ENVIRONMENTAL ASSESSMENT

Final Rule to Authorize the Incidental Take of Small Numbers of Polar Bear (*Ursus maritimus*) and Pacific Walrus (*Odobenus rosmarus divergens*) During Oil and Gas Activities in the Beaufort Sea and Adjacent Coastal Alaska

DEPARTMENT OF INTERIOR

U.S. FISH AND WILDLIFE SERVICE

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1.1 Introduction

This environmental assessment (EA) is prepared to implement provisions of the National Environmental Policy Act of 1969 [(NEPA) 42 U.S.C. § 4321 *et cetera*]. The action being considered under NEPA is whether issuance of regulations authorizing the incidental taking of Pacific walrus *(Odobenus rosmarus divergens*) and polar bears (*Ursus maritimus*) is, or is not, a major Federal action. A positive finding would require the development of an Environmental Impact Statement. In Alaska, oil and gas industry activities occurring in Federal waters and on Federal lands are permitted by the Department of Interior's Mineral Management Service (MMS). While oil and gas industry activities on State lands are permitted by the State of Alaska. Further, oil and gas industry activities may occur in habitat frequented by Pacific walrus and polar bears. The issuance of incidental take regulations do not permit the actual oil and gas industry activities. Therefore industry activities will likely continue to occur in polar bear and Pacific walrus habitat regardless of a positive or negative determination being made under this EA.

It is important to note that the U. S. Fish and Wildlife Service (Service) is not evaluating the impact of industry on polar bears and Pacific walrus in this document. Rather this EA evaluates the impact of issuing incidental take regulations on polar bear and Pacific walrus. A separate assessment of the cumulative effects of oil and gas activities during the length of the regulations will be conducted in the regulations.

Based upon this EA, a decision will be made concerning the environmental impacts on polar bears and Pacific walrus resulting from the implementation of regulations governing the taking of small numbers of polar bear and Pacific walrus incidental to oil and gas activities in the Beaufort Sea and adjacent coastal Alaska. This EA will then determine if the action will have significant impacts, address any unresolved environmental issues, and provide a basis on whether or not to issue regulations authorizing the incidental take of Pacific walrus and polar bears.

1.2 By what authority can we issue incidental take regulations?

Section 101(a)(5)(A) of the Marine Mammal Protection Act of 1972 (Act), As Amended (16 U.S.C. § 1371), directs the Service to allow the incidental, but not intentional, take of small numbers of marine mammals in a specified activity (other than commercial fishing) within a specified geographical area for a specified time, upon the request of U.S. citizens. However, prior to allowing such incidental takings, the Service must find in the regulations, based on the best scientific evidence available, that the total taking will have a negligible impact on the species or stock, and, will not have an unmitigable adverse impact on the availability of the species or stock for subsistence uses. If both of these findings are made, we will issue specific regulations regarding the incidental taking of marine mammals that will include permissible methods of taking and other means to ensure the least practicable adverse impact on the species. The scope of such regulations will include the species, habitat, and the availability of the species for subsistence uses, as well as habitat areas of significance, monitoring activities and reporting requirements. Service regulations [50 CFR 18.27(f)] provide for the issuance of Letters of Authorization (LOA) once specific regulations are in place to authorize activities under the provisions of these regulations. LOA's may only be issued to citizens of the United States. Definitions of key terms used in these regulations are listed below. Additional definitions can be found in 50 CFR Part 18.

Harass. The term "harass" as defined by the Act, for non-military readiness activities, means any act of pursuit, torment, or annoyance that a) has the potential to injure a marine mammal or marine mammal stock in the wild; or b) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

Incidental, but not intentional. Incidental, but not intentional, take means take events that are infrequent, unavoidable, or accidental. It does not mean that the taking must be unexpected.

Negligible impact. Negligible impact is an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival

Small numbers. Small numbers means a portion of a marine mammal species or stock whose taking would have a negligible impact on that species or stock. We decline to quantify small numbers explicitly. Such numerical limits would ignore the significant differences in the status and population dynamics among the various marine mammal stocks and the type of taking (i.e., harassment versus mortality) or other impacts. Furthermore, Congress recognized the imprecision of "small numbers" but offered no additional guidance.

Take. The term "take" as defined by the Act means to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

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1.3 Why do we need incidental take regulations?

Section 101 of the Act placed a moratorium on the taking of marine mammals. Section 101(a)(5)(A), as described in Section 1.2 of this document, allows the incidental, but not intentional, taking of marine mammals upon request of a U.S. Citizen once certain findings are made. In Alaska, the Service is responsible for the management of three marine mammal species: the polar bear, the northern sea otter (*Enhydra lutris kenyoni*), and the Pacific walrus. These species are protected under the Act. Neither the Pacific walrus nor polar bears are currently listed as threatened or endangered and, therefore, are not provided protection by the Endangered Species Act. A petition to list polar bears as threatened throughout its range under the Endangered Species Act was received on February 16, 2005, from the Center for Biological Diversity. On February 9, 2006, the Service published its finding that the petition presented substantial scientific information indicating that the listing action may be warranted, thereby initiating a status review for the species.

Both the Alaska Oil and Gas Association (AOGA), on behalf of the oil and gas industry (Industry) in Alaska, and BP Exploration (Alaska), Inc. (BPXA) petitioned the Service to issue regulations to authorize the incidental take of small numbers of polar bear and Pacific walrus while engaged in a specified activity (other than commercial fishing) within specified geographical regions. In their petitions AOGA and BPXA requested the Service to allow the non-lethal forms of incidental take of small numbers of Pacific walrus and polar bears.

The oil and gas industry (Industry) operates in polar bear and Pacific walrus habitat. Thus, it is possible that while conducting legal activities in pursuit of oil and gas resources, Industry actions could result in the incidental take of polar bears or Pacific walrus. Section 101(a)(5)(A) directs the Service to allow such incidental takings as long as certain findings can be made. Section 101(a)(5)(A) of the Act further requires monitoring and reporting programs by anyone operating under these regulations. Monitoring provides us with additional information to evaluate the effect of the activities on polar bears and Pacific walrus and also provides information to design and develop human/polar bear interaction plans which may serve to enhance human safety and protect polar bears. Without the regulations, industrial activities could continue; however, the Service would have no formal means of communicating with Industry or have the ability to require monitoring and mitigation of specific activities and any form of "take" would be a violation of the Act.

1.3.1. Specified activity.

The specified activities described in this request include Industry exploration, development, and production and associated actions.

1.3.2. Specified geographical region.

The geographical extent of these regulations is the same area, referred to as the Beaufort Sea Region, as covered by our previous regulations (November 28, 2003 through March 28, 2005) (68 FR 66744). The geographic area is defined by a north/south line at Barrow, Alaska, including all Alaska State waters and Outer Continental Shelf waters, and east of that line to the Canadian border. The onshore region is the same north/south line at Barrow, 25 miles inland and east to the Canning River. The Arctic National Wildlife Refuge is excluded from these regulations (Figure 1).

1.3.3. Duration.

The regulations will be effective for a period of five years from the date of issuance.

1.3.4. Permissible methods of taking.

The following are types of take that are deemed permissible for the incidental take of small number of polar bears and Pacific walrus.

1.3.4.1. Noise.

Oil and gas exploration, development, and production activities produce noise from many different sources. Noise can be generated by stationary or mobile sources. Stationary sources include coastal production facilities, or production facilities located either on offshore oil platforms, or on man-made or artificial islands. Mobile sources include vessel and aircraft traffic, open-water seismic exploration, geotechnical surveys, drilling, dredging, and ice-breaking vessels. The type of noise generated by industrial activities is also seasonally dependent, where activities occurring during the ice-covered season may be different than those occurring during the open-water season and may produce different sounds. Routine vessel traffic and seismic exploration activities may occur during the open-water season, while vibroseis activities, ice-road construction and associated vehicle traffic, geotechnical activities, and exploratory drilling are most likely to occur during the ice-covered season.

1.3.4.2. Physical obstruction.

Northstar Island, the Endicott and West Dock causeways, associated production facilities, transportation corridors, and pipelines are examples of physical obstructions, which may impact movements of polar bears or Pacific walrus.

1.3.4.3. Human/animal encounters.

Oil field facilities on the North Slope of Alaska overlap with polar bear and Pacific walrus habitat. Therefore, encounters between people and either or both species may occur. Human encounters with polar bears typically occur more frequently then those with Pacific walrus due to polar bear use of both marine and terrestrial environments in the specified geographical region. Therefore, the current regulatory process requires each applicant to develop a polar bear interaction plan for each type of proposed operation. Such plans must outline the steps the applicant will take to minimize impacts on polar bears, such as garbage disposal procedures to reduce the attraction of polar bears and placement of facilities on pads to reduce human/bear interactions. Interaction plans must also outline the chain of command for responding to a polar bear sighting. In addition to interaction plans, Industry personnel participate in polar bear awareness training while on site. The intent of polar bear interaction plans and training activities is to allow for the early detection and appropriate response to polar bears which may be encountered during Industry activities. Most often, the appropriate response involves monitoring the bear's activities, though it may involve deterring the bear from the site. Such plans and training ultimately seek to minimize the possibility of an encounter with a polar bear resulting in the lethal take of the bear in defense of human life.

1.3.4.4. Contact with oil spills.

A principal Service concern regarding Industry activities in this specified geographical region is the potential for a large oil spill in the offshore environment and its impact on marine mammals. An oil spill is not a permissible means of incidental take for polar bears or Pacific walrus and authorization to take by oiling is not covered within the regulations. However, the potential of an oil spill impact on Pacific walrus and polar bears needs to be addressed when promulgating incidental take regulations. As a potential source of mortality, the Service needs to include an overall assessment of the effects of establishing incidental take regulations.

Should an oil spill occur during Industry operations, injury or death to animals may occur. The impacts associated with an oil spill would depend on the location, size of the spill, environmental conditions, success of clean-up measures, and the behavior of the animals to the spill and the clean-up activities associated with a spill.

1.3.5. Activities to be conducted.

The scope of the regulations is limited to activities that will be conducted during the exploration, development, and production of oil and gas resources along the Beaufort Sea and adjacent northern coast of Alaska within the defined geographic region. Throughout the five years that the future regulations will be in place, the petitioners expect that oil and gas activities will remain at similar levels of frequency, seasonality, and type as under the prior regulations. Examples of future Industry activities include the completion of the Alpine Satellite Development, development at Point Thomson, Oooguruk, Nikaitchuq and areas in the National Petroleum Reserve – Alaska (NPR-A). The locations of these operations are assumed by the petitioners, for the purpose of meeting Act requirements, to be approximately equally divided among the onshore and offshore tracts presently under lease and to be leased during the period under consideration.

For the purpose of assessing possible impacts related to this action, the petitioners assume that these activities will occur equally spaced over time and area for the upcoming ice-covered and open-water seasons.

Due to the large number of variables affecting exploration activities, predictions of exact dates and locations of operations for the open-water and ice-covered seasons is speculative. However, operators must provide specific dates and locations of proposed activities prior to receiving a LOA.

Below is a summary of operations and actions submitted by Industry that are anticipated to be conducted annually for the open-water and ice-covered seasons. Similar activities have been conducted in the past and are likely to continue to be conducted over the life of the oil fields.

1.3.5.1. Exploration Operations.

Most exploration and development activities occur during the snow/ice-covered season to limit disturbance to habitat and wildlife. Historically, the State of Alaska set the time period when vehicles could safely travel on the tundra, "tundra travel," to protect the vegetation. This was based on a minimum of six inches of snow and one foot of frozen ground. This originally created a 200-day working season. More recently, tundra travel has only lasted for approximately 120 days. Currently, a study sponsored by the State of Alaska is investigating several strategies to increase the length of tundra travel and still limit disturbance to protect the vegetative mat (DNR 2004).

Exploration includes a variety of types of geological and geophysical surveys aimed at gathering information about potential oil-bearing subsurface structures. Typical geophysical surveys, such as "shallow hazard" and "site clearance" surveys are designed to identify hazards that may be encountered during exploratory drilling. Geophysical surveys can be divided into two classes, "deep seismic" and "shallow hazard"; both classes generally use the "reflective" method of data collection. In geotechnical site investigations, shallow core samples provide information about soil conditions. Site investigations are required to develop foundation design criteria for any planned structure, and to determine the optimal location for the facility.

Several methods of seismic exploration could be used. Reflective seismic exploration, gathers information about the earth's subsurface by measuring acoustic waves, which are generated on or near the surface. Large numbers of personnel (40-140) and vehicles (45) may be required to conduct seismic operations. Vibrator seismic data collection utilizes a continuous cable along the length of the seismic line being recorded. In a typical 16 to 18 hour day, four to five miles of vibrator seismic operation can be conducted. Air gun and water gun seismic data collection utilize compressed air or water to create a pressure wave, the seismic impulse. Air gun and water gun techniques are generally used in open water conditions and not during Arctic winter exploration. Vertical seismic profiling is a form of well logging that is conducted on or near the drill pad. This process is used to correlate the reflections on the seismic data with formations seen during drilling.

1.3.5.2. Drilling.

Exploratory drilling is used as a means of delineating the oil reserve and can be conducted off of a variety of platforms. Artificial islands, such as Northstar Island, are commonly used. These man-made structures are constructed in shallow offshore waters, usually less than 50 feet deep, primarily for the purpose of providing a foundation for drilling equipment and personnel. Artificial islands have been most utilized for exploratory operations; however, Northstar and Endicott (causeway connected to the mainland) are examples of an artificial island supporting production operations.

Artificial islands have been constructed from sand, gravel, and water (ice) at various times of the season. Usually the construction materials (sand and gravel) are hauled to the site via barge (open-water) or truck (ice-road).

Bottom-founded structures can also be used during exploration. The Steel Drilling Caisson (SDC) is a drilling unit constructed by modifying the forward section of an oceangoing vessel designed to carry out year-round drilling operations under Arctic environmental conditions. Most recently, the SDC was used as an exploration platform for the McCovey prospect in 2002.

Drillships are used in Arctic waters deeper than 60 to 80 feet because bottom-founded drilling structures (e.g., SDC) are limited to water depths of less than 80 feet. Drillships operate only during periods of open water. Drillships are usually supported by one or more ice management vessels (icebreakers) to ensure that ice will not damage the drilling operation. A blowout preventer is typically located at the seabed in a hole dug below the ice-scour depth. The blowout preventer is an important safety feature enabling the drillship to shut down operations and move from the site without exposing the well. A barge and a tug typically accompany the drill ship to serve as a standby safety vessel and also provide support for oil spill response and refueling. Personnel, usually around 100, are routinely ferried between the ship and shore by helicopter.

The Kulluk is a floating drilling unit that was designed for extended-season drilling in Arctic waters of 60 to 600 deep. The Kulluk is capable of drilling wells to depths of 20,000 feet. Due to its construction, the Kulluk is also capable of withstanding ice forces that may be encountered during breakup and freeze-up and this permits it to operate during periods well beyond those of an ordinary Arctic-class drillship.

Ice pads and roads are commonly used to provide access to terrestrial and nearshore facilities. Ice roads provide seasonal routes for heavy equipment and supplies to be moved to remote areas. These temporary, seasonal roads are constructed by spreading water from local sources (lakes or rivers) to create a rigid surface. Ice pads, islands, and roads can also be constructed using the spray ice technique. The technique consists of spraying water into the air allowing the water to freeze and fall to the surface. This technique is used to reduce cost and impacts to the area.

For grounded ice roads in shallow (< 2 m) waters of the Beaufort Sea, seawater is initially used for the foundation and the ice road is eventually "capped" with freshwater, strengthening it. Floating ice roads may also be constructed in deeper water. Ice bridges may be constructed to provide winter access across frozen rivers. Ice airstrips are built in the same manner as ice roads. Ice drilling pads are now commonly used for winter exploration pads. Ice pads are also built in a similar way to ice roads and airstrips. The thickness of ice roads, pads and bridges depends on the loads that must be supported and on terrain, and can range from 15 cm (6 in) to 3 m (10 ft).

1.3.5.3. Potential Exploration Activities

Oooguruk Unit

The Oooguruk Unit is located adjacent to and immediately northwest of the Kuparuk River Unit in shallow waters of the Beaufort Sea, near Thetis Island. The unit operator, Pioneer Natural Resources, is currently conducting a feasibility study for the potential development of reservoirs encountered in previous exploration drilling. Pioneer may conclude the study and move forward with development and, ultimately, production activities during the regulatory period if results from the feasibility study prove favorable. Facilities would include an offshore production island between Thetis Island and the Colville River Delta, a 5.7 mile underground pipeline, where landfall will occur near the mouth of the Kalubik Creek.

Nikaitchuq Unit

The Nikaitchuq Unit is located near Spy Island, north of Oliktok Point and the Kuparuk River Unit, and northwest of the Milne Point Unit. Operator Kerr–McGee Oil and Gas Corporation drilled three exploratory wells on and immediately adjacent to Spy Island, 4 miles north of Oliktok Point in the ice-covered season of 2004-2005. Kerr-McGee is moving to develop this site as a future production area. Facilities will include 3 offshore production islands south of the Jones Island group and approximately 13 miles of underground pipeline connecting the sites to a mainland landfall near Oliktok Point.

Two Bits Prospect

Armstrong Oil and Gas has filed a plan of operation with the State of Alaska to drill up to three onshore exploratory wells west of the Kuparuk River unit in 2005. Operations at the "Two Bits" prospect will occur either from an existing gravel pad (West Sak 18) or from an ice pad constructed immediately adjacent to that pad.

