III.E.2. Alternative II – No Sale. This alternative would cancel proposed Sale 202 and defer leasing until after 2007 as part of the next 5-Year Program.

III.E.3. Alternative III - Barrow Subsistence Whaling Deferral. This alternative is similar to Alternative VII, except that it would exclude (not offer for lease) only a subarea within which Barrow residents conduct subsistence whaling. The area that would be removed by the Barrow Subsistence Whaling Deferral (Figure 1) consists of 26 whole or partial blocks equaling approximately 138,000 acres, or 1% of the Area of Call. The full rationale for the deferral is explained in the multiple-sale final EIS (USDOI, MMS, 2003:Sec. I.C.2.a(3)). Protection of the Barrow subsistence area was requested during Sales 186 and 195 by the AEWC, Inupiat Community of the Arctic Slope (ICAS), and North Slope Borough (NSB). Protection of the area was requested again by the AEWC in a letter about proposed Sale 202 (Appendix A). A letter from Senator Murkowski to Secretary Norton, dated August 24, 2005, about the 2007-2012 5-year leasing program being developed, referred to future deferral of the subsistence-whaling area. Senator Murkowski acknowledges that MMS has stipulations to protect biological resources, to require a bowhead monitoring program, and to require conflict avoidance agreements, but requests that MMS use lease deferrals in addition to these stipulations to protect Native whaling.

III.E.4. Alternative IV – Nuiqsut Subsistence Whaling Deferral. This alternative is similar to Alternative VII, except that it would not offer for lease a subarea within which Nuiqsut residents conduct subsistence whaling to the northeast of Cross Island. The area that would be removed by the Nuiqsut Subsistence Whaling Deferral (Figure 1) consists of 30 whole or partial blocks equaling approximately 162,000 acres, or 2% of the Area of Call. The full rationale for the deferral is explained in the multiple-sale final EIS (USDOI, MMS, 2003:Sec. I.C.2.a(4)). Protection of the Nuiqsut subsistence area was requested during Sales 186 and 195 by the AEWC, Native Village of Nuiqsut, ICAS, and NSB. As noted above, protection of subsistence-whaling areas was requested also by the AEWC in a letter about proposed Sale 202 and by Senator Murkowski in a letter about future leasing.

III.E.5. Alternative V – Kaktovik Subsistence Whaling Deferral. This alternative is similar to Alternative VII, except that it would not offer for lease only a subarea within which Kaktovik residents conduct subsistence whaling. The area that would be removed by the Kaktovik Subsistence Whaling Deferral (Figure 1) consists of 28 whole or partial blocks equaling approximately 121,000 acres, or 1% of the Area of -Call. The full rationale for the deferral is explained in the multiple-sale final EIS (USDOI, MMS, 2003:Sec. I.C.2.a(5)). Protection of the Kaktovik subsistence area was requested during Sales 186 and 195 by the AEWC, Native Village of Kaktovik, ICAS, and NSB. As noted above, protection of subsistence-whaling areas also was requested by the AEWC in a letter about proposed Sale 202 and by Senator Murkowski in a letter about future leasing.

III.E.6. Alternative VI - Eastern Deferral. This alternative is similar to Alternative I, except that it would not offer for lease a subarea within which bowheads feed. The area that would be removed by the Eastern Deferral (Figure 1) consists of 60 whole or partial blocks equaling approximately 283,000 acres, or 3% of the Area of Call. The full rationale for the deferral is explained in the multiple-sale final EIS (USDOI, MMS, 2003:Sec. I.C.2.a(6)). Deferral of this area was requested during Sales 186 and 195 by the AEWC, Native Village of Kaktovik, ICAS, and NSB. As noted above, protection of the area also was requested by the AEWC in a letter about proposed Sale 202 and by Senator Murkowski in a letter about the 2007-2012 5-Year Program being developed.

IV. UPDATED IMPACT ANALYSIS

The multiple-sale final EIS (USDOI, MMS, 2003) concluded that, in the unlikely event of a large oil spill, there could be significant effects on subsistence-harvest patterns and sociocultural systems, several bird species, and local water quality. It concluded also that the potential cumulative effects on several resources, including bowhead whales, would be a primary concern and would warrant continued close attention and effective mitigation practices.

The Sale 195 EA (USDOI, MMS, 2004) updated the oil-spill-occurrence estimates for large spills, because the potentially significant effects in the multiple-sale final EIS were related to a large spill. The EA concluded that no new significant impact would occur that was not already assessed in the multiple-sale EIS, and it identified ringed seals and other ice-dependent pinnipeds as additional resources of primary concern due to the speculative effects of climate change in the Arctic.

This Sale 202 EA updates the oil-spill-occurrence estimates, information on routine, permitted operations, and the effects assessment for each resource. As in the Sale 195 EA, the effects of spills on the significantly affected resources are assessed first, reflecting MMS guidance to focus EA's on those aspects of the Proposal that could cause adverse effects that are significant. This EA includes updated information on the affected environment, updated effects assessments of other alternatives, updated cumulative effects assessments, and an overall summary. The summary concludes in Section IV.B that parts of the Beaufort Sea environment have changed substantially since preparation of the multiple-sale EIS. For example, the statistical analysis of long-term data sets indicates substantial reductions in both the extent and thickness of the arctic sea-ice cover during the past 20-40 years. Also, some resources that are dependent on summer and autumn ice cover have declined in abundance. The Sale 195 EA projected that more polar bears might be forced to stay onshore during summer, leading to increased interaction between polar bears and oil-industry personnel (USDOI, MMS, 2004:Appendix I, Sec. I.2.g). Recent observations confirm that more polar bears are staying onshore during the autumn, as explained in Sections IV.B.4.b and IV.C.2.e.

This EA concludes in Section IV.C.2, that the likelihood of one or more large oil spills occurring and contacting a land segment still is very low (e.g., <2% within 60 days). Due primarily to increased concentrations of polar bears on parts of the coast, the relative oil-spill risk to the population has increased since preparation of the multiple-sale EIS. The biological potential for polar bears to recover from any perturbation is low because of their low reproductive rate. The MMS rules can require mitigation that will moderate the spill risk to polar bears (Sec. III.C.2). Our overall finding is that the Proposed Action with the mitigation would lead to no new significant impact that was not already assessed in the Beaufort Sea multiple-sale EIS.

IV.A. Updated Information on the Physical Environment and Potential Operations.

This section updates the available information on physical oceanography, summarizing recent studies of circulation and sea ice, and the acoustic environment in the Beaufort Sea. This section also updates the information on the oil-spill risk and an increase in the anticipated level of seismic exploration.

IV.A.1. Physical Oceanography. Comparison of ocean temperature, salinity, sea-ice extent, and sea-ice thickness data from the 1990's and 2000's to earlier data shows changes in the Arctic Ocean. Both the multiple-sale EIS and the Sale 195 EA (USDOI, MMS 2003, 2004) and an MMS study report (Eicken et al., 2006) summarize the reduction in sea-ice extent and thickness in recent years. The statistical analysis of long-term data sets indicate substantial reductions in both the extent and thickness of the arctic sea-ice cover during the past 20-40 years, with record minimum extent in 2002 and again in 2005, and extreme minima in 2003 and 2004 (Stroeve et al., 2005; NASA, 2005; Comiso, 2006). In September 2002, sea ice in the Arctic reached a record minimum during summer, 4% lower than any previous September since 1978 and 14% lower than the 1978-2000 mean (Serreze et al., 2003). Three years of low ice extent followed 2002. Taking these 3 years into account, the September ice-extent trend for 1979-2004 declined by 7.7% per decade (Stroeve et al., 2005) and from 1979-2005 declined by 9.8% per decade (Comiso, 2006). The multiple-sale EIS (USDOI, MMS 2003:Sec III.A.4.g) discussed the estimated ice-reduction rate of 3% per decade. This rate is now approximately three times faster. Within the Arctic, the Chukchi and Beaufort seas have some of the largest declines in ice extent during summer. In 2005, the ice in the Beaufort Sea did not retreat towards the central Arctic as far as the previous 3 years (Comiso, 2006). Melling, Riedel, and Gedalof (2005) report a small trend (0.07 meters [m]/decade) of thinner ice with a low statistical significance in the Canadian Beaufort Sea from Herschel Island to McClure Strait.

When the ice cover is reduced, particularly during the late arctic summer, the amount of open water and the influence of the wind on the water increases, and the waves grow in height. Typical wave heights are up to 1.5 m during summer and up to 2.5 m during fall. Expected maximum wave heights are 7-7.5 m in the Beaufort Sea (Brower et al., 1988). A late-summer storm in the Beaufort in September 2000 developed waves 3 m high near Point Barrow (Lynch et al., 2003).

Changes in the landfast ice have been occurring. The landfast ice season is now shorter, with a less stable ice cover in the Alaskan Beaufort Sea (Eiken et al., 2006). Events of shorefast ice breaking off have occurred near Barrow in January or February and even as late as March (George et al., 2003).

While changes in the reduction of sea ice are apparent, the cause(s) of change is ambiguous. Lindsay and Zhang (2005) hypothesize that the thinning of sea ice, based on a combination of modeling and analysis of data; is due to:

> (1) the fall, winter, and spring air temperatures over the Arctic Ocean have gradually increased over the last 50 yr, leading to reduced thickness of first-year ice at the start of summer; (2) a temporary shift, starting in 1989, of two climate indices caused a flushing of older, thicker ice out of the basin and an increase in the summer open water extent; and (3) the increasing amounts of summer open water allow for increasing absorption of solar radiation which melts the ice, warms the water and promotes creation of winter first-year ice that often entirely melts by the end of the subsequent summer.

Francis et al., (2005) suggest that downwelling long-wave radiation fluxes account for a large percentage of the variability of perennial sea-ice extent in the Beaufort and Chukchi sea area. In the Chukchi Sea, meridonal wind (one with a strong north-south component) also had an influence but played a lesser role in the Beaufort. Shimada et al. (2006) present evidence that the pattern of sea-ice extent is similar to the distribution of warm Pacific summer Water. Kwok (2004) and Kwok, Maslowski, and Laxon (2005) identify and discuss the implications of multiyear ice distribution both in terms of an unusual outflow of multiyear ice into the Barents Sea and its consequences as a freshwater source to the transformation of Atlantic Water circulating in the Arctic.

Widespread changes of temperature and salinity occurred in the central Arctic Ocean water column during the 1990's. There were observations of widespread temperature increases in the Atlantic water layer (Carmack et al., 1995; McLaughlin et al., 1996; Morrison, Steel, and Anderson, 1998; Grotefendt et al., 1998). These appear related to an increased temperature (Swift et al., 1998) and strength (Zhang, Rothrock, and Steele, 1998) of the Atlantic inflow into the Arctic Basin. Increased transport caused a displacement of the Pacific-Atlantic water boundary toward the Canadian Basin. The pronounced warming of Atlantic water in the central basin tapered off by 1998-1999 (Gunn and Muench, 2001; Boyd et al., 2002). Kikuchi, Inoue, and Morison (2005) report that the temperature anomalies appear first on the Markov Basin side of the Lomonosov Ridge and then arrive on the Amundsen side of the basin approximately 7 years later. Karcher et al. (2003) suggest, from modeling, that the warming of the Atlantic Layer resulted from changes in inflow from Fram Strait and the Barents Sea as well as changes in local current speeds. They suggest these events are episodic with a warming event in the early 1980's and again in the early 1990's. Woodgate et al. (2001) also present observations of warming and cooling events near the Chukchi Borderlands. There still is discussion in the literature regarding the cause of the warming.

