water/broken ice period are particularly vulnerable to the effects of an oil spill, which lessees must account for in their OSCP's.

The levels of effect on other resources, including subsistence, marine and coastal birds, local water quality, bowhead whales, fish and Essential Fish Habitat, and other organisms, were similar to those levels in the multiple-sale EIS (USDOI, MMS, 2003). Therefore, no new significant impact was identified for the proposed lease sale that was not already assessed in the multiple-sale EIS.

IV.D. Updated Effects of Other Alternatives.

This section updates the assessments of Alternatives I through VI. The level of effect with Alternative II - No Sale would be lower for all resources. The other alternatives would not alter the level of effect for all resources; they would alter the effects for subsistence-harvest patterns and sociocultural resources. However, the Eastern Deferral - Alternative VI would alter the level of effects on bowhead whales, and polar bears.

IV.D.1. Alternative I – The Area of Call. This alternative is similar to the Proposed Action, except that it would include no deferrals; leasing would be deferred in none of the subsistence whaling areas. The level of effect on subsistence-harvest patterns would be slightly higher than for the Proposed Action, which would defer leasing in two subsistence areas. However, the overall conclusion in the multiple-sale EIS that significant oil-spill effects on subsistence-harvest patterns could occur from a large oil spill remains the same for proposed Sale 202.

IV.D.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 schedule. The level of effect on all resources would be lower than for the Proposed Action. However, the level of effect would not drop to negligible because of existing OCS and State leases in the area and because of plans for further State and OCS leasing.

IV.D.3. Alternative III - Barrow Subsistence Whaling Deferral. This alternative is similar to the Proposed Action, except that it would not offer for lease only the subarea within which Barrow residents conduct subsistence whaling; leasing would be deferred in only one of the three Beaufort Sea subsistence-whaling areas. The level of effect on subsistence-harvest patterns would be slightly higher than for the Proposed Action, which would defer leasing in two subsistence areas.

Specifically, effects on subsistence resources and practices are expected to be about the same as the Preferred Alternative for Sale 202. Changes in noise and oil-spill effects to bowhead whales from this deferral as compared to the Preferred Alternative likely would be reduced, but this reduction would be difficult to measure. Subsistence whalers have indicated that this deferral is too small and does not defer areas near Barrow that protect the bowhead whale migration route from seismic sound disturbance; that protect subsistence staging, pursuit, and butchering areas; and that protect critical whale feeding and calving areas. Given the increasing levels of seismic survey activity expected in the Chukchi and Beaufort seas, enlarging the Barrow Deferral should be considered. Additionally, stakeholders object to the name of this deferral, because it is not the one originally proposed by Barrow subsistence whalers and the AEWC but a smaller one conceived by MMS based solely on subsistence-strike data. We suggest this deferral be called simply the Barrow Deferral.

This alternative is not expected to reduce noise, disturbance, and oil-spill effects on seals, polar bears, and gray and beluga whales from air and vessel traffic, drill platforms, or reduce habitat effects from platform and offshore pipeline installation in this area, and effects are expected to be the same as for the Preferred Alternative. However, potential risks of oil-spill contact to the Barrow subsistence whaling area (ERA 42) would be reduced with the partial removal of the highest conditional risk, a 64% chance of contact to this area from launch area LA2. Spill-contact risks to other habitat areas would not be reduced under this alternative for Sale 202.

Even though effects on sociocultural systems with Alternatives III would be essentially the same as described the Preferred Alternative, effects on sociocultural systems in Barrow are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on a portion of Barrow's traditional subsistence-whaling area. Because effects to subsistence-harvest patterns are expected to be reduced in Barrow under this alternative, subsequent effects reductions to sociocultural systems also would be expected.

Alternative III would reduce the potential for effects on prehistoric or historic resources in the deferral areas. The potential for encountering shipwrecks during offshore operations would be greatly reduced because of the high potential for possible shipwrecks to occur in the general area offshore Barrow. There would be less potential disturbance in the adjacent land areas, which otherwise might have experienced construction activities related to pipeline infrastructure or a staging area.

The draft seismic-survey PEA concluded that OBC seismic surveys potentially could impact both prehistoric and historic archaeological resources in waters inshore of the 20-m isobath or in deeper water, if cables are laid from shallow to deep water as part of the seismic-survey program. Assuming compliance with existing Federal, State, and local archaeological regulations and policies and the application of MMS's G&G Permit Stipulation 6 and its NTL 05-A03, most impacts to archaeological resources in shallow offshore waters of the Beaufort Sea Planning Area would be avoided. Therefore, no impacts or only minor impacts to archaeological resources are anticipated. Without compliance with Federal, State, and local regulations and the application of MMS stipulations and NTL's, greater potential impacts to prehistoric and historic archaeological resources would be anticipated.

IV.D.4. Alternative IV – Nuiqsut Subsistence Whaling Deferral. This alternative is similar to the Proposed Action, except that it would not offer for lease only a subarea within which Nuiqsut residents conduct subsistence whaling to the northeast of Cross Island; leasing would be deferred in only one of the three Beaufort Sea subsistence-whaling areas. The level of effect on subsistence-harvest patterns would be slightly higher than for the Proposed Action, which would defer leasing in two subsistence areas. Specifically, effects on subsistence resources and practices are expected to be about the same as the Preferred Alternative. Differences in chronic noise and disturbance effects on bowhead whales, subsistence whaling, and other subsistence resources and practices in Nuiqsut are expected to be reduced because no exploration or production activities would occur in this deferral area. Effects from oil spills would not be diminished, because LA12 and P12 would not be excluded from the OSRA scenario. As a result, the effects from noise, disturbance, and oil spills associated with Alternative IV are expected to be somewhat less than under the Preferred Alternative. Reductions in effect from this deferral compared to the Preferred Alternative would be difficult to measure.

Given the increasing levels of seismic-survey activity expected in the Chukchi and Beaufort seas, enlarging the Nuiqsut Deferral should be considered. In lieu of such a deferral, it has been suggested that leasing incentives could be discontinued in the areas off Cross Island most critical to Nuiqsut whaling. Additionally, stakeholders object to the name of this deferral, because it is not the one originally proposed by Nuiqsut subsistence whalers and the AEWC but a smaller one conceived by MMS based solely on subsistence strike data. We suggest this deferral be called simply the Cross Island Deferral.

Even though effects on sociocultural systems with Alternative IV would be essentially the same as described under the Preferred Alternative, effects on sociocultural systems in Nuiqsut likely would be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling. Effects from oil spills would not be diminished, because LA12 and P12 would not be excluded from the OSRA scenario. Because effects to subsistence-harvest patterns are expected to be reduced under this alternative, subsequent effects reductions to sociocultural systems also would be expected.

A previous paragraph in this section refers to the discontinuation of leasing incentives in the Nuiqsut subsistence whaling area. The rationale for leasing incentives is summarized in Section III.D; it is partly to encourage additional industry activities in remote areas, leading to commercial production. So, the exclusion of leasing incentives from the Nuiqsut subsistence area would allow the previous rate of

development to continue, would be an alternative to the Nuiqsut Subsistence Whaling Deferral, and would address in part the comments from the AEWC (Appendix A) and Senator Murkowski (Sec. III.E.3).

IV.D.5. Alternative V – Kaktovik Subsistence Whaling Deferral. This alternative is similar to the Proposed Action, except that it would not offer for lease only a subarea within which Kaktovik residents conduct subsistence whaling; leasing would be deferred in only one of the three Beaufort Sea subsistence whaling areas. The level of effect on subsistence-harvest patterns would be slightly higher than for the Proposed Action, which would defer leasing in two subsistence areas. Specifically, effects on subsistence resources and practices are expected to be about the same as the Preferred Alternative. Differences in noise and oil-spill effects to bowhead whales from this deferral alternative compared to the Preferred Alternative are not likely to be measurable. Even though noise and oil-spill effects on subsistence resources and practices with Alternative V would be essentially the same as described for the Preferred Alternative, effects on subsistence-harvest patterns in Kaktovik are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on subsistence whaling in the western half of Kaktovik's traditional subsistence-whaling area.

Given the increasing levels of seismic survey activity expected in the Chukchi and Beaufort seas, enlarging the Kaktovik Deferral should be considered. Additionally, stakeholders object to the name of this deferral, because it is not the one originally proposed by Kaktovik subsistence whalers and the AEWC but a smaller one conceived by MMS based solely on subsistence-strike data. We suggest this deferral be called simply the Kaktovik Deferral.

Even though effects on sociocultural systems with Alternative V would be essentially the same as described under the Preferred Alternative, effects on sociocultural systems in Kaktovik are expected to be reduced, because no exploration or production activities would occur in this deferral area, potentially reducing sources for chronic noise and disturbance effects on a portion of Kaktovik's traditional subsistence-whaling area. Because effects to subsistence-harvest patterns are expected to be reduced in Kaktovik under this alternative, subsequent effects reductions to sociocultural systems also would be expected.

IV.D.6. Alternative VI - Eastern Deferral. This alternative is similar to the Proposed Action, except that it would not offer for lease a subarea within which bowheads feed. As explained in the multiple-sale EIS, this alternative would decrease slightly the level of effects for bowhead whales and polar bear. The level of effect on subsistence-harvest patterns, sociocultural systems, marine and coastal birds, water quality, air quality, archaeology, terrestrial mammals, and lower trophic-level organisms would not be lowered; and new information does not change those conclusions.

IV.D.6.a. Subsistence-Harvest Patterns and Sociocultural Systems. Leasing would be deferred in none of the three Beaufort Sea subsistence-whaling areas. The level of effect on subsistence-harvest patterns would be slightly higher than for the Proposed Action, which would defer leasing in two subsistence areas. Specifically, effects on subsistence resources and practices are expected to be about the same as the Preferred Alternative. Differences in oil-spill and noise effects to bowhead whales from this deferral as compared to the Preferred Alternative are not likely to be measurable. This alternative potentially could reduce oil-spill effects on subsistence resources from Barter Island east to Demarcation Bay and on important Kaktovik subsistence-harvest areas. If oil exploration and development were deferred under this alternative, potential oil-spill contact to offshore habitats for seals, polar bears, and beluga whales from Barter Island east to Herschel Island would be reduced somewhat. Potential oil-spill risks to habitats west of Beaufort Lagoon would remain unchanged.

Potential reductions in oil-spill contact would reduce effects on important subsistence resources and important Kaktovik subsistence harvest areas from Barter Island east to Demarcation Bay. Because effects to subsistence-harvest patterns are expected to be reduced under this alternative, subsequent effects reductions to sociocultural systems also would be expected.

IV.D.6.b. Bowhead Whales. Leasing would be deferred in an area where bowheads have been observed frequently to feed. The likelihood of a large spill in the area would be decreased slightly if leasing were deferred, but the spill risk would not be eliminated because of existing leases in the area, State leasing in the area, and non-OCS related ship traffic. The level of effect on bowheads would be slightly lower than for the Proposed Action. A slightly lower level of effect would be consistent with the conclusion in the multiple-sale EIS that no significant impacts to this endangered species are expected due to activities associated with proposed Sale 202.

IV.D.6.c. Polar Bear. The assessment of the effects of the Proposed Action –Alternative VII—on polar bear explained that, if an oil spill does occur, the chance of it contacting the coastline of ANWR specifically would be highest for any inshore spill in the eastern Alaskan Beaufort Sea (USDOI, MMS, 2003:Sec. IV.C.2.a(3)(b)(2)). The Kaktovik area (LS 47) has one of the highest chances of spill contact, up to 16% from either LA1-LA18 or P1-P13, assuming spills occur during the summer season and contact the coastline within 30 days (USDOI, MMS, 2003:Sec. IV.C.7.a(2)(c)(2)). The Eastern Deferral would reduce the likelihood of a spill contacting this prime polar bear habitat.

IV.D.7. Environmental Justice Summary for All Alternatives. Disturbance and noise effects could affect subsistence resources and the subsistence bowhead whale hunt in the communities of Barrow, Nuiqsut, and Kaktovik periodically, but no resource or harvest area is expected to become unavailable and no resource population would experience an overall decrease if such noise and disturbance effects are effectively mitigated by conflict avoidance agreements. Our analysis indicates that disturbance and noise from Alternatives III, IV, V, and VI would not be substantial sources of potential environmental justice effects. Our analysis does indicate that Environmental Justice-related effects from Sale 202 to these Native villages would occur in the event of a large oil spill.