Nearshore Stratigraphic Test Well, Eastern Beaufort Sea

The State of Alaska awarded a contract to ASRC Energy Services to drill a stratigraphic test well at one of two potential locations in state waters offshore of the 1002 area of the Arctic National Wildlife Refuge (ANWR). One location is approximately 20 miles southwest of Kaktovik near Anderson Point; the second is approximately 30 miles southeast of Kaktovik near Angun Point. The locations are in water depths of 25-30 feet, and drilling operations will be conducted in winter utilizing the SDC, a mobile offshore drilling unit. Originally planned to take place during the 2004-2005 drilling season, no decision to move forward has yet been made.

Shell Exploration and Production Company's Beaufort Sea Program

Shell Exploration and Production Company is planning an open water seismic program, which will consist of an estimated 3,000 miles of 3D seismic line acquisition and site clearance surveys in the eastern Beaufort Sea. The open water seismic program will consist of two vessels, one active in seismic acquisition and the second providing logistical support. The open water program will involve a geotechnical investigation supported by a soil-boring vessel. The offshore open water seismic program is proposed to occur between August and October 2006, depending on ice and whaling activities.

An onshore/on-ice geotechnical program will acquire soil borings from approximately 200 ft onshore seaward to 10 kilometers (km) offshore. The work will be conducted on offshore ice over waters approximately 10 to 15 meters in depth. Shell will drill approximately 60 borings ranging from 35 to 75 ft in depth. Thermister strings will be placed in 2 or 3 borings and recovered a month later. The onshore/on-ice geotechnical program activities will occur between March and May 2006.

Cape Simpson Support Program; Ukpeagvik Inupiat Corporation (UIC)

UIC has entered into lease agreements with the North Slope Borough to operate North Slope facilities between Prudhoe Bay and Barrow in support of oil and gas exploration activities. UIC is developing a staging area at Cape Simpson, between Smith Bay and Dease Inlet, on the Beaufort Sea coast. The following activities are likely to occur during their operations on the North Slope: marine transportation and barging, fixed and temporary camp operations, equipment and materials staging and storage, flight operations, ice road construction, and exploration site support.

1.3.5.4. Future Developments: Recent and Planned Lease Sales

State of Alaska Lease Sales

In 1996, the State of Alaska adopted an "area-wide" approach to leasing. Under area-wide leasing, the state annually offers all available state acreage not currently under lease within each the area. North Slope Area-wide Lease Sales are held annually in October. Five lease sales have been held to date. As of July, 2004, there are 777 active leases in this area, encompassing 2.4 million acres. Beaufort Sea Area-wide Lease Sales are held annually in October. Four lease sales have been held to date. As of July, 2004, there are 194 active leases in this area, encompassing 440,000 acres. Future State of Alaska lease sales will continue.

Northeast Planning Area of NPRA

Two lease sales have been held in the Northeast Planning Area of NPRA. The 1999 lease sale resulted in the sale of 133 tracts, and the 2002 sales resulted in the sale of 60 tracts. Acreage awarded under these two lease sales totals 1.4 million acres. Thirteen exploratory wells have been drilled to date.

In June, 2004, the Bureau of Land Management issued a Draft Environmental Impact Statement for the northeast planning area, proposing to expand the acreage available for leasing within this area. BLM is currently reviewing a preferred alternative for the FEIS. If the preferred alternative is adopted, lease sales would occur at two and three year intervals. Production from new leases issued from these sales is not projected to occur until 2018.

OCS Lease Sales

In February, 2003, the Minerals Management Service issued the Final Environmental Impact Statement for three lease sales planned for the Beaufort Sea Planning Area in the Outer Continental Shelf (OCS). Sale 186 was held in September, 2003, resulting in the leasing of 34 tracts. Lease Sale 195 was held in August, 2005. Sale 202 is scheduled for March, 2007. While the disposition of the leases purchased is highly speculative at this time, it is probable that at least some seismic exploration and possibly some exploratory drilling could take place during the five-year period of the regulations.

1.3.5.5. Development and Production Operations.

North Slope oil field developments include a series of major fields and their associated satellite fields. In some cases a new oil field discovery has been developed completely using existing oil field facilities. For example, the Kuparuk oilfield development incorporates the Kuparuk, West Sak, Tarn, Palm, Tabasco and Meltwater oil fields. After processing, oil and gas liquids are sent through gathering lines to the Trans-Alaska Pipeline System (TAPS). Development and production are ongoing year-round operations. Operations are likely to remain constant over the next five years as some reservoirs become depleted and other reserves are brought on-line and into production.

Details on some of the larger operating fields such as; Prudhoe Bay, Kuparuk, Endicott, Milne Point, Point McIntyre, Badami, Northstar, and Alpine are provided by Industry and described below. All of the oil fields lie within the range of polar bears, while those in the offshore/nearshore region may encounter Pacific walrus on an infrequent and irregular basis.

Prudhoe Bay. The Prudhoe Bay field is the largest oil field in North America and the 18th largest field ever discovered worldwide. It encompasses approximately 350 square miles. The Prudhoe Bay Oilfield Unit encompasses the Prudhoe Bay, Lisburne, Niakuk, West Beach, North Prudhoe Bay, Pt. McIntyre, Borealis, Midnight Sun, Polaris, Aurora and Orion fields. Oil wells within the production area are clustered together on gravel pads. Approximately 10 billion barrels have been produced from a field originally estimated at 25 billion barrels. The Prudhoe Bay field also contains an estimated 46 trillion cubic feet of natural gas, with approximately 26 trillion cubic feet of that deemed recoverable. Information presented by Industry indicates that in early 1997 more than 1,300 wells had been drilled, and several hundred more may be required to fully develop the reservoir. This figure includes gas and water injection wells. The technology of directional drilling (angle drilling) allows greater subsurface areas to be developed while minimizing the number of gravel pads, thus impacting less surface area.

Approximately 2000 hectares (5000 acres) have been affected due to the construction of roads, pads and airstrips within the Prudhoe Bay oilfield and its associated satellite fields, including approximately 350 km (218 mi) of roads, 341 km (212 mi) of pipelines, 6 gravel mine sites, 43 gravel pads and 106 reserve pits. Production facilities at Prudhoe Bay include six separation centers, an electric power station, a central gas facility and the central compression plant. Each of these facilities provides a unique service, which prepares the crude oil for shipment down the TAPS.

Kuparuk. The Kuparuk field is the second-largest producing oil field in the U.S. More than 2.6 billion barrels of oil are expected to be produced from the 6 billion-barrel oilfield. The Greater Kuparuk Area includes the satellite oilfields of Tarn, Tabasco, West Sak and Meltwater. These satellite fields have been developed using existing facilities. To date, nearly 900 wells have been drilled in the Greater Kuparuk Area. The total area directly affected by development in the Greater Kuparuk Area is approximately 603 hectares (1508 acres), including 167 km (104 mi) of gravel roads, 231 km (144 mi) of pipelines, 6 gravel mine sites, and over 50 gravel pads. The major production installations include three separation centers called Central Production Facilities that separate the oil, gas and water and a seawater treatment plant at Oliktok Point. The seawater treatment plant treats seawater for injection into the reservoir for the enhancement of oil recovery.

Endicott. The Endicott field was discovered in 1978 and began production in 1987. It is located offshore in the Beaufort Sea and is about 10 miles northeast of Prudhoe Bay. Endicott is the first continuous, offshore producing field in the Arctic. The Endicott Production project consists of two artificial gravel islands; a 55-acre main production island and a 16-acre satellite drilling island. The two islands are connected to the mainland and the Prudhoe Bay road system by a 5-mile causeway. Approximately 100 wells have been drilled to develop the field. Two satellite fields—Sag Delta North and Sag Delta-have also been developed using existing infrastructure. The Endicott development has disturbed 156.8 hectare (392 acres) of land with 25 km (15 mi) of roads, 47 km (29 mi) of pipelines and one gravel mine site. Processed oil is sent through a 24-mile aboveground pipeline to the TAPS.

Milne Point. The Milne Point field is located along the south shore of Simpson Lagoon and immediately northeast of the Kuparuk field about 35 miles northwest of Prudhoe Bay. The field was discovered in 1969, and production began in 1985. The field consists of more than 220 wells drilled from 12 gravel pads. Three satellite fields (Cascade, Schrader Bluff and Sag River) have been developed within the Milne Point Unit, mainly using existing infrastructure. An additional 300 wells may be needed to fully develop the Schrader Bluff reservoir. Milne Point and its satellites have resulted in the disturbance of 94.4 hectares (236 acres) of tundra, including 31 km (19 mi) of gravel roads, 64 km (40 mi) of pipelines and 1 gravel mine site.

Point McIntyre. The Point McIntyre field is located nearshore, about two miles north of the Prudhoe Bay producing area and contains over 400 million barrels of recoverable oil. Production began in late 1993 from the first of two production pads. The second pad began production in mid-1994 in conjunction with field-wide waterflooding.

Badami. The Badami reservoir is located primarily offshore beneath Mikkelsen Bay, about 25 miles east of existing North Slope oil field facilities. The Badami Unit is located in the vicinity of the Shaviovik River, east of Prudhoe Bay and south of Mikkelsen Bay. The Facility includes a Central Processing Unit (CPU), satellite well pad, dock, airstrip, and an infield road system. An elevated pipeline connects the Badami Unit with the Endicott pipeline. Production began from Badami in 1998, but has not been continuous. The Badami field development has resulted in the disturbance of approximately 34 hectares (85 acres) of tundra, including 7 km (4.5 miles) of gravel roads, 56 km (35 miles) of pipeline, one gravel mine site and two gravel pads with a total of 50 wells. There is no road access from Deadhorse to Badami. Summer access to the site is by barge, aircraft and helicopter. Winter access occurs via air or ice roads.

Badami is entering a period of warm shut down, where facilities will be maintained, but not active. Badami will be continually staffed by four personnel that will maintain the facility and ensure regulatory compliance.

Northstar. The Northstar oil field is located approximately 6 miles offshore of the Point McIntyre/Point Storkersen area in the central Alaskan Beaufort Sea. The Northstar oilfield was discovered in 1983. The offshore oilfield is located 6 km (4 mi) northwest of the Point McIntyre field and 10 km (6 mi) from Prudhoe Bay. The 15,360-hectare (38,400-acre) reservoir has now been developed from a 5-acre artificial island. Production from the Northstar reservoir began in late 2001. The 2-hectare (5-acre) island will eventually contain 16 producing wells, 5 gas injectors, and one waste disposal well. A subsea pipeline connects facilities to the Prudhoe Bay oilfield.

Transport to and from the island is facilitated by a combination of ice road travel, hovercraft, and helicopter. An ice road is constructed between Northstar Island and West Dock annually. The ice road is used throughout the winter season by crew vehicles and other operations support vehicles. During the broken ice and open water season, a hovercraft or helicopter are used to transport personnel and equipment to and from the island. Additional travel on ice may also occur to access the pipeline shore crossing, pipeline corridor, or to conduct operationally related activities.

Alpine. ConocoPhillips Alaska , Inc., and its partners are developing the Alpine oil field located in the Colville River delta 34 miles west of the Kuparuk oil field. Discovered in 1996, the Alpine oilfield began production in 2000. Alpine is the westernmost oilfield on the North Slope, located 55 km (34 mi) west of the Kuparuk oilfield and just 13 km (8 mi) from the village of Nuiqsut. The Alpine oilfield covers 16,000 hectares (40,000 acres) and has been developed from 38.8 hectares (97 acres) of pads. There are two drill sites and more than 112 wells. There is no permanent road connecting Alpine with the Kuparuk oilfield; small aircraft are used to provide supplies and crew changeovers.

1.3.5.6. Potential Oilfield Developments 2006-2011

Possible future development activities, which could occur within the five-year period covered by the requested regulations, are discussed below. These include the Pt. Thomson, Palm, Alpine satellite developments, and areas in the NPR-A. Seismic exploration and exploratory drilling could occur at unidentified locations and potential new satellite oilfields across the North Slope in areas recently leased or in those areas subject to continuing evaluation. A description of announced exploration drilling activities is included below. In any event, drilling activity is limited by rig availability. As of July 2004 a total of 24 drilling rigs were located on the North Slope. Currently, eleven drilling rigs are available for on-shore exploration and one rig is available for off-shore exploration.

Palm

The Palm oilfield is an extension of the Kuparuk oilfield and is located to the west of the main Kuparuk field. It was discovered in 2001 and is located 5 km (3 mi) to the west of the Kuparuk field. This field will be developed as an extension of the Kuparuk oilfield using Kuparuk facilities.

Point Thomson

The Point Thomson reservoir is located both onshore and offshore app. 32 km (20 miles) east of the Badami field. Development plans are currently being re-assessed. During the petition period the Point Thomson area will remain subject to field surveys and other evaluative programs, up to potential drilling activity.

Alpine Satellite Development

The development and construction of five Alpine satellite drill sites (identified as CD-3 through CD-7), gravel roads, an airstrip, and pipelines is currently in its first year of construction. Two of the drill sites, CD-3 (also known as Fiord prospect or CD-North), and CD-4, (also known as the Nanuq prospect or CD-South), are in the Colville River Delta. The CD-3 drillsite is located north of CD-1 (Alpine facility) and is proposed to be a roadless development. The remaining drill sites are proposed to be connected to CD-1 by road. Three of the drill sites, CD-5 (also known as Alpine West prospect), CD-6 (Lookout prospect) and CD-7 (Spark prospect), are in the National Petroleum Reserve – Alaska (NPR-A), an area bordered by the Beaufort Sea coast to the north, to the Brooks Range to the south. Gravel sources for roads are from an existing mine near Nuiqsut and a new gravel mine site (Clover) near the Ublutuoch River in NPR-A. Construction of CD-3 and CD-4 drill sites began in winter 2005, with production startup for both drill sites in late summer 2006. The three NPR-A drill sites are scheduled for construction from the winter 2007 through winter 2010. All drill sites are scheduled to be in production by summer 2010.

Gwydyr Bay

Pioneer Natural Resources acquired several leases at the October 2003 State Lease Sale adjacent to and immediately north of the Prudhoe Bay Unit. Pioneer is evaluating development scenarios for relatively small hydrocarbon accumulations identified by several previously drilled exploration wells.

Oil Field Units

In addition, the North Slope oil fields are segregated into oil field units. These units can encompass exploration and production activities. Currently, there are at least 11 oil field units associated with Industry on the North Slope. They include the Greater Prudhoe Bay, Duck Island, Badami, Northstar, Kuparuk River, Colville River, Oooguruk, Tuvaq, Nikaitchuk, Milne Point, and Point Thomson.

1.3.5.7. Oil Production Processes.

Production Facilities

Oil production wells are grouped together at a number of locations surrounding each separation plant. New wells are drilled from these locations called well pads or drill sites. From the surface wellhead, crude oil flows into the manifold building, which is also located on the well pad. The primary function of the manifold building is to combine production from many wells and transport it to separation facilities through flow lines.

At the separation or gathering centers, gas and water are removed from the oil. For example, in the Prudhoe Bay Unit, following the separation process, oil is routed by pipeline to Pump Station 1, which is the beginning of the TAPS. The water is injected back into the underground rock formation to help maintain reservoir pressure and enhance recovery of petroleum products. The gas is routed to the Central Gas Facility (CGF) where natural gas liquids are extracted by a refrigeration process and sent down the TAPS with the crude oil. Miscible gas liquids are also removed and used as an injectant for enhanced oil recovery. The remaining gas is routed to the Central Compressor Plant (CCP) where it is compressed for reinjection into the gas cap of the reservoir.

Each production facility has emergency gas-flaring capabilities in case of compressor failure. For example, in the Western Operating Area (WOA), these consist of seven 15-m (50-ft) flares for each gathering center.

Production Wastes

Wastes generated from oil production activities include drilling muds and cuttings and are known as "associated wastes." The drilling mud is designed to prevent the uncontrolled release of oil or gas from the well and is typically water-based mixtures of naturally occurring clays and weighting materials with small amounts of other additives. Much of the muds and cuttings are recycled. When the muds and cuttings must be disposed, they are injected into confining subsurface geologic formations. Reserve pits, for surface disposal of cuttings, have been eliminated by new technology that grinds drilling cuttings to a size small enough to inject into a confining geologic layer. Also included in "associated wastes" are tank-bottom sludge, residues, and pigging wastes. The liquid wastes are injected into approved Class II disposal wells, and the solids are placed in lined surface impoundments. The small amounts of hazardous waste that are generated by the production area facilities are managed in accordance with current Federal regulations.

Other wastes generated by oil field operations include well treatment fluids, spent chemicals used for processing crude oil, rig washwater, hydraulic fluids from rig equipment, and cooling waters. These wastes are disposed of by underground injection. A small amount of hazardous waste is generated by production facilities. These wastes are handled in accordance with Environmental Protection Agency regulations. Hazardous wastes are sent out of state by truck and barge to EPA-permitted disposal facilities in the contiguous United States.