Shimada et al. (2004) identify the remnants of this warmed Atlantic Water recently reaching the Canada Basin. Comparisons of recent and historical data show that the Canada Basin waters are in transition and are responding to inflow from upstream (McLaughlin et al., 2004). The appearance of higher temperatures near the Chukchi Plateau suggests that temperatures may continue to increase in the Beaufort Sea in coming years. Steele et al. (2004) state that the distribution of summer Pacific halocline is changing in the Canada Basin of the Arctic Ocean and so is its influence. They relate these changes to the two different Arctic Oscillation states where during a high Arctic Oscillation, Alaska Coastal Water and summer Bering Shelf Water may outflow at different locations from the Arctic. During a low Arctic Oscillation, both watermasses are mixed into the Beaufort Gyre, and the separation of these watermasses is reduced.

Determining whether this trend persists depends on acquiring additional data. Polyakov et al. (2005) report two warm Atlantic Water anomalies (1999 and 2004) in the eastern Eurasian Basin that could propagate towards the Arctic Ocean interior with a time lag. Polyakov et al. (2004) present data showing multidecadal fluctuations in temperature, with time scales of 50-80 years for Atlantic Water temperature variability. Observations in the next years may be particularly important in view of the changes observed in the Arctic Oscillation, which had a persistent, positive phase through the 1990's, but it has been negative or near neutral for 6 of the previous years from 1996-2004 (Overland and Wang, 2005). This warming in the early 1990's was thought to be associated with cyclical, large-scale shifts in atmospheric forcing (Proshutinsky and Johnson, 1997; Proshutinsky et al., 2000). Even without the driving force of a positive Arctic Oscillation, Arctic indicators continue to indicate a continuing linear trend of warming. Tracking multiple lines of evidence will be crucial to understanding change in the Arctic as a whole (Overland, 2006).

IV.A.2. Acoustic Environment. Sounds generated by the oil and gas industry are propagated into a marine environment that already receives sounds from numerous natural and human sources. The main sources of noise occurring in the Beaufort Sea, both natural and anthropogenic (manmade) are described in detail in the Programmatic Environmental Assessment (PEA) for seismic surveys in the Arctic Ocean (USDOI, MMS, 2006a:Sec. III.B), are incorporated by reference and are summarized below.

IV.A.2.a. Ambient Sound. Ambient noise levels in the Beaufort Sea can vary dramatically between and within seasons because of: (1) variability in components of environmental conditions such as sea ice, temperature, wind, and snow; (2) the presence of marine mammals; (3) the presence of industrial shipping, research activities, and subsistence activities; and (4) other miscellaneous factors. Natural sound sources in the Beaufort Sea include the wind stirring the surface of the ocean, lightning strikes; animal vocalizations and noises (including whale calls, echolocation clicks, and snapping shrimp); subsea earthquakes; and ice movements. Burgess and Greene (1999) report that collectively, these sources create an ambient noise range of 63-133 decibels (dB).

The presence of ice can contribute substantially to ambient noise levels and can affect sound propagation, as ice cover radically alters the ocean noise field with factors such as the type and degree of ice cover (National Research Council [NRC], 2001). The NRC (2001, citing Urick, 1984) reported that variability in air temperature over the course of the day can change received sound levels by 30 dB between 300 and 500 Hertz (Hz). Temperature also affects the mechanical properties of the ice, and temperature changes can result in cracking, especially in winter and spring when landfast ice produces loud thermal cracking noises (Milne and Ganton, 1964). In areas characterized by a continuous fast-ice cover, the dominating source of ambient noise is the ice cracking induced by thermal stresses (Milne and Ganton, 1964). The spectrum of cracking noise typically displays a broad range from 100 Hz-1 kiloHertz, and the spectrum level has been observed to vary as much as 15 dB within 24 hours due to the diurnal change of air temperature. Ice deformation occurs primarily from wind and currents and usually produces low frequency noises around 4-200 Hz (Greene, 1981). As icebergs melt, they produce additional background noise as they tumble and collide with each other.

While sea ice can produce high levels of background noise, it also can function to dampen ambient noise. Areas of water with 100% sea-ice cover can reduce or completely eliminate noise from waves or surf (Richardson et al, 1995). In the Arctic, wind and waves (during the open-water season) are important sources of ambient noise with noise levels tending to increase with increased wind and sea state, all other factors being equal (Richardson et al., 1995).

Marine mammals contribute to the background noise in the acoustic environment of the Beaufort Sea. For example, source levels of seal songs and calls have been estimated to be up to 178 decibels re 1 microPascal at 1 meter (178 dB re 1 μPa at 1 m) (Cummings et al., 1983; Richardson et al., 1995). Bowhead whales, which are present in the Arctic Region from early spring to mid- to late fall, produce sounds with source levels ranging from 128-189 dB re 1 μPa at 1 m in frequency ranges from 20-3,500 Hz.

IV.A.2.b. Anthropogenic Sound. Human sources include noise from vessels (motor boats used for subsistence and local transportation, commercial shipping, research vessels, etc.); navigation and scientific research equipment; airplanes and helicopters; human settlements; military activities; and marine development.

IV.A.2.b(1) Vessel Activities and Traffic. Shipping noise, often at source levels of 150-190 dB, since 1950 has contributed a worldwide 10- to 20-dB increase in the background noise in the sea (Acoustic Ecology Institute, 2005). The types of vessels that produce noise in the Beaufort Sea include barges, skiffs with outboard motors, icebreakers, scientific research vessels, and vessels associated with geological and geophysical exploration and oil and gas development and production. In the Beaufort Sea, vessel traffic and associated noise presently is limited primarily to late spring, summer, and early autumn.

In shallow water, vessels more than 10 kilometers (km) away from a receiver generally contribute only to background noise (Richardson et al., 1995). In deep water, traffic noise up to 4,000 km away may contribute to background-noise levels (Richardson et al., 1995). Barging associated with activities such as onshore and limited offshore oil and gas activities, fuel and supply shipments, and other activities contributes to overall ambient noise levels in some regions of the Beaufort Sea. The use of aluminum skiffs with outboard motors during fall subsistence whaling in the Alaskan Beaufort Sea also contributes noise. Fishing boats in coastal regions also contribute sound to the overall ambient noise. Sound produced by these smaller boats typically is at a higher frequency, around 300 Hz (Richardson et al., 1995).

Icebreaking vessels used in the Arctic for activities including research and oil and gas activities produce stronger, but also more variable, sounds than those associated with other vessels of similar power and size (Richardson et al., 1995). Even with rapid attenuation of sound in heavy ice conditions, the elevation in noise levels attributed to icebreaking can be substantial out to at least 5 km (Richardson et al., 1991). In some instances, icebreaking sounds are detectable from more than 50 km away.

IV.A.2.b(2) Oil and Gas Development and Production Activities. There are two oil-production facilities on artificial islands in the Beaufort Sea (Endicott/Duck Island and Northstar). Richardson and Williams (2004) summarized results from acoustic monitoring of the offshore Northstar production facility from 1999-2003. Northstar is located on an artificial gravel island in the central Alaskan Beaufort Sea. In the open-water season, in-air broadband measurements reached background levels at 1-4 km and were not affected by vessel presence. However, Blackwell and Greene (2004) pointed out that "...an 81 Hz tone, believed to originate at Northstar, was still detectable 37 km from the island." Based on sounds measurements of noise from Northstar obtained during March 2001 and February-March 2002 (during the ice-covered season), Blackwell et al. (2004) found that background levels were reached underwater at 9.4 km when drilling was occurring and at 3-4 km when it was not. Irrespective of drilling, in-air background levels were reached at 5-10 km from Northstar.

During the open-water season, Northstar-associated vessels such as tugs, self-propelled barges, and crew boats were the main contributors to underwater sound levels, with broadband sounds from such vessels often detectable approximately 30 km offshore. In 2002, sound levels were up to 128 dB re 1 μPa at 3.7 km when crew boats or other operating vessels were present (Richardson and William, 2003). In the absence of vessel noise, underwater-averaged broadband island sounds generally reached background levels 2-4 km from Northstar. Underwater sound levels from a hovercraft, which BPXA began using in 2003, were quieter than similarly sized conventional vessels.

IV.A.2.b(3) Miscellaneous Sources. Acoustical systems are associated with some research, military, commercial, or other vessel use of the Beaufort Sea. Such systems include multibeam sonar, sub-bottom profilers, and acoustic Doppler current profilers. Active sonar is used for the detection of objects underwater. These range from depth-finding sonar, found on most ships and boats, to powerful and sophisticated units used by the military. Sonar emits transient, and often intense, sounds that vary widely in intensity and frequency. Acoustic pingers used for locating and positioning oceanographic and geophysical equipment also generate noise at high frequencies. LGL, Ltd. (2005) describes many examples of acoustic navigational equipment.

IV.A.2.c. Seismic Sound. The oil and gas industry in Alaska conducts marine geophysical surveys in the summer and fall, and on-ice seismic surveys in the winter, to locate geological structures potentially capable of containing petroleum accumulations. These surveys use individual airguns or a combination of individual airguns called an airgun array to produce high-energy sound waves that typically are aimed directly at the seafloor. The sound is created by the venting of high-pressure air from the airguns into the water column and the subsequent production of an air-filled cavity (a bubble) that expands and contracts, creating sound with each oscillation. Airgun sizes are quoted as chamber volumes in cubic inches, and individual guns may vary in size from a few tens to a few hundreds of cubic inches. While the seismic airgun pulses are directed towards the ocean bottom, sound propagates horizontally for several kilometers (Greene and Richardson, 1988; Hall et al., 1994). In waters 25-50 m deep, sound produced by airguns can be detected 50-75 km away, and these detection ranges can exceed 100 km in deeper water (Richardson et al., 1995). In addition to the airgun arrays, vessels also tow long cables with hydrophones (streamers), which detect the reflected airgun-generated sounds from the seafloor.

Seismic-survey sounds vary, but a typical two-dimensional/three dimensional (2D/3D) seismic survey with multiple airguns would emit energy at about 10-120 Hz, and pulses can contain energy up to 500-1,000 Hz (Richardson et al. 1995). Goold and Fish (1998) recorded a pulse range of 200 Hz-22 kHz from a 2D survey using a 2,120-cubic inch (in^3) array.

Richardson et al. (1995) summarized that typical signals associated with vibroseis sound source used for on-ice seismic survey sweep from 10-70 Hz, but harmonics extend to about 1.5 kHz (Richardson et al., 1995). In this activity, hydraulically driven pads mounted beneath a line of trucks are used to vibrate, and thereby energize the ice. Noise incidental to the activity is introduced by the vehicles associated with this activity.

Safety radii traditionally are established around a seismic-survey operation to help prevent potential harm to marine mammals that are exposed to the high-energy sound sources. The safety radii around an airgun array vary with water depth. Tolstoy et al. (2004) provide both predicted and measured values for a variety of airgun configurations ranging from 2-20 airguns. Recent National Marine Fisheries Service (NMFS) incidental harassment authorizations (IHA's) (e.g., Lamont-Doherty, 2005; University of Alaska, 2005) used the data from Tolstoy et al. (2004) to estimate safety radii and exclusion zones for shallow (less than [<]100 m), intermediate, (100-1,000 m), and deep (greater than [>] 1,000 m) waters, depending on the type of airgun configuration used.

The NMFS has established two levels of harassment: Level A and Level B. Simplified, Level A harassment has the potential to injure a marine mammal, while Level B harassment is a disturbance impact. Current Level A harassment criteria for nonexplosive sounds are 180 dB for cetaceans and 190 dB for pinnipeds. A Level B harassment criterion for impulse noises is 160 dB. These criteria are then coupled with existing data (e.g., Tolstoy et al., 2004) or field-test data to determine exclusion zones or safety radii on a case-by case basis based on water depths and airgun configurations. Typically, lower output systems produce smaller exclusion zones.

IV.A.3. Oil-Spill-Risk Analysis. This section summarizes information on the oil-spill data and assumptions we use in the analysis of large spills in this EA as well as new information about oil spills relevant to the Proposed Action and its alternatives. This information has become available since the publication of the Beaufort Sea multiple-sale EIS in February 2003 and the Sale 195 EA in 2004.