Sale-specific Environmental Justice effects would derive from potential noise, disturbance, and oil-spill effects on subsistence resources, subsistence-harvest patterns, and sociocultural systems. The only substantial source of potential Environmental Justice-related effects to Native villages from Alternatives III, IV, V, and VI would occur in the event of a large oil spill, which could affect subsistence resources. In the event that a large oil spill occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such major disruptions to subsistence resources and practices would be considered disproportionately high adverse effects on Alaskan Natives. Any potential effects on subsistence resources and subsistence harvests are expected to be mitigated substantially, though not eliminated.

IV.D.8. Summary of Effects of the Alternatives. The effects of the alternatives would be similar to the effects of the Proposed Action with two exceptions. One exception is that the Eastern Deferral would reduce slightly the level of effect on subsistence-harvest patterns, bowhead whales and polar bear. The other exception is that the other deferrals would reduce the level of effects on subsistence-harvest patterns. A similar reduction of subsistence effects in the Nuiqsut subsistence area could be achieved by the exclusion of leasing incentives from this area.

IV.E. Updated Cumulative Effects of Proposed Sale 202.

The following section contains updated information on the cumulative scenario and on the resource-specific effects.

IV.E.1. Cumulative Scenario. The AEWC asserted in a recent letter (Appendix A) that "MMS did not contemplate cumulative effects at the level of intensity that is likely to result from the combination of Sale 195, National Petroleum Reserve-Alaska (NPR-A), Liberty, and even state lease sales...." Therefore, we have reviewed carefully the scenario for cumulative effects. The cumulative-effects scenario for Sale 202 has changed with regard to spill risk and the assumed level of future seismic exploration. The level of other operations is similar to the level that was assumed in the multiple-sale EIS. We believe that this is still an optimistic projection of future activities because decades of leasing and exploration have yet to

result in new developments in either NPR-A or Beaufort Sea OCS areas. Development on State lands has occurred, but most activities are associated with (or contained in) existing fields, with the exception of the Alpine filed on the Colville River delta.

The mean number of spills, including all past, present, and reasonably foreseeable reserves and resources, was estimated in the multiple-sale EIS. The estimate, using an assumed spill rate of 0.23 spills per billion barrels, was 0.66 spills (USDOI, MMS.2003:Table V-12). The spill rate has been updated in this EA; as explained in Section IV.A.3, "our best estimate of the spill rate for large spills...is that there may be 0.53 oil spills (95% confidence interval 0.35-0.73) per billion barrels produced." The increase in the spill rate from 0.23-0.53 per billion barrels means that the assumed cumulative number of spills has approximately doubled. In spite of the doubling, the most likely cumulative number of spills is close to one.

Cumulative effects on seismic-survey activity were summarized recently in the seismic-survey PEA (USDOI, MMS, 2006a). The PEA contains new projections of seismic activity (Table 1). The projections are for seismic surveys in both the OCS and State waters and in the Beaufort and Chukchi seas. The effects of the 14 seismic surveys in the Beaufort OCS waters were assessed in Section IV.C. This section assesses the effects of 35 surveys—14 surveys in the Beaufort OCS, 3 surveys in Beaufort State waters, and 18 surveys in the Chukchi Sea. The projection includes 13 high-resolution site-clearance surveys, which would be conducted in a small area over a short period of time.

Assuming still that each of the 35 2D/3D surveys would cover roughly six OCS blocks (9 mi^2 or 24 km^2), the total estimated amount of seismic exploration for the Beaufort Sea is 315 mi^2 (approximately 840 km^2). The total time for the 13 high-resolution site-clearance surveys is estimated to range from 26-65 days.

IV.E.2. Resource-Specific Cumulative Effects. The cumulative effects on the resources are discussed in the same order in which the resources were described: subsistence-harvest patterns, marine and coastal birds, water quality, other resources (including bowheads and polar bears), and environmental justice.

Available evidence indicates that the total extent of arctic sea ice has declined over the past several decades; however, these declines are not consistent across the Arctic (Gloersen and Campbell, 1991; Johannessen, Miles, and Bjorgo, 1995; Maslanki, Serreze, and Barry, 1996; Parkinson et al., 1999; Vinnikov et al., 1999). Warming trends in the Arctic (Comiso, 2003) appear to be affecting thickness of multiyear ice in the polar basin (Rothrock, Yu, and Maykut, 1999) and perennial sea-ice coverage (declines 9% per decade) (Comiso, 2002a,b).

The presence, thickness, and movement of sea ice contribute significantly to ambient noise levels. The presence of sea ice also affects the timing, nature, and possible locations of human activities such as shipping; research; barging; whale hunting; oil- and gas-related exploration (e.g., seismic surveys and drilling); military activities; and other activities that introduce noise into the marine environment. Because of sea ice and its effects on human activities, ambient noise levels in the Beaufort and Chukchi seas can vary dramatically between seasons and sea-ice conditions. The presence of ice also impacts which marine species are present, another factor that affects ambient noise levels.

If climate warming continues, it is likely that changes in the acoustic environment also will occur in many parts of the waters off of Alaska due to increased human use of the seasonally ice-covered waters (Tynan and DeMaster, 1997; Brigham and Ellis, 2004). Climate warming potentially could affect the acoustic environment in ways including: (a) increased noise and disturbance related to increased shipping and other vessel traffic, and possibly related to increased development; (b) expansion of commercial fishing and/or changes in areas where intensive fishing occurs; (c) decreases in ice cover; (d) potential changes in subsistence-hunting practices; and (e) changes in the distribution of marine mammal species (MacLeod et al., 2005).

IV.E.2.a. Subsistence-Harvest Patterns and Sociocultural Systems.

IV.E.2.a(1) Subsistence-Harvest Patterns. Cumulative effects on subsistence-harvest patterns include effects from Sale 202 exploration and development and other past, present, and reasonably foreseeable projects on the North Slope. The Proposed Action for Sale 202 exploration and development itself could affect subsistence resources because of potential oil spills; noise and traffic disturbance; or disturbance from construction activities associated with ice roads, pipelines, and landfalls. Noise and traffic disturbance might come from building, installing, and operating production facilities and from supply efforts. See Section IV.C.1.b, Effects on Subsistence-Harvest Patterns, for a more detailed discussion of effects on subsistence resources and harvest patterns.

For subsistence-harvest patterns, the multiple-sale EIS concludes specifically that:

> Cumulative effects on subsistence-harvest patterns include effects from Sale 186 exploration and development and other past, present, and reasonably foreseeable projects on the North Slope with one or more important subsistence resources becoming unavailable or undesirable for use for 1-2 years, a significant adverse effect. Sources that could affect subsistence resources include potential oil spills, noise and traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. The communities of Barrow, Nuiqsut, and Kaktovik would potentially be most affected, with Nuiqsut potential being the most affected community because it is within an expanding area of oil exploration and development both onshore (Alpine, Alpine Satellite, and Northeast and Northwest National Petroleum Reserve-Alaska) and offshore (Northstar and Liberty). In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major additive significant effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Because the likelihood of a large oil spill is unlikely, attaining a level of significant effect is also unlikely. The placement of a drilling structure or production island near the bowhead whale migration corridor that operated over the life of a field (15-20 years) would represent a far more significant effect because of potential long-term noise disturbance to migrating whales. We expect that mitigation would be developed to prevent any long-term disruption to migrating whales from industrial noise. (USDOI, MMS, 2003:Sec. V.C.11.b(3))

After publication of the multiple-sale EIS, the effects of a proposed lease sale in the Northwest NPR-A were assessed (USDOI, BLM and MMS, 2003). The NPR-A assessment summarizes the effects of an offshore spill on subsistence resources and subsistence-harvest patterns:

> Any actual or perceived disruption of the bowhead whale harvest from oil spills and any actual or perceived tainting anywhere during the bowhead's inmigration, summer feeding, and fall migration could disrupt the bowhead hunt for an entire season, even though whales still would be available. Tainting concerns also would apply to polar bears, seals, fish, and birds. Biological effects on other subsistence resources might not affect species' distributions or populations, but disturbance could force hunters to make more frequent and longer trips to harvest enough resources in a given season. For beluga whales, more traditionally flexible hunting patterns could reduce the effects of noise and disturbance. Hunters can take belugas in ice leads and open water at various times from early May to late July. This seasonal flexibility could constitute possible mitigation against noise and disturbance effects. In the unlikely event that a large oil spill were to occur, it could cause potential short-term (but significant) adverse effects to long-tailed ducks and king and common eider populations. Subsistence-bird resources might only experience short-term, local disturbance, but such disturbance could cause waterfowl to avoid productive subsistence-hunting sites. For the spring subsistence-waterfowl harvest, cumulative loss of habitat from development activities and population losses from oil spills could significantly disrupt harvests. An onshore pipeline spill that contacted rivers and streams could kill many fish and affect these fish populations. Although polar bears are most often hunted opportunistically by North Slope subsistence hunters while in pursuit of more-preferred subsistence resources, a

> potential loss of polar bears from oil-spill effects could reduce their availability locally to subsistence users. (USDOI, BLM and MMS, 2003:Sec. IV.F.8.n)

After publication of the multiple-sale EIS and the Sale 195 EA, the effects of additional development around the Alpine Field, as described in the Alpine Satellite Development Plan Final EIS (USDOI, BLM, 2004), and a proposed lease sale in the Northeast NPR-A, as described in the Northeast NPR-A Final Amended IAP/EIS were assessed (USDOI, BLM, 2005).

The Alpine Satellite Development Plan assesses the effects of increased oil field development in the area on subsistence resources and harvests. The conclusion to the cumulative analysis states:

> Development has already caused increased regulation of subsistence hunting, reduced access to hunting and fishing areas, altered habitat, and intensified competition from non-subsistence hunters for fish and wildlife (Haynes and Pedersen 1989).
>
> Additive impacts that could affect subsistence resources include potential oil spills, seismic noise, road and air traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. Based on potential cumulative, long-term displacement and/or functional loss, habitat available for caribou may be reduced or unavailable or undesirable for use. Changes in population distribution due to the presence of oilfield facilities or activities may affect [the] availability for subsistence harvest[s] in traditional subsistence use areas. The communities of Barrow, Atqasuk, Nuiqsut, and Anaktuvuk Pass would be most affected.
>
> Overall, impacts to subsistence harvest[s] and use[s] may have synergistic impacts with community health, welfare, and social structure. To the extent that subsistence hunting success is reduced in traditional use areas near Nuiqsut because of the presence of oilfield facilities and activities, subsistence hunters will need to travel to more distant areas to harvest sufficient resources in order to meet community needs. Greater reliance on more distant subsistence use areas will result in greater time spent away from the community for some household members and competition for resources with members of other communities. These changes in subsistence patterns may result in stress within households, family groups, and the community. (USDOI, BLM, 2004:Sec. 4G.7.3.4)

The Northeast NPR-A Final Amended IAP/EIS assesses the effects of increased oil development in the area on local subsistence practices. The conclusion to the cumulative analysis states:

> Exploration and development activities on the North Slope have greatly impacted subsistence activities, as noted during public scoping testimony. In the Planning Area, exploration and development could originate from Inigok, Point Lonely, and the Umiat vicinity, and could encompass important subsistence harvest areas for moose, fish, caribou, and furbearers, affecting subsistence users in Nuiqsut, Atqasuk, Barrow, and Anaktuvuk Pass. Subsistence hunters traveling in nearly every direction from Nuiqsut would have to pass through some kind of development en route to subsistence harvest areas. Iñupiat hunters are reluctant to use firearms near oil production facilities and pipelines, so subsistence users would be unlikely to harvest subsistence resources in these areas. Aircraft have interfered with hunts by scaring game away from hunters, and the increase in air traffic by fixed-wing aircraft and helicopters would make this worse and over a much greater area if development goes forward. This issue has been raised several times by residents of Nuiqsut, who have also noted that oil and gas development is impacting traditional use areas and their ability to pass on knowledge of subsistence resources in these area, and use of these resources, to their children.
>
> Development along the north side of Teshekpuk Lake, outside the area closed to leasing, could deflect or divert caribou hunted in and near the area by Nuiqsut, Barrow, and Atqasuk residents in the summer and winter (SRBA 2003b). Numbers of animals available for harvest could be reduced through the slow destruction of species by habitat loss, predation, climate change, and

disease. Diverting animals from their usual and accustomed locations, or building facilities in proximity to those locations, could compel resource harvesters to travel further to avoid development areas. Harvest of subsistence resources in areas further from the communities would require increased effort, risk, and cost on the part of subsistence users. Increasing the areas open for leasing and exploration would lead to development in previously closed areas, leading to concentrating subsistence harvest efforts in the undeveloped areas and increasing the potential for conflict over harvest areas within a community.