Non-hazardous solid waste and sanitary wastes are also generated at North Slope oil field facilities. Solid wastes such as empty drums, paper products, wood, etc., are handled at the North Slope Borough landfill or incinerated. Disposable food waste is also handled at the North Slope Borough landfill facility, and predator-proof dumpsters have been installed in the oilfield to minimize wildlife attraction to these potential food sources. Sewage wastes are physically and chemically treated by wastewater treatment facilities. North Slope area facilities also operate various recycling programs. Paper products, wood, scrap metal, Styrofoam, cardboard, and other materials are collected and transported off the North Slope to appropriate recycling facilities.

Production Support Operations

Equipment and supplies are delivered by air, barge, and by the 360-mile Dalton Highway. Barge shipments are limited to a 6-week period each summer when the Arctic icepack moves offshore enough to allow passage of vessels. Two docks and staging areas handle bulk supplies and heavy equipment, including huge modular buildings delivered by barge. Aircraft landing at Deadhorse, Alaska are the primary carriers of personnel, mail, cargo, and perishable items.

Chapter 2 - Alternatives Including the Proposed Action

2.1. Alternative 1: No Action.

The no action alternative for this EA would result in no incidental take regulations being issued. The moratorium and prohibitions on the taking of marine mammals imposed by the Act prohibits Industry from "taking" marine mammals, including incidental taking. Letters of Authorization would not be issued. Therefore, no mitigation to minimize the effects of Industry activities on polar bears and walrus, monitoring, or reporting would be required. Under this alternative, takings that could occur incidental to oil and gas activities would be subject to prohibitions found in the Act, and Industry would be liable for penalties should a take occur.

2.2. Alternative 2: The Proposed Action (Incidental Take Regulations)

The proposed alternative is to promulgate regulations, which will authorize incidental take of small numbers of marine mammals associated with oil and gas activities in the Beaufort Sea and adjacent northern Alaska coast. These activities must be conducted according to state and Federal law.

The proposed action would allow us to issue LOAs for incidental take, which include mitigation, monitoring and reporting requirements. We will review each request for a LOA and a determination will be made on the adequacy of mitigation, monitoring and reporting requirements to protect polar bears and walrus. In addition, LOAs may be conditioned on a case-by-case basis to afford additional protection to sensitive areas, such as areas being used by denning polar bears.

2.3. Alternatives Considered but Not Feasible

The Service considered alternatives that were not appropriate when determining the mechanism to authorize non-lethal incidental take of small numbers of marine mammals associated with oil and gas activities in the Beaufort Sea and adjacent northern Alaska coast. They included; 1) issuing authorizations to Industry operations on a case by case basis, such s Incidental Harassment Authorizations; 2) separating Industry operations by the type of activity (i.e., exploration, development, production); 3) separating Industry operations by location (i.e., geographic location or oil and gas units); 4) separating Industry operations by timing of the activity (i.e., ice-covered, open-water or calendar year); 5) issuing lethal incidental take.

In evaluating the effects of incidental take regulations on polar bears and Pacific walrus, the Service is required to evaluate takes expected from all specified activities in the specific geographic area on polar bear and Pacific walrus. This evaluation involves assessing the accumulation of impacts from all anticipated activities combined (the applicant's anticipated takes, as well as takes from other citizens conducting similar activities in the geographic region), regardless of the type or location of activity, or season in order to evaluate the cumulative effects of Industry activities. Hence, separating Industry operations is not an alternative, as we cannot separate specific activities in making a negligible finding.

Chapter 3 - Affected Environment

3.1. Physical Environment

The regional climate of Alaska’s North Slope is typical of the Arctic zone, where weather extremes are common and climate influences the geographic features (Truett and Johnson 2000). Summers are short in duration, with continuous daylight, where average summer temperatures range between 5 to 15 ^{o}C. During the summer the ground thaws to a depth of 12 to 16 inches and the landscape is dominated by wetlands. Winters are dark and cold and last 8 to 9 months. Average winter temperatures range between -20 and - 60^{o}C in January (Truett and Johnson 2000). Annual precipitation is low and averages 13 – 18 cm, usually in the form of snow (Truett and Johnson 2000). Surface winds are common throughout the year and result in wind chill factors well below the actual temperature.

The Beaufort Sea can be divided into three separate dynamic conditions based upon seasonal variations:

Summer (open water). The open-water season, usually begins in late June and is characterized by warming temperatures and stream runoff. The shore fast ice melts and the pack ice recedes northward, resulting in an area of open water along the coast. By mid-July, much of the lagoon and open-shelf area is ice free. The extent of open water along the coast varies from year to year depending upon climatic factors, but it reaches its fullest extent in August/September.

Broken ice. The broken ice period is that time the sea transitions from ice-covered to open water (break-up) and from open-water to ice-covered (freeze-up). These periods usually occur in June and October, respectively.

Winter (ice covered). Winter conditions in the Beaufort Sea begin with freeze-up and an increase in the amount of sea ice. The ice reaches a maximum thickness of approximately 2 m by March/April. There are considerable variations from year to year and the edge of the pack ice in September ranges from about 12 to 66 miles offshore (Labelle et al. 1983). In recent years, however, the sea ice has exhibited record lows in sea ice extent, where the forms later in the fall and retreats earlier in the summer. summers (Rigor and Wallace 2004)**.** By October, the ice edge has usually moved south of Barrow. From November through May, ice covers nearly all of the Beaufort Sea. The winter sea-ice regime can be divided into three distinct zones: landfast-ice, shear, and pack-ice.

Landfast-ice. The landfast-ice zone extends from the shore out to the zone of grounded ridges. These ridges first form in about 24 to 45 feet of water but by late winter may extend to deeper water. Wind and water stress on floating sheets of ice results in deformation and displacement. Ice deformations take the form of ridges and rubble fields. As winter progresses, displacements and deformations decrease because the ice in the landfast zone thickens and strengthens and becomes more resistant to movement.

Shear. Seaward of the landfast ice zone is the shear zone. The shear zone, as the name indicates, is a region of dynamic interaction between the stable land-fast ice and the moving ice of the pack-ice zone. This interaction in the shear zone results in the formation of ridges and leads. Leads are channels of open water through areas of ice, which provide habitat for marine mammals.

Pack-Ice. The pack-ice zone lies seaward of the shear zone and includes first year ice, and multi-year ice. The first year ice that forms in the fractures, leads, and polynyas (large areas of open water) varies in thickness from less than one inch to greater than a few feet. Multi-year ice is ice that has persisted for more than a year.

The violent interactions between ice zones creates deformed ice, known as ice ridges. These ridges are usually about 3 to 6 feet in height, but may reach heights of 20 feet.

3.2. Biological Environment

The biological environment associated with this environmental assessment in the Beaufort Sea includes the Pacific walrus and polar bears from the Southern Beaufort Sea stock.

3.2.1. Pacific walrus.

Pacific walrus, which includes about 80 percent of the world's walrus population, occur primarily in the Bering and Chukchi seas (Sease and Chapman 1988). The most recent reported survey estimate (1990) for the Pacific walrus population was 201,039 animals (USFWS 2002c). Currently, the size of the walrus population is unknown.

Walrus distribution is closely tied to the movements of sea ice in the Chukchi and Bering seas (Figure 2). In winter and early spring, the entire walrus population congregates on the pack ice in the Bering Sea, south of St. Lawrence Island. As the ice edge retreats northward, females with dependent young move north into the Chukchi Sea. A few walrus may move east into the Beaufort Sea, but the majority of the population occurs north and west of Barrow, Alaska, outside of the area covered by these regulations. Adult and subadult males remain to the south, where they come ashore at terrestrial "haulouts" in Bristol Bay, Alaska, or along the Russian coast. As the ice edge advances southward in the fall, walrus reverse their migration, where they re-group on the Bering Sea pack ice.

Walrus sightings in the Beaufort Sea have consisted solely of widely scattered individuals and small groups. While walruses have certainly been encountered and are present in the Beaufort Sea, there were only five sightings of walruses between 146^{o} and 150^{o}W during annual aerial surveys conducted from 1979 to 1995 (LGL and Greeneridge 1996).

In addition, 9 walrus sightings have been reported as a result of Industry monitoring efforts (Kalxdorff and Bridges 2003; USFWS unpub. data). Two sightings occurred in 1996; one walrus was observed from a seismic vessel near Point Barrow, and a walrus was sighted during an aerial survey approximately five miles northwest of Howe Island. In 1997, another walrus was sighted during an aerial survey approximately twenty miles north of Pingok Island. In 1998, a dead walrus was observed on Pingok Island being scavenged by polar bears. One walrus was observed hauled out near the SDC at McCovey in 2002. In 2004, one walrus was observed 50m from the Saltwater Treatment Plant, on West Dock. In addition, walrus have been observed on the armor of Northstar Island three times since 2001, where in 2004, 3 walrus were observed on the armor in two separate instances.

3.2.2. Polar Bear.

Polar bears are found throughout the Arctic. In Alaska, they have been observed as far south in the eastern Bering Sea as St. Matthew Island and the Pribilof Islands (Ray 1971), but they are most commonly found within 180 miles of the Alaskan coast of the Chukchi and Beaufort seas, from the Bering Strait to the Canadian border (Amstrup and DeMaster 1988). In Alaska, two stocks occur: 1) Bering/Chukchi Sea stocks; and 2) Beaufort Sea stock (Figure 3). A reliable population estimate is not available for the Bering/Chukchi Sea stock. The Southern Beaufort Sea population (from Point Hope, Alaska, to Banks Island, Northwest Territories) was estimated at 2,200 bears in 2002 (USFWS Stock Assessment 2002a; 2002b). The most recent population growth rate was estimated at 2.4% annually based on data from 1982 through 1992, although the population is believed to have slowed their growth or stabilized since 1992.

In the nearshore environment, Beaufort Sea polar bears are generally widely distributed in low numbers across the Beaufort Sea area; however, polar bears have been observed congregating on the barrier islands in the fall and winter resting, moving, and feeding on available food. Polar bears will occasionally feed on bowhead whale (*Balaena mysticetus*) carcasses on Cross and Barter islands, two areas where bowhead whales are harvested for subsistence purposes. An increase trend by polar bears to use coastal habitats in the fall during open-water and freeze-up conditions has been noted since 1992.

From 2000 to 2004, the Service has conducted systematic coastal aerial surveys for polar bears from Point Barrow to the Alaska-Canada border. During these surveys as many as 15 polar bears at Cross Island and 80 polar bears on Barter Island have been observed within a 2-mile radius of bowhead whale carcasses (Schliebe et al. 2001; Kalxdorff et al. 2002; USFWS unpublished data). In one survey during October 2002, the Service observed 114 polar bears on barrier islands and the coastal mainland from Cape Halkett to Barter Island, a distance of approximately 300 survey miles (480 km).

During these same coastline aerial surveys between 2000-2004, an average of 43 polar bears (range: 16 – 74 bears/survey year) were observed in the portion of the North Slope coastline which included the Industry complex. This portion, from Atigaru Point to Brownlow Point, contained approximately 600 km of main coastline and 300 km of barrier island coastline. The average density of bears per survey-year in this area was 20.0 km per bear. The average density of bears per survey-year in the region around Kaktovik, where bears fed on subsistence harvested carcasses was 1.94 km per bear.

Polar bears spend most of their time in the shear zone and the active ice adjacent to the shear zone because this area is shallow and more productive then continental shelf waters. Sea ice and food availability are two important factors affecting the distribution of polar bears. Although opportunistic feeders, polar bears feed primarily on ringed seals (*Phoca hispida*) and to a much lesser extent on bearded seals (*Erignathus barbatus*). Polar bears may also come to shore to feed on human refuse or marine mammal carcasses found on coastal beaches and barrier islands.

Although insufficient data exist to accurately quantify polar bear denning along the Alaskan Beaufort Sea coast, dens in the area are less concentrated than in Canada to the east and in Russia to the west. Females without dependent cubs breed in the spring. Females with cubs do not mate. Pregnant females enter maternity dens by late November and the young are usually born in late December or early January (Harington 1968; Amstrup *in* Truett and Johnson 2000). Only pregnant females den for an extended period during the winter; however, other polar bears may excavate temporary dens to escape harsh winter winds. An average of two cubs are usually born and after giving birth the female and her cubs remain in the den where the cubs are nurtured until they can walk and stay close to the female. Reproductive potential (intrinsic rate of increase) is low. The average reproductive interval for a polar bear is 3- 4 years and a female polar bear may produce about 8-10 cubs in her lifetime. Female bears can be quite sensitive to disturbances during this denning period (Belikov 1976, Lentfer and Hensel 1980, Amstrup 1986, Smith et. al. in prep.).

In late March or early April, the female and cubs emerge from the den. If the mother moves young cubs from the den before they can walk or withstand the cold, mortality to the cubs may increase (Amstrup and Durner 1995), therefore, successful denning, birthing, and rearing activities likely require a relatively undisturbed environment. Radio and satellite telemetry studies indicate that denning in multi-year pack ice in the Alaskan Beaufort Sea is common (Amstrup 1986). Between 1981 and 1991, of the 90 dens found in the Beaufort Sea, 48 (53%) were on pack ice (Amstrup and Gardner 1994). Terrestrial denning accounted for 47% in the same study. The highest density of land dens occur along the coastal barrier islands of the eastern Beaufort Sea and within the Arctic National Wildlife Refuge. Amstrup (1993) also suggested that females exhibit fidelity to den substrates (e.g., sea ice or terrestrial) rather than geographic locations.

3.3. Socio-Economic Environment

Pacific walrus and polar bears have been traditionally harvested by Alaska Natives for subsistence purposes. The harvest of these species plays an important role in the culture and economy of many villages throughout coastal Alaska. An exemption under the Act allows Alaska Natives to take polar bears and walrus if such taking is for subsistence purposes or occurs for purposes of creating and selling authentic native articles of handicrafts and clothing as long as the take is not done in a wasteful manner.

3.3.1. Pacific walrus.

Few walrus are harvested in the Beaufort Sea along the northern coast of Alaska as the primary range of Pacific walrus is west and south of the Beaufort Sea. Walrus constitute a small portion of the total marine mammal harvest for the village of Barrow. According to records from the Service's Marking, Tagging and Reporting Program, between 1994 and 2004, 322 walrus were reported taken by Barrow hunters. Reports indicate that up to 4 of 182 animals were taken east of Point Barrow, within the limits of the incidental take regulations. Hunters from Nuiqsut and Kaktovik do not normally hunt walrus due to the limited occurrence of walrus in their hunting grounds. They have reported taking only three walrus since the inception of the regulations. Two percent of the walrus harvest for Barrow, Nuiqsut, and Kaktovik has occurred within the geographic range of the incidental take regulations since 1994.

3.3.2 Polar Bear.

Based on the movements of the two polar bear populations that occur in the Alaska, the Chukchi/Bering Seas stock is shared with Russia while the Southern Beaufort Sea stock is shared with Canada. Alaska Natives from coastal villages are permitted to harvest polar bears. There are no restrictions on the number, season, or age of polar bears that can be harvested in Alaska unless the population is declared depleted and harvest is found to prevent recovery. Presently it is thought that the current levels of harvest are sustainable for the Southern Beaufort Sea population. Although there are no restrictions under the Act, a more restrictive Native to Native agreement between the Inupiat from Alaska and the Inuvialuit in Canada was created in 1988 (Brower et al. 2002). This agreement is now referred to as the Inuvialuit-Inupiat Polar Bear Management Agreement, established quotas and recommendations concerning protection of denning females, family groups, and methods of take. Although this Agreement does not have the force of law from either Canada or the United States governments, the users have abided by the terms set forth by the Inuvialuit-Inupiat Agreement. In Canada, users are subject to provincial regulations consistent with the Agreement. Commissioners for the Inuvialuit-Inupiat Agreement set the original quota at 76 bears in 1988 and it was later increased to 80. The quota was based on estimates of the population size and age specific estimates of survival and recruitment. Taylor et al. (1997) estimated that harvest up to 1.5% of the adult females was sustainable. Combining this estimate and a 2:1 sex ratio (male:female) of the harvest ratio, 4.5% of the total population could be harvested each year.

The Service has monitored the Alaska polar bear harvest since 1980. The Native subsistence harvest from the Southern Beaufort Sea has remained relatively consistent since 1980 and averages approximately 36 bears per year. The combined harvest from Alaska and Canada from the Southern Beaufort Sea appears sustainable and equitable. During the last five years (2000-2004), 125 bears were harvested by residents of Barrow, 34 for Kaktovik, 22 for Nuiqsut, 17 for Kaktovik, and 2 for Atqasuk. The Native subsistence harvest is the greatest source of mortality related to human activities although several bears have been killed during research activities, euthanasia of sick and or injured bears, and defense of life kills by non-Natives (Brower et al. 2002).

In addition, tourism, such as, wildlife viewing (predominantly for polar bears), has occurred in Barrow and Kaktovik. Viewing opportunities, however, are unpredictable as polar bears are limited to certain seasons when the bears move along the coast and the availability of non-mobile food sources. Wildlife viewing is also limited to these communities, which are located on the periphery of Industry activities. Industry does not allow wildlife viewing in its areas of operation.

3.4. Nature of Effects between Industry and the Biological Resources

Incidental take regulations which allow the take of small numbers of polar bear and Pacific walrus were first established in November 1993. Each Letter of Authorization issued pursuant to the regulations required the Letter holder to monitor the effects of their activity on polar bears and Pacific walrus. Potential impacts likely to affect polar bears and/or Pacific walrus, as well as the Native subsistence harvest are noise, physical obstructions, animal/human encounters, and oil spills. Although potential impacts of Industry are known, the effects of Industry on Pacific walrus and polar bears is difficult to measure and disturbances are sometimes difficult to predict (NRC 2003).