Information regarding the source, type, and sizes of oil spills; their behavior; the estimated path they follow; and the conditional remain the same as discussed in the multiple-sale EIS in Section IV.A and Appendix A. For purposes of analysis, we assume one large spill of 1,500 barrels (bbl) or 4,600 bbl for crude or diesel oil, depending upon whether the assumed spill originates from a platform or a pipeline.

In our analysis, we assume the following fate of the crude oil without cleanup. After 30 days in open water or broken ice:

- 27-29% evaporates,
- 4-32% disperses, and
- 28-65% remains.

After 30 days under landfast ice:

- nearly 100% of the oil remains in place and unweathered.

The chance of one or more large spills occurring is derived from two components: (1) the spill rate and (2) the oil production estimates. The oil production estimate remains 460 million barrels (MMbbl) for the entire sale area, as discussed in the Beaufort multiple-sale EIS (USDOI, MMS, 2003:Sec. II.B). This resource volume is undiscovered and there is no accurate way to predict the size and location of future commercial fields. Because sufficient historical data on offshore arctic oil spills for the Beaufort Sea region do not exist to calculate a spill rate, a model based on a fault-tree methodology was developed and applied for the Beaufort multiple-sale EIS (Bercha Group, Inc., 2006). Using fault trees, oil-spill data from the offshore Gulf of Mexico and California were modified and incremented to represent expected performance in the Arctic. The multiple-sale EIS and the Sale 195 EA explain that the confidence estimate includes only part of the variability in the Arctic effects on the spill rate. During Fiscal Year 2004, MMS procured the study NSL AK-04-02, entitled *Improvements in the Fault Tree Approach to Oil Spill Occurrence Estimators for the Beaufort and Chukchi Seas*. The study included the non-arctic variability of spill frequency and spill size. An implication from this study for this EA is that the chance of one or more large spills increased from 8-10% (USDOI, MMS, 2003:Section IV.A.4.a.(1)) to 21% for Sale 202. Appendix C discusses this study further, and the reader is directed to Appendix C.

Considering the variance in the arctic and non-arctic effects, our best estimate of the spill rate for large spills (greater than or equal to [≥] 1,000 bbl) from platforms and pipelines total is that there may be 0.53 oil spills (95% confidence interval 0.35-0.73 oil spills) per billion barrels produced. We are 95% confident that the spill rate for large spills from platforms and pipelines will be no more than 0.73 spills per billion barrels produced.

Using the platform and pipeline spill rates to estimate the mean spill number, we estimate the following: the chance of one or more large pipeline spills would be 9%, and the chance of one or more large platform spills would be 13-14% for Alternative VII, the Proposed Action and its alternatives over the life of the project. The chance of one or more large spills from platforms and pipelines combined is 21% versus 8-10% (USDOI, MMS, 2003:Section IV.A.4.a.(1)). Using the spill rate at the 95% confidence interval, the chance of one or more large spills from platforms and pipelines combined ranges from 14-29%. Appendix C discusses how these spill rates were derived, and the reader is directed to Appendix C for more detail.

Regardless of the likelihood of future production or the chance of spill occurrence, for purposes of analysis we analyzed the consequences of one large oil spill.

IV.A.4. Oil-Spill Prevention and Response. The Beaufort Sea multiple-sale EIS explains that MMS has standard regulations with regard to both the prevention of spills and response to spills.

IV.A.4.a. Spill Prevention. The MMS safety and pollution prevention regulations (30 CFR 250 and 254) govern oil, gas, and sulfur exploration, development, and production operations on the OCS. These Federal regulations require that OCS exploration and development are conducted according to the OCS Lands Act (OCSLA); the lease or right-of-way permit requirements; and other applicable laws, regulations, and amendments. The regulations establish strict regulatory requirements to prevent oil spills. The regulations address topics such as shallow-hazards surveys; well design and construction; redundant well-control equipment; well-control training; emergency plans for adverse weather; platform design and construction verification; production safety systems; subsurface safety valves; production safety equipment training; and pipeline design, operation, maintenance, and monitoring.

The MMS conducts on-site inspections for compliance with environmental protection measures. The Alaska Region uses a Potential Incident of Noncompliance (PINC) checklist developed from the MMS safety and pollution prevention regulations. In addition to the PINC list, the Alaska Region also develops project-specific compliance checklists highlighting any unique environmental protection measures. This checklist includes mitigation adopted by the operator as described in their OCS plan and conditions of approval imposed by the Alaska Region. Through the compliance and inspection process, MMS ensures that the stipulations of all the items on the checklists are met by the lessee. In the event of noncompliance, MMS has the authority to shut down operations until compliance is achieved.

The Beaufort Sea Multi-Sale final EIS noted that leak detection of chronic small leaks over an extended period of time from buried subsea pipelines under the ice has been a concern. One of the requirements placed on the approval of the Northstar pipeline was the requirement to develop a prototype leak-detection system to be used in addition to the two proposed state-of-the-art systems. BPXA met this requirement by installing a German leak detection system, Leck Erkennurgs Ortungs Sytems (LEOS), which was developed 20 years ago for a pipeline project in Bavaria, Germany (*Oil and Gas Journal*, 2002). As stated in the article, the LEOS system detects a leak by collecting vapor through a liquid impermeable acetate layer within a perforated tube. The system is tested every 24 hours, and the sensitivity of the system depends on the type of the hydrocarbon being detected, proximity to the leak and, to a lesser extent, on the type of soil surrounding the sensor tube. The LEOS system was installed as part of the bundled-pipeline systems for the Northstar Project. Prior to transporting oil through the pipeline, the LEOS system was checked to ensure it was functioning properly (*Oil and Gas Journal*, 2002). As noted in the article, "After a year of operation the LEOS systems has been field calibrated to account for increasing background methane due to soil warming" (*Oil and Gas Journal*, 2002). The ability to detect hydrogen from all the anodes demonstrates the system is working. The article notes the leak-detection thresholds for fluids is <1 liter per hour and <1 m^3 per hour for gas. This type of technology will help prevent large, undetected oil spills from small, chronic leaks under the ice.

One method to determine whether a leak has occurred during solid-ice conditions is to drill holes through the ice surface at various intervals throughout the solid-ice season. The MMS and others continue research to develop new technology to detect leaks in both solid-ice and broken-ice environments. Field trials for detecting oil under ice using remote sensing and detection technologies were conducted recently in the Beaufort Sea in the first quarter of 2007. Methods to date include satellite imagery, forward-looking infrared radar, acoustic-detection systems, and external pipeline leak-detection systems that identify hydrocarbons in the water column through a permeable membrane.

The MMS requires that pipelines be designed to accommodate site-specific environmental loads, including ice and permafrost. Pipelines include real-time leak-detection systems that measure changes in pressure or volumetric measurements between the start and end of the pipeline. Pipelines must be protected against internal and external corrosion using anodes, protective coatings and chemical inhibitors. Pipelines are monitored using smart pigs (instruments that are run inside a pipeline) that can detect potential corrosion, settlement, or other changes to the pipeline design. Pipeline operators are required to have scheduled maintenance programs to correct potential problems with pipelines that could result in an oil spill. The MMS monitors these pipeline activities.

IV.A.4.b. Spill Response. As also explained in the Beaufort Sea multiple-sale final EIS, each OCS permittee is required to have an Oil-Spill-Response Plan with sufficient cleanup equipment and trained personnel to meet Federal and State regulations. The Federal regulations are found in 30 CFR 250.300 and 254 and 40 CRF 110, 112, and 300. To help comply with these regulations, oil and gas companies have combined their capabilities in a joint spill-response organization, Alaska Clean Seas (ACS).

The spill response organization at Prudhoe Bay, ACS, has been conducting routine drills in the Arctic since the 1980's. The ACS and an offshore operator, BPXA, have determined that, based on the tests of their equipment and tactics in the shallow and nearshore environment around the Northstar development, smaller vessels are more flexible platforms for conducting response activities in the changing conditions of the Beaufort Sea. The focus of the BPXA spill-response planning and equipment has shifted from the barge-based concept to one using smaller, more maneuverable vessels to conduct recovery operations even in broken ice conditions. The smaller vessels are better able to access pools of collected oil against the ice edge, move between floes and large pieces of ice, and respond more quickly to changing weather and ice conditions. Two river-class tugs, dedicated for oil-spill response activities, are now anchored at West Dock and ready for immediate deployment. These vessels enable skimming operations to be conducted in water depths of 3 feet (ft) and less.

To ensure that logistics support is readily available, BPXA now intends to employ a smaller logistics vessel such as a river-class tug that will service the skimming vessels and any staging points established for spill-response activities. This vessel will be able to navigate in shallower waters than the barge and tug system currently used. In the course of response tactic testing, BPXA also discovered that for response efforts for the Northstar facility, it is time-effective to cycle the minibarges used for storing recovered oil to West Dock for lightering and return to service. This also allows the empty minibarges to be used as cargo barges to carry supplies back out to on-water skimming operations.

The barge was initially thought to provide safety advantages in heavy ice and weather conditions, but reviews of safety incidents have indicated that more safety hazards exist on the barge than on smaller vessels. Also in the area around Northstar, smaller vessels can respond quickly to changes in weather and return to shore instead of relying on the barge for protection. A barge-based spill-response system would be a more appropriate approach, when development moves further offshore into deeper waters and a large logistics platform is needed because of the distance from shore.

In addition to mechanical recovery equipment, ACS also maintains the largest inventory of fire boom in the United States for the purpose of conducting in situ burns (ISB) of spilled oil in the environment. An ISB burns oil as it floats on the water's surface and has been demonstrated to remove in excess of 90% of oil from the water surface (Buist and S.L. Ross Environmental Research, Ltd., 1999). During broken-ice conditions, the ice acts as a natural containment boom concentrating the oil and enabling greater usage of ISB tactics. Responders would be able to conduct more burns with less equipment, thereby removing more oil from the environment and limiting sensitive resource exposure to the oil.

IV.A.5. Seismic Surveying. This section updates the assumed level of activity first for seismic exploration with 2D/3D surveys, and then for high-resolution site-clearance surveys. The recent seismic-survey PEA assumed that 14 2D/3D seismic surveys would be conducted in the Beaufort Sea between 2006 and 2010, but the estimate included some surveys in State of Alaska water (USDOI, MMS, 2006a:Table III.C-1). The multiple-sale EIS assumed that, as a result of Sale 202, 11 exploration and delineation wells would be drilled between 2010 and 2018; however, it did not specify the amount of 2D/3D survey for this exploratory drilling (USDOI, MMS, 2003:Table IV.A-3). Because the projected number of wells for exploration/delineation has changed only slightly (i.e., from 11 in the multiple-sale EIS to less than 14 in the seismic-survey PEA), the level of seismic for exploration/delineation also probably has changed only slightly.

With regard to high-resolution site-clearance surveys, the projected amount has approximately doubled since the assessment for the multiple-sale final EIS. Specifically, the projection for site-specific seismic surveys from the multiple-sale final EIS (USDOI, MMS, 2003:Sec. IV.A.2.b(1)(a)) is that:

> We estimate each survey would cover roughly six OCS blocks (9 square miles or 23 square kilometers) for each exploration well. For Sales 186, 195, and 202, the total area covered by these surveys would equal 54 square miles (approximately 138 square kilometers). The average time needed to survey each site should range between 2 and 5 days, allowing for down time for bad weather and equipment failure.

As stated, 54 square miles (mi^2) (approximately 138 square kilometers [km^2]) was the estimated amount of seismic exploration for Sales 186, 195, and 202.

The seismic-survey PEA contains new projections of high-resolution seismic surveys. The projected amount of seismic activity in the Beaufort OCS between 2006 and 2010 is 11 high-resolution site-clearance surveys, with 3 surveys during the peak year (Table III-4).