Climate change and the associated effects of anticipated warming of the climate regime in the Arctic could significantly affect subsistence harvests and uses if warming trends continue...(NRC 2003, ACIA 2004). Every community in the Arctic is potentially affected by the anticipated climactic shift and there is no plan in place for communities to adapt to or mitigate these potential effects. The reduction, regulation, and/or loss of subsistence resources would have severe effects on the subsistence way of life for residents of Nuiqsut, Atqasuk, Barrow, and Anaktuvuk Pass. If the loss of permafrost, and conditions beneficial to the maintenance of permafrost, arise as predicted, there could be synergistic cumulative effects on infrastructure, travel, landforms, sea ice, river navigability, habitat, availability of fresh water, and availability of terrestrial mammals, marine mammals, waterfowl and fish, all of which could necessitate relocating communities or their population[s], shifting the population[s] to places with better subsistence hunting and causing a loss or dispersal of community (NRC 2003, ACIA 2004). (USDOI, BLM, 2005:Sec. 4.7.7.12)

The recent seismic-survey PEA (USDOI, MMS, 2006a) provides and updated cumulative effects discussions for the Beaufort Sea region. The seismic PEA is available on the MMS web site at: http://www.mms.gov/alaska/ref/pea_be.htm.

IV.E.2.a(2) Cumulative Effects on Subsistence in the Context of Climate Change. A factor of increasing concern is the potential for adverse effects on subsistence-harvest patterns and subsistence resources from global climate change. The Council on Environmental Quality (CEQ) bases its guidance on the National Environmental Policy Act (NEPA) regulations, which mandate that all "reasonably foreseeable" environmental impacts of a proposed Federal action must be considered in the NEPA assessment. The CEQ considers that there is adequate scientific evidence (e.g., in the *Second Assessment Report* by the Intergovernmental Panel on Climate Change [IPCC]) indicating that climate change is a "reasonably foreseeable" impact of greenhouse gas emissions (CEQ, 1997; IPCC, 2001).

Permafrost thawing is expected to continue to damage roads and buildings and contribute to eroding coastlines and increase building and maintenance costs. The cost of shifting buildings, broken sewer lines, buckled roads, and damaged bridges already has caused $35 million worth of damage in Alaska annually. In Kotzebue, the local hospital had to be relocated, because it was sinking into the ground (ARCUS, 1997). Sea-level rise and flooding threaten buildings, roads, and power lines along low coastlines in the Arctic and, combined with thawing permafrost, can cause serious erosion. Kaktovik's 50-year-old airstrip has begun to flood because of higher seas and may need to be moved inland (Kristof, 2003). Shore erosion in Shishmaref, Kivalina, Wainwright, and Barrow in Alaska and Tuktoyaktuk at the mouth of the Mackenzie River in Canada has become increasingly severe in recent years, as sea-ice formation occurs later, allowing wave action from storms to cause greater damage to the shoreline. Eventually, some of these communities will be forced to relocate.

The duration of ice-road usefulness in the Arctic already has diminished and has led to an increased need for more permanent gravel roads. However, gravel roads are more prone to the effects of permafrost degradation, thermocarst, and consequent settling that increases maintenance costs (Nelson, 2003a,b). Gravel roads also contribute to the fragmentation of landscapes and habitats that through time can lead to reduced species' productivity. Such an impact on species is a threat to subsistence livelihoods.

Continuing sea-ice melting and permafrost thawing could threaten subsistence livelihoods. Typically, peoples of the Arctic have settled in particular locations because of their proximity to important subsistence food resources and dependable sources of water, shelter, and fuel. Northern peoples and subsistence practices will be stressed to the extent that settlements are threatened by sea-ice melt, permafrost loss, and

sea-level rise; traditional hunting locations are altered; subsistence travel and access difficulties increase; and game patterns shift and their seasonal availability changes.

Large changes or displacements of resources are likely, leaving little option for subsistence communities: they must quickly adapt or move (Langdon, 1995; Callaway, 1995; *New Scientist*, 2002; Parson et al., 2001; AMAP, 1997; *Anchorage Daily News*, 1997; Weller, Anderson, and Nelson, 1998; IPCC, 2001). Great decreases or increases in precipitation could affect local village water supplies, shift the migration patterns of land mammals, alter bird breeding and molting areas, affect the distribution and abundance of anadromous and freshwater fishes, and limit or alter subsistence access routes (particularly in spring and fall) (AMAP, 1997). Changes in sea ice could have dramatic effects on sea mammal migration routes and this, in turn, would impact the harvest patterns of coastal subsistence communities and increase the danger of hunting on sea ice (Callaway et al., 1999; Bielawski, 1997). Between 1980 and 2000, three sudden ice events caused Barrow whalers to abandon their spring whaling camps on the ice lead (George et al., 2003; National Assessment Synthesis Team, 2000; Groat, 2001).

If the present rates of climate change continue, changes in diversity and abundance to arctic flora and fauna still could be significant; but at the same time, these impacts "cannot be reliably forecast or evaluated" and:

> ...positive effects such as [1] extended feeding areas and seasons in higher latitudes, [2] more productive high latitudes, and [3] lower winter mortality may be offset by negative factors that alter established reproductive patterns, breeding habitats, disease vectors, migration routes, and ecosystem relationships (IPCC, 2001).

Climate change impacts on Alaska's North Slope have become a growing concern among the coastal subsistence-based communities there. During the 2005 NSB mayoral election, the winning candidate, Edward Itta, identified climate change as the biggest threat to subsistence:

> Recent changes in the climate have the ice moving greater distances from shore. This not only means that hunters and whalers have to go out farther and use more fuel, it's becoming more dangerous...The window of opportunity for seal hunting and whaling is getting shorter and shorter. (Stapleton, 2005)

Because polar marine and terrestrial animal populations would be particularly vulnerable to changes in sea ice, snow cover, and alterations in habitat and food sources brought on by climate change, rapid and long-term impacts on subsistence resources (availability), subsistence-harvest practices (travel modes and conditions, traditional access routes, traditional seasons and harvest locations), and the traditional diet could be expected over the lifetime of Sale 202 development (IPCC, 2001; NRC, 2003).

IV.E.2.a(3) Sociocultural Systems. Cumulative effects on sociocultural systems include effects of Sale 202 exploration, development, and other past, present, and reasonably foreseeable projects on the North Slope. Cumulative effects on sociocultural systems would come from changes to subsistence-harvest patterns, social organization and values, and other issues, such as stress on social systems.

For sociocultural systems, the multiple-sale EIS concludes that:

> In this cumulative analysis, effects on social institutions (family, polity, economics, education, and religion) could result from industrial activities, changes in population and employment, and changes in subsistence-harvest patterns. These effects would be similar to those described in Section IV.C under Effects Common to All Alternatives, but the level of effects would increase because collectively, activities would be more intense. More air traffic and non-Natives in the North Slope region could increase interaction and, perhaps, conflicts with Native residents. In the past, non-Native workers have stayed in enclaves, which kept interactions down. However, recent activity in the Alpine field has brought non-Natives directly into the Native village of Nuiqsut, and this has added stresses in the community. Already, these workers have made demands on the village for more electrical power and health care. This potential remains for the communities of Barrow and Kaktovik.

> Increases in population growth and employment could cause long-term disruptions to (1) the kinship networks that organize the Inupiat communities' subsistence production and consumption, (2) extended families, and (3) informally derived systems of respect and authority (mainly respect of elders and other leaders in the community). Cumulative effects on social organization could include decreasing importance of the family, cooperation, sharing, and subsistence as a livelihood, and increasing individualism, wage labor, and entrepreneurship. Long-term effects on subsistence-harvest patterns also could be expected. Chronic disruption could affect subsistence task groups and displace sharing networks, but it would not tend to displace subsistence as a cultural value.
>
> At the same time, revenues from NSB taxation on oil development produce positive cumulative impacts that include increased funding for infrastructure, higher incomes (that can be used to purchase better equipment for subsistence), better health care, and improved educational facilities. We may see increases in social problems, such as rising rates of alcoholism and drug abuse, domestic violence, wife and child abuse, rape, homicide, and suicide. The NSB already is experiencing problems in the social health and well-being of its communities, and additional development, including offshore oil development on the North Slope, would further disrupt them. Health and social-services' programs have tried to respond to alcohol and drug problems with treatment programs and shelters for wives and families of abusive spouses, in addition to providing greater emphasis on recreational programs and services. These programs, however, sometimes do not have enough money, and NSB city governments cannot help as much now that they get less money from the State. Based on experiences after the *Exxon Valdez* spill, Native residents employed in cleanup work could stop participating in subsistence activities, have a lot of money to spend, and tend not to continue working in other lower paying community jobs. Because Nuiqsut is relatively close to oil development activities on the North Slope, cumulative effects chronically could disrupt sociocultural systems in the community--a significant effect; however, overall effects from these sources are not expected to displace ongoing sociocultural systems, community activities, and traditional practices for harvesting, sharing, and processing subsistence resources. This potential exists for the communities of Barrow and Kaktovik as Beaufort Sea areawide leasing, exploration, and development proceed on- and offshore. In the unlikely event that a large oil spill occurred and contaminated essential whaling areas, major additive effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.

After publication of the multiple-sale EIS, the effects of a proposed lease sale in the Northwest NPR-A were assessed (USDOI, BLM and MMS, 2003). Sections IV.F.8.o of the NPR-A assessment summarizes the effects of an offshore spill on sociocultural systems:

> In the unlikely event that a large oil spill were to occur and contaminate essential whaling areas, major additive, significant effects on sociocultural systems could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together.... The additive stress created by the fear of an oil spill becomes a distinct impact-producing agent within the human environment.... Also, cleanup activities could generate many cleanup and response jobs. Based on the *Exxon Valdez* spill experience, Alaska Native residents employed in cleanup work could stop participating in subsistence activities, have a lot of money to spend, and tend not to continue working in other, lower-paying community jobs. In the case of a large spill, these dramatic changes could cause tremendous social upheaval (Human Relations Area Files, Inc., 1994; Alaska Department of Fish and Game, 1995b; Impact Assessment, Inc., 1990c, 1998).

After publication of the multiple-sale EIS and the Sale 195 EA, the effects of additional development around the Alpine Field as described in the Alpine Satellite Development Plan Final EIS (USDOI, BLM, 2004) and a proposed lease sale in the Northeast NPR-A as described in the Northeast NPR-A Final Amended IAP/EIS were assessed (USDOI, BLM, 2005).

Section 4G.7.1.2 of the Alpine Satellite Development Plan assesses the effects of increased oil field development in the area on sociocultural systems. The conclusion to the cumulative analysis states:

> Overall, both additive and synergistic impacts to the socio-cultural characteristics of North Slope communities associated with Alternative A – CPAI [ConocoPhillips Alaska, Inc.] Development Plan and past, present, and reasonably foreseeable future development may occur. Changes to community structure, cultural values and community health and welfare, predate oil and gas development on the North Slope. However, change in community socio-cultural characteristics has continued during the period of oil development. As the area impacted by oil development in the future increases, especially in proximity to local communities, cumulative impacts are likely to increase. For example, Nuiqsut, Barrow, Atqasuk, and Anaktuvuk Pass are currently dependent on subsistence caribou harvest from the CAH [Central Arctic Herd] and TLH [Teshekpuk Lake Herd]; additional future development may have additive impacts to subsistence harvest from these herds leading to synergistic impacts on subsistence-harvest patterns (including disruption of community activities and traditional practices for harvesting, sharing, and processing subsistence resources), social bonds, and cultural values.