3.4.1. Pacific Walrus.

Noise. Oil and gas industry activities that generate noise include air and vessel traffic, seismic surveys, ice breakers, supply ships, and drilling. Noise may disturb or displace Pacific walrus which, in turn, may result in insufficient rest, increased stress, and energy expenditure, interference with feeding, masking communication, and impaired thermoregulation of calves that spend too much time in the water (Born et. al. 1995). The potential impact of Industry noise by walrus may be limited to individuals rather than the population due to their geographic range and seasonal distribution within the geographic region. For example, Pacific walrus generally inhabit the pack ice of the Bering Sea. Pacific walrus do not normally range into the Beaufort Sea, though individuals and small groups are occasionally observed. In addition, the winter range of the Pacific walrus is well beyond the geographic area covered by these regulations (as defined above).

Noise from stationary sources could impact many Pacific walrus. Currently, Endeavor Island, the saltwater treatment plants located on the West Dock causeway and Oliktok Point, and Northstar are the only offshore facilities that could potentially produce noise that could disturb walruses; however, walruses are rare in the vicinity of these facilities. In instances where walrus have been seen near these facilities, they have appeared to be attracted to them (USFWS, unpublished data).

The intensity of the reaction to noise is variable (Born et. al. 1995), although Richardson et al. (1989) concluded that walrus were probably most susceptible to disturbance by aircraft, especially fast moving planes overhead (Fay et al. 1984).

Walrus react variably to noise from vessel traffic; however, it appeared that low-frequency diesel engines cause less of a disturbance than high-frequency outboard engines (Fay et. al. 1984). Brueggeman et al. (1991) found that effects of noise on walrus in drilling operations in the Chukchi Sea were limited in time geographic scale, and proportion of the population. The primary source of disturbance to walrus was the icebreaker in ice breaking activities associated with the operation. Brueggeman (1991) reported that 25% of walrus groups encountered responded to the icebreaker by diving off ice floes, where most groups reacted within 1.8 nm.

Underwater noise form vessel traffic and stationary offshore facilities in the Beaufort Sea may "mask" ordinary communication between individual by preventing them from locating one another (Born et. al. 1995). It may also disturb walrus away from potential critical habitats in the Beaufort Sea (Born et. al. 1995) and may also have the potential to impede movement. Vessel traffic may increase if offshore Industry expands or if climate change alters the northern shipping lanes resulting in increased vessel traffic.

Physical Obstructions. Physical structures, such as causeways and man-made islands could impede the movement of walrus. Conversely, walrus could use these structures to haulout. For example, since its construction three sightings, involving four walrus, have been reported on Northstar Island. If walrus are present, their movements may be affected by stationary drilling structures. Walrus are attracted to certain activities and are repelled from others by noise or smell. In 1989, an incident occurred during a drilling operation in the Chukchi Sea where a young walrus surfaced in the center hole (i.e., moonpool) of a drill ship. The crew used a cargo net to remove the walrus from the drilling area, after which the walrus left the scene of the incident and was not seen again. No similar incidents have been reported in the area of these regulations.

Walrus/Human Encounters. Walrus/human encounters could occur although it may be a rare occurrence due to the limited distribution of Pacific walrus in the Beaufort Sea. These encounters may occur within certain cohorts of the population, such as calves or unhealthy animals. In 2004, an apparent orphaned calf hauled-out on the armor of Northstar Island numerous times over a 48-hour period and affected Industry activity before it disappeared.

Contact with Oil Spills. As stated earlier, the Beaufort Sea is not within the primary range for the Pacific walrus, therefore the probability of individual walrus encountering oil, as a result of an oil spill from Industry activities is assumed to be low. Onshore oil spills would not impact walrus unless oil moved into the offshore environment. During the open-water season, if a small spill occurred at offshore facilities or by vessel traffic, few walrus would likely encounter the oil. In the event of a larger spill during the open-water season, oil in the water column could drift offshore and possibly encounter a limited number of walrus. During the ice-covered season, spilled oil would be incorporated into the thickening sea ice. During spring melt, the oil would then travel to the surface of the ice, via brine channels, where most could be collected by spill response activities, but may eventually contact a limited number of walrus.

Not much is known about the effects of oil specifically on walrus; however, hypothetically, walrus may react to oil much like other pinnipeds. Adult walruses may not be severely affected by the oil spill through direct contact, but they will be extremely sensitive to any habitat disturbance by human noise and response activities. In addition, due to their natural gregariousness, an oil spill would most likely affect multiple individuals in the area.

Walrus calves are the portion of the population most likely to suffer the effects of oil contamination. Female walruses with calves are very attentive; the calf will stay close to its mother at all times, including when the female is foraging for food. Walrus calves can swim almost immediately after birth and will often join their mother in the water. It is possible that an oiled calf will be unrecognizable to its mother either by sight or by smell, and be abandoned.

The greater threat, however, may come from an oiled calf that is unable to swim away from the contamination and a devoted mother that would not leave without the calf, resulting in the death of both animals (Geraci and St. Aubin 1990).

Walruses have thick skin and blubber layers for insulation and very little hair. Thus they exhibit no grooming behavior, which lessens their chance of ingesting oil. Heat loss is regulated by control of peripheral blood flow through the animal's skin and blubber. The peripheral blood flow is decreased in cold water and increased at warmer temperatures. Direct exposure of Pacific walruses to oil is not believed to have any effect on the insulating capacity of their skin and blubber, although it is unknown if oil could affect their peripheral blood flow.

Geraci and St. Aubin (1990) reported damage to the skin of pinnipeds from contact with oil: some of the oil penetrates into the skin, causing inflammation and death of some tissue. The dead tissue is discarded, leaving behind an ulcer. While these skin lesions have only rarely been found on oiled seals, the effects on walruses may be greater because of a lack of hair to protect the skin (Geraci and St. Aubin 1990; Hansen 1992). Direct exposure to oil can also result in conjunctivitis, a condition which is reversible.

Like other pinnipeds, walruses are susceptible to oil contamination in their eyes. Continuous exposure to oil will quickly cause permanent eye damage (Geraci and St. Aubin 1990). Depending on the viscosity of the oil, as it thickens it may also accumulate and limit the movements of eyelids or vibrissae as well as impeding the movement of flippers in very young animals (Geraci and St. Aubin 1990; Hansen 1992). Walruses may also expose themselves more often to the oil that has accumulated at the edge of a contaminated shore or ice lead if they repeatedly enter and exit the water.

Ingestion of oil can result in digestive tract bleeding, and in liver and kidney damage. Ingestion of oil is of greater concern for species that groom themselves with their mouth, such as polar bears and sea otters. Exact numbers are not known, however because of their large size, walruses would apparently have to ingest large amounts of oil (several liters) before any acute damage to organs would occur (Geraci and St. Aubin 1990). Continuous ingestion of small amounts of oil through contaminated prey species may have effects that would only be seen in the long-term (Geraci and St. Aubin 1990). While most of the oil ingested by pinnipeds is excreted, some portions of ingested oil will be broken down and stored in blubber. This may present a problem during times of increased metabolic stress such as molting or pregnancy/lactation, when those blubber stores are used, releasing the hydrocarbons into the system of the animal, or passing them to a calf through the mother's milk (Geraci and St. Aubin 1990). Ingestion by calves is a serious threat because they have significantly less of the enzymes needed to break down the hydrocarbons and thus may have a much stronger reaction than an adult walrus (Geraci and St. Aubin 1990).

Inhalation of hydrocarbon fumes presents another threat to marine mammals. In studies conducted on pinnipeds, pulmonary hemorrhage, inflammation and congestion resulted after exposure to concentrated hydrocarbon fumes for a period of 24 hours (Carpenter et al. 1975, 1976 in Geraci and St. Aubin 1990). If the walrus were also under stress from molting, pregnancy, etc., the increased heart rate associated with the stress would circulate the hydrocarbons more quickly, lowering the tolerance threshold for ingestion or inhalation (Geraci and St. Aubin 1990).

Walruses are benthic feeders and much of the benthic prey contaminated by an oil spill would be killed immediately. Others that survived would become contaminated from oil in bottom sediments, possibly resulting in slower growth and a decrease in reproduction . Bivalve mollusks, a favorite prey species of the walrus, are not effective at processing hydrocarbon compounds, resulting in highly concentrated accumulations and long term retention of the contamination within the organism (Neff 1987). Hansen (1992) states that because walrus feed primarily on mollusks, they may be more vulnerable to a loss of this prey species than other pinnipeds that feed on a larger variety of prey. Furthermore, complete recovery of a bivalve mollusk population may take ten years or more (Hansen 1992), forcing walrus to find other food resources or move to non-traditional areas.

3.4.2. Polar Bear.

Noise. Female polar bears with cubs, especially in dens, are thought to be more sensitive than other age and sex groups to noises. Although, it is assumed that polar bears, like most animals would avoid sources of extremely loud noises, they commonly approach noise sources, such as industrial sites (Stirling 1988) and ships (Fay et al. 1986). Industry activities could disturb polar bears that are close to the noise sources; however, polar bears have approached to within 100 m (328 ft) of some of these noise sources in the Canadian Beaufort Sea during the winter (Stirling 1988), and in the late fall and early winter are observed regularly within the production infrastructure of Prudhoe Bay and the satellite oilfields (USFWS unpubl. data).

Mobile noise could impact polar bear denning activities. If these activities coincide with the initiation of denning by a pregnant female polar bear, there is a possibility that the preferred denning site may be avoided. Also, if a female bear is disturbed and leaves the den before the cubs are of adequate size or strength, the cubs may not survive (Amstrup and Gardner 1994).

On-ice seismic exploration may have various effects on polar bears. Although the reaction of bears to human disturbance is highly variable, polar bears are especially susceptible to disturbance during the denning period (Belikov 1976; Amstrup and Gardner 1994; Linnell et al. 2000). Altricial cubs are unable to leave dens post-partum for > 2 months (T. Smith, USGS, pers. comm.). Even after the bears emerge, disturbance may cause den abandonment before cubs are developed enough to survive on the ice. For example, a female bear fitted with a satellite collar was monitored during on-ice vibroseis exploration in 1998 (Amstrup and Gardner 1994). The female and her two cubs remained in their den when vibroseis operations passed within 1 km (0.6 mi) of the den. While this bear left her den early during the season, it was unknown if her early departure correlated with these activities. However, after leaving the den, the female moved a short distance to the southeast, which might indicate some avoidance of the exploration activities (Amstrup and Gardner 1994). Another example of anthropogenic polar bear disturbance at the den involved researchers monitoring bear activity (Smith et al. in press). It was believed that a female with cubs abandoned its den due to field camp and snowmachine activities related to a study monitoring bear behavior. This female was subsequently captured within one month without any cubs. One explanation for a lack of cubs may have been an early abandonment of the female's den caused by disturbance from the field camp.

Conversely, polar bears exposed to routine industrial noises may acclimate to those noises and show less vigilance than bears not exposed to such stimuli (Smith et. al. in press). This study occurred in conjunction with industrial activities performed on Flaxman Island in 2002. Researchers assessed vigilant behavior with two potential measures of disturbance: proportion of time scanning their surroundings and the frequency of observable vigilant behaviors. Bears exposed to industrial activity spent less time scanning their surroundings than bears in undisturbed areas and engaged in vigilant behavior significantly less often.

Although the auditory ability of polar bears is not known, researchers have quantified noise levels produced by Industry activities. Blix and Lentfer (1992) studied the propagation of sounds and vibrations from various human activities into artificial bear dens. They concluded that only seismic testing activities less than 100 m (328 ft) from a den produced noise significantly louder than ambient levels inside the den.

More recently, MacGillivray et al. (2003) studied noise and ground vibration data collected at man-made dens in polar bear habitat on Flaxman Island, in the vicinity of remediation activities involving the use of heavy equipment, helicopter activity and blasting. They found that the maximum distance vehicle noise was detected above background noise in the dens ranged from < 500 m to 2000 m. Both studies suggest that snow is an important insulative substrate that may be beneficial to bears when denning.

Another recent study examining potential disturbance of anthropogenic noise to polar bears investigated the post emergence behavior of polar bears at den sites (USGS unpubl. data). In March 2002 and 2003, researchers investigated polar bear family groups at eight maternal dens along the Beaufort Sea coastline to observe the post-emergent behavior. Behavior states of the sow and cubs were recorded, as well as all occurrences of human activity in the immediate area (e.g., foot travel, aircraft over flights, or snowmobile), and weather variables. Once initiated, observations continued daily, until bears abandoned the den site.

USGS found that the average duration at dens from emergence to den site abandonment was approximately 8 days (range: 1.5 to 14 days). Family groups emerged from their dens at least once daily, where outside of the den, adults spent 49 % of their time inactive, while cubs were inactive 13 % of their time outside of the den. In addition, post emergence observations of polar bears at den sites suggested that bears respond with varying degrees of intensity, ranging from slight reaction to significant reaction, when exposed to human disturbances near den sites. Polar bears reacted to vehicle and foot traffic near their den by re-entering dens, focusing on the source of disturbance, or possibly abandonment.

Physical Obstructions. Physical structures such as causeways, roadways, artificial islands, and offshore drill rigs appear to have very little effect on the movements of polar bears. Bears routinely traverse causeways and roads, and investigate artificial islands and offshore drill rigs. Given the small size of these structures and the ability of bears to travel great distances, these structures appear to have little direct impact on polar bear movement, but may become areas that are investigated by curious bears.

Bear/Human Encounters. Bear/human encounters can be dangerous for both the polar bear and the human. Whenever humans work in the habitat of the animal, there is a chance of an encounter, even though, historically, such encounters have been uncommon in association with Industry.

Although bears may be found along the coast during open-water periods, most of the Southern Beaufort Sea bear stock inhabitants the multi-year pack ice during this time of year. Encounters are more likely to occur during fall and winter periods when the proportion of the bears are found in the coastal environment searching for food and possibly dens sites later in the season. Potentially dangerous encounters are most likely to occur at gravel islands or on ice exploratory sites. These sites are at ice level and are easily accessible by polar bears. Industry has developed and uses devices to aid in detecting mobile polar bears, including bear monitors and motion detection systems.

Offshore production islands, such as the Northstar production facility, could potentially attract polar bears. Indeed, in 2004, Northstar reported 37 sightings in which 54 polar bears were observed (USFWS unpublished data). This accounted for 41% of all polar bear observations Industry-wide in 2004. Such offshore facilities could potentially increase the rate of human/bear encounters, which could result in increased levels of harassment to bears. Employee training and company policies are implemented to reduce and mitigate such encounters.

One mechanism that bear/human encounters are measured is through the Service's Intentional Take Program. Intentional takes of walrus and polar bears are not authorized by the incidental take regulations. Authority to harass polar bears may be requested under Section 112(c) of the Act, which allows the Service to set up cooperative agreements with Industry or other publics, and under Section 109(h), which states that a person may take a marine mammal in a humane manner if such taking is for: a) protection or welfare of the mammal; b) protection of the public health and welfare; or c) non-lethal removal of nuisance animals. The Service, under Sections 109(h) and 112(c), authorizes Industry to deter polar bears for safety of personnel and polar bears. All deterrence actions are monitored and reported to the Service as part of the monitoring plan.

Forms of harassment used by Industry have included the use of the following deterrents: yelling, flashlights, spotlights, vehicle/vehicle horns, air horns, sirens, snow machines, helicopters, bean bags, cracker shells and rubber/plastic bullets. The most common form of deterrent activity reported was use of cracker shells. Herding with vehicles and use of sirens were also frequently employed.

In addition, Industry has also developed polar bear encounter/interaction plans to educate personnel in safely working in polar bear habitat. Many of these practices have been incorporated into the standard operating procedures required by the LOAs.

Contact with oil spills. The possibility of oil spills from Industry activities and the subsequent impacts on polar bears are a major concern. However, no large spill in the marine environment that could contact polar bears have occurred in the Beaufort Sea. With limited background information available regarding oil spills in the Arctic environment it is unknown what the outcome of such a spill would be if one were to occur. Polar bears could encounter oil spills during the open-water and ice-covered seasons in offshore or onshore habitat. Although the majority of the Southern Beaufort Sea polar bear population spends a large amount of their time offshore on the pack ice, it is likely that some bears will encounter oil from a spill regardless of the season and location.

Operational spills may occur during transfer of fuel, during refueling, during handling of lubricants and liquid products, and during general maintenance of equipment. These spills are projected to be small in quantity, commonly involving < 1 to 50 barrels of spilled oil per incident.

To date, large oil spills from Industry activities in the Beaufort Sea and coastal regions that can impact polar bears have not occurred, although the development of offshore production facilities has increased the potential for large offshore oil spills. For the Northstar EIS, Anderson et al. (1999) modeled a large oil spill for the Northstar production facility in August and October, months when an oil spill at Northstar would most likely impact polar bears. In a large spill (i.e., 3,600 barrels: the size of a rupture in the Northstar pipeline and a complete drain of the subsea portion of the pipeline), oil would be influenced by seasonal weather and sea conditions. These would include temperature, winds, and for offshore events wave action and currents. In normal weather conditions for the August spill scenario (open-water season) the model indicated that within eight hours of stopping the leak, only scattered thin sheens would be expected on the water surface, the majority of the oil would disperse into the water column or on shore, and at least 25% of the oil was expected to evaporate. Weather and sea conditions would also affect the type of equipment needed for spill response and how effective spill clean-up would be. For example, spill response has been unsuccessful in the clean-up of oil in broken ice conditions. These factors, in turn, would dictate how large spills impact polar bear habitat and numbers.