Assuming still that each of the 11 high-resolution surveys would cover roughly 6 OCS blocks (9 mi^2 or 24 km^2), the total estimated amount of seismic exploration for the Beaufort Sea is 99 mi^2 (approximately 226 km^2). The 99 mi^2 is about twice the former projection of 54 mi^2.

IV.B. Updated Information on the Affected Environment.

This section updates the information that was unavailable at the time of the Sale 195 EA (USDOI, MMS, 2004). The section includes an introduction, updates of the information on the specific resources, and a brief summary of the updated information.

The resources in this section are organized according to the severity of the potential impacts as determined in the multiple-sale final EIS and the Sale 195 EA. The information is updated first for the resource with potentially significant levels of effects: (a) subsistence-harvest patterns and sociocultural systems; (b) coastal and marine birds; and (c) local water quality. It is updated next for bowhead whales, polar bears, and other resources. Information on subsistence-harvest patterns and sociocultural systems is updated first also because of comments on the Request for Information for the proposed lease sale (Appendix A). Information on Environmental Justice and Coastal Zone Management is updated last, partly because of different scales of effects and of significance criteria. Detailed updates of the information for some resources are contained in Appendix D.

After publication of the Sale 195 EA (USDOI, MMS, 2004), the Arctic Climate Impact Assessment (ACIA, 2004) became available. The EA and ACIA contain similar conclusions about climate change. For example, the multiple-sale final EIS concluded that the potential cumulative effects on several resources would be a primary concern and would warrant continued close attention and effective mitigation practices. The Sale 195 EA identified ringed seals and other ice-dependent pinnipeds as additional resources of primary concern due to the speculative effects of climate change in the Arctic. And the ACIA Key Finding Number 4 is similar, stating in part that reductions in sea ice will drastically shrink marine habitat for some ice-dependent animals. The following summaries show that the distribution and abundance has changed for several ice-associated resources in the proposed lease-sale area—changes that correlate with the Arcticwide retreat of the summer ice cover.

IV.B.1. Subsistence-Harvest Patterns and Sociocultural Systems. This section contains a summary of the updated information on subsistence-harvest patterns and sociocultural systems presented in Section 1 of Appendix D. It updates the information on subsistence-harvest patterns and sociocultural systems that might be affected by proposed Beaufort Sea Lease Sale 202, which was assessed in the multiple-sale final EIS and Sale 195 EA (USDOI, MMS, 2003, 2004). The final EIS and EA summarize information about subsistence and sociocultural systems in especially the villages of Barrow, Nuiqsut, and Kaktovik that have offshore subsistence-harvest areas within the proposed Sale 202 area. The information was updated recently in the seismic-survey PEA (USDOI, MMS, 2006a:Sec. III.G.2.a). The PEA is available on the MMS web site at: http://www.mms.gov/alaska/ref/pea_be.htm.

The MMS is conducting long-term environmental monitoring around the Northstar development, which is near the Nuiqsut subsistence-whaling area. As part of this monitoring effort, MMS has conducted a multiple-year collaborative project with Nuiqsut whalers that describe present-day subsistence whaling practices at Cross Island to empirically verify any changes to whaling due to weather, ice conditions, or oil and gas activities. The project findings were summarized during the 2005 MMS Information Transfer Meeting (USDOI, MMS, 2005a). Overall, the project has shown that the Nuiqsut whalers have continued to obtain their quota of whales. However, Nuiqsut whalers reported the following recent changes in whale behavior and whaling practices:

In 2004:

- Ice conditions in 2004 were even more moderate than in previous years.
- Weather prevented scouting a significant number of days but not as many days as in 2003.

- The level of whaling effort, as measured by time spent out on the water, was about twice that of 2003, but still much less than in 2002 or 2001.
- Whalers reported seeing many whales; whalers did not compare one year to another, but 2004 was probably comparable to 2003 in terms of whales sighted, and "better" than in 2002 or 2001.
- Whalers found whales relatively close to Cross Island; whales were harvested about the same distance from Cross Island in 2004 as in 2003 (which was closer than in 2001 or 2002).
- Whalers took shorter trips, both in terms of length and time duration, than in 2002 or 2001, but longer than in 2003 (which is why total effort was greater in 2004 than in 2003).
- No whaler explicitly mentioned observing skittish or "spooky" whale behavior.

Possible causes suggested by whalers for these behavioral changes were:

- The lack of ice that could have moderated the effects of the wind.
- Weather generally was poor, and whalers sometimes went scouting in relatively marginal conditions.
- Whales may have been more difficult to spot, due to wave height.
- Whales could have been traveling more rapidly than in past years (Galginaitis and Funk, 2006a).

In 2005:

- Whalers encountered a great deal of ice in 2005, which was a dramatic change from the previous four years.
- Weather also was very unfavorable and was dominated by strong east winds.
- Whalers saw relatively few whales in 2005 compared to previous years; swells and waves due to wind made spotting and observing difficult.
- In most cases, whalers were not able to follow or chase whales long enough to have a good opportunity for a strike.
- Whalers indicated that whales were traveling fast, not staying on the surface very long, and changing directions in unpredictable ways when first sighted.
- Ice and weather were not considered to be factors in making whales more "skittish."
- There were no reports of whale feeding behavior.

Possible causes suggested by whalers for these behavioral changes were:

- Heavy ice cover was encountered on most days.
- Significant ice cover allows whales to "hide" and makes them more difficult to spot.
- Significant ice cover allows whales that are seen to escape more easily and makes them more difficult to follow.
- "Spooked" behavior by whales was attributed to their reactions to encounters with barges and other vessel activity in the area.
- Whalers believed that the migration of whales in 2005 was similar to that of previous years, but that ice and weather conditions prevented them from reaching the whales.
- The same ice and weather conditions made nearshore waters the preferred operating areas for nonwhaling vessel traffic and increased potential encounters with whalers (Galginaitis and Funk, 2006b).

According to Galginaitis, "the need for a better mechanism to implement the common goal of conflict avoidance for years of extreme environmental conditions as 2005 is quite obvious" (Galginaitis and Funk, 2006b).

The Nuiqsut subsistence-whaling area is discussed in the Sale 195 EA (USDOI, MMS, 2004:Appendix H). Appendix H illustrates the extent of Nuiqsut whaling crew voyages for the 2001 and 2002 whaling seasons. The data just cited have been updated. Updates were gathered as part of the ongoing MMS Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA) monitoring effort in development regions

(Galginaitis and Funk, 2004, 2005), which reports on recent data about the level of subsistence activity around Cross Island. For example, the reports explain that during 2001, the four whaling crews on Cross Island spent more than 10 hours on each scouting trip looking for whales. The total amount of time scouting was about 600 hours (Galginaitis and Funk, 2004). Rough weather prevented scouting during about one-third of the time that the whalers were on Cross Island during 2001 (Galginaitis and Funk, 2004:24) and about half of the time during 2003 (Galginaitis and Funk, 2005:18).

The unusually rough water that restricted the scouting for whales might have been related to the unusual retreat of the summer ice cover in the Beaufort Sea during recent years, which created an unusually long fetch (see Sec. IV.A.1). The changes in the ice cover and some of its effects on coastal erosion were summarized by Comiso (2005) and Wisniewski (2005). Comiso (2005) showed the minimum extent and minimum area for the arctic ice cover from 1979-2003, depicted in a graph as determined by satellite imagery. The graph illustrated that the ice cover was unusually small during 2003—the year when Nuiqsut subsistence-whaling activity was cut to half of its normal time by rough water.

In summary, the recent offshore subsistence-whale hunts have been affected by the retreat of the ice cover far from the coast. This contrasts with the situation decades ago, when the whale hunts were sometimes limited by heavy ice covers.

IV.B.2. Marine and Coastal Birds. This section summarizes the updated information on marine and coastal birds presented in Section 2 of Appendix D. It summarizes information that has become available since publication of the multiple-sale EIS, incorporating information from recent research, the Sale 195 EA and the PEA for seismic surveys in the Chukchi and Beaufort seas (USDOI, MMS, 2003, 2004, 2006a). The MMS also hosted an information exchange meeting October 30-31, 2005 (Appendix F), which included presentations by researchers on the latest information on bird species of concern in the Beaufort and Chukchi seas. The updated information includes recently obtained research results on size, status, trends, and distribution of eiders, the long-tailed duck, the yellow-billed loon, and other bird (species/guilds) populations potentially at risk of substantial effects from the Proposed Action. Also included is new information on breeding biology, habitat use, and migratory patterns that may help to improve our understanding of the vulnerability of these species to oil and gas exploration and development activities.

As described in the multiple-sale EIS, spectacled and Steller's eiders are listed as threatened under the Endangered Species Act (ESA). The Kittlitz's murrelet (*Brachyramphus brevirostris*) is designated a candidate species under the ESA (69 *Federal Register* (*FR*) 24876-24904) and is thought "likely to occur" in the Beaufort Sea by the Fish and Wildlife Service (FWS) (USDOI, FWS, 2006a). The MMS, however, has no records of its occurrence in the Beaufort Sea Sale 202 project area. If any Kittlitz's murrelets occur in or near the project area, their numbers would be expected to be very small and there would be a low potential for effects on this species.

IV.B.2.a. Spectacled Eider. Aerial surveys of spectacled eiders conducted in June 2005 on the Arctic Coastal Plain resulted in a population index of 7,820, which was above the 2004 index of 5,985 and the long-term average of 6,916 (Larned, Stehn, and Platte, 2005). The 13-year trend has remained level, and the mean annual population growth rate for the last 7 years was not statistically different than 1.0 (a stable population = 1.00) (Larned, Stehn, and Platte, 2005). For 2005, one can extrapolate crude estimates of relative contributions (%) for each of the breeding populations. Using North Slope (n = 7,820) aerial survey estimates (Larned, Stehn, and Platte, 2005) and corrected Yukon-Kuskokwim Delta (Y-K Delta) nest estimates from ground plots (n = 5,822) (in Platte and Stehn, 2005) and dividing by the Arctic Russian 'population' estimate (146,000; USDOI, FWS, 1999), roughly 5.1% and 3.8% of the world spectacled eiders nested on the North Slope and Y-K Delta, respectively (less than or equal to [$\leq$]2% if one considers Petersen, Larned, and Douglas, 1999 estimates).

Changes in benthic habitats of the wintering area have been suggested as one cause of interannual population changes in spectacled eiders. Petersen and Douglas (2004) developed annual indices based on historic remotely-sensed ice conditions and weather patterns and literature-based descriptions of benthic communities. In general, Petersen and Douglas (2004) found that annual population estimates on the breeding grounds can be negatively impacted by extended periods of dense sea ice and weather during the previous winter. However, the examination of population indices did not support the hypothesis that changes in the benthic community on the wintering grounds has contributed to the decline or inhibited the recovery of spectacled eiders breeding in western Alaska.

IV.B.2.b. Steller's Eider. When the Steller's eider was petitioned in December 1990 to be listed as endangered under the ESA, listing the species rangewide did not appear to be warranted given the relatively large number (~138,000) of Steller's eiders observed on the wintering area(s) in southwest Alaska. However, the Alaska breeding population of Steller's eiders was listed as threatened on June 11, 1997, based on an apparent contraction of the species' breeding range in Alaska (e.g., Kertell [1991] reported that Steller's breeding virtually was absent from 1975-1990 and due to a perceived increase in its vulnerability to extirpation [62 *FR* 31,748-31,757]).

So few Steller's eiders were detected during the annual eider breeding population survey of the Arctic Coastal Plain in 2005 that Larned, Stehn, and Platte (2005) concluded it was of little value in calculating a population trend. Similarly, very few Steller's eiders are observed during annual aerial population surveys designed for common eiders in nearshore and along barrier islands (Dau and Larned, 2004, 2005).