Section 4.7.7.13 of the Northeast NPR-A Final Amended IAP/EIS assesses the effects of increased oil development in the area on sociocultural systems. The conclusion reads:

> Both additive and synergistic impacts to sociocultural characteristics of North Slope communities are associated with oil and gas exploration and development on the North Slope. Because of the primary dependence of Anaktuvuk Pass, Atqasuk, Barrow, and Nuiqsut residents on the subsistence caribou harvest from CAH, TLH, and WAH [Western Arctic Herd] caribou, bowhead whaling offshore, and continued healthy fish, cumulative effects could potentially chronically disrupt sociocultural systems in the community [communities?], particularly in the case of bowhead whaling, around which the sociocultural system is based. Caribou hunting provides food and materials that support whaling. Seal hunting provides skins for Barrow's skin boat whaling in the spring and supplies meat for food. Fishing and bird hunting provide meat and fish for whalers, as well as for the festivals, *Nalukataq* and *Kivgiq,* associated with whaling. These festivals are important social activities that unify the communities, reunite families, and maintain the continuity of the present with past practice and tradition.
>
> Effects from industrial activities (e.g., noise, light, and chemical pollution), changes in human population and employment, and the accompanying changes in subsistence-harvest patterns, social bonds, and cultural values would be expected to disrupt community activities and traditional practices for harvesting, sharing, and processing subsistence resources, but they would not be expected to displace sociocultural institutions, social organization, or sociocultural systems. Funding cuts and reduced wage earnings would not likely reduce subsistence uses, but may require changes in seasonal round and longer periods of travel to get to subsistence harvest areas; however, these would more than likely resemble the pre-1950 pattern of residence and travel, and technology is available that could facilitate education services delivery via electronic means.
>
> Health issues caused by persistent and short-term pollution could shorten life spans of elders, who are the key repositories of traditional and cultural knowledge in the communities. Health issues from increased injuries as a result of the need to travel further over rough terrain to support families with subsistence foods could reduce community involvement with employment, tax the community health infrastructure, encourage outmigration, and lead to increases in substance abuse and depression in those no longer able to participate in subsistence activities. Cuts in funding for services would increase the severity of the problem of delivery of health services, as well as maintaining health and hygiene infrastructure (e.g., fresh water, sewers, and washeteria).
>
> Because of impacts from climate change on long-standing traditional hunting and gathering practices that promote health and cultural identity, and, considering the limited capacities and choices for adaptation and the ongoing cultural challenges of globalization to indigenous communities, North Slope peoples would experience cultural stresses, as well as impacts to

> population, employment, and local infrastructure. The termination of oil activity could result in the outmigration of non-Iñupiat people from the North Slope, along with some Iñupiat who may depend on higher levels of medical support or other infrastructure and services than may be available in a fiscally-constrained, post-oil production circumstance. If subsistence livelihoods are disrupted, Iñupiat communities could face increased poverty, drug and alcohol abuse, and other social problems resulting from a loss of relationship to subsistence resources, the inability to support a productive family unit, and a dependence on non-subsistence foods (Langdon 1995, Peterson and Johnson 1995, USGCRP 2000, IPCC 2001). As stated by Parson et al. (2001), "It is possible that projected climate change will overwhelm the available responses. It is also realistic to expect that some general assistance could be found to mitigate the losses of nutrition, health, and income from diminished subsistence resources, but such assistance would likely have little effect in mitigating the associated social and cultural impacts."

The seismic-survey PEA (USDOI, MMS, 2006a) provides and updated cumulative effects discussion for the Beaufort Sea region. The seismic PEA is available on the MMS web site at: http://www.mms.gov/alaska/ref/pea_be.htm.

The NSB communities were concerned by a recent legislative initiative to reallocate revenues from Federal lease sales in the NPR-A. The proposal in the State legislature tightened the rules for awarding these monies to locally impacted communities and taking a bigger cut for the Permanent Fund (Sutton, 2006). Protests from local communities, the NSB, and regional legislators eventually defeated the effort, but the action does point out the difference in views among some legislators and local communities for development-oriented impacts to communities in the region. Locally, the NSB continues to adopt rezoning ordinances to accommodate nearshore development projects, including the Nikaitchuq and Oooguruk projects, both seaward of the Colville River Delta (Cashman, 2006a). As part of the rezoning measure, the operator was tasked with entering into a conflict avoidance agreement with the AEWC and formulating a Good Neighbor Policy, as well as coordinating barging and vessel traffic with whaling activities. The operator, as well, established a Nuiqsut Mitigation Fund with Nuiqsut's Kuukpik Corporation, the City of Nuiqsut, and the Native Village of Nuiqsut (Cashman, 2006b). Conoco Phillips has also recently established a subsistence mitigation fund protocol with Nuiqsut.

Locally, the NSB and the Northwest Arctic Borough have convened two joint Arctic Economic Development Summits to address the region's economic future, increase the availability of local jobs, and develop strategies to enhance the future well-being and success of Inupiat children through better education (Community Engagement Steering Committee, 2005).

IV.E.2.a(4) Cumulative Effects on Sociocultural Systems in the Context of Climate Change. Because of rapid and long-term impacts from climate change on long-standing traditional hunting and gathering practices that promote health and cultural identity, and considering the limited capacities and choices for adaptation and the ongoing cultural challenges of globalization to indigenous communities, we conclude that communities in the Arctic would experience significant cultural stresses, as well as major impacts on population, employment, and local infrastructure. If subsistence livelihoods are disrupted, communities in the Arctic could face increased poverty, drug and alcohol abuse, and other social problems (Langdon, 1995; Peterson and Johnson, 1995; National Assessment Synthesis Team, 2000; IPCC, 2001; Callaway et al., 1999; ARCUS, 1997). As stated by Parson et al. (2001):

> It is possible that projected climate change will overwhelm the available responses. It also is realistic to expect that some general assistance can be found to mitigate the losses of nutrition, health, and income from diminished subsistence resources, but such assistance would likely have little effect in mitigating the associated social and cultural impacts.

Summary. The incremental contribution of Sale 202 to overall cumulative effects is likely to be quite small. Sources that could affect subsistence resources include potential oil spills, noise and traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. The communities of Barrow, Nuiqsut, and Kaktovik potentially would be most affected, with Nuiqsut potentially being the most affected community, because it

is within an expanding area of oil exploration and development both onshore (Alpine, Alpine Satellite, Northeast and Northwest NPR-A, Liberty); nearshore (Oooguruk and Nikaichug field developments); and offshore (Northstar, increased seismic-exploration activity, potential drilling operations off Kaktovik, and Canadian drilling off the Mackenzie River Delta).

In the event of a large spill from Sale 202, many harvest areas and some subsistence resources would become unavailable or undesirable for use for 1-2 years, a significant adverse effect. If a large spill assumed in the cumulative case occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Any potential effects to subsistence resources and subsistence harvests are expected to be mitigated substantially but not eliminated.

Sale 202 represents a small proportion, 2-4%, of the total past, present, and reasonably foreseeable oil and gas development in the Beaufort Sea and the North Slope area. While the most likely number of oil spills $\geq$500 bbl from all past, present, and future activities onshore is estimated to be 0.65, the most likely number of offshore spills is estimated to be one. Sale 202 is estimated to contribute about 17% of the estimated mean number of cumulative offshore spills, with a most likely number of spills being zero.

In the event of a spill from Sale 202, many harvest areas and some subsistence resources would be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated. The contribution from Sale 202 to cumulative effects on the sociocultural systems of the communities of Barrow, Nuiqsut, and Kaktovik could come from disturbance from oil-spill-cleanup activities; small changes in population and employment; and disruption of subsistence-harvest patterns from oil spills and oil-spill cleanup, seismic noise, and climate change. Disturbance effects periodically could disrupt, but not displace, ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources; however, such traditional practices could be seriously curtailed in the short term, if there are concerns over the tainting of bowhead whales from an oil spill. In the event of a large spill, which is still considered to be a low-likelihood event, significant cumulative effects would be expected from Sale 202.

Any realistic analysis of cumulative effects on the North Slope needs to consider both onshore and offshore effects. Although onshore and offshore cumulative effects are difficult to separate, most cumulative effects are thought to result from onshore development. To date, no comprehensive onshore monitoring or baseline data gathering has ever been undertaken by responsible Federal and State agencies and industry; the most obvious cumulative effects have occurred and continue to occur onshore, as oil-field development expands westward from the initial Prudhoe Bay/Deadhorse area of development. Proposed and ongoing studies that will contribute to a more comprehensive understanding of cumulative effects to the Native population of the North Slope are discussed in the Environmental Justice cumulative effects section.

Conclusion. Conclusions and updated levels of effect on subsistence-harvest patterns and sociocultural systems, including the contribution of Sale 202 leases, would be the same as described in the multiple-sale EIS, i.e., there would be no new significant cumulative impacts other than those that already have been addressed in the Beaufort Sea multiple-sale EIS.

We conclude that potential overall cumulative impacts on subsistence and sociocultural systems from noise, disturbance, large oil-spills, and global climate change would be significant, warrant continued close attention, and the development, monitoring, and enforcement of effective mitigation practices. Additionally, the potential effects of the lease sale are assessed within the context of climate change. If any new major effect due to climate change were to occur, MMS would require changes to exploration or development/production designs and activities.

IV.E.2.b. Marine and Coastal Birds. The multiple-sale EIS addressed cumulative effects on threatened spectacled eiders, generally concluding that: "Potential cumulative effects on the...spectacled

eider...would be of primary concern and warrants continued close attention and effective mitigation practices" (USDOI, MMS, 2003:Sec. V.A.6). More specifically, the EIS concluded that: "The spectacled eider population...may be slow to recover from small losses and declines in fitness or productivity" associated with various disturbance factors, but: "No significant overall population effect is expected to result from small losses ... (and in) the event a large oil spill occurs in the marine environment ... any substantial loss (for example, 25+ individuals) would represent a significant effect ... ." It also states: "Recovery from substantial mortality is not expected to occur while the population exhibits a declining trend...."

A similar analysis was completed for the Steller's eider, stating: "Although little Steller's eider mortality is expected from an oil spill, knowledge regarding their numbers and distribution in this region is insufficient to allow realistic calculation of risk or effects from cumulative adverse factors."

Conclusions regarding cumulative effects on other bird species were that: "Disturbance may cause some small loss of productivity and lowered fitness or survival of birds occupying areas with high levels of industry activity, but these effects are not expected to be significant...." The EIS also stated: "Overall cumulative effects of oil-industry activities on marine and coastal birds potentially could be...significant in the case of long-tailed duck and king and common eiders, primarily as a result of mortality in the unlikely event a large oil spill occurs."

Section IV.B.2.b and Appendix D review relevant information pertaining to species distribution, abundance, and other important information since publication of the multiple-sale EIS. Section IV.C.1.b details recent information regarding the susceptibility of marine and coastal birds to mitigation or anticipated effects following Lease Sale 202, including bird-strike studies and changes in the OSRA. Overall, these updates include evidence for ongoing modifications to bird habitats resulting from changes in the abundance, distribution, and duration of arctic ice. These changes also may be affecting other species in ways not yet detected, and are anticipated to continue. Any negative effects from climate change would be in addition to nonsignificant changes associated with the proposed lease sale. It also is conceivable that some marine or coastal birds could realize short- or long-term benefits from arctic climate change.

Subsequent to the multiple-sale EIS and Sale 195 EA, the BLM amended the Northeast NPR-A IAP/EIS (USDOI, BLM, 2005). The amended IAP/EIS addressed opening up of previously protected areas within the Northeast Planning Area for oil and gas leasing and exploration. According to BLM (USDOI, BLM, 2006), a series of lease stipulations and Required Operating Procedures would be implemented to minimize resource impacts, including marine and coastal birds, following oil and gas leasing. The FWS prepared a Biological Opinion that specified an incidental take of 104 spectacled eiders and 9 Steller's eiders over the life of the Northeast NPR-A project (USDOI, FWS, 2005). This level of anticipated killing was not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat. Similarly, BLM concluded their "...obligations to protect...wildlife and their habitat..." would be satisfied through "...strict restrictions on land use activities and...all practicable mitigation and monitoring...."