The major concern regarding large oil spills is the impact a spill would have on the Southern Beaufort Sea polar bear population. Given the estimated size and its annual subsistence harvest, the polar bear population may be able to sustain the additional mortality caused by a large oil spill of a small number of bears, such as 1-5 individuals. The additive effect, however, of numerous bear deaths (i.e. in the range of 20-30) caused by an oil spill coupled with the subsistence harvest and other potential impacts, both natural and human-induced, may reduce recruitment and survival. The removal rate of bears from the population would then exceed sustainable levels, potentially causing a decline in the bear population and affecting bear productivity and subsistence use.

During the ice-covered season, mobile, non-denning bears would have a higher probability of encountering oil or other production wastes than denning females. Current Industry management practices are designed to minimize the potential for such incidents by requiring the proper use, storage and disposal of hazardous materials. In the event of an oil spill, it is also likely that polar bears would be hazed away from the area, further reducing the likelihood of impacts.

Polar bears may be impacted by external contact with oil and/or ingestion of oil. Polar bears could contact spilled oil in the water, on ice, or on land. External contact with oil could foul fur, irritate skin and eyes, and cause severe inflammation of the nasal passages. Effects on experimentally oiled bears (where bears have been forced into oil) have included acute inflammation of the nasal passages, marked epidermal responses, anemia, anorexia, biochemical changes indicative of stress, renal impairment, and death (Engelhardt 1981; Øritsland et al. 1981). In experimental oiling, many effects did not become evident until several weeks after exposure to oil (Engelhardt 1981).

External oiling of the pelt could cause significant thermoregulatory problems by reducing the insulation value of the pelt (Øritsland et al. 1981; Hurst and Øritsland 1982; Hurst et al. 1982). Polar bears rely on their fur as well as their layer of blubber for thermal insulation (Irving 1972; Frisch et al. 1974). In addition, oiled bears would probably ingest oil while grooming to restore the insulation value of the oiled fur (Øritsland et al. 1981). Derocher and Stirling (1991) observed a bear with lubricating oil matted into its fur on parts of its head, neck and shoulders. The bear was re-sighted two months later, at which time it had suffered substantial hair loss in the contaminated areas. Four years later, the bear was recaptured and no skin or hair damage was detectable, which suggests that while oiling can damage the fur and skin, and in some instances the damage is temporary.

Oil ingestion by polar bears through consumption of contaminated prey and by grooming or nursing could have adverse effects, depending on the amount of oil ingested and the individual's physiological state. Death would be likely if a large amount of oil were ingested or if volatile components of oil were aspirated into the lungs. Ingestion of sub-lethal amounts of oil can have various physiological effects on a polar bear, depending on whether the animal is able to excrete and/or detoxify the hydrocarbons. Oil can be eliminated by vomiting and in the feces, but some can be absorbed into the body fluids and tissues (Engelhardt 1981).

It is likely that polar bears swimming in or walking adjacent to an oil spill will inhale petroleum vapors. Øritsland et al. (1981) reported on the effects of vapor inhalation on polar bears. Their report indicated that inhalation of hydrocarbons from unweathered crude oil in an confined space may have been a contributing factor in the death of two of three polar bears exposed to oil in their experiments. Given the effects of diffusion, dispersion and winds on an open ocean spill, it is likely that harmful concentrations of vapors would be short lived. Following an oil spill, most light hydrocarbons would evaporate within a few days to a week and would not pose a serious threat from inhalation to polar bears or the population.

A local reduction in ringed seal numbers, the polar bears main food source, as a result of direct or indirect effects of an oil spill could, also, temporarily affect the local distribution of polar bears. A reduction in density of seals as a direct result of mortality from contact with spilled oil could result in polar bears not using a particular area for hunting. In addition, if the spill were widespread and affected seal pups regionally, it could affect physiological conditions of a greater number of polar bears. Also, seals that die as a result of an oil spill could be scavenged by polar bears, thus increasing the bears' exposure to hydrocarbons.

It is expected that oil spills have a low probability of occurrence and thus impacts are unlikely to happen. Impacts for other forms of contaminant ingestion could be avoided by current management practices, which require the proper use, storage or disposal of hazardous materials. In a strategy to minimize effects of oil spill on bears, it is likely that polar bears would be deliberately hazed (under separate authority) to prevent them from entering the affected area, and thus further reduce the likelihood of human/bear interactions and exposure to hydrocarbons.

3.4.3. Native subsistence.

The affected region contains the Inupiat communities of Barrow, Nuiqsut, and Kaktovik. All are represented by Alaska Native Claims Settlement Act Corporations, municipal governments, and active tribal organizations. The North Slope Borough (NSB), the Arctic Slope Regional Corporation, and the Inupiat Community of the Arctic Slope also represent the entire North Slope region. The NSB provides opportunities for education, job-training and employment to the local residents. Barrow, Nuiqsut and Kaktovik are influenced by the geographical and economic expanse of the oil industry.

Subsistence harvesting activities could be adversely impacted by a major oil spill. In certain areas, polar bear or walrus populations may decrease or be less available during oil spill cleanup activities. In addition, both animals and subsistence hunters may avoid historical hunting grounds. Consequently, a decrease in the populations of polar bears or walrus could affect the subsistence harvest of polar bears (USDOI-MMS/DEIS 1997).

3.5. Current and Proposed Impacts of Oil and Gas Activities

When incidental take regulations were first issued in 1993, seven oil fields were in production. Oil and gas development is an ongoing activity on Alaska's North Slope, which now contains 11 oil and gas units, 8 in production with 26 oil and gas fields, including satellite fields. Exploration, development and production are ongoing year-round, and we anticipate additional activities to explore new areas. Due to the large number of variables influencing exploration activity, any predictions as to the exact dates and locations of these operations that will take place over the effective period of the regulations is highly speculative.

3.5.1. Pacific walrus.

3.5.1.1 Current Impacts

During the history of the incidental take regulations actual impacts from Industry activities on Pacific walrus have been minimal. From 1994 to 2004, a total of nine sightings, involving 10 Pacific walrus were recorded by Industry during the open-water season. Most of the observations were of walrus undisturbed by human interactions. However, three sightings involved potential disturbance to the walrus; two sightings were of walrus hauling out on the armor of Northstar Island and one sighting occurred at the SDC on the McCovey prospect, where the walrus reacted to helicopter noise. Walrus were observed during the following types of activity: exploration (3 sightings); development (2 sightings); and production (4 sightings) activities. Physical effects or impacts of the individual walrus were not noted. We know of no other interactions that occurred between walrus and Industry during the duration of the incidental take program.

3.5.1.2 Proposed Impacts

A small number of Pacific walrus seasonally inhabit the geographic range of the incidental take regulations, which is extra-limital to the normal range of walrus. Hence, in the Beaufort Sea, the impact of the proposed Industry activities to the walrus population is expected to be insignificant and similar to levels that occurred during the previous regulations.

3.5.2. Polar Bears.

3.5.2.1. Current Impacts**.**

Actual impacts on the Southern Beaufort Sea population by Industry during the past 30 years appear to have been minimal. In the southern Beaufort Sea, polar bears spend the majority of their lives on the ice, limiting the opportunity for impacts on bear recruitment or survival from Industry. In addition, polar bears spend a limited amount of time on land, moving onshore to feed, den, or traverse to other areas. At times bears move into the nearshore areas after large storms "deposit" them along the coast or on barrier islands where they can wait until ice is created in the nearshore environment and will be able to move north. During these periods, the likelihood of interactions between polar bears and Industry activities increases. Indeed, the majority of Industry polar bear observations occur at or near most coastal and offshore production facilities, or along the roads and causeways that link these facilities to the mainland.

Over the past years numerous studies and monitoring efforts have been conducted to help describe the impacts of Industry on polar bears. Listed below are examples of studies where information has been gathered to help managers more fully understand the impacts of industry on polar bears or to assist in mitigating potential impacts. These studies have been conducted by the Service and the United States Geological Survey (USGS), Alaska Science Center (ASC).

Polar Bear Fall Coastal Surveys

The Service has conducted five years of aerial surveys along the coastline and barrier islands of the Beaufort Sea during the fall period. The data collected on the abundance and spatial distribution of polar bears in the fall during the open water period until freeze-up provides useful information to assess the importance of these habitat areas to polar bears for resting and feeding. This data will also be useful in assessing distribution patterns in relationship to potential impact of environmental change, or offshore exploration and production activities.

A total of 73% of the bears observed in all surveys (955 of 1301) were seen within a 21 km radius of Barter Island and the village of Kaktovik. A total of 215 individual polar bears were seen during surveys in the fall of 2003 (n = 5) and 374 individual polar bears were seen during surveys in 2004 (n = 5). Although the actual number of bears observed during individual surveys or between years varied considerably during the fall freeze-up period from 2000 – 2003, the percentage of adult females with dependent young have remained fairly consistent (range

47.0-53.6%). Figure 4 depicts the relative density of polar bears observed during the 2000-2004 aerial surveys. This map is a visual representation of the relative number's of bears observed during coastal surveys. For example, 73% (955 of 1301) of the bears were observed within a 12 km radius of the village of Kaktovik In contrast, only 4% (54 of 1301) of the bears observed were within the green area which encompasses Barrow. The area between Atigaru Point and just east of Barrow is an area of very low observed bear densities. However, the map does not indicate that bears were not seen in this area only that very few bears observed there relative to other areas.

Polar Bear Feeding Ecology Study

Along Alaska's Beaufort Sea coastline, polar bears aggregate near and feed on stranded marine mammal carcasses during fall months (Kalxdorff and Fischbach 1997). An increase in polar bear numbers, as well as protracted use of the coastline and barrier islands of the Beaufort Sea has been noted in recent years (Amstrup *in* Truett and Johnson 2000). This increase in use of coastal areas by polar bears is of interest due to the increased likelihood that polar bears may be affected by human activities such as oil and gas development.

In 2002, the Service initiated a study to evaluate foraging and carcass utilization patterns of polar bears using the near shore environment. The objectives of the study were to determine the number, age/sex composition, habitat use, and behavior of polar bears using bowhead whale carcasses on Barter and Cross Islands, Alaska, during the fall open water period.

Preliminary results indicate that large numbers of bears aggregate near marine mammal carcasses during the fall open water period at Cross and Barter islands, particularly bears in family groups at Barter Island. Overall, polar bears appear to feed more actively at night. Family groups made up the highest proportion of bears observed at Barter Island. At Cross

Island, single adult bears made up the highest proportion of animals. Polar bear use of marine habitat during the fall open-water and freeze-up period is important because of the associated risk of contacting oil from a potential spill. At Barter Island, polar bears accessed and departed from the feeding site by swimming. Marine habitat use was observed during 20% (44/225) and 13% (30/229) of focal samples in 2002 and 2003, respectively. Once on Cross Island, polar bears accessed the feeding site from anywhere on the island without having to enter marine habitat. However, in 2004, on numerous occasions, bears were observed entering, swimming, or playing in marine waters. Use of marine habitat was documented during approximately 8% (2/25) and 5% (2/38) of focal samples in 2002 and 2003, respectively.

Detecting Denning Polar Bears with Forward Looking Infra-Red Imagery (FLIR)

In order to help manage and mitigate potential disruptions of polar bear denning, USGS tested the ability of forward-looking infrared (FLIR) viewing devices to detect the heat signature of maternal polar bear dens (Amstrup et. al. 2004). USGS tested FLIR to detect known den sites. Flight and environmental conditions were recorded for each observation. Whether or not the den was detected was determined.

USGS conducted FLIR surveys of 23 known polar bear dens on 67 occasions (1 to 7 times each). Four dens were never detected (17%), but 3 of those only were visited under marginal conditions. Nine dens were always detected and 10 dens visited more than once were detected on some flights and not on others. For every one-degree (C) increase in Temperature Dew-point spread, the chance of detecting a den increased 3X. We were 4.8 times more likely to detect a den when airborne moisture (snow, blowing snow, fog etc.) was absent than when it was present, and we were approximately 28 times more likely to detect a den at night than we were after sunrise. Data suggest that some dens are not detectable with FLIR. Conversely, FLIR surveys conducted during conditions that maximize the chances of detection will locate most dens most of the time and can be an important management/mitigation tool.

Use of Trained Dogs to Verify Polar Bear Den Occupancy

During winter, female polar bears den in snow caves to give birth and care for their young. This period of maternal denning (November to mid April), is the time when polar bears are potentially most vulnerable to human disturbances. Oilfield exploration, remediation, and production activities, as well as support operations could disrupt polar bear denning and subsequent cub survival.

The current techniques to determine the presence of denning polar bears includes: radio-telemetry surveys to determine den location of instrumented female bears; and FLIR imagery surveys for heat signatures indicative of denning bears. The only way to verify den occupancy from FLIR heat signatures (hotspots) is to monitor bear emergence later in the season or identify evidence of bear presence at the site, such as hair or scat, after snow melt.

During winter 2002, Perham et. al. (2003) conducted a pilot study to determine if trained, air-scenting dogs could verify the locations of known or suspected polar bear dens. Coastline bluff denning habitat on various barrier islands in the Beaufort Sea was surveyed for known den locations with dogs. The dogs alerted at the dens of three radio-instrumented bears and one additional non-instrumented bear not detected with FLIR, but they did not alert on four hotspots previously identified during forward-looking infrared FLIR aerial surveys conducted earlier in the winter. The use of trained dogs to locate and confirm occupied polar bear dens appears to be a viable technique that could help minimize impacts from oil and gas industry activities on denning polar bears and could be a technique used conditionally in LOAs, as warranted.

Results of this study included, 1) the use of dogs provides a higher degree of resolution than aerial FLIR surveys when determining the exact location of a known bear den; 2) prior to industrial activities near hotspots determined by FLIR,, trained dogs could be used to verify polar bear occupancy; and 3) dog verification could be a "stand-alone" technique in place of FLIR if conducted on potential polar bear denning habitat prior to the initiation of industrial activities.

Polar Bear Monitoring Workshop

In 2003 the Service sponsored a polar bear monitoring workshop. The goal of the workshop was to identify components of a comprehensive, long-term program to monitor the effects of oil and gas industry in Alaska to polar bears. This workshop was an initial effort to design a more effective monitoring strategy to assess effects of industry activities on polar bears, to reduce bear/human interactions, and to protect polar bear habitat for the Southern Beaufort Sea polar bear population. The management plan identifies the types of information to be collected over time necessary to monitor polar bears of the Southern Beaufort Sea stock. Potential oil and gas industry impacts on polar bears discussed during the workshop included: habitat alteration, chemical contamination, attraction and preclusion of areas, oil spills, industrial noise, and polar bear interactions with humans.

Some monitoring recommendations included: 1) continue research involving population estimation of the Southern Beaufort Sea polar bear stock; 2) continue industry support (direct funding and/or logistics) of polar bear research efforts; 3) consider additional cooperative research studies with other federal and state agencies; 4) follow-up the fall coastal polar bear aerial surveys with mark/recapture efforts in order to check accuracy of the aerial survey; 5) initiate a capture and marking program for polar bears in the Chukchi Sea; 6) develop new technologies, such as radio frequency identification (RFID) tags to use in polar bear research and monitoring; and 7) promote industry involvement in information collection on polar bears in the field.

In order to create a workable monitoring plan, tasks have been identified and the Service has established a 10-year timeline.

Polar Bear Bio-monitoring Program

Liver, kidney, and muscle tissues were analyzed for 19 trace elements and adipose tissues were analyzed for polychorinated biphenyls (PCB), hexachlorocyclohexanes (HCH), chlordane-related compounds (CHL) and DDT and its metabolites (DDT). The sum of PCB concentrations (S-PCB, 18 congeners) were significantly greater from bears the Southern Beaufort Sea Population than the Chukchi/Bering Seas Population. Mean S-PCB were lower than levels found in Eastern Hudson Bay, Canada, East Greenland, and Svalbard, Norway. Mean levels of the sum HCHs (S-HCH) for the Southern Beaufort Sea and Chukchi/Bering Seas populations were not significantly different and are among the highest levels reported from the Arctic. Mean liver mercury levels for both Alaskan populations combined were lower than those reported for populations in Western Canada, whereas cadmium levels were greater. Cadmium levels were below toxic threshold levels. Concentrations by tissue types for cadmium, mercury, and selenium concentrations generally decreased in the order kidney>liver>muscle. Methyl mercury levels in muscle tissues were similar to those in Greenland and much lower than levels found in muscle tissues of seals, toothed whales, and baleen whales from Greenland (Dietz et al. 1990).

Polar Bear Den Site Behavior and Response to Human Disturbance

Between 2001 and 2004 researchers from the USGS have studied maternal den activity at

9 dens that occurred in close proximity to the Prudhoe Bay oil field. During the winters of 2001-02, 8 maternal dens were located by conventional aerial radio-tracking or by forward-looking infrared (FLIR) mounted on aircraft. Researchers observed bear activity from blinds that were approximately 400 m from dens and continuously logged behaviors of adult polar bears while out of their dens. They also recorded polar bear cub behavior at 5-minute intervals using scan sampling protocols. Bear behavioral data included: behavioral states, occurrence of human activity in the immediate area, and polar bears' responses to human activity, and weather. Den sites were visited daily to determine when bears first emerged. Upon emergence, observations continued daily, weather permitting, until family groups abandoned the den site.