Steller's eiders were surveyed in marine waters within 100 km of the Beaufort Sea shoreline east of Barrow to Demarcation Point by Fischer and Larned (2004) during the summers 1999-2001. Steller's eiders were the least numerous (n=3) of all the birds (27, 517 total) observed during the surveys (Fischer and Larned 2004).

IV.B.2.c. Yellow-Billed Loon. Aerial breeding-pair surveys have been conducted in late June on the Arctic Coastal Plain for the past 19 years (Mallek, Platte, and Stehn, 2005). The yellow-billed population index for 2004 was 2, 262 and was 22.5% below the previous 18-year average. The 19-year growth trend is flat. However, the Center for Biological Diversity (CBD) petitioned the FWS to list the yellow-billed loon as an endangered or threatened species under the ESA on March 30, 2004 (CBD, 2004). The petition identifies threats to the species as oil and gas development, human disturbance, increased predation, small population size and low productivity, marine health, incidental bycatch from fishing, hunting, and the inadequacy of existing regulatory mechanisms. The FWS has not issued a 90-day finding on the CBD petition but has worked with local, State, and Federal resource agencies to draft a Conservation Agreement for the yellow-billed loon (YBLO), available for public comment in April 2006 (71 *FR* 13,155-13,157). The goal of the draft Conservation Agreement was to "... protect YBLO and their breeding, brood-rearing, and migrating habitats in Alaska, such that current or potential threats in these areas are avoided, eliminated or reduced to the degree that the species will not become threatened or endangered from these threats within the foreseeable future."

IV.B.2.d. Other Bird Species. Recent data on the king eider, common eider, long-tailed ducks, etc. are summarized in Appendix D. Most other species in the proposed Beaufort Sea lease-sale area have exhibited relatively stable populations in recent surveys, although populations of black guillemot and several shorebird species (buff-breasted sandpiper and bar-tailed godwit) are of some concern.

IV.B.3. Local Water Quality. This section contains a summary of the updated information on local water quality presented in Section 3 of Appendix D. The section updates the information in the multiple-sale final EIS and Sale 195 EA, incorporating recent research (USDOI, MMS, 2003, 2004).

Several studies showed that the hydrocarbons in marine particulate matter and sediments were characteristic of immature bitumens, shales, or coals; the degree of anthropogenic influence on the polycyclic aromatic hydrocarbon load in the Mackenzie River delta was small; and a large amount of dissolved organic carbon was carried into the coastal Beaufort Sea during peak flows at the time of river breakup in early June (USDOI, MMS, 2004). A recent study of Beaufort Lagoon inshore sediments examined the concentrations of 12 metals (copper, chromium, cadmium, nickel, vanadium, lead, tin, zinc, arsenic, barium, iron, and manganese in the mud fraction) and of total mercury and hydrocarbons (Naidu et al., 2005). The concentrations of metals and hydrocarbons generally were lower than those reported for polluted marine sediments. The hydrocarbon components in the sediments essentially were of terrestrial and biogenic sources with undetectable petroleum inputs. Another study of sediment samples through 2004 (Brown et al., 2005) analyzed for a full suite of hydrocarbons useful in determining petroleum contamination. These data from a subset of sediment cores, where deposition rates can be well established, generally show uniform levels and distributions of background hydrocarbons, extending back 50 years and more, with no discernable increases from recent offshore development activities. Preliminary results from the 2004 field season reveal hydrocarbon levels within the range of previous years. These studies confirm the multiple-sale EIS conclusion that North Slope rivers carry hydrocarbons from peat, coal, and natural seeps into the coastal waters, and that the petroleum hydrocarbon concentrations were relatively low.

Water quality in the Arctic Ocean is determined by both physical properties and chemical composition, and it may be affected by both anthropogenic and natural sources. The principal sources of pollutants entering the marine environment in general include discharges from industrial activities (petroleum industry) and accidental spills or discharges of crude or refined petroleum and other substances. The broad arctic distribution of pollutants is described in the Arctic Monitoring and Assessment Program (AMAP, 1997) report *Arctic Pollution Issues: A State of the Arctic Environmental Report.*

Available water quality data exist mainly for the Beaufort Sea area and are associated with monitoring of oil and gas development. Background hydrocarbon concentrations in Beaufort Sea waters appear to be biogenic and on the order of 1 part per billion (ppb) or less; however, sediment concentrations are relatively high compared with other undeveloped OCS areas (Steinhauer and Boehm, 1992). The greatest concentrations of hydrocarbons (suggestive of petroleum sources) were found offshore near the Colville and Kuparuk rivers. Marine sediment concentrations there are greater than riverine sediment concentrations and suggest the possibility of natural marine seeps (USDOI, MMS, 1996). Hydrocarbon concentrations in the Chukchi Sea also appear to be biogenic in origin and are typical of levels found in unpolluted marine waters and sediments (USDOI, MMS, 1996). The oil- and gas-related activities in the vicinity of Prudhoe Bay may have localized effects from year-round input of treated sewage and industrial wastes. The increased oxygen demand of these inputs may lower oxygen levels and increase turbidity.

Degradation to OCS water quality may occur from seasonal plankton blooms (a natural process); seasonal changes in water turbidity due to terrestrial runoff and shoreline erosion; and, water column stratification due to temperature differentials. Another natural source of altered water quality is sea-ice cover. As sea ice forms during the fall, particulates are removed from the water column by ice crystals as they form and are locked into the ice cover. The result is very low turbidity levels during the winter. Seasonal plankton blooms occur primarily during spring and fall, with the most active blooms during spring, as the ice cover melts and sunlight reaches the nutrient-rich surface waters.

Trace metal concentrations in the Chukchi and Beaufort seas are elevated compared to the eastern portions of the Arctic Ocean. However, these waters are still considerably lower in trace-metal concentrations than the USEPA criteria for the protection of marine life (Boehm et al., 1987; Crecelius et al., 1991).

IV.B.4. Resources With Lower Levels of Effects. Other resources are those for which a potentially significant level of effects was not identified in the multiple-sale EIS or Sale 195 EA. These resources include bowhead whales, polar bear, other marine mammals, fish and Essential Fish Habitat, and air quality.

IV.B.4.a. Bowhead Whales. This section contains a summary of the updated information on bowhead whales presented in Appendix D, Section 4.a. It updates the information in the multiple-sale final EIS and Sale 195 EA (USDOI, MMS, 2003, 2004) for proposed Beaufort Sea Lease Sale 202. The information recently was updated recently in the seismic-survey PEA and updates the information on subsistence and sociocultural systems (USDOI, MMS, 2006a:Sec. III.G.2.a). Updated information on bowhead whales also can be found in MMS' Biological Evaluation (BE) (USDOI, MMS, 2006b) on the potential effects on bowhead whales of oil and gas leasing and exploration in the Arctic OCS. The BE is available on the MMS website. The seismic-survey PEA is available on the MMS web site at: http://www.mms.gov/alaska/ref/pea_be.htm. The information on bowhead whales in the PEA and BE is incorporated by reference in this EA and summarized below and in Section 4a of Appendix D. Beluga and gray whales also inhabit the proposed lease area; information on these whales is updated in Section IV.B.2.d(3) of this EA.

There is one ESA-listed marine mammal species, the bowhead whale, that regularly and seasonally occurs within the Beaufort Sea OCS Planning Area and within areas of the Chukchi Sea that could be affected by actions within the Beaufort Sea. This population stock of bowheads is the most robust and viable of surviving bowhead populations and, thus, its viability is critical to the long-term future of the biological species as a whole. There is scientific uncertainty about the population structure of bowheads that use the Beaufort and Chukchi seas. Available new information does not indicate that there has been any statistically significant changes in the population status of the Bering-Chukchi-Beaufort Sea (BCB Seas) bowhead whale population since MMS consulted with NMFS in 2003 regarding Beaufort Sea Lease Sale 195 (USDOI, MMS, 2004) or the Beaufort Sea multiple-sale EIS (USDOI, MMS, 2003). Data indicate that what is currently referred to as the Western Arctic stock (by the National Marine Fisheries Service [NMFS]) or as the BCB Seas stock (by the International Whaling Commission [IWC]) of bowheads is increasing in abundance. All recent available information indicates that the population has continued to increase in abundance over the past decade and may have doubled in size since about 1978. The estimated current annual rate of increase is similar to the estimate for the 1978-1993 time series. There are scientific analyses indicating that BCB Seas bowheads may have reached or are approaching, the lower limit of their historic population size. There is discussion in the scientific and regulatory communities regarding the potential delisting of this population. The cause of the historic decline of this species was overharvesting by commercial whalers. The primary known current human-related cause of mortality is a regulated subsistence hunt by Alaskan Natives. Conservation concerns include: the introduction of noise and related disturbance from existing, but especially potential future, oil and gas activities; shipping; other vessel traffic; hunting in calving, migration, and feeding areas; contamination of their habitat by pollutants from planned and potential future oil and gas activity and by other local and distant pollution sources; uncertain potential impacts of climate warming; vessel strikes; and entanglement. No data are available indicating that, other than historic commercial whaling, any previous human activity has had a substantial, adverse impact on the current status of BCB Seas bowheads or their recovery. The uncertainty of the stock structure adds some uncertainty to summaries of the status of bowheads that may be impacted by the Proposed Action. Currently available information indicates that bowheads that use the Alaskan Beaufort Sea and Chukchi Sea Planning Areas are resilient at least to the level of human-caused mortality and disturbance that currently exists, and has existed since the cessation of commercial whaling, within their range. Data indicate that at least some bowheads are extremely long-lived (100+ years or more), and this longevity can affect the potential for a given individual to be exposed to a high number of disturbance and pollution events in its lifetime.

Geographic areas of particular importance to this stock include the spring lead system in both the Chukchi and Beaufort Seas and areas that are used for feeding by large numbers of individuals in some years, but not in all years. However, the importance of feeding in particular areas to the overall food requirements of the population or segments of the population is not clear. Available information indicates that most or much of the total calving of the bowheads, which comprise most of the bowhead whales in the world, occurs during the spring migration in, and adjacent to, the spring lead systems especially in the eastern Chukchi Sea and also in the Beaufort Sea. Bowheads feed in the Alaskan Beaufort Sea, but the extent and location of that feeding varies widely among years and locations. Bowheads are extremely long lived, slow growing, slow to mature, and currently have high survival rates. These characteristics affect their vulnerability to pollution and disturbance in their environment. They are also unique in their ecology and their obligate use of lead systems to transit to summering grounds. This reliance on spring leads, and the fact that they apparently calve during the spring northward migration, also are features of their ecology that heightens their vulnerability to disturbance and oil spills in some areas.

Available new information does not indicate there has been any substantial change in the distribution of this population during the autumn in the Beaufort Sea since NMFS wrote its Biological Opinion in 2001. Recent data on distribution, abundance, or habitat use in the Chukchi Sea are not available, and there is little information about summer use in the Beaufort Sea. We have taken available information into account in the update of our analyses of potential effects on this population.

The MMS has recently prepared a Biological Evaluation (USDOI, MMS, 2006b). Information provided in this section provides, updates and, in some cases, summarizes information from the Beaufort Sea multiple-sale EIS (USDOI, MMS, 2003), the Biological Evaluation for Lease Sale 195, and the EA for Sale 195 (USDOI, MMS, 2004) and supplements this information with more recent information on the Western Arctic stock of the bowhead whale. All available information is considered in our update of our analyses of the potential effects of the Proposed Action on bowhead whales. Additionally, we provide an update of information related to evaluating potential cumulative anthropogenic impacts on this population, as defined under the National Environmental Policy Act (NEPA). As noted in the beginning of this document, we incorporate by reference all information provided previously in the Beaufort Sea multiple-sale final EIS, which provided a detailed evaluation of the bowhead whale and its habitat, the potential effects of three lease sales in the Beaufort Sea Planning Area and related activities on this stock of whales, and an evaluation of cumulative effects on this population stock.