Cumulative effects, including disturbance from increases in the potential for vehicle, vessel, and/or aircraft traffic and collision from additional buildings and pipelines, are expected to result from new infrastructure developments described in Section IV.E.1. However, substantial simultaneous developments in high bird-density areas would be required to cause significant effects beyond those described in the cumulative analysis of the multiple-sale EIS. The expected low probability of a large oil-spill occurrence in the context of the updated information presented here suggests that the potential level of cumulative-effect significance would be the same as stated in the multiple-sale EIS.

Conclusion. The updated information suggests, as stated in the multiple-sale EIS, that: "The incremental contribution of Sale [202] to the cumulative effects likely would be quite small." Specific potential effects of cumulative factors may include the loss of small numbers of spectacled eiders and other sea ducks or aquatic bird species as cumulative projects are developed. Minor declines in fitness, survival, or production of young resulting from exposure of these species to disturbance factors, or mortality from collision with structures, warrants continued close attention and effective mitigation practices. Mortality

from a large oil spill, an unlikely event, could be relatively substantial and represent a significant effect for any of several marine or coastal bird species; recovery of these species from such mortality is not expected to occur if their population is exhibiting a declining trend. In the context of new information that has become available since publication of the multiple-sale EIS, these conclusions remain consistent; thus, the updated level of effect on marine and coastal bird populations is expected to be the same as stated in that document.

IV.E.2.c. Local Water Quality. The multiple-sale EIS concluded that the cumulative effects on water quality would be due primarily to three factors: discharges of drilling muds, cuttings and produced waters; construction of gravel islands and pipeline trenches; and oil spills. The assessment included also the effects of transportation. The following is the EIS conclusion with regard to cumulative effects on water quality (USDOI, MMS, 2003:Sec. IV.C.1):

> A spill could affect water quality for 10 or more days in a local area. The effects of discharges and offshore construction activities are expected to be short term, lasting as long as the individual activity, and (to) have the greatest impact in the immediate vicinity of the activity.
>
> Levels of activities estimated for Alternative I for Sale 186 are used to estimate the contribution to the cumulative effects. There are more than 40 projects in the past, present, and reasonably foreseeable future development/production projects, 17 of which would be offshore prospects. Most of the 17 projects would be located completely offshore; however, 6 of the projects are or might be developed from onshore facilities. The contribution from Alternative I for Sale 186 to the total number of offshore projects (11) is about 9%. Therefore, we assumed that Alternative I for Sale 186 would contribute about one-tenth of the cumulative effects described in the previous paragraph.

The cumulative scenario or assumptions for proposed Sale 202 have not changed with regard to discharges, construction, transportation, and oil spills (Sec. IV.E.1). The cumulative scenario has changed with regard to only projected seismic exploration. The projected seismic exploration would not affect water quality (USDOI, MMS, 2006a: Sec.III.D.1.f).

There are no other proposed projects that would have a substantial, adverse effect on Beaufort Sea water quality. As explained in Section IV.C.1.c, climate change—especially the retreat of the summer and autumn ice cover—will probably increase the water-column mixing in the Beaufort Sea, and thereby mix and disperse any pollutants. This might reduce the level of local water-quality effects. Therefore, the cumulative conclusions for proposed Sale 202 are similar to those above for Sale 186.

IV.E.2.d. Bowhead Whales. The multiple-sale EIS concluded that potential cumulative effects on the bowhead whale would be of primary concern and would warrant continued close attention and effective mitigation practices (USDOI, MMS, 2003). During June 2006, the NMFS updated the Arctic Region Biological Opinion (ARBO), including the assessment of cumulative effects on bowhead whales (Appendix E). As explained in EA Section IV.C.2.d, the updated ARBO concludes that:

> After reviewing the current status of the bowhead whale, the environmental baseline for the action area, the biological and physical impacts of oil leasing and exploration, and cumulative effects, and in consideration that the described actions are expected to impact only the Western Arctic stock of bowhead whales, it is NMFS's biological opinion that oil and gas leasing and exploration in the Chukchi and Beaufort Seas is not likely to jeopardize the continued existence of the *Balaena mysticetus* endangered bowhead whale. No critical habitat has been designated for the bowhead whale, therefore none will be affected.

Cumulative effects are assessed in detail in ARBO Section V, including the effects of oil and gas operations in the Beaufort and Chukchi Seas, in the Canadian Beaufort Sea, and in nearshore waters of the State of Alaska. Activities that are not oil and gas related are included also, as explained in the following five paragraphs from the ARBO.

Activities that are not oil and gas related include ship strikes. Between 1976 and 1992, only three ship-strike injuries were documented out of a total of 236 bowhead whales examined from the Alaskan subsistence harvest (George et al. 1994). The low number of observed ship-strike injuries suggests that bowheads either do not often encounter vessels or they avoid interactions with vessels, or that interactions usually result in death of the animals. However, as discussed in section III, there is recent evidence that interaction of bowhead whales with ships and fishing gear may be increasing.

Subsistence harvest by Alaska Natives is another non-OCS activity that affects the bowhead whale. Bowheads are taken in the northern Bering Sea and in the Chukchi Sea on their spring migration and in the Beaufort Sea on their fall migration. Barrow whalers harvest whales during both the spring and fall migrations. Requests to harvest bowheads also have been made by Canadian ad Russian Natives. The Canadian Government granted permission in 1991 to kill one bowhead, and a bowhead was harvested in Mackenzie Bay in the fall of 1991. Additional permits were granted in 1993 and 1994, but no bowheads were harvested in either year. There has been a renewed interest by villages along the Russian Chukchi Sea coast to hunt bowhead whales. At the 1997 IWC meeting, the Commission approved a combined quota allowing an average of 56 bowheads to be landed each year to meet the needs of Eskimos in Alaska and Chukotka Natives of the Russian Far East.

The cumulative effects of noise on bowheads from offshore oil and gas activities would be similar to that described and summarized for OCS leasing and exploration. The effects from an encounter with aircraft generally are brief, and the whales should resume their normal activities within minutes. Bowheads may exhibit temporary avoidance behavior to vessels at a distance of 1-4 km. Fleeing from a vessel generally stopped within minutes after the vessel passed, but scattering may persist for a longer period. Bowheads also exhibited tendencies for reduced surfacing and dive duration, fewer blows per surfacing, and longer intervals between successive blows. Bowheads appear to recover from these behavioral changes within 30-60 minutes following the end of seismic activity. However, recent monitoring studies indicate that bowhead whales during the fall migration avoid an area around a seismic vessel operating in nearshore waters by a radius of about 20 km. Avoidance did not persist beyond 12 hours after the end of the seismic operations. This work also stated that bowhead whales may begin to deflect around a seismic source at distances up to 35 km.

Bowheads have been sighted within 0.2-5 km from drill ships, although bowheads change their migration speed and swimming direction to avoid close approach to most noise-producing activities. Bowheads may avoid drilling noise at 20-30 km. There are no observations of bowhead reactions to icebreakers breaking ice, but it has been predicted that roughly half of the bowheads would respond at a distance of 4.6-20 km when the S:N is 30 dB. Overall, bowhead whales exposed to noise-producing activities most likely would experience temporary, nonlethal effects. Some avoidance behavior could persist up to 12 hours.

Some bowhead whales could be exposed to spilled oil, resulting in temporary, nonlethal effects, although some mortality might result if there were a prolonged exposure to freshly spilled oil. Overall, bowhead whales exposed to noise-producing activities and oil spills associated with the proposal and other future and existing projects with the Arctic region—combined with the other activities with the range of migrating bowhead whales—most likely would experience temporary, nonlethal effects. However, exposure to oil spills could result in lethal effects.

Vessel traffic and, perhaps, aircraft activity may be expected to occur in the future in both the Chukchi and Beaufort Seas. The effects of these actions would be the same as that present for traffic associated with oil and gas actions. The NMFS is aware of the speculation that warmer ocean temperatures associated with climate change may allow for increased commercial fishing in the Chukchi Sea. However, we have no further information which would substantiate or quantify such development.

Overall, we conclude similarly that the cumulative effects on bowhead whales would not be significant. However, we also conclude, as we did in the multiple-sale EIS (USDOI, MMS, 2003), that cumulative effects on bowhead whales are of primary concern and, thus, warrant continued close attention and effective mitigation practices.

IV.E.2.e. Polar Bear. Despite the fact that the amount of proposed seismic activity has approximately doubled since the multi-sale EIS was written, the main effects of concern to polar bears are climate change, overharvest, and oil and fuel spills.

The Sale 195 EA concludes that:

> ...partly because of climate changes, we still conclude that potential effects on polar bears...would be a primary concern. We identify ringed seals and other ice-dependent pinnipeds as additonal resources of primary concern. Therefore, we conclude that the potential cumulative effects on polar bears, seals, and other ice-dependent pinnipeds would be of primary concern and would warrant continued close attention and effective mitigation practices (USDOI, MMS, 2004:Appendix I, Sec. I.2.e(3)).

Considering ongoing assessments of climate change (Section IV.A.1; Appendix D, Sec. D.2), this assessment still is relevant. Polar bears also face increased industrial development and increased human activity in the Arctic, which likely would interact synergistically in a cumulative fashion. Quantitative data is lacking that specifically addresses the potential cumulative impacts of development on polar bears and the effects of disturbance related to human activities on polar bear-habitat use, as well as recruitment and survival (Perham, 2005). There also is a high degree of uncertainty regarding the spatial scope of potential industry activities on the Alaskan OCS. However, the proposed activities would increase the overall industry footprint and add to the amount of industry activity in the sale area.

IV.E.2.e(1) Seismic Activities and Other Industrial Noise. Impacts to polar bears from marine open-water seismic-survey activity have not been studied but likely would be minimal. When swimming, polar bears normally keep their heads above or at the water's surface, where underwater noise is weak or undetectable (Richardson et al., 1995). Direct impacts causing injury (Level A) from seismic surveys are possible if animals entered the 190-dB zone immediately surrounding the sound source. However, with appropriate measures in place (e.g., marine mammal observers and shutdown procedures), seismic-survey-generated injuries could be mitigated. There also is the possibility that bears could be struck by seismic vessels or exposed to small-scale fuel spills, though these risks are considered slight. Because the proposed seismic operations will not be concentrated in any one area for extended periods, and are largely limited to the ice-free period, any impacts to polar bears should be relatively short in duration and should have a negligible impact on polar bear populations.

For a recent comprehensive overview of the effects of seismic activities, see the seismic-survey PEA on the MMS web site at: http://www.mms.gov/alaska/ref/pea_be.htm.

IV.E.2.e(2) Human Harvest of Polar Bears. Because of the lack of information concerning the CBS population, FWS has designated its status as "uncertain" at this time, although it likely is declining. Current human removals from the SBS population are believed to be at or near maximum sustainable levels, although recent information suggests that the SBS population may be smaller than previously estimated, which would indicate that current human harvest levels are no longer appropriate. See Appendix D, Section D.2 and Section IV.C.1.d (2) for more information.

IV.E.2.e(3) Oil and Fuel Spills. In addition to potential oil spills from industry infrastructure, as outlined in Section IV.C.1.d(2), the potential also exists for oil/fuel spills to occur from associated vessels, fuel barges, and even aircraft. However, this risk is considered slight in ice-free waters, and any spills that result from the Proposed Action most likely would be of small volume, and they are not considered a major threat to marine mammals in the Proposed Action area. Impacts to polar bears most likely would include temporary displacement until cleanup activities are completed. The potential impacts of a larger spill are similar to those discussed in Section IV.C.1.d(2).

Oil spills from offshore production activities are of concern because, as additional offshore oil exploration and production, such as the Liberty, Oooguruk and Nikaitchuq projects, occurs, the potential for large spills in the marine environment increases.