Direct observations were logged at 8 den sites in March of 2002 and 2003. On multiple occasions, bears observed researchers outside their blinds, but did not overtly respond to these anthropogenic stimuli.

In 2003, no bears denned within the study area. However, in 2004 several bears denned within the study area but prior to initiating den observations, one adult female was killed and partially consumed at the den site by a large male polar bear and the other two females prematurely abandoned their dens.

In 2005, researchers used video camera systems to continuously record bear activities at den sites rather than human observers. At that time researchers were able to locate only one den within the study area and it was continuously observed during den emergence. In 2006, three maternal dens were monitored by video cameras to record den activity.

Researchers logged 459 hours while monitoring 8 den sites in March of 2002 and 2003 on Alaska's North Slope. In 40 sessions they observed 8 female polar bears for a total of 37.5

hours (8.2% of total observation time). Researchers also recorded the activities of 5 cubs during 11 focal observation sessions for a total of 6.6 hours observation. Bears remained at den sites post-emergence from 1.5 to 14 days ($\bar{x} = 8.1 \pm 5.1$ SD). Analysis of individual bears' behavioral data provided insight regarding the temporal-spatial nature of their activity patterns.

Pack Ice Position and Polar Bear Distribution

A regression analysis of the number of bears using coastal habitats and the distance to the pack ice indicated that the number of bears on shore increased up to a certain date and then decreased as pack ice became available near-shore. There was a significant relationship between the mean distance to ice edge and the numbers of bears observed on the coast (Figure 5). As distance to ice increased, the number of bears increased, and conversely as ice advanced near-shore the number of bears decreased.

Assessment of industrial sounds and received in artificial polar bear dens

MacGillivray et al. (2003) conducted a study to determine the absolute sound levels of various industrial activities and estimated potential noise and vibration exposure of polar bears within artificial dens. Types of sounds recorded included: tracked vehicles, front end loaders, scrapers, Maxihaul dump trucks, and helicopters. Comparison of sound levels, measured with microphones placed outside and inside the dens, permitted estimation of the sound-insulating properties of the dens. Vibration data were acquired from sensors placed in the tundra and the snow of den floors. In addition to other sound sources, a single blast event, which was used to cut a well pipe, was recorded in the dens.

The maximum distance vehicle noise was detected above background noise in the dens ranged from < 500 m to 2000 m. In-den sound pressure levels for vehicles at the closest point of approach ranged from 37 – 55 dB re 20 μPa. The Hägglunds tracked vehicle produced the loudest noises near the den, while the Tucker Sno-Cat and pick-up trucks produced the lowest. Helicopter noise was well above background levels in the den until helicopters were greater than 1000 m from the den. Snow and the man-made dens were found to attenuate or reduce noise exposure within the den significantly. The snow surrounding the man-made dens reduced the level of outside sounds by 25 dB at 50 Hz, and by 40 dB at 1000 Hz. In addition, the in-den ambient noise levels for the man-made dens were typically very low.

Spring 2005 Capture-Recapture and Radio-Collar Deployments

Researchers from the USGS captured a total of 90 individual polar bears; 69 by standard search (i.e., random encounters while searching polar bear habitat) and 21 by telemetry or other methods. The sex ratio of polar bears captured by standard search was 0.50 (SE = 0.06). The age class composition of polar bears captured by standard search was 0.57 (SE = 0.08) adult, 0.13 (SE = 0.11) subadult, 0.03 (SE = 0.12) two-year-old, 0.01 (SE = 0.12) yearling, and 0.26 (SE = 0.10) cub of year (COY).

They resighted 23 bears tagged earlier this capture season 33 times and located 5 maternal dens during the 2005 field season. In 2005, 22 (41%) of the adult polar bears captured by standard search were first-time captures, and the remaining 32 (59%) were recaptures. In addition, researchers deployed 18 new radio collars, 12 of which were equipped with global positioning system (GPS) technology. These collars provided 6 locations per day of operation and also recorded activity and, temperature sensors.

All of the radio collars deployed in 2004 and 2005 were equipped with a timed release mechanism, which automatically releases the collar from the polar bear on a user-programmed date. The collars were programmed to release on April 15th in order to maximize the chances of recovering the collars during spring capture operations.

Mapping Polar Bear Maternal Den Habitat with Interferometric Synthetic Aperture Radar (IFSAR) Data

Over the past 24 years, a number polar bear maternal dens in NPRA have been identified, indicating that NPRA is an important denning region. During that time, den habitat, had not been classified in NPRA and hence was not available to be included in resource management plans. Analysis of Interferometric Synthetic Aperture Radar (IFSAR) data indicated polar bear den habitat throughout the coastal areas of NPRA. Den habitat coincided with features that cause snow to accumulate and where we would expect den habitat, i.e., coastal and river banks and lake shores.

Den habitat delineated by IFSAR data appears to have greater spatial accuracy than den habitat delineated by photo interpretive methods. Identifying den habitat with IFSAR data presents several advantages over standard photogrammetric methods for mapping and identifying habitat. IFSAR data are already interpreted by the satellite system eliminating the need to physically examine remotely gathered landscape data and interpret that data. Currently, IFSAR is considered as a useful tool to help to identify and protect denning polar bears and denning habitat. Additional research will be required to more fully understand its potentials and limitations.

Monitoring efforts during oil and gas operations

The Service, under terms of the MMPA, is responsible for assessing impacts of industrial activities on polar bears walrus and their availability for subsistence uses. The Service works closely with Industry to monitor polar bear and walrus occurrences during exploration, development, and production activities. LOAs issued by the Service under Incidental Take

Regulations include requirements for monitoring the effects of industry activities on polar bears and walrus.

During 2005, five LOAs were issued to the oil and gas industry to take a small number of polar bears and Pacific walrus incidental under the Incidental Take Regulations prior to the expiration of the regulations on March 28, 2005 (a 3-month period). Alternatively, during the full calendar year of 2004, 19 Letters of Authorization (LOAs) were issued to the oil and gas industry to take a small number of polar bears and Pacific walrus incidental under the Incidental Take Regulations. The number of LOAs issued remained the same as in 2003 (19 LOAS). Annual Letters of Authorization issued under the Incidental Take Program since its inception in 1993 have ranged from 4 to 62 between 1993 and 2004 (Figure 6).

Eight intentional take authorizations were issued to the oil and gas industry in 2005. This number increased from 2004 when three intentional take authorizations were issued, the same as was issued in 2003. These authorizations allowed companies to legally deter polar bear from industry activities.

During the 3-month regulatory period of 2005 (January to March), the oil and gas industry reported 13 polar bear sightings involving 14 individual bears. An additional 99 sightings involving 160 individual bears occurred during 2005 after the regulations had expired (April to December 2005). Thus, the total number of bear sightings for 2005, during the regulatory period and after was 112 sightings involving 174 bears.

2004 was the last full calendar year to be covered under incidental take regulations. During 2004, the oil and gas industry reported 89 polar bear sightings involving 113 individual bears. Polar bears were more frequently sighted during the months of August to January (Figure 7). Seventy-four sightings were of single bears and 15 sightings consisted of family groups.

Offshore oil facilities, Northstar and Endicott, accounted for 63 % of all polar bear sightings, 42% and 21%, respectively, which suggest that Industry activities that occur on or near the Beaufort Sea coast have a greater possibility for encountering polar bears than Industry activities occurring inland. Fifty-nine percent (n=53) of polar bear sightings consisted of observations of polar bears traveling through or resting near the monitored areas. Many bears did not exhibit a reaction to human presence. Forty-one percent (n=36) of polar bear sightings involved Level B harassment, where bears were deterred from industrial areas. We have no data that indicates whether the encounters, which alter the behavior and movement of individual bears, have a long-term effect on the Southern Beaufort Sea population.

Numbers of LOAs issued to Industry may serve as an indicator to the characteristics of the oil and gas activity throughout the Beaufort Sea region, the extent of which may indirectly impact polar bear population. For example, a total of 262 LOAs were issued for incidental (unintentional) take of polar bears between 1993 to 2004 (2004 being the last full calendar year where regulations were in place prior to expiration). From 1993-2004, 262 LOAs were issued: 78 percent were for exploration; 12 percent were for development; and 10 percent were for production activities. A total of 726 polar bear sightings were recorded in monitoring programs during this period. Twenty-one percent (55 of 262 LOAs) of these activities actually sighted polar bears.

The majority of discernable impacts from current activities on polar bears have resulted from direct human/bear encounters. Monitoring efforts by Industry required under previous regulations for the incidental take of polar bears and walrus have documented various types of interaction between polar bears and Industry. During a 7-year period (1994-2000) while incidental take regulations were in place, Industry reported 258 polar bear sightings (Kalxdorff and Bridges 2003). Sixty-one percent of polar bear sightings (157 of 258 sightings) consisted of observations of polar bears traveling through or resting near the monitored areas, while 101 polar bear sightings involved bear-human interactions. Twenty-one percent of all bear-human interactions (21 of 101 sightings) involved anthropogenic attractants, such as garbage dumpsters and landfills, where these attractants altered the bear's behavior. Sixty-five percent of polar bear-human interactions (66 of 101 sightings) involved Level B harassment to maintain human and bear safety by preventing bears from approaching facilities and people.

Disturbances to denning females, either on land or on ice, are of particular concern. For example, as part of the LOA application, Industry provides us with the proposed ice road and seismic survey routes for review to minimize the likelihood of disturbance to denning females. We evaluate these routes along with information about known polar bear dens, historic denning sites, probable denning habitat, and decide on the best route.

A standard condition of LOAs requires Industry to maintain a 1-mile buffer between survey activities and known denning sites. In addition, we may require Industry to avoid denning habitat until the time when bears have left their dens. To further reduce the potential for disturbance to denning females, we have incorporated the use of remote sensing techniques, such as FLIR imagery (Amstrup et. al. 2004) and the use of scent-trained dogs to accurately locate active dens (Perham et. al. 2003) previously discussed and to minimize impacts to polar bears.

LOAs also require the applicant to develop a polar bear interaction plan for each operation for bears that may be attracted by the activity. The plan outlines the steps the applicant must take to minimize impacts, such as proper garbage disposal procedures to reduce the attraction of polar bears. Interaction plans also describe the chain of command, and individual responsibilities for responding to a polar bear sighting. Industry personnel are also required to participate in polar bear interaction training while on site. Some personnel are also trained to deter (haze) bears away from facilities. The objective of polar bear interaction plans and training is to detect the bear quickly when it encounters Industry activities, and respond appropriately. Often, this response involves deterring the bear from the site. Without such plans and training, an undesirable outcome could be the lethal take of the bear in defense of human life.

No lethal take or injury to polar bears associated with Industry have occurred during the period covered by incidental take regulations. Prior to the issuance of regulations, lethal takes by Industry were rare. Since 1968, there have been two documented cases of lethal take of polar bears from the Southern Beaufort Sea stock associated with oil and gas activities (Brooks et. al. 1971). In winter 1968-1969, an Industry employee on the Alaskan North Slope shot and killed a polar bear. This record appears limited and no further information is available at this time. In 1990 a female polar bear was killed at a drill site on the west side of Camden Bay. In both instances, the lethal take was in defense of human life. In contrast, 33 polar bears were killed in the Canadian Northwest Territories between 1976 to 1986 as a result of encounters with Industry (Stenhouse et. al. 1988).

Polar bears are known to eat toxic nonfood items such as car batteries (Lunn and Stirling 1985); hydraulic and lubricating fluids (Russell 1975, Derocher and Stirling 1990); and one polar bear, discovered on Leavitt Island, is known to have died as a result of consuming antifreeze (ethylene glycol colored with rhodamine B). This chemical combination is used for marking airport runway centerlines on snow and ice (Amstrup et al. 1989).

Subsistence Harvest

Prior to receipt of an incidental take authorization, Industry companies have provided evidence to the Service that an adequate Plan of Cooperation has been presented to the subsistence communities. The plan will ensure that the Industry activities will not to have an unmitigable adverse impact on the availability of the species or stock for subsistence uses. This Plan of Cooperation must provide the procedures on how the companies will work with the affected Native communities and what actions will be taken to avoid interference with subsistence hunting of polar bear and walrus, as warranted.

The North Slope native communities involved include Barrow, Nuiqsut, and Kaktovik. Industry interacts with the Native communities in numerous informational meetings. From records of these meetings, members of the community have not indicated that Industry activity was adversely affecting the availability of walrus and polar bear for subsistence hunting opportunities.

3.5.2.2. Proposed impacts.

Within the described geographic region of Incidental Take, Industry effects on polar bears are expected to occur on a similar level to what has taken place in the previous regulation. We expect no change in the level of impact to polar bears as a result of the proposed activities. However, on a much larger scale, there are future concerns that may cumulatively affect the recruitment and survival of polar bears, Pacific walrus and their habitat, regionally, statewide, stock-wide, and globally. Industry impacts or effects will be additive within the cumulative effects of the factors. Below are some concerns that may affect polar bears in the future.

Climate Change

Although not directly an impact from Industry activities, climate change and its effect on the arctic environment will likely affect polar bears and their interactions with Industry in the future. Polar bears depend on sea ice, which is being altered by climate change (Derocher et al. 2004). Although the exact magnitude of the effects on the Southern Beaufort Sea polar bear population is not known. Climate change effects on polar bears in the Beaufort Sea may be manifested similar to those described by Derocher et. al. (2004) fro the Western Hudson Bay polar bear population. Some of these effects may include: increased use of coastal environments, increased bear/human encounters, changes in polar bear body condition, decline in cub survival, and increased potential for stress and mortality, and energetic needs in hunting for seals, as well as traveling and swimming to denning sites and feeding areas.

Cumulative Impacts

Over the years, the Prudhoe Bay oil field has developed into an expansive industrial complex. All of the potential impacts can become additive over time to form cumulative impacts (NRC 2003). As the Industry complex grows, with the steady expansion of Industry both westward and eastward over time, the cumulative effects may impact polar bear and Pacific walrus. Expansion of oil and gas development in the nearshore and coastal areas by Industry will likely increase the potential for more negative effects.

However, the five-year regulatory period is relatively short for cumulative assessment. Changes in ice distribution, population dynamics, and overall health of bears due to climate change or other factors may increase bear/human interactions and thus the cumulative impact on polar bears.

Oil Spill Risk Assessment Analysis

Lethal take is not authorized, but it is evaluated through our oil spill risk assessment analysis. Currently, there are two offshore Industry facilities producing oil, Endicott and Northstar. Oil spilled from an offshore facility, from a subsea pipeline, such as Northstar, is a unique scenario that has been considered in previous regulations. Northstar transports crude oil from a gravel island in the Beaufort Sea to shore via a 5.96-mile buried subsea pipeline buried in a trench in the sea floor deep enough to theoretically remove the risk of damage from ice gouging and strudel scour. Northstar began producing oil in 2001. Endicott is connected by a causeway to the mainland.

Other offshore sites are in various states of planning and could be developed to produce oil from the nearshore environments in the future. One of these proposed offshore sites, Liberty, has completed a draft EIS and has been included in the Risk Assessment Analysis for these regulations. Other potential offshore production sites have not been finalized and are without completed environmental impact documentation. Consequently, these sites are not included within the scope of these regulations.

It is necessary to understand how offshore sites could affect marine mammals if a spill were to occur. Only polar bears were incorporated in this analysis. A large amount of movement and distribution data is available to accurately calculate polar bear densities with the area.

Polar bears are at risk from an oil spill in the Beaufort Sea. Limited data from a Canadian study suggest that polar bears experimentally oiled with crude oil will most likely die (Øritsland et. al. 1981). This finding is consistent with what is known of other marine mammals that rely on their fur for insulation. The Northstar FEIS concluded that mortality of up to 30 polar bears could occur as the result of an oil spill greater than 1,000 barrels. Amstrup et al. (2000) calculated that the number of polar bears potentially oiled at the Liberty prospect was 0-25 polar bears for open water and 0 to 61 bears in the broken ice period. However, neither estimate for the facilities accounts for the likelihood of spills seasonally during the period that the regulations are in effect.

Two independent lines of evidence support our determination that only a negligible impact to the Beaufort Sea polar bear stock will occur, one largely anecdotal, and the other quantitative. The anecdotal information is based on Industry site locations and Service studies investigating polar bear aggregations on barrier islands and coastal areas in the Beaufort Sea (USFWS, unpublished data). This information suggests that polar bear aggregations may occur for brief periods in the fall. The presence and duration of these aggregations are likely influenced by the presence or absence of sea ice near shore and the availability of marine mammal carcasses, notably bowhead whales from subsistence hunts at specific locations. In order for significant impacts on polar bears to occur, an oil spill would have to contact an aggregation of polar bears. We believe the probability of all these events occurring simultaneously is low.

The quantitative assessment for the current request of incidental take regulations was based the methodology from the previous risk assessment using current data. The quantitative assessment of potential impact is based on a risk assessment that considered oil spill probability estimates for two sites; Northstar and the Liberty prospect, located in Foggy Island Bay, oil spill trajectory models, and a current polar bear distribution model based on location of satellite-collared females during September and October (Amstrup et al. in press).