The following are some additional sources of information that have been reviewed for this update of bowhead information. The NOAA and the North Slope Borough (NSB) convened a Workshop on Bowhead Whale Stock Structure Studies in the Bering-Chukchi-Beaufort Seas: 2005-2006 (USDOC, NOAA and NSB, 2005). The Scientific Committee of the IWC reviewed and critically evaluated new information available on the bowhead whale at their 2003 and 2005 meetings (IWC, 2003a, 2005a,b) and conducted an in-depth status assessment of this population in 2004 (IWC, 2004a,b). The MMS published *Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 2002-2004* (Monnett and Treacy, 2005). The report described the yearly distance of bowhead whale sightings from the coast, and specifically calculated the statistical mean value and the 25th and 75th quartile range for the sightings in two survey Regions. The report concludes that mean values for both Regions in all 3 years were within the respective 25th – 75th quartile ranges for all years (1982-2001). The *Final 2003 Alaska Marine Mammal Stock Assessment* (Angliss and Lodge, 2003) for this stock remains the most recent finalized stock assessment available, as no stock assessment was finalized in 2004. There is a revised draft stock assessment for 2005 available for this population (Angliss and Outlaw, 2005). The NMFS published the *Notice of Determination - Endangered and Threatened Species; Final Determination on a Petition to Designate Critical Habitat for the Bering Sea Stock of Bowhead Whales* (67 *FR* 55767). Details on bowheads that might lie outside the scope of the material provided here, in our multiple-sale EIS, or in our EA for proposed Lease Sale 195, may be provided in one or more of these documents. We have reviewed and considered information in these documents and other available information in our evaluation of potential environmental impacts.

IV.B.4.b. Polar Bear. This section contains a summary of the updated information on the polar bear in Appendix D, Section 4.b. The section updates the information in the multiple-sale final EIS, incorporating information from the Sale 195 EA, the seismic-survey PEA, and recent research (USDOI, MMS, 2003, 2004, 2006a).

On February 16, 2005, the CBD petitioned the FWS to list the polar bear as a threatened species under the ESA due to global warming and the melting of their sea ice habitat (CBD, 2005). In June, 2005 the World Conservation Union/Species Survival Commission (IUCN/SSG) Polar Bear Specialist Group (PBSG) concluded that the IUCN Red List classification of the polar bear should be upgraded from Least Concern to Vulnerable, based on the likelihood of an overall decline in the size of the total world polar bear population by more than 30% within the next 35-50 years. The principle reason for this projected decline is "climatic warming and its consequent negative effects on the sea ice habitat of polar bears" (IUCN/PBSG press release, 2005). On February 7, 2006, the 90-day finding by the FWS determined that the CBD petition contained sufficient information indicating that listing polar bears as threatened may be warranted. Therefore, the FWS is conducting a 12-month status review of the species to determine whether listing is warranted; if that finding is positive, the FWS will publish a proposed rule to list the species.

Recent information suggests that the Southern Beaufort Sea (SBS) polar bear population may be smaller than previously estimated. In May, 2006, U.S. Geological Survey (USGS) researchers stated that:

> High recapture rates during capture/recapture studies in 2005 and 2006 suggest that the number of polar bears in the Beaufort Sea region may be smaller than previously estimated. Final analyses of

these new population data will not be completed until early in 2007, but preliminary evaluations of ongoing data collection suggest that conservative management is warranted until final estimates are calculated (S. C. Amstrup and E. V. Regehr, pers. comm.).

Reduction in the summer ice cover in the Beaufort Sea would affect polar bears in several ways. For example, the Sale 195 EA explained that reductions in sea-ice coverage would adversely affect the availability of pinnipeds as prey for polar bears (USDOI, MMS, 2004:Appendix I, Sec. I.2.e(1)). Also, summer sea-ice reduction would affect the severity of storm events along the coast of Alaska, with consequent effects on polar bears. When the ice cover is reduced, particularly during late summer, the available open-water surface increases, and waves are able to grow in height. Specifically, rough weather prevented scouting about one-third of the time that whaling crews were on Cross Island during 2001 (Galginaitis and Funk, 2004:24) and about half of the time during 2003 (Galginaitis and Funk, 2005:18). The unusually rough water that restricted the scouting for whales might have been related to changes in the summer sea-ice cover during recent years, which created an unusually long fetch, as explained in Section IV.A.1. The analysis of long-term data sets indicate substantial reductions in both the extent and thickness of the arctic sea-ice cover during the past 20-40 years, with record minimum extent in 2002 and again in 2005, and extreme minima in 2003 and 2004 (Stroeve et al., 2005; NASA, 2005). Wave heights in the Beaufort Sea typically range from 1.5 meters (m) during summer to 2.5 m during fall, although maximum wave heights of 7-7.5 m are expected (Brower et al., 1988). In fact, a late-summer storm in the Beaufort in September 2000 developed waves 6-7 m high at Point Barrow (Lynch et al., 2003). Such large waves undoubtedly would induce energetic stress, or worse, if any swimming bears were unfortunate enough to be caught in them.

Polar bears are excellent swimmers and swim while actively hunting, while moving between hunting areas, and while moving between sea ice and terrestrial habitats. In June 2005, USGS researchers identified a female polar bear that apparently swam over 557 km, from Norton Sound back to the retreating pack ice in the Beaufort Sea northwest of Wainwright (Amstrup et al., 2006). Swimming is believed to be more energetically costly than walking, which helps explain why bears often will abandon the melting sea ice in favor of land, when ice concentrations drop below 50% (Derocher, Lunn, and Stirling, 2004). Polar bears also may become energetically stressed when the pack ice retreats and carries them to deeper waters beyond the productive continental shelf zone. These bears eventually may choose to swim for shore where annual food resources, such as carcasses of whales killed by Alaskan Natives, can be found along the coast. Despite being strong swimmers, energetically stressed bears are susceptible to misfortune on such long-distance swims. For example, Monnett and Gleason (2006) reported that substantial polar bear mortality may have occurred following a severe storm event in the Beaufort Sea in fall 2004. While acknowledging their limited ability to provide accurate estimates of polar bear mortality during a survey that covered about 10% of their study area, they extrapolated that 27 bears may have died as a result of this one storm; they attributed this phenomenon to longer open-water periods and reduced sea-ice cover. Considering that current human removals of the SBS population are believed to be at or near maximum sustainable levels, it could take polar bears in the SBS from 4-7 years or longer to recover from such mass mortalities (USDOI, FWS, pers. commun.).

Additionally, polar bear use of coastal areas during the fall open-water period has increased in recent years in the Beaufort Sea (Schliebe et al., 2005). In fact, nearshore densities of polar bears were usually two to five times greater in autumn than in summer (Durner and Amstrup, 2000). Aerial surveys flown in September and October from 2000-2005 revealed that 53% of the bears observed along the coast were females with cubs, and that 71% of all bears observed were within a 30-km radius of the village of Kaktovik, on the edge of the Arctic National Wildlife Refuge (ANWR) (USDOI, FWS, pers. commun.). Congregations of more than 60 polar bears and as many as 12 brown bears have been observed feeding on whale carcasses near Kaktovik in recent years during the fall open-water period (Miller, Schliebe, and Proffitt, 2006). These observed changes in polar bear distribution have been correlated with the distance to the pack ice at that time of year. The farther from shore the leading edge of the pack ice is, the more bears are observed onshore in fall (Schliebe et al., 2005).

IV.B.4.c. Other Marine Mammals. This section contains a summary of the updated information presented in Section 4.c of Appendix D. It updates the information on other marine mammals that might be affected by proposed Beaufort Sea Sale 202. The section updates the information in the multiple-sale final EIS, incorporating information from the Sale 195 EA, the seismic-survey PEA, and recent research (USDOI, MMS, 2003, 2004, 2006a). The Sale 195 EA concluded that ringed seals and other ice-dependent pinnipeds were resources of primary concern, partly because of climate change (USDOI, MMS, 2004:Appendix I, Sec. I.2.e(1)). For that reason, special attention has been focused on them.

IV.B.4.c(1) Seals. The only ice-dependent seal in the proposed lease-sale area is the ringed seal. No reliable estimate for the size of the Alaska ringed seal stock is currently available (Angliss and Outlaw, 2005), although past estimates ranged from 1.0 million to 3.6 million (Frost et al., 1988). Because of the absence of a reliable estimate, we summarize some background information. Ringed seal numbers are considerably higher in the Bering and Chukchi seas, particularly during winter and early spring (71 *FR* 9783). They are closely associated with ice and have the unique ability to maintain breathing holes in thick ice; therefore, they are able to exploit the ice-covered parts of the Arctic during the winter when most other marine mammals have migrated south (Rosing-Asvid, 2006).

In winter and spring, the highest densities of ringed seals are found on stable shorefast ice. In the summer, ringed seals often occur along the receding ice edges or farther north in the pack ice. Ringed seals seem to prefer large icefloes >48 m in diameter and often are found in the interior pack ice, where sea ice concentrations exceed 90% (Simpkins et al., 2003). Ringed seal densities in the Beaufort Sea are greatest in water with >80% ice cover (Stirling, Kingsley, and Calvert, 1981) and depths between 5 and 35 m (Frost et al., 2004). Densities also are highest on relatively flat ice and near the fast-ice edge, declining both shoreward and seaward of that edge (Frost et al., 2004). Ringed seal densities historically have been substantially lower in the western than the eastern part of the Beaufort Sea (Burns and Kelly, 1982; Kelly, 1988). The lower densities to the west appear to be related to very shallow water depths in much of the area between the shore and barrier islands. Surveys flown from 1996-1999 indicate that the highest density of seals along the central Beaufort Sea coast in Alaska occurred from approximately Kaktovik west to Brownlow Point (Frost et al., 2004). This may be due to the fact that relative productivity, as measure by zooplankton biomass, is approximately four times greater there than the average biomass in other areas of the eastern Beaufort Sea (Frost et al., 2004). Additional information on ringed seal, and on other Beaufort Sea seal species that are not ice-dependent, is included in Appendix D.

IV.B.4.c(2) Pacific Walrus. Pacific walruses range throughout the shallow continental shelf waters of the Bering and Chukchi seas, where their distribution is closely linked with the seasonal distribution of the pack ice. The juxtaposition of broken ice over relatively shallow continental shelf waters is important to them for feeding, particularly for females with dependent young that may not be capable of deep diving or long-term exposure to the frigid water. Considering this, the recent observations of nine motherless calves stranded on icefloes in deep waters off of northwest Alaska are troubling (Cooper et al., 2006). Recent trends in seasonal sea-ice breakup have resulted in seasonal sea-ice retreating off the continental shelves and over deep Arctic Ocean waters. This trend poses adaptive challenges for the walrus population (Tynan and DeMaster, 1997). In contrast, adult males generally abandon the sea ice in spring for coastal haulouts in Bristol Bay and Gulf of Anadyr (Jay and Hills, 2005). The Chukchi Sea west of Barrow is the northeastern extent of the main summer range of the walrus; few are seen farther east in the Beaufort Sea (e.g., Harwood et al., 2005). Those observed in the Beaufort Sea typically are lone individuals. No reliable estimate for the size of the Alaska Pacific walrus stock is available (Angliss and Outlaw, 2005), although the FWS is launching a substantial effort to produce a more precise abundance estimate of Pacific walrus. Results from these survey efforts should be available in 2007 (USDOI, FWS, 2006b). The population size has never been known with certainty, although the most recent survey estimate was approximately 201,039 animals (Gilbert et al., 1992). Walrus are benthic feeders, and prefer areas <80 m deep (Fay, 1982). In a recent study, 98% of satellite locations of tagged walruses in Bristol Bay were in water depths of 60 m or less (Jay and Hills, 2005). Walrus most commonly feed on bivalve mollusks (clams), but they also will feed on other benthic invertebrates (e.g., snails, shrimp, crabs, worms). Pacific walrus are an important subsistence species for Alaskan Native hunters. The number of walrus taken annually has varied over the years, with recent harvest levels much lower than historic highs. Based on harvest data from Alaska and Chukotka in the years 2001-2005, mean harvest mortality levels are estimated at 5,458 animals per year (USDOI, FWS, 2006b).