IV.E.2.e(4) Climate Change. According to the FWS, the status of polar bears worldwide is declining as a result of climate changes, loss of ice habitat, and unregulated hunting pressures (USDOI, FWS, 2005). The recent release of the Arctic Climate Impact Assessment's report on *Impacts of a Warming Arctic* (ACIA, 2004), combined with a peer-reviewed analysis of the effects of climate change on polar bears by three of the world's foremost polar bear experts (Derocher, Lunn, and Stirling, 2004) indicate that polar bears are facing a cascading array of effects as a result of dramatic changes to their habitat. Observed changes to date include reduced sea-ice extent, particularly in summer (Sec. IV.A.1) and progressively earlier sea-ice breakup dates, especially in more southerly areas. Bears at the southern edge of the species' range already are showing the impacts of these changes. Breakup of the annual ice in Western Hudson Bay (WHB) in Canada is now occurring more than 2 weeks earlier than it did 30 years ago (Stirling, Lunn, and Iacozza, 1999; Stirling et al., 2004), which is causing declining reproductive rates, subadult survival, and body mass in polar bears there. There is a highly significant correlation between this earlier breakup of the sea ice and condition of bears when they come to shore (Derocher, Lunn, and Stirling, 2004), which in turn is correlated with their reproductive success. Stirling, Lunn, and Iacozza (1999) correlated decreased body condition and reproductive performance in WHB bears with the trend toward earlier sea ice breakup, which shortens their feeding season and increases the length of their fasting season. Stirling, Lunn, and Iacozza (1999) also reported a significant decline in the body condition of both male and female adult polar bears in WHB, as well as a statistically significant relationship between the date of sea-ice breakup and the condition of adult female polar bears and natality. The earlier the breakup, the poorer the condition of females coming onshore and the lower their natality level. This is directly related to the effects of sea-ice condition on ringed seals. For example, ringed seals often give birth to and care for their pups on stable shorefast ice; therefore, changes in the extent and stability of shorefast ice or the timing of breakup could reduce their productivity. Because of the close predator-prey relationship between polar bears and ringed seals, decreases in ringed seal abundance can be expected to cause declines in polar bear populations (Stirling and Oritsland, 1995). In fact, a new analysis of the WHB subpopulation confirms that it has declined by almost 20% in the last 30 years (IUCN/PBSG press release, 2005), and that this decline is linked to significant reductions in the apparent survival of ringed seal pups coincident with larger amounts of open water earlier in the summer. Similar impacts also may be occurring in other polar bear populations, but they either have not yet been documented or have not yet been published.

Climate change also may explain why coastal communities in WHB recently have experienced increased bear-human conflicts prior to freezeup each fall. With earlier sea ice breakup, polar bears are forced ashore earlier, in poorer nutritional condition, and remain without access to seals for a longer time. As they exhaust their fat reserves towards the end of the ice-free period, they are more likely to encroach on human settlements in search of alternative food sources and come into conflict with humans. Thus, the increase in polar bear-human interactions in WHB probably reflect an increase in nutritionally stressed bears searching for food (Amstrup et al., 2006). Similar effects may be expected to occur in Alaska if global climate change continues.

Polar bear use of coastal areas during the fall open-water period has increased in recent years in the Beaufort Sea (Sec. IV.C.1.d (2)). This change in distribution has been correlated with the distance to the pack ice at that time of year (i.e., the farther from shore the leading edge of the pack ice is, the more bears are observed onshore) (Schliebe et al., 2005).

Climate change also has affected the severity of autumn storm events as a result of reduced sea-ice cover. In 2001, rough weather prevented scouting about one-third of the time that whaling crews were on Cross Island (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 ice cover during recent years, which created an unusually long fetch. As explained in Section IV.A.1.a, analysis of long-term data sets indicates that substantial reductions in both the extent and thickness of the arctic sea-ice cover have occurred 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).

The increased temporal and spatial extent of late summer and early autumn open water in northern Alaska has led also to the dramatic erosion of coastal shorelines and bluff habitats, which often are preferred den

sites for maternal polar bears (Durner et al., 2006). When the ice cover is reduced, particularly during late summer, the available open-water surface area increases and waves are able to 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 6-7 m high at Point Barrow (Lynch et al., 2003). Such large waves undoubtedly would induce energetic stress, or worse, in any swimming bears unfortunate enough to be caught in them. Despite being strong swimmers, energetically stressed bears are susceptible to misfortune on long-distance swims. For example, Monnett and Gleason (2006) reported unprecedented polar bear mortalities following a severe storm event in the Beaufort Sea in fall 2004. They estimated that at least 27 bears may have died as a result of this one storm and attributed the phenomenon to longer open-water periods and reduced sea-ice cover.

Polar bear terrestrial denning likely will become more important in the near future. The SBS polar bear population is unique in that approximately 50% of its maternal dens occur annually on the pack ice (Amstrup and Garner, 1994), which requires a high level of sea-ice stability for successful denning. Reproductive failure is known to occur in polar bears that den on unstable ice (Lentfer, 1975; Amstrup and Garner, 1994). If global climate change continues to decrease sea ice in the Arctic and increases the amount of unstable ice, a greater proportion of polar bears may seek to den on land (Durner et al., 2006). Those that do not may experience increased reproductive failure, which would have population-level effects. Considering that 65% of confirmed terrestrial dens found in Alaska from 1981-2005 were on coastal or island bluffs, the loss of such habitats, through storm-surge erosion, likely would alter future denning distributions (Durner et al., 2006) which, in turn, could affect reproductive success.

Polar bears also are susceptible to mortality from den collapse resulting from warmer temperatures and unusual rain events during late winter (Clarkson and Irish, 1991). In Alaska and western Canada, winter temperatures have increased by as much as 3-4 °C (5.4-7.2 °F) over the last 50 years, and rain events have increased substantially across much of the Arctic (ACIA, 2004).

In contrast to other species that may be able to shift northwards as the climate warms, polar bears are constrained to productive sea-ice habitat over relatively shallow waters. There is limited scope for a northward shift in distribution, as deep-water habitats likely would provide an unsuitable prey base for these large carnivores (Derocher et al, 2004). There also is limited scope for polar bears to move to terrestrial habitats. Although polar bears are known occasionally to feed on vegetation, berries, kelp, caribou, muskoxen, ptarmigan, sea birds, crabs, and even ground squirrels, they remain the apical predators of the arctic marine ecosystem (Amstrup, 2003) specialized in preying on phocid seals in ice-covered waters (Derocher, Lunn, and Stirling, 2004). Polar bears are very susceptible to overheating and are very inefficient walkers and runners, expending about twice the average energy of other mammals when walking (Best, 1982). This inefficiency helps explain why polar bears are not known to regularly prey on muskoxen, caribou, and other land animals, as the energy required to catch such animals almost certainly would exceed the amount of energy a kill would provide. For these reasons, polar bears are unlikely to be able to compensate for reduced ring seal availability by switching to terrestrial food sources (Derocher, Lunn, and Stirling, 2004).

Projected impacts to polar bears from climate change would affect virtually every aspect of the species' existence. The timing of ice formation and breakup will determine how long and how efficiently polar bears can hunt seals. Reductions in sea ice will result in increased distances between the ice edge and land which, in turn, will lead to increasing numbers of bears coming ashore during the open-water period, or drowning in the attempt. Reductions in sea ice also will also increase the polar bears' energetic costs of traveling, as moving through fragmented sea ice and open water is more energy intensive than walking across consolidated sea ice. Reductions in sea ice may result in reduced availability of ringed seals, and would result in direct mortalities of bears from starvation. Continued climate change also likely would increase the occurrence of bear-human interactions on land. All of these factors are likely to result in impacts to polar bear populations and distribution similar to what has already been documented in more southerly areas, such as WHB.

Conclusion. The potential impacts of a large oil spill are similar to those discussed in Section IV.C.1.e(2). Due primarily to increased concentrations of bears on parts of the coast, the relative oil-spill risk to the population has increased since preparation of the multiple-sale EIS. Further, based on the observed and predicted impacts that global climate change can have on polar bears, their distribution and population trends still warrant continued close attention and effective mitigation practices. The existing MMS operating regulations, the standard mitigation measures, and the proposed new ITL in Section III.C.2, would moderate the spill risk to polar bears. Thus, there would be no new significant cumulative effect.

IV.E.2.f. Other Marine Mammals. The Sale 195 EA states:

> We identify ringed seals and other ice-dependent pinnipeds as additional resources of primary concern. Therefore, we conclude that the potential cumulative effects on...seals, and other ice-dependent pinnipeds would be of primary concern and would warrant continued close attention and effective mitigation practices (USDOI, MMS, 2004:Appendix I, Sec. I.2.e(3)).

It also states: "Based on the assessment in this appendix, we have identified ringed seals and other ice-dependent pinnipeds as additional resources of primary concern due to the speculative effects of Arctic climate change" (USDOI, MMS, 2004:Appendix I, Sec. I.2.g).

Considering ongoing assessments of climate change (Sec. IV.A.1), the above statements still are relevant. Therefore, this discussion of cumulative impacts will focus on the effects of industrial noise climate change.

IV.E.2.f(1) Seismic and other Industrial Noise. There is a high degree of uncertainty regarding the spatial scope of potential industry activities on the Alaskan OCS. However, the proposed activities would increase the amount of seismic activity in the Beaufort Sea, increase the overall industry footprint, and add to the amount of industry activity in the sale area.

For a recent comprehensive overview of the effects of seismic activities on marine mammals, please see the draft seismic-survey PEA (USDOI, MMS, 2006a) on the MMS web site at: http://www.mms.gov/alaska/ref/pea_be.htm.

Seismic surveys in the Beaufort Sea are expected to have similar effects to those described in that document. No significant effects to nonendangered marine mammal populations are expected to result from planned seismic activities.

IV.E.2.f(2) Climate Change. As explained in Section IV.A.1.a, analysis of long-term data sets indicate that substantial reductions in both the extent and thickness of the arctic sea-ice cover have occurred 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). In Alaska and western Canada, winter temperatures have increased by as much as 3-4 °C (5.4-7.2 °F) over the last 50 years, and rain events have increased substantially across much of the Arctic (ACIA, 2004).

Many authors have reported climate change effects on marine mammals. For marine mammals adapted to life with sea ice, the effects of reductions in sea ice are likely to be reflected initially by shifts in range and abundance (Tynan and DeMaster, 1997), particularly for seals, gray whales, and walruses. This is due not only to the changing sea-ice habitat but also to concurrent shifts in their prey distributions, such as fish, bivalves, and amphipods. Ice-associated pinnipeds, which rely on suitable ice substrate for resting, pupping, and molting, may be especially vulnerable to such changes. Indirect effects of climate change include regional or seasonal shifts in prey availability, which can affect nutritional status, reproductive success, and geographic range, and alterations in the timing or patterns of migrations, which may produce changes in species distribution and stock structure. Changes in the extent and concentration of sea ice may alter the seasonal distributions, geographic ranges, patterns of migration, nutritional status, reproductive success, and ultimately the abundance and stock structure of some species, including beluga and gray whales. Alteration in the extent and productivity of ice-edge systems may also affect the density and

distribution of important ice-associated prey of marine mammals, such as arctic cod and sympagic ("with ice") amphipods" (Tynan and DeMaster, 1997).

Because of the Arctic Ocean's relatively low species diversity, it may be particularly vulnerable to trophic-level alterations caused by global warming (Derocher, Lunn, and Stirling, 2004). For example, Mecklenburg et al. (2005) and others show that changes in the arctic ice cover are affecting arctic fish (Loeng et al., 2005). In Hudson Bay for instance, Gaston, Woo, and Hipfner (2003) concluded that the decline in arctic cod and increase in capelin and sand lance were associated with a general warming of the waters and a significant decline in the amount of ice cover. In fact, their evidence suggests that the fish community in northern Hudson Bay shifted from arctic to subarctic from 1997 onwards, which was reflected in dramatically altered diets of thick-billed murres (*Uria lomvia*) in the region. Likewise, fish assemblages and populations in Alaska have undergone observable shifts in diversity and abundance during the last 20-30 years. Changes in distributions of important prey species, such as arctic cod, could have cascading effects throughout the ecosystem.