Methodology

The first step in the risk assessment analysis was to calculate oil spill probabilities at the Northstar and Liberty sites for open water (September) and broken ice (October) seasons. We considered spill probabilities for the drilling platform and the sub-sea pipeline, since this is where spills are most likely to occur. Using production estimates from the Northstar EIS and the

Liberty DEIS, we estimated the likelihood of one or more spills greater than 1,000 barrels in size occurring in the marine environment during the 5-yr period covered by the regulations.

The second step in the risk assessment was to calculate the number of polar bears that could be oiled from a spill. This involved modeling the probabilistic distribution of bears that could be in the area and overlapping polar bear distributions with oil spill trajectories.

Trajectories previously calculated for Northstar and Liberty sites were used. The trajectories were provided by the U.S. Minerals Management Service (MMS) and reported in Amstrup et al. (2000). MMS estimated probable sizes of oil spills from the transportation pipeline and the island as well. These spill sizes ranged from a minimum of 125 to a catastrophic release event of 5,912 barrels. Hence, the size of the modeled spill was set at the worst-case scenario of 5,912 barrels, simulating rupture and drainage of the entire sub-sea pipeline. Each spill was modeled by tracking the location of 500 "spillets." Spillets were driven by wind and currents, and their movements were stopped by the presence of sea ice. Open water and broken ice scenarios were each modeled with 360-500 simulations. A solid ice scenario was also modeled, in which oil was trapped beneath the ice and did not spread. In this later event, we found it unlikely that polar bears will contact oil, and removed this scenario from further analysis. Each simulation was run for at least 10 days with no cleanup of containment efforts simulated. At the end of each simulation, the size and location of each spill was represented in a geographic information system.

The second component incorporated up to date polar bear densities overlapped with the oil spill trajectories. In 2004, USGS, completed analysis investigating the potential effects of hypothetical oil spills on polar bears. Movement and distribution information was derived from radio and satellite relocations of collared adult females. Density estimates from 15,308 satellite locations of 194 polar bears collared between 1985 and 2003 was used to estimate the distribution of polar bears in the Beaufort Sea. Using a technique called ‘‘kernel smoothing,’’ they created a grid system centered over the Northstar production island and the Liberty site was created to estimate the number of bears expected to occur within each 1 km^2 grid cell. Standard errors of bear numbers per cell were estimated with resampling procedures. Each of the simulated oil spills was overlaid with the polar bear distribution grid. Oil spill footprints for September and October, the timeframe that hypothesized effects of an oil-spill would be greatest, were estimated using real wind and current data collected between 1980 and 1996. ARC/Info software was used to calculate overlap, numbers of bears oiled between oil-spill footprints and polar bear grid-cell values. If a spillet passed through a grid cell, the bears in that cell were considered oiled by the spill.

Finally, the likelihood of occurrence for the number of bears oiled during the duration of the of the 5-year incidental take regulations were estimated. This was calculated by multiplying the number of polar bears oiled by the spill by the percentage of time bears were at risk for each period of the year, and summing these probabilities.

Results

Numbers of bears potentially oiled by a 5,912 barrel spill ranged from 0 to 27 polar bears for September open water conditions, and from 0 to 74 polar bears in October mixed ice conditions for Northstar and from 0 to 23 polar bears for September open water conditions, and from 0 to 55 polar bears in October mixed ice conditions for Liberty. Median number of bears oiled by the 5,912 barrel spill from the Liberty site in September and October were 1 and 3 bears, respectively; equivalent values for the Northstar site were 3 and 11 bears, respectively. Variation among oil spill scenarios was the result of differences in oil spill trajectories among those scenarios and not the result of variation in the estimated bear densities. In October, 75% of trajectories from the 5,912 barrel spill at Liberty oiled nine or fewer bears, while 75% of the trajectories affected 20 or fewer polar bears when the October spill occurred at our Northstar simulation site (Figures 8 – 11).

When calculating the probability that a spill would oil five or more bears we found that as oil spills and trajectories were more likely to affect small numbers of bears (5 bears) than larger numbers of bears. Thus, for Northstar, the probability of a spill that oils (mortality) 5 or more bears is 1.0–3.4 percent; for 10 or more bears is 0.7–2.3 percent; and for 20 or more bears is 0.2–0.8 percent. For Liberty, the probability of a spill that will cause a mortality of 5 or more bears is 0.3–7.4 percent; for 10 or more bears is 0.1–0.4 percent; and for 20 or more bears is 0.1– 0.2 percent.

Discussion

Northstar Island is nearer the active ice flaw zone than Liberty, and it is not sheltered from deep water by barrier islands. These characteristics contribute more polar bears being distributed in close proximity to the island and also contributes to oil being dispersed more quickly and further into surrounding areas. By comparison, oil spill trajectories from Liberty were more erratic in the areas covered and the numbers of bears impacted. Hence, larger numbers of bears were consistently exposed to oil trajectories by Northstar simulations than those modeled for Liberty. This difference was especially pronounced in October spill scenarios. In October, the land fast ice, inside the shelter of the islands and surrounding Liberty, dramatically restricted the extent of most oil spills in comparison to Northstar which lies outside the barrier islands and in deeper water. At both locations, oil-spill trajectories affected small numbers of bears far more often than they affected larger numbers of bears. At Liberty, the number bears affected declined more quickly than they did at Northstar. The proposed Liberty Island production site presents less risk to polar bear than the existing facility at Northstar Island.

The greatest source of uncertainty in the calculations was the probability of an oil spill occurring. The oil spill probability estimates for Northstar and Liberty were calculated using data for sub-sea pipelines outside of Alaska and outside of the Arctic, which likely do not reflect conditions that would be routinely encountered in the Arctic, such as permafrost, ice gouging, and strudel scour in the nearshore environment. They may include other conditions unlikely to be encountered in the Arctic, such as damage from anchors and trawl nets. Consequently, oil spill probabilities as presented in the Northstar FEIS incorporate unquantified levels of uncertainty in their estimate. If the probability of a spill were twice the estimated value, the probability of a spill that would cause a mortality of five or more bears would remain low (approximately six percent for Northstar and 1.5 % for Liberty).

The spill analysis was dependent on numerous assumptions, some of which underestimate, while others overestimate, the potential risk to polar bears. For example, these included variation in spill probabilities during the year (underestimate, overestimate), the length of time the oil spill trajectory model was run (longer time periods would overestimate the risk), whether or not containment occurred during the trajectory model (containment could underestimate the risk), lack of effective hazing to deter wildlife during the model runs (overestimate the risk), contact with a spillet constitutes mortality (overestimate the risk), and an even distribution of polar bears - polar bear aggregations were not included (underestimate or overestimate the risk). We determined that the assumptions that will overestimate and underestimate mortalities were generally in balance. For example, if an oil spill were to occur during the fall or spring broken-ice periods, a significant impact to polar bears could occur;

however, in balancing the level of impact with the probability of occurrence at both sites, we concluded that the probability of serious impacts (large-volume spills that cause high polar bear mortalities) was low. In addition, fall coastal aerial surveys have shown that the Northstar and Liberty sites are not associated with large aggregations of bears in the immediate areas, although aggregations do occur consistently during this time at Cross Island (approximately 17 miles northeast from Northstar and 17 miles northwest of Liberty, respectively) and Barter Island and may occur wherever whale carcasses are present.

We conclude that if an offshore oil spill were to occur during the fall or spring broken-ice periods, a significant impact to polar bears could occur; however, in balancing the level of impact with the probability of occurrence, we conclude that the probability of serious impacts (large-volume spills that cause high polar bear mortalities) is low. Due to the small volume of oil associates with onshore spills, the rapid response system in place to clean up spills, and protocols to deter bears away from the affected area for their safety, onshore spills would have little impact on the polar bear population as well. Therefore, the total expected taking of polar bear during oil and gas industry exploration, development, and production activities will have no more than a negligible impact on this species.

Chapter 4 - Environmental Consequences

4.1. Alternative 1: No Action

The previous Incidental Take Regulations expired on March 28, 2005. If this alternative is implemented, no further Incidental Take Regulations and LOAs would be issued. These regulations do not explicitly permit or prohibit Industry activity; however, it is likely that Industry would continue to conduct exploration, development, and production activities as planned. Without regulations, monitoring and reporting of interactions between Industry and polar bears and/or Pacific walrus would not be required and our interaction with the Industry to monitor potential effects on polar bear and Pacific walrus would be greatly reduced. In addition, there would by reduced interaction between the Service and Industry for safety training, facility design, and monitoring data to minimize impacts to polar bears.

4.2. Alternative 2: Proposed Action (Non-lethal Incidental Take Regulations)

The Service concludes that the effect of promulgating Incidental Take Regulations to allow for the non-lethal incidental take of small numbers of polar bears and Pacific walrus would be positive for polar bears and Pacific walrus. Under terms of the MMPA and based on 12 years of monitoring and reporting, Industry effects on Pacific walrus and polar bears resulting from incidental take authorization appear to be negligible. Between 1994 and 2004, Industry activities have not resulted in any polar bear or Pacific walrus deaths while incidental take regulations have been in place, while at the same time, 262 LOAs were issued. It is likely that this alternative will actually reduce the level of incidental take that would occur in the absence of regulations, due to active monitoring and reporting of polar bears and Pacific walrus by Industry and Outreach programs put in place to minimize direct encounters with polar bears.

Under this alternative, monitoring and reporting will be implemented to evaluate the effects of Industry activities on polar bear and Pacific walrus populations. Section 101(a)(5)(A) of the Act states that the Secretary of the Interior may allow the incidental, but not intentional, taking of marine mammals provided regulations set forth requirements pertaining to the monitoring and reporting of such taking.

Prior to issuance of a LOA, the applicant will be required to submit a monitoring and reporting plan to the Service. Upon review and approval of the submitted monitoring and reporting plan, the plan will become an integral part of the LOA.

The purpose of monitoring and reporting is to determine effects of authorized oil and gas activities on polar bear and walrus in the Beaufort Sea and the northern coast of Alaska. Plans will be required to identify the methods used to determine and assess the effects of the authorized activity on polar bear and walrus. Monitoring and reporting plans will be reviewed annually and modifications will be made, if necessary, based upon interpretation of results.

Based on the information presented, and under terms of the MMPA, the number of encounters anticipated occurring between polar bears or walrus and Industry are unlikely to have a significant effect on the populations of polar bears or Pacific walrus. In addition, any take reasonably likely to or reasonably expected to be caused by oil and gas activities will not result in more than a negligible effect on the recruitment or survival or polar bear or walrus populations inhabiting the Beaufort Sea region. Furthermore, non-lethal take associated with Industry should not reduce, or limit, subsistence harvest of polar bears or Pacific walrus within the requested geographic region.

Chapter 5 - Agencies/Persons Consulted

A copy of the petition submitted by the Alaska Oil and Gas Association, on August 23, 2002, was distributed to the following groups.

Alaska Eskimo Whaling Commission

Alaska Nanuuq Commission

North Slope Borough

Defenders of Wildlife

Eskimo Walrus Commission

Marine Mammal Commission

Arctic Connections

National Wildlife Federation

Greenpeace

Center for Biological Diversity

Audubon Alaska

Trustees for Alaska

Sierra Club, Alaska Chapter

Earthjustice

Wilderness Society, Anchorage

Northern Alaska Environmental Center

Friends of Animals

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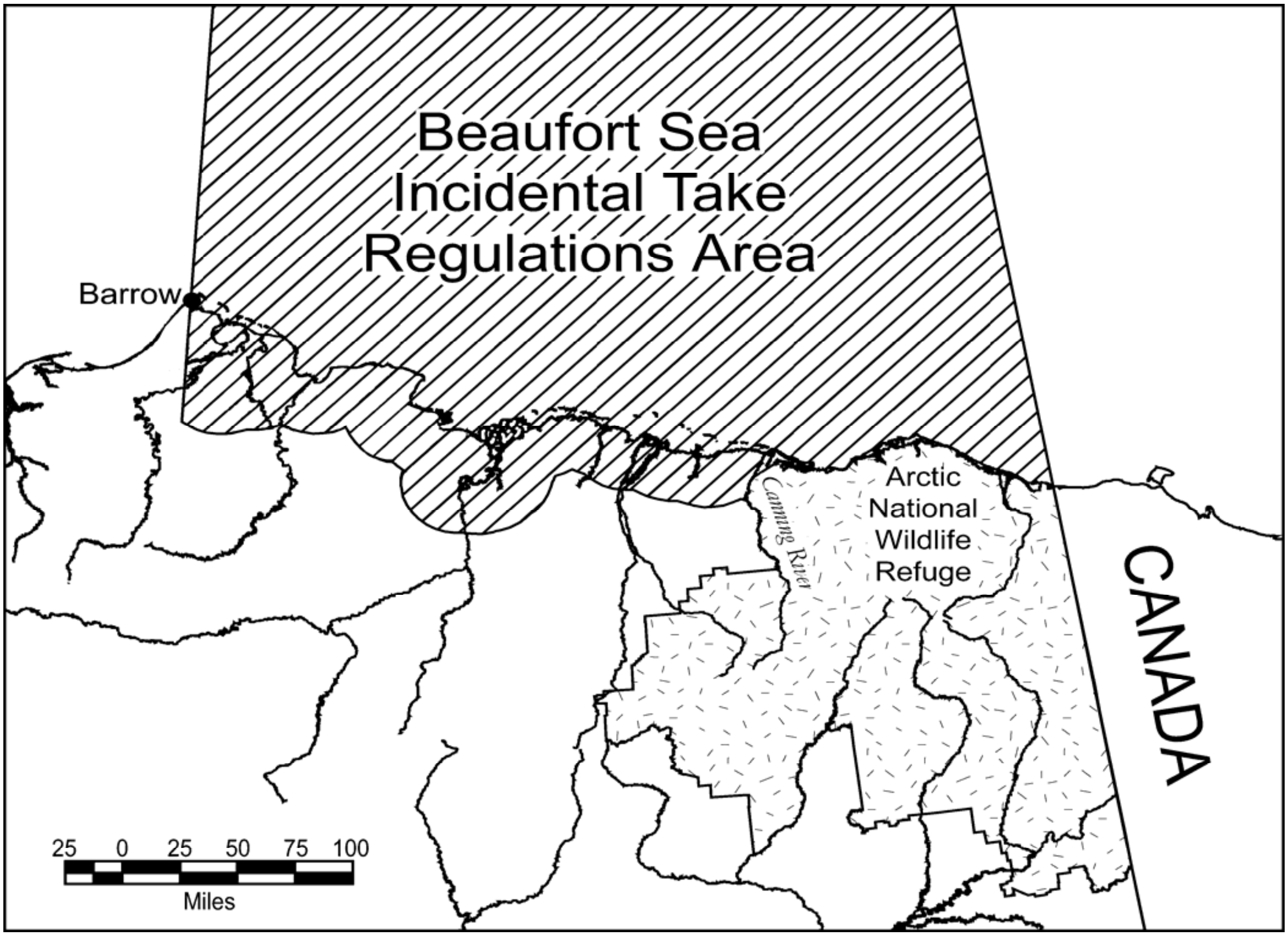

Figure 1. Specific geographic area covered by the 2006-2011 Beaufort Sea incidental take regulations.

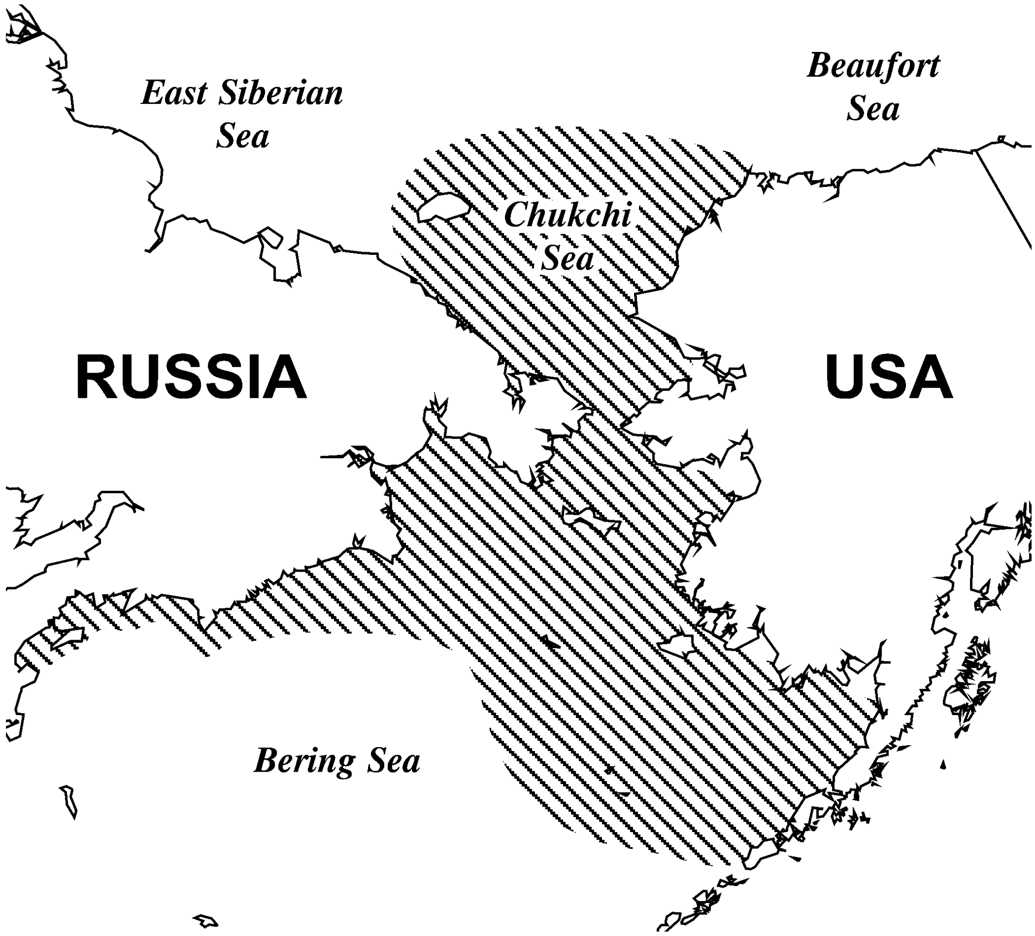

Figure 2. Distribution of Pacific walrus.