IV.B.4.c(3) ***Beluga Whales.*** Beluga whales are found throughout the arctic and subarctic waters of the Northern Hemisphere. In Alaska there are five recognized stocks: (1) Eastern Chukchi Sea; (2) Beaufort Sea; (3) Cook Inlet; (4) Bristol Bay; and (5) Eastern Bering Sea (O'Corry-Crowe et al., 1997). Within the Proposed Action area, only the Beaufort Sea stock and eastern Chukchi Sea stocks are present. The NMFS has set the minimum population estimate for the Beaufort Sea beluga whale stock at 32, 453 and the total corrected abundance estimate for the eastern Chukchi Sea stock at 3,710 (Angliss and Outlaw, 2005). Beluga whales of both stocks winter in the Bering Sea and summer in the Beaufort and Chukchi seas, migrating around western and northern Alaska (Angliss and Outlaw, 2005). The majority of belugas in the Beaufort stock migrate into the Beaufort Sea in April or May, although some whales may pass Point Barrow as early as late March and as late as July (Braham et al., 1984; Ljungblad et al., 1984; Richardson et al., 1995). Belugas of the eastern Chukchi stock satellite tagged in the eastern Chukchi Sea in summer traveled 1,100 km north of the Alaskan coastline and to the Canadian Beaufort Sea within 3 months of tagging (Suydam et al., 2001), indicating extensive stock overlap with the Beaufort Sea stock. Belugas are rarely seen in the central Alaskan Beaufort Sea during the summer. They are strongly associated with the ice (Burns, Shapiro, and Fay, 1981), and prefer areas with moderate to high ice cover (54-66%) (Moore and DeMaster, 1997).

IV.B.4.c(4) ***Gray Whales.*** There are two stocks of gray whale recognized in the North Pacific: the eastern north Pacific stock, which lives along the west coast of North America and the western north Pacific stock, which lives along the coast of eastern Asia (Angliss and Lodge, 2005). The latest abundance estimate for the eastern north Pacific stock is 18,178 individuals (Rugh et al., In press, as cited in Angliss and Outlaw, 2005). The NMFS has provided a minimum population estimate of 17,752 (Angliss and Outlaw, 2005). Federal protection under the ESA was removed in 1994, and further evaluation determined that the stock was neither in danger of extinction nor likely to become endangered in the foreseeable future (Rugh et al., 1999). Gray whales are bottom feeders, sucking sediment from the seafloor. Their primary prey is amphipods, although other food items are ingested. Although gray whales probably feed opportunistically throughout their range, they return annually to primary feeding areas in the northern Bering Sea and Chukchi Sea (e.g., Nerini, 1984; Moore et al., 1986; Weller et al., 1999). Only a small number of gray whales enter the Beaufort Sea east of Point Barrow, though in recent years, ice conditions around Barrow have become lighter and gray whales may have become more common there. In fact, Moore et al. (2006) reported that Native hunters have noticed increasing numbers of gray whales near Barrow in the late summer and autumn, which may indicate a northward shift in the distribution of this species. Gray whale calls also were recorded each month from October 2003 through May 2004 northeast of Barrow, indicating that some whales did not migrate to California as expected (Moore et al., 2004). This extended occurrence of gray whales in the Beaufort Sea complements observations of feeding whales moving north from the Bering Sea to the Chukchi Sea in summer (Moore, Grebmeier, and Davies, 2003), and may be indicative of marine ecosystem changes occurring in the North Pacific. For example, Moore, Grebmeier, and Davies (2003) suggested that gray whale use of the Chirikov Basin has decreased, likely as a result of the combined effects of changing currents and a downturn in amphipod productivity.

Additional information on the above species, and on other marine mammals, is included in Appendix D.

IV.B.4.d. Fishes and Essential Fish Habitat. This section is a summary of the information presented in Appendix D, Section D.4. It updates the information on fishes and Essential Fish Habitat (EFH) that might be affected by proposed Beaufort Sea Lease Sale 202. The section updates the information in the multiple-sale final EIS and Sale 195 EA (USDOI, MMS, 2003, 2004). As summarized in the EIS, the marine coastal environment of the Beaufort Sea consists of inlets, lagoons, bars, and numerous mudflats. During the open-water season, the nearshore zone of this area is dominated by a band of relatively warm, brackish water that extends across the entire Beaufort Sea coast. It is formed after breakup by freshwater input from rivers such as the Ikpikpuk, the Colville, the Sagavanirktok, and the Canning. The summer distribution and abundance of coastal fishes (marine and migratory species) is strongly affected by this band of brackish water. The band typically extends 1-6 mi offshore and contains more abundant food resources than waters farther offshore.

The information in the multiple-sale final EIS and the Sale 195 EA is augmented by a summary in the seismic-survey PEA (USDOI, MMS, 2006a). Only two of the updated PEA descriptions will be summarized here, because the entire PEA is available on the MMS web site at: http://www.mms.gov/alaska/ref/pea_be.htm.

We have updated information about recent evidence of the effect of the changing ice cover on arctic fish and about the few commercial fisheries in the Alaskan Beaufort Sea and, therefore, the few species covered by fishery-management plans in these waters.

Distribution and Abundance Trends of EFH Pacific Salmon in the Alaskan Beaufort Sea. The literature largely treats the Beaufort Sea as a population sink for Pacific salmon, in some cases suggesting that none of the salmon species have established sustained populations in waters east of Point Barrow (Bendock and Burr, 1984). Many reports describe salmon as "straying" into the Beaufort Sea (Craig and Halderson, 1986) or comprising only a few isolated spawning stocks of pink and chum salmon (Craig and Halderson, 1986; Fechhelm and Griffiths, 2000). The occurrence of pink and chum salmon in arctic waters probably is due to their relative tolerance of cold water temperatures and their predominantly marine life cycle (Craig and Halderson, 1986, citing Salonius, 1973). The expansion of chinook, sockeye, and coho salmon into the Arctic appears restricted by cold water temperatures, particularly in freshwater environments (Craig and Halderson, 1986). However, the recent range extensions of pink, sockeye, and chum salmon in the Canadian Arctic, as described by Babaluk et al. (2000), indicate that some Pacific salmon may be expanding their distribution in arctic waters, and possibly their abundance as well. Babaluk et al. (2000) also note that large temperature increases in arctic areas as a result of climate warming may result in greater numbers of Pacific salmon in the area.

Because Pacific salmon appear to be expanding their range eastward and northward in the Canadian Beaufort Sea, it is reasonable to expect that Pacific salmon are expanding their distribution in the Chukchi Sea and that their populations may be increasing in both the northeastern Chukchi Sea and western Beaufort Sea.

Further information on fish and EFH is summarized in Appendix D. Information on current distribution and abundance (e.g., density per square kilometer) estimates, age structure, population trends, or habitat use areas are not available or are outdated for fish populations in the western Beaufort Sea. For example, it is not known if the findings of Frost and Lowry (1983) still accurately portray the diversity and abundance of demersal fishes in the Alaskan Beaufort Sea. Another important data gap is the lack of information concerning discrete populations for arctic fishes using modern scientific methods. Although Pacific salmon are known to occur in the region, studies directed at investigating their population dynamics, migration, and habitat use are nonexistent.

IV.B.4.e. Other Resources. This section updates the information on local air quality, archaeological resources, and additional resources.

IV.B.4.e(1) Local Air Quality. As explained in the summary of air quality in the seismic-survey PEA (USDOI, MMS, 2006a), the combination of limited industrial development and low population density results in good to excellent air quality throughout the Beaufort Seas area. Only a few small, scattered emissions from widely scattered sources exist on the adjacent onshore areas. The only major local sources of industrial emissions are in the Prudhoe Bay/Kuparuk/Endicott oil-production complex. However, during the winter and spring, additional pollutants are transported by the wind to the Alaska Arctic Ocean from industrial sources in Europe and Asia (Rahn, 1982). These pollutants cause a phenomenon known as arctic haze.

The Environmental Protection Agency (USEPA) defines Air Quality Control Regions (AQCR's) for all areas of the United States and designates classifies them based on six "criteria pollutants," and has established for each of them a maximum concentration above which adverse effects on human health may occur. These threshold concentrations are called National Ambient Air Quality Standards (NAAQS). When an area meets NAAQS, it is designated as an "attainment area." An area not meeting air quality standard for one of the criteria pollutants is designated as a "nonattainment area."

Areas are designated "unclassified" when insufficient information is available to classify areas as attainment or nonattainment. All areas in and around the Chukchi and Beaufort seas are classified as attainment areas.

The provisions of Alaska's Prevention of Significant Deterioration (PSD) program are applied to attainment areas and unclassified AQCR's with good air quality to limit its degradation from development activities. The areas are classified as PSD Class I, II, or III areas (in decreasing order of relative protection) based on land status/use and the associated protection afforded to the area. The region of Alaska adjacent to the Chukchi and Beaufort seas is a PSD Class II area. The nearest PSD Class I area is the Denali National Park. There are no Class III areas in Alaska. States strive to allow industrial and commercial growth within PSD Class II areas without causing significant degradation of existing air quality or exceeding the NAAQS.

IV.B.4.e(2) Archaeological Resources. This is a summary of the updated information in presented Appendix D. "Archaeological resources" can be defined as "any prehistoric or historic district, site, building, structure, or object [including shipwrecks].... Such term includes artifacts, records, and remains which are related to such a district, site, building, structure, or object" (National Historic Preservation Act, Sec. 301[5] as amended, 16 U.S.C. 470W[5]). Important archaeological resources are either historic or prehistoric and generally include properties older than 50 years that: (1) are associated with events that have made a definite contribution to the broad patterns of our history; (2) are associated with the lives of important persons in the past; (3) embody the distinctive characteristics of a type, period, or method of construction; (4) represent the work of a master; (5) possess high artistic values; (6) present an outstanding and distinguishable entity whose components may lack individual distinction; or (7) have yielded, or may be likely to yield, information important in history. These resources represent the remains of the material culture of past generations of the region's prehistoric and historic inhabitants. They are basic to our understanding of the knowledge, beliefs, art, customs, property systems, and other aspects of the nonmaterial culture. The two major locational categories and two major time sequences of archaeological resources identified in the Sale 202 area are, respectively, offshore/onshore and prehistoric/historic. Archaeological resources in the Beaufort Sea region that may be impacted by the Proposed Action, primarily from ocean-bottom cable seismic surveys and/or the drilling of exploration wells, include historic shipwrecks, aircraft, and inundated prehistoric sites offshore. A more extensive discussion of archaeological resources can be found in the seismic-survey PEA (USDOI, MMS, 2006a). The PEA is available on the MMS web site at: http://www.mms.gov/alaska/ref/pea_be.htm.

IV.B.4.e(3) Additional Resources. This section updates some recent findings on terrestrial mammals and lower trophic-level organisms. There is no new information on caribou and other terrestrial mammals that would alter the analysis of potential effects of OCS operations on them. With regard to lower trophic-level organisms, the distribution of phytoplankton chlorophyll-a (chl-a) in the Beaufort Sea was illustrated with satellite images in the multiple-sale final EIS (USDOI, MMS, 2003:Figs. III.B-1a and III.B-1b). The final EIS explained that the images show the "greenness" of the water, and that chl-a was highest in the coastal water. That explanation is confirmed and augmented by a recent study of many satellite images from the summers 1998-2004 (Mizobata and Wang, 2006). The investigators confirm that chl-a was highest during 1998 in a stable surface layer near the Mackenzie River Delta. The investigators observed a gradual extension of the high chl-a concentrations westward from the Mackenzie through the proposed lease area during the summers of 1999, 2000, and 2001. The investigators describe also the low chl-a concentrations in offshore waters, except for upwelling events in the Barrow Canyon during 2003. In summary, the chl-a concentrations indicate that production is highest in coastal water near river deltas, and typically is low in offshore waters.

Grebmeier et al. (2006) observed some changes in the planktonic food webs, which they relate to the changing ice cover. In the past, the ice cover has delayed the spring phytoplankton bloom, causing it to be intense for a short duration. As a result, the bloom was not grazed efficiently by zooplankton, and much of the phytoplankton organic matter sank to the seafloor. Many of the higher trophic-level consumers that were abundant in the marginal ice zone were benthic feeders. Recent changes in the ice cover have resulted in a bloom over a longer period of time that is not as intense. The planktonic production is grazed more efficiently by pelagic consumers such as fish, making them more like pelagic food webs in the Bering Sea.

IV.B.5. Environmental Justice. Environmental Justice analysis began with President Clinton's February 11, 1994, Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and an accompanying Presidential memorandum. The EO requires each Federal Agency to make the consideration of Environmental Justice part of its mission. Its intent is to promote fair treatment of people of all races, so no person or group of people shoulders a disproportionate share of the negative environmental effects from this country's domestic and foreign programs. It focuses on minority and low-income people. However, the USEPA defines environmental justice as the "equal treatment of all individuals, groups or communities regardless of race, ethnicity, or economic status from environmental hazards" (U.S. Department of Energy, 1997; USEPA, 2006). Specifically, EO 12898 requires an evaluation as to whether the proposed project would have "disproportionately high adverse human health and environmental effects...on minority populations and low income populations." The EO also includes consideration of potential effects to Native subsistence activities and, to this end, MMS continues to maintain a dialogue on Environmental Justice with local communities in this region.

Since 1999, all MMS public meetings have been conducted under the auspices of Environmental Justice and the concerns of Inupiat residents, and discussions about mitigation are conducted. Environmental Justice-related concerns are taken back to MMS management and incorporated into environmental study designs and new mitigating measures.

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, requires Federal Agencies to consult with tribal governments on Federal matters that significantly or uniquely affect their communities. In January 2001, a USDOI Alaska Regional Government-to-Government policy was signed by all the USDOI Alaska Regional Directors, including the MMS.

The Inupiat People of the NSB have made MMS aware of the potential burden of participating in too many planning and public meetings. Therefore, MMS has taken measures to plan more carefully the number and timing of meetings with regional tribal groups and local governments. The following three aspects of the Inupiat's demographics and culture relate particularly to Environmental Justice: race, income, and consumption of fish and game.

IV.B.5.a. Race. Alaska Inupiat Natives, a recognized minority, are the predominant residents of the NSB and the Northwest Arctic Borough (NWAB), which make up the Alaska regional governments in the project area. The 2000 Census counted 7,385 persons resident in the NSB; 5,050 identified themselves as American Indian and Alaskan Native, for a 68.38% indigenous population. In the NWAB, the 2000 Census counted 7,288 persons, 5,944 identified themselves as American Indian and Alaskan Native, for an 82.5% indigenous population (USDOC, Bureau of the Census, 2000).

Inupiat Natives are the only minority population allowed to conduct subsistence hunts for marine mammals in the region and, in potentially affected Inupiat communities, there are no substantial numbers of "other minorities." Additionally, "other minorities" would not be allowed to participate in subsistence marine mammal hunts and, therefore, would not constitute a potentially affected minority population (North Slope Borough, 1999).

Because of the NSB and NWAB's homogenous Inupiat population, it is not possible to identify a "reference" or "control" group within the potentially affected geographic area, for purposes of analytical comparison, to determine if the Inupiat are affected disproportionately. This is because a nonminority group does not exist in a geographically dispersed pattern along the potentially affected area of the NSB and the NWAB.

IV.B.5.b. Income. The U.S. average median household income in 2000 was $42,148, and the U.S. average per-capita income was $29,469. The Alaskan average median household income in 2000 was $50,746, and the Alaska average per-capita income was $29,642. The average NSB median household income ($63,173) was above State and national averages, but the average per-capita income ($20,540) was below the State and national averages. The median household incomes in all subsistence-based communities in the Borough were above State averages except Nuiqsut ($48,036), and all were above national averages. Per-capita incomes in all these communities were below State and national averages. The average NWAB median household income ($45,976) was below the State average but above the national average, but the average per-capita income ($15,286) was below State and national averages. The median household incomes of the subsistence-based communities of Kivalina ($30,833), Buckland ($38,333), and Deering ($33,333) were below State and national averages, and those for Kotzebue ($57,163) and Noorvik ($51,964) were above. Per-capita incomes in all these communities were below State and national averages.

Low income commonly correlates with Native subsistence-based communities in coastal Alaska; however, subsistence-based communities in the region qualify for Environmental Justice analysis based on their racial/ethnic minority definitions alone (USDOC, Bureau of the Census, 2000, 2002). The poverty-level threshold for a family of four, based on the U.S. Census Bureau, 2000 Survey data, is $17,761. Low income is defined by the U.S. Census Bureau as 125% of the poverty level or $22,201. Median household incomes for the NSB and the NWAB fall well above the Census Bureau threshold for low income. The 2000 Census "tiger" files (files from the U.S. Census' Topologically Integrated Geographic Encoding and Referencing [TIGER] database) identify no nonsubsistence-based coastal communities in the NSB and the NWAB with median household incomes that fall below the low income threshold.

IV.B.5.c. Consumption of Fish and Game. As defined by the NSB Municipal Code, subsistence is "an activity performed in support of the basic beliefs and nutritional need of the residents of the borough and includes hunting, whaling, fishing, trapping, camping, food gathering, and other traditional and cultural activities" (State of Alaska, 1997). This definition gives only a glimpse of the importance of the practice of the subsistence way of life in Inupiat culture, but it does underscore that it is a primary cultural and nutritional activity on which Native residents of the North Slope depend. For a more complete discussion of subsistence and its cultural and nutritional importance, see Appendix D, Sections 1 and 5.

IV.B.6. Land Use Plans and Coastal Zone Management.

This section contains a summary of the detailed information presented in Appendix D, Section 6.

IV.B.6.a. Land Use Plans. Revisions during 2005 to the documents addressing land use in the NSB include the NSB Comprehensive Plan (NSBCP) and the NSB Coastal Management Program (NSBCMP). The revisions to the NSBCP simplified the regulatory process but did not alter the basic premise of the comprehensive plan, which is to preserve and protect the land and water habitat essential to the subsistence character of Inupiat life. The revisions to the NSBCMP are explained in the following.

IV.B.6.b. Alaska Coastal Management Program. The State of Alaska recently amended its Alaska Coastal Management Plan (ACMP) program and adopted new regulations under Title 11, Alaska Administrative Code (AAC), Chapters 110, 112, and 114. The State regulations became effective on October 29, 2004. On December 29, 2005, the USDOC, NOAA, Office of Ocean and Coastal Resource Management (OCRM), completed its review and approved the amendments to the ACMP, finding that the amended ACMP meets all requirements of the Coastal Zone Management Act (CZMA).

Under the amended ACMP, all coastal districts including the North Slope Borough must revise their local plans to conform to the new Statewide standards. A district's existing coastal management program, including its enforceable policies, remains in effect until March 1, 2007, unless the Department of Natural Resources (ADNR) disapproves or modifies all or part of the district's program before March 1, 2007. However, any existing district-enforceable policy that duplicates, restates, or incorporates by reference a statute or regulation of a Federal or State agency or addresses any matter regulated by the Department of Environmental Conservation (ADEC) are repealed and declared null and void under State law. Consequently, while the existing NSBCMP remains in effect, some of the enforceable policies may no longer apply under the amended ACMP.

The amended Statewide standards that may be relevant to hypothesized sale activities include: (1) coastal development; (2) natural hazard areas; (3) coastal access; (4) energy facilities; (5) utility routes and facilities; (6) sand and gravel extraction; (7) subsistence; (8) transportation routes and facilities; (9)

habitats; (10) air, land, and water quality; and (11) historic, prehistoric, and archaeological resources. With a few exceptions, the amended Statewide standards are similar to the old standards under which OCS Sales 187 and 195 were conducted.

Under the amended ACMP, several of the Statewide policies first require that an area be designated before any enforceable policies can be established to protect the resource. For example, the subsistence policy requires a designation of an area in which subsistence is an important use of coastal resources. Once designated, a Federal OCS project affecting a subsistence-use area would need to avoid or minimize impacts to subsistence uses. Another example is the policy addressing historic, prehistoric, and archaeological resources, which requires the designation of areas of the coastal zone that are important to the study, understanding, or illustration of national, State, or local history or prehistory, including natural processes. A Federal OCS project affecting a properly designated historic area would need to comply with the applicable requirements of AS 41.35.010-41.35.240 and 11 AAC 16.010-11 AAC 16.900. Districts also may designate areas for recreation, tourism, important habitats, or commercial fishing, or areas where natural hazards are an important consideration, or areas appropriate for the development of major energy facilities. The amended ACMP also defers to the mandates and expertise of ADEC to protect air, land, and water quality. The standards incorporate ADEC's statutes, regulations, and procedures.

There currently are no designated areas on the North Slope, although the ADNR has the authority to designate areas as part of a coastal project consistency review. In conclusion, because the amended Statewide standards are similar to the old standards, no conflicts with the amended Statewide standards or with the enforceable policies of the NSBCMP are anticipated.

IV.B.7. Summary of Sections IV.A and IV.B. Overall, parts of the Beaufort Sea environment have continued to change since preparation of the multiple-sale EIS. For example, the summer Arcticwide ice cover has continued to decrease, now at a rate of about 10% per decade (Sec. IV.A.1). The resources that are dependent on summer and autumn ice cover also have changed. The Sale 195 EA predicted that more polar bears might be forced to stay onshore during summer, and recent observations confirm that more are staying onshore during the autumn (Sec. IV.B.2.d(2)). In contrast, no substantial changes have been observed in either anadromous fish or marine and coastal birds (Secs. IV.B.2.b and d(3)(b)). Further, the MMS monitors the bowhead whale migration yearly via aerial surveys; the most recent survey report concludes that bowhead sightings were within the normal historical range from the coast (Sec. IV.B.2.d(1)). Similarly, the Beaufort stock of ringed seals, which are dependent on the ice cover during spring (as opposed to summer and autumn), appear to be within their normal historical range (Sec. IV.B.2.d(3)(a)(1)).

IV.C. Updated Effects of the Proposed Action.

This section updates the assessments in the multiple-sale final EIS and the Sale 195 EA. The Proposed Action is Alternative VII; this is the Area of Call, excluding the Barrow and Kaktovik Deferral Areas (see Sec. III.B). The effects are updated in the context of current environmental situation, including the leasing in Sale 195.

IV.C.1. Impact Significance Criteria and Major Findings. The following section specifies the impact criteria and the major findings of the detailed assessments that are contained in following Section IV.C.2.

IV.C.1.a. Impact Significance Criteria. As stated above, this EA updates the assessments in the multiple-sale EIS, so the significance criteria are those in the EIS. The MMS recently published the *Programmatic Environmental Assessment, Arctic Ocean Outer Continental Shelf Seismic Surveys – 2006* (USDOI, MMS, 2006a), which is available on the MMS web site at: http://www.mms.gov/alaska/ref/pea_be.htm. Because the assessed operation was more specific in scope and duration than those assessed in the multiple-sale EIS, plus the Sale 195 EA and this update for proposed Lease Sale 202, the seismic assessment used a more specific significance threshold than those used for lease-sale assessments. In the near future, we intend to meet with other regulatory agencies to discuss further the significance criteria used in all MMS NEPA documents.