The arctic cod is a pivotal species in the arctic food web, as evidenced by its importance as a prey item to belugas, narwhals, ringed seals, and bearded seals (Davis, Finley, and Richardson, 1980). In arctic regions, no other prey items compare with arctic cod in abundance and energetic value. Arctic cod are believed to be adapted to feeding under ice, and ice-edge habitat is critical to cod recruitment (Tynan and DeMaster, 1997). Hydroacoustic surveys of fish have recorded the highest densities immediately below landfast sea ice (Crawford and Jorgenson, 1990). Because the life history of arctic cod is closely linked to sea ice, regional changes in the extent of sea ice may lead to a redistribution of this key prey species and, consequently, to redistributions and altered migrational patterns of the marine mammals that feed on it, such as belugas, ringed seals, and spotted seals. For example, belugas are known to forage at ice edges and ice cracks (Bradstreet, 1982; Crawford and Jorgenson, 1990), presumably to feed on arctic cod; beluga feeding aggregations primarily occur in nearshore areas, where dense schools of arctic cod concentrate in late summer. As a result, the IWC considers all stocks of beluga whale to be particularly vulnerable to global climate change.

Reduction in the extent of the ice edge and its associated biota may have deleterious consequences for marine mammals that have evolved with these unique systems (Tynan and DeMaster, 1997). For example, there is a linkage between ice algal production and benthic communities. Ungrazed ice algae that settle to the bottom provide a flux of carbon to the benthic community, and many marine mammals depend on this (Tynan and DeMaster, 1997). This sedimentation of carbon on shallow arctic shelves is critical to the benthic foraging success of walruses, bearded seals, and gray whales, and regional changes in this carbon flux could affect the distribution and reproductive success of these animals. In addition, the juxtaposition of the ice edge with shallow-shelf habitat suitable for benthic feeding is critical to walruses and bearded seals.

Species such as walruses and bearded seals feed on benthic prey and, therefore, are found on ice cover over shallow continental shelf areas (Derocher, Lunn, and Stirling, 2004). Arctic warming may move the summer position of the ice edge over deep water unsuitable for these shallow-water-adapted species; the effects of such changes on their populations could be substantial (Tynan and DeMaster, 1997). As sea ice declines, these species are forced farther offshore to find suitable habitat for feeding, making these activities more difficult, if not impossible, which ultimately may lead to a net reduction in their abundance (ACIA, 2004; Derocher, Lunn, and Stirling, 2004). Recent trends have resulted in seasonal sea-ice retreating off the continental shelf and over deep Arctic Ocean waters. This trend poses adaptive challenges for the walrus population (Tynan and DeMaster, 1997). For example, in the summer of 2004, nine motherless walrus calves were observed stranded on icefloes in deep waters off of northwest Alaska. These calves may have been abandoned by their mothers due to lack of food, and the authors speculate that many more motherless calves than the nine observed were present in their study area. Walrus calves depend on maternal care for 2 years or more before they are able to forage for themselves, and females with calves are not normally observed in deep Arctic basin waters due to the lack of food and depth limits to their diving. Thus, such events could have implications for the Pacific walrus population if they become more common (Cooper et al., 2006).

Phocid seals also may be particularly vulnerable to habitat loss from changes in the extent or concentration of arctic ice, because they depend on pack-ice habitat for pupping, foraging, molting, and resting (Tynan and DeMaster, 1997; ACIA, 2004; Derocher, Lunn, and Stirling, 2004). The ring seal, a species intricately entwined with the sea ice, likely would be among the first marine mammals to show the negative effects of climatic warming (Ferguson, Stirling, and McLoughlin, 2005). This species depends on the stability of ice for the successful rearing of its young (Burns, Shapiro, and Fay, 1981), and global warming likely would reduce its abundance and distribution. In the eastern Beaufort Sea, Harwood, Smith, and Melling (2000) found that early breakup of the ringed seals' landfast-ice breeding habitat had significant negative impacts on growth, condition, and survival of nursing pups. Although earlier spring breakup and an increased open-water season initially might benefit growth and reproduction of seals and, hence, recruitment, a continued trend toward earlier breakup eventually could be detrimental to ringed seals (Ferguson, Stirling, and McLoughlin, 2005). For example, young seal pups that are forced into open water at an early age may be exposed to increased risks of predation and thermal challenges (Smith and Harwood, 2001). Swimming exacts a high energy cost from pups (Smith, Hammill, and Taugbol, 1991), and they require access to ice for resting after they have molted and weaned (Smith, 1987).

Unseasonable warming and unusual rainfall events due to climate change have both been implicated in lower ringed seal reproduction and pup survival (Smith and Stirling, 1975; Hammill and Smith, 1991; Stirling and Smith, 2004). In WHB, spring breakup has occurred earlier each year over the past 30 years (Ferguson, Stirling, and McLoughlin, 2005) and decreased snow depth, particularly below 32 cm, has corresponded with a significant decrease in ringed seal recruitment there. Pups in subnivean birth or haulout lairs with thin snow roofs are more vulnerable to predators than those in lairs with thick roofs (Smith and Stirling, 1975; Hammill and Smith, 1991; Furgal, Innis, and Kovacs, 1996), as well as to death by exposure and hypothermia due to den collapse (Smith, Hammill, and Taugbol, 1991). For example, during a mild period with some rain in Canada in 1979, polar bear-hunting success was three times greater than previously recorded in the high Arctic, largely because many pups' lairs melted open, exposing them to predation (Hammill and Smith, 1991; Stirling and Smith, 2004). Researchers suspected that most of the pups in the affected area eventually were killed by polar bears, arctic foxes, and possibly gulls. Earlier spring breakup of sea ice together with snow trends suggest continued low pup survival in WHB (Ferguson, Stirling, and McLoughlin, 2005). If early-season rains become regular and widespread, the mortality of ringed seal pups will increase and populations may be significantly reduced, which likely also would produce negative effects on the reproduction and survival of polar bears (Stirling, 2002; Stirling and Smith, 2004; IUCN/PBSG press release, 2005).

In contrast, gray whales may benefit from global climate change. For example, sightings data of gray whale calves suggest that higher calf counts in the spring are associated with years of delayed onset of freezeup in the Chukchi Sea. During years of earlier freezeup, pregnant females must leave their feeding grounds sooner, having less time to nourish the developing fetus and store the fat necessary to support lactation during their stay in Mexican waters and long migration back to Alaska. Therefore, a warmer Arctic may be beneficial to gray whales (Tynan and DeMaster, 1997).

Conclusion. Due to the ongoing effects of climate change in the Arctic, continued close attention and effective mitigation practices with respect to nonendangered marine mammals populations and distributions are warranted, particularly with respect to ringed seals, which likely would be among the first marine mammals to show the negative effects of climatic warming.

IV.E.2.g Fishes and Essential Fish Habitat. The following section assesses the cumulative effects of the lease sale on fish in the context of climate change.

The Effect of Climate Change on Fish Resources. The climate of the Arctic is changing and affecting fish distributions. Evidence of such change is discussed in the Arctic Climate Impact Assessment (ACIA, 2005). Trends in instrumental records over the past 50 years indicate a reasonably coherent picture of recent environmental change in northern high latitudes (ACIA, 2005). It is probable that the past decade was warmer than any other in the period of the instrumental record. The observed warming in the Arctic might be without precedent since the early Holocene.

Climate change can affect fish production (e.g., individuals and/or populations) through a variety of means (Loeng et al., 2005). Direct effects of temperature on the metabolism, growth, and distribution of fishes occur. Food-web effects also occur through changes in lower trophic-level production or in the abundance of predators, but such effects are difficult to predict. Fish-recruitment patterns are strongly influenced by oceanographic processes such as local wind patterns and mixing and by prey availability during early lifestages. Recruitment success sometimes is affected by changes in the time of spawning, fecundity rates, survival rate of larvae, and food availability.

IV.E.2.h Additional Resources. This section updates the cumulative effects on air quality, archaeology, terrestrial mammals, and lower trophic-level organisms. There is no new information that would change the level of cumulative effects on air quality, terrestrial mammals or lower tropic-level organisms.

With regard to archaeological resources, the greatest cumulative effect in the Beaufort Sea region is from natural processes such as ice gouging, bottom scour, and thermokarst erosion. Because the destructive effects of natural processes are cumulative, they have affected and will continue to affect archaeological resources in this area. These natural processes would cause artifacts to be dispersed and the site context to be disturbed or even completely destroyed, resulting in the loss of archaeological information. Overall, a significant loss of data from submerged and coastal prehistoric sites probably has occurred, and will continue to occur, from the effects of natural geologic processes in the Beaufort Sea region. It is assumed that some of the data lost have been significant and/or unique, resulting in a major level of impact.

Accidental oil spills would affect onshore archaeological sites the most, but past cleanups have shown that spilled oil had little direct effect on archaeological resources (Bittner, 1993). Following the *Exxon Valdez* spill, the greatest effects came from vandalism, because more people knew about the locations of the resources and were present at the sites. Various mitigation measures used to protect archaeological sites while cleaning up oil spills are avoidance (preferred), site consultation and inspection, onsite monitoring, site mapping, scientific collection of artifacts, and programs to make people aware of cultural resources (Haggarty et al., 1991).

Although archaeological resources are not renewable, they are not affected directly or cumulatively by oil spills, the buildup of toxic substances, noise, or air pollution. Effects are minimized due to modern technologies and practices that reduce the impact to the environment and, therefore, to archaeological resources (no thawing of permafrost, restricted personnel access, wintertime operations, small-footprint drilling, and transportation technologies). Furthermore, mitigation measures, such as offshore high-resolution seismic surveys with archaeological analysis in zones of potential resources, and onshore archaeological surveys where offshore pipelines make landfall, would avoid damage or destruction of potential archaeological resources. Although a number of sites in the *Exxon Valdez* spill area were vandalized during the 1989 cleanup season, the large number of Exxon and Government agency archaeologists visible in the field may have lessened the amount of site vandalism that may have occurred (Mobley et al., 1990).

A study by Dekin (1993) found that small amounts of petroleum hydrocarbons may occur in most archaeological sites within the study area. This suggests a low-level petroleum contamination that previously had not been suspected. Because the researchers found no evidence of extensive soil contamination from a single definable source (the oil spilled from the *Exxon Valdez*), they "now add the continuing contamination of soils from small and large petroleum spills in areas where present and past land use coincide" (Dekin, 1993). Vandalism was found to have a significant effect on archaeological site integrity but could not be tied directly to the oil spill (Dekin, 1993).

Ocean bottom-cable seismic surveys potentially could impact both prehistoric and historic archaeological resources in waters inshore of the 20-m isobath or in deeper water, if cables are laid from shallow to deep water. Such offshore seismic-exploration activities projected for the 2006 open-water season could disturb these resources and their in situ context. Assuming compliance with existing Federal, State, and local archaeological regulations and policies and the application of MMS's G&G Permit Stipulation 6 (regarding the discovery of archaeological resources) and CFR 251.6 (a) (5) regarding G&G Explorations of the Outer Continental Shelf to not "disturb archaeological resources," most impacts to archaeological resources in

shallow offshore waters of the Beaufort Sea Planning Area would be avoided. Therefore, no impacts or only minor impacts to archaeological resources are anticipated; cumulatively, proposed projects are not likely to disturb the seafloor. Under the cumulative scenario, the impact to both prehistoric and historic archaeological sites should be negligible. The incremental contribution of the Proposed Action to the cumulative impacts on archaeological resources should be minor.

Conclusion. In addition to Alternative I for Sale 202, other activities associated with this cumulative analysis that may affect archaeological resources in the Beaufort Sea include lease sales and activity onshore on Federal and State lands, State oil and gas fields, oil and gas transportation, noncrude carriers, and any Federal activities. Cumulatively, these proposed projects likely would disturb the seafloor more often, but remote-sensing surveys made before approval of any Federal or State lease actions should keep these effects low. Federal laws would preclude effects to most archaeological resources from these planned activities.

Contribution of the Preferred Alternative for Sale 202 to Cumulative Effects. The contribution of the Preferred Alternative for Sale 202 to the cumulative case is expected to be minimal for archaeological resources, because any surface-disturbing activities that could damage archaeological sites would be mitigated by current State and Federal procedures, which require identification and mitigation of archaeological resources in the proposed project areas. Overall effects of the Preferred Alternative would be additive to effects anticipated for other future projects and, in the case of oil spills, are uncertain. However, data from the *Exxon Valdez* oil spill indicate that <3% of the resources within a spill area would be significantly affected.