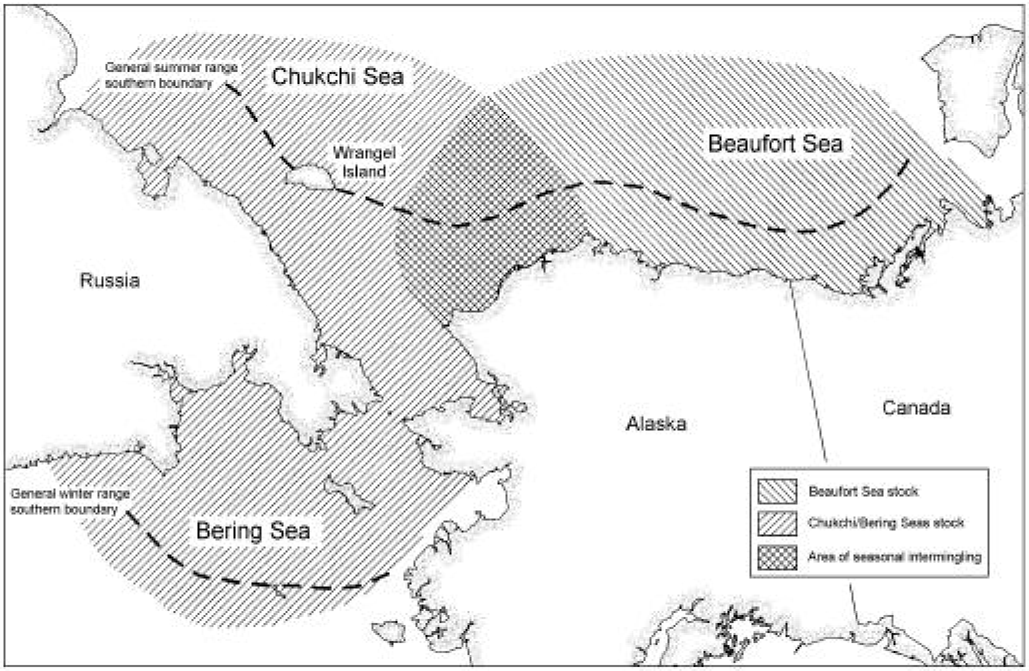

Figure 3. Stock boundaries for polar bears in Alaska.

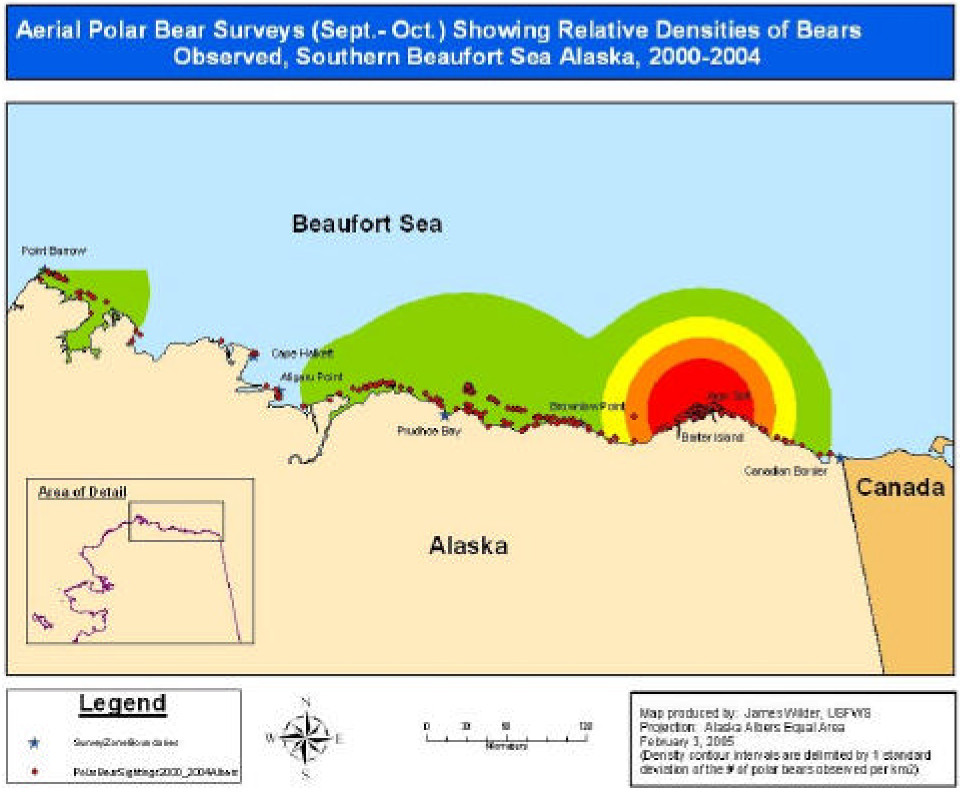

Figure 4. Relative densities of polar bears observed during coastal surveys during the fall, 2000-2004 determined by ArcMap Spatial Analyst Kernel Density Estimator.

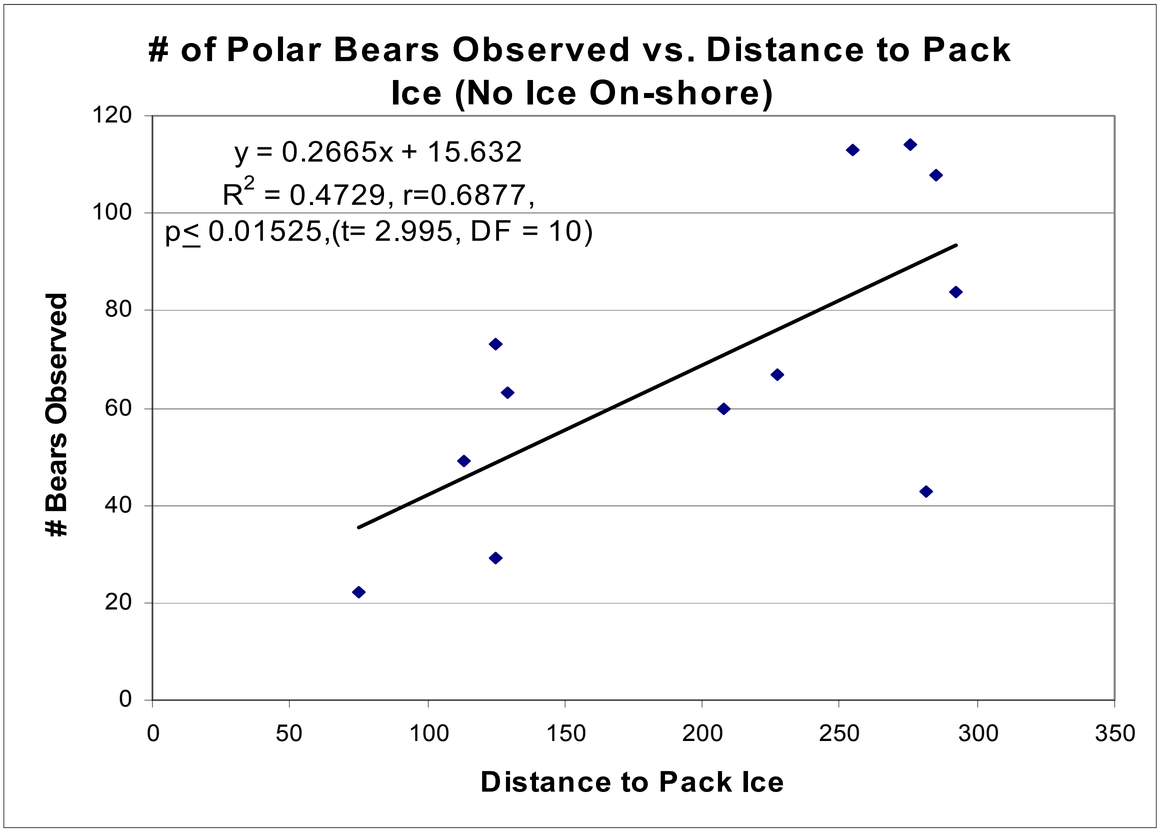

Figure 5. Chart of regression relationship between the numbers of polar bears present on shore and the distance the pack ice was located from shore (Preliminary data, unpubl.).

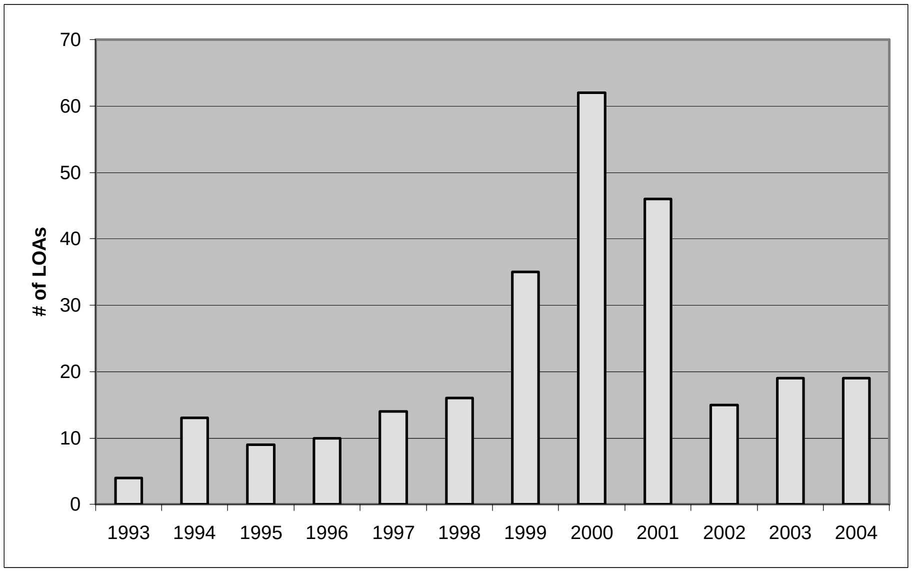

Figure 6. The number of Letters of Authorization issued by the Service to incidentally take small numbers of polar bears during oil and gas activities on the North Slope of Alaska, 1993-2004.

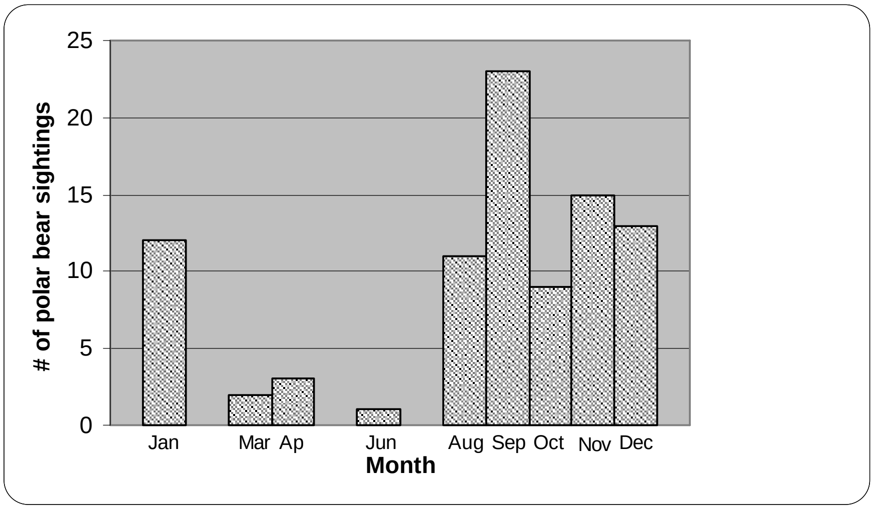

Figure 7. The number of polar bear sightings by month reported by North Slope oil and gas operators as a condition of their LOAs to incidentally take small numbers of polar bears during oil and gas activities on the North Slope of Alaska, 2004.

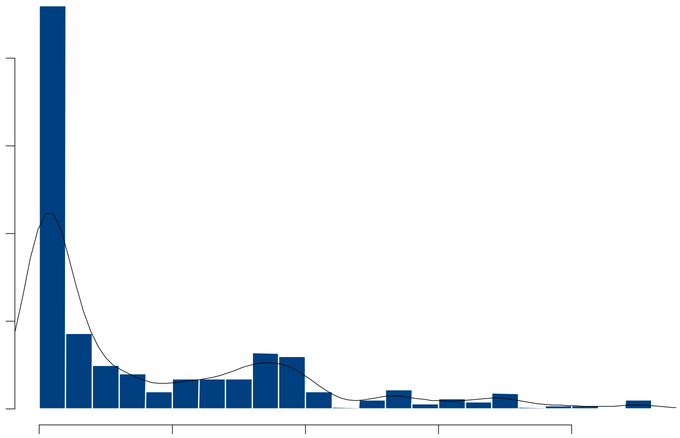

Figure 8. Numbers of bears estimated to be oiled by simulated oil spills from the Liberty site during the month of September. Shown here is the frequency histogram resulting from 500 simulated spills (trajectories) of 5912 barrels of crude oil. September conditions were predominated by open water and low coverage of sea ice (Courtesy of USGS).

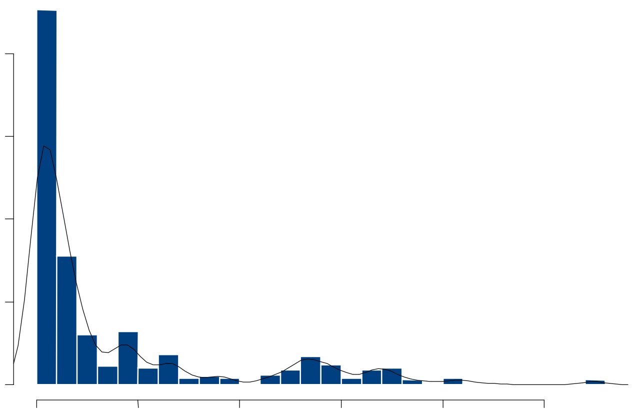

Figure 9. Numbers of bears estimated to be oiled by simulated oil spills from the Liberty site during the month of October. Shown is the frequency histogram resulting from 495 simulated spills (trajectories) of 5912 barrels of crude oil. October conditions were predominated by open and refreezing sea-water (Courtesy of USGS).

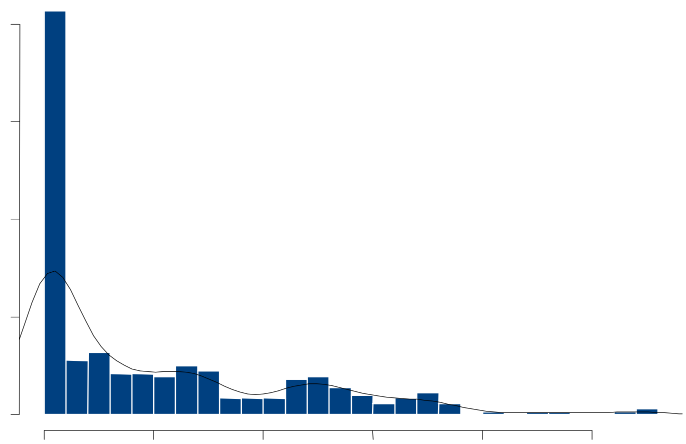

Figure 10. Numbers of bears estimated to be oiled by simulated oil spills from the Northstar site during the month of September. Shown here is the frequency histogram resulting from 360 simulated spills (trajectories) of 5912 barrels of crude oil (Courtesy of USGS).

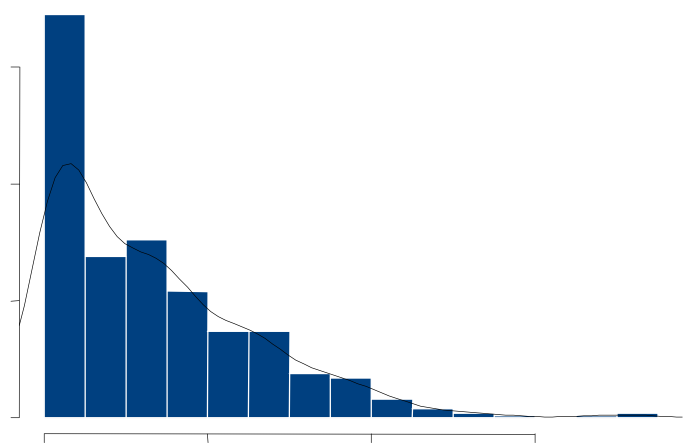

Figure 11. Numbers of bears estimated to be oiled by simulated oil spills from the North Star site during the month of October. Shown here is the frequency histogram resulting from 499 simulated spills (trajectories) of 5912 barrels of crude oil. October conditions were predominated open and refreezing sea-water and mixed new and older ice (Courtesy of USGS).