sites are having any significant impacts on polar bears or that they will do so in the future.

Water Quality Monitoring and Assessment

The Clean Water Act (CWA) mandates that each state develop a program to monitor the quality of its surface and groundwaters and prepare a report describing the status of its water quality. The U.S. Environmental Protection Agency (EPA) then compiles and summarizes the information from all the state reports and sends this information to Congress. The process for developing information on the quality of the nation's water resources is contained in several sections of the CWA: Section 305(b) requires that the quality of all waterbodies be characterized; Section 303(d) requires that states list any waterbodies that do not meet water quality standards.

As part of these efforts, ADEC and EPA already performed field monitoring in Southcentral and Southeast Alaska. ADEC and EPA plan to perform field monitoring in the Arctic in the near future. Until an assessment comparable to that underway for Southcentral and Southeast Alaska coastal waters is completed, ADEC has no independent baseline water quality data for the Arctic Ocean. However, as indicated above, due to the remoteness and relatively pristine nature of the area, ADEC has no reason to believe that there are currently any water quality problems in the Alaskan Arctic.