IV.E.2.i. Environmental Justice. Alaskan Inupiat Natives, a recognized minority, are the predominant residents of the NSB, the area potentially most affected by Sale 202 exploration and development. Effects on Inupiat Natives could occur because of their reliance on subsistence foods, and cumulative effects could affect subsistence resources and harvest practices. Potential effects from noise, disturbance, and oil spills on subsistence resources and practices and sociocultural patterns, as described in Section IV.E.2.a and IV.E.2.b, would focus on the Inupiat communities of Barrow, Atqasuk, Nuiqsut, and Kaktovik.

For Environmental Justice, the multiple-sale EIS concludes that:

> Potential effects would focus on the Inupiat communities of Barrow, Nuiqsut, and Kaktovik, within the NSB; however, effects are not expected from routine activities and operations. If a large spill assumed in the cumulative case occurred and contaminated essential whaling areas, major effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. Such impacts would be considered disproportionately high adverse effects on Alaskan Natives, because oil-spill contamination of subsistence foods is the main concern regarding potential effects on Native health. Any potential effects to subsistence resources and subsistence harvests are expected to be mitigated substantially, though not eliminated. (USDOI, MMS, 2003:Sec. V.C.16)

After publication of the multiple-sale EIS, the effects of a proposed lease sale in the Northwest NPR-A final IAP/EIS were assessed (USDOI, BLM and MMS, 2003). That assessment summarizes the effects of an offshore spill on environmental justice:

> In the unlikely event that a large spill were to occur and if it contaminated essential whaling areas, major effects could result from the combined factors of shoreline contamination, tainting concerns, cleanup disturbance, and disruption of subsistence practices. Such impacts would be considered disproportionately high adverse effects on Alaska Natives. Oil-spill contamination of subsistence foods is the main concern regarding potential effects on Native health.
>
> Any potential effects on subsistence resources and subsistence harvests would be expected to be mitigated substantially, though not eliminated. (USDOI, BLM and MMS, 2003:Sec. IV.F.8.p)

After publication of the multiple-sale EIS and the Sale 195 EA, the effects of additional development around the Alpine Field as described in the Alpine Satellite Development Plan Final EIS (USDOI, BLM, 2004) and a proposed lease sale in the Northeast NPR-A as described in the Northeast NPR-A Final Amended IAP/EIS (USDOI, BLM, 2005) were assessed. Section 4G.7.4.2 of the Alpine Satellite Development Plan assesses the effects of increased oil field development in the area on environmental justice. The conclusion to the cumulative analysis states:

> Alaska Inupiat Natives, a recognized minority, are the predominant residents of the NSB, the area potentially most affected by ASD development and other past, present, and reasonably foreseeable projects on the North Slope. Environmental justice effects on Inupiat Natives could occur because of their reliance on subsistence foods, and cumulative effects may affect subsistence resources and harvest practices.
>
> Potential effects would focus on the Inupiat communities of Nuiqsut, Barrow, Atqasuk, and Anaktuvuk Pass. Development as contemplated in the cumulative case could cause long-term displacement and/or functional loss of habitat to CAH, TCH, and WAH caribou over the life of CPAI's proposed development. This could result in a significant impact on access to, and perhaps the availability of, this important subsistence resource. Such impacts would be considered disproportionately high adverse effects on Alaskan Natives. Access to subsistence-hunting areas and subsistence resources, and the use of subsistence resources could change if oil development were to reduce the availability of resources or alter their distribution patterns.
>
> In the unlikely event that a large spill were to occur, and if it were to contaminate essential whaling areas, major effects could result from the combined factors of shoreline contamination, tainting concerns, cleanup disturbance, and disruption of subsistence practices. Such impacts would be considered disproportionately high adverse effects on Alaskan Natives. Oil-spill contamination of subsistence foods is the main concern regarding potential effects on Native health.
>
> Any potential effects on subsistence resources and subsistence harvests would be expected to be mitigated, though not eliminated.

Section 4.7.7.14 of the Northeast NPR-A Final Amended IAP/EIS assesses the effects of increased oil development in the area on environmental justice. The conclusion reads:

> Alaska Iñupiat Natives, a recognized minority, are the predominant residents of the NSB, the area that would likely be affected by exploration and development in the Planning Area and other past, present, and reasonably foreseeable projects on the North Slope. Environmental justice effects on Iñupiat Natives could occur because of their reliance on subsistence foods, and cumulative effects would increase the effects on subsistence resources and harvest practices.
>
> Potential effects would focus on the Iñupiat communities of Point Lay, Wainwright, Barrow, Atqasuk, and Nuiqsut within the NSB. Based on potential cumulative, long-term displacement and/or functional loss of CAH, TLH, and WAH caribou habitat over the life of the Northeast National Petroleum Reserve-Alaska oil and gas lease sales, and from other oil and gas developments on the North Slope, this important subsistence resource could become less readily available or undesirable for use, or experience long-term population and productivity effects. Such impacts would disproportionately affect Alaska Natives. Access to subsistence-hunting areas and subsistence resources, and the use of subsistence resources, could change if oil development were to reduce the availability of resources or alter their distribution patterns.
>
> Because the potential impacts of climate change on marine and terrestrial ecosystems in the Arctic would cause impacts on subsistence resources, traditional culture, and community infrastructure, subsistence-based indigenous communities in the Arctic would be expected to experience disproportionate, environmental and health effects.

> In the unlikely event that a large spill were to occur and contaminate essential whaling areas, major effects to subsistence resources could result from the combined factors of shoreline contamination, tainting concerns, clean-up disturbance, and disruption of subsistence practices. Such impacts would have a disproportionately high affect on Alaska Natives. Contamination of subsistence foods by oil spills would potentially affect Native health.
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> It is expected that the cumulative effects on subsistence resources and subsistence harvests in the Planning Area would...be mitigated substantially, though not eliminated, by proposed ROPs [Required Operating Procedures] and lease stipulations.

The seismic-survey PEA (USDOI, MMS, 2006a) provides an updated cumulative effects discussion for the Beaufort Sea region. The seismic PEA is available on the MMS web site at: http://www.mms.gov/alaska/ref/pea_be.htm.

For a detailed discussion of ongoing and proposed studies that will contribute to a more comprehensive understanding of cumulative impacts to the Native population of the North Slope, see the Environmental Justice cumulative effects sections in the Beaufort Sea Multiple Sale final EIS (USDOI, MMS, 2003), the Northwest NPR-A final IAP/EIS (USDOI, BLM and MMS, 2003), the Beaufort Sea Sale 195 EA (USDOI, MMS, 2004), the Alpine Satellite Development Plan final EIS (USDOI, BLM, 2004), and the Northeast NPR-A final Amended IAP/EIS (USDOI, BLM, 2005).

More recent ongoing and proposed research and sovereignty initiatives regarding cumulative impacts to the indigenous populations in the Arctic and Native populations on the North Slope include:

- the Second International Conference on Arctic Research Planning (ICARP-2) that met in April 2005 to develop a plan to study the resilience and vulnerability of rapid change to local communities in the Arctic;
- a U.S. Census Bureau report *We the People: American Indians and Alaska Natives in the United States* that provides a portrait of the demographic, social, and economic characteristics collected from Census 2000 of indigenous American populations and discusses specific tribal groupings, reservations, and Alaska Native village statistical areas;
- *Food Security in Arctic Alaska: A Preliminary Assessment* (Caulfield, 2000) that advocates for a better understanding of subsistence food security, more up-to-date research to determine country foods types, pricing, transportation systems, and a better understanding of relevant laws, policies, and controlling institutions;
- *Human and Chemical Ecology of Arctic Pathways by Marine Pollutants* study (O'Hara et al., 2002) that will document reliance by indigenous arctic marine communities in Canada, Alaska, and Russia on arctic resources at risk from chemical pollutants and incorporate traditional knowledge systems for harvesting;
- the *Arctic Human Development Report* developed by the Arctic Council in 2005 to provide an overview of human development in the Arctic, identify critical data gaps, establish priorities for sustainable development, and shed light on the dimensions of human well-being in the region;
- *Vital Arctic Graphics Report* (UNEP, 2006) that identifies critical Arctic ecosystems to protect important indigenous regions and food sources to ensure sustainable development in the region; and
- the subsistence foods study *The Contribution of Subsistence Foods to the Total Diet of Alaska Natives in 13 Rural Communities* funded by the Agency for Toxic Substances and Disease Registry conducted by Ballew et al. Researchers confirmed, as many other studies have before, that subsistence foods make up a large part of the total Alaska Native diet. They quantified this intake and set the stage for the long-term goal of the study which is to evaluate the health benefits and risks of consuming subsistence foods to allow people to make more informed food choices. They were unable to quantify the economic balance of subsistence and purchased foods. They reiterated that the data to assess exposure to contaminants in subsistence foods were inadequate, because many traditional foods have yet to be tested, and that testing of the foods that people consume most should be the highest research priority (Ballew et al., 2006).

Since 2003, MMS has funded the Nuiqsut-based study *Analysis of Variation in Abundance of Arctic Cisco in the Colville River*, which sponsored a local workshop in Nuiqsut for Traditional and Western science experts on arctic cisco to answer questions about arctic cisco abundance. The proceedings of this workshop were published in the MMS Study Report MMS 2004-033. Separate Traditional Knowledge and Western Science reports will be final products of this study.

Indigenous initiatives to address Arctic issues include the formation of an alliance of grass-roots Native activists called Resisting Environmental Devastation on Indigenous Lands (REDOIL) to confront oil and gas development issues in Alaska. This alliance condemns extractive industries and the Alaska Native Claims Settlement Act (ANCSA) and has come together to address aboriginal, economic, and Environmental Justice issues concerning the role of corporations, the State of Alaska, and the Federal Government in oil and gas development (Dobbyn, 2003). In April 2006, the Indigenous Peoples and Nations Coalition sent a petition to the United Nations challenging U.S. title to Alaska and Hawaiian Native lands, referring the situation to the proper United Nations agencies, "so that the rights of the Indigenous Peoples can be vindicated, including the right to self-government and to enjoyment of their natural resources" (AITC, 2006).

The formation of the North Slope Science Initiative Science Technical Group in February 2006 bodes well for addressing cumulative impacts on Alaska's North Slope. This 15-member group, composed of Federal, State, local, and industry leadership, is tasked with developing a consistent scientific approach to North Slope research and is the most likely group to develop and implement research, monitoring, and mitigation regimes that will address community impacts from North Slopewide oil exploration and development (*Petroleum News,* 2006).

Cumulative Effects on Environmental Justice in the Context of Climate Change. Because potential climate change impacts on marine and terrestrial ecosystems in the Arctic would cause significant impacts on subsistence resources, traditional culture, and community infrastructure, subsistence-based indigenous communities in the Arctic and on Alaska's North Slope would be expected to experience disproportionate, high adverse environmental and health effects. See the discussion on global climate change in the subsistence-harvest patterns cumulative effects section.

Summary. The incremental contribution of Sale 202 to overall cumulative effects is likely to be quite small. Sources that could affect subsistence resources include potential increased seismic-survey activity, oil spills, noise and traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. The communities of Barrow, Atqasuk, Nuiqsut, and Kaktovik potentially would be most affected, with Nuiqsut potentially being the most affected community because it is within an expanding area of oil exploration and development onshore (Alpine, Alpine Satellite, Northeast and Northwest NPR-A); nearshore (Oooguruk and Nikaichug field developments); and offshore (Northstar, the proposed Liberty project, increased seismic-exploration activity, potential drilling operations off Kaktovik, and Canadian drilling off the McKenzie River Delta). In the event of a large spill from Sale 202, many harvest areas and some subsistence resources would be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use.

Major additive significant effects could occur when impacts from contamination of the shoreline, tainting concerns, cleanup disturbance, and disruption of subsistence practices are factored together. One or more important subsistence resources would become unavailable or undesirable for use for 1-2 years, a significant adverse effect. Increases in population growth and employment could cause long-term disruptions to (1) the kinship networks that organize the Inupiat communities' subsistence production and consumption, (2) extended families, and (3) informally derived systems of respect and authority (mainly respect of elders and other leaders in the community). Cumulative effects on social organization could include decreasing importance of the family, cooperation, sharing and subsistence as a livelihood, and increased individualism, wage labor and entrepreneurship. Long-term effects on subsistence-harvest patterns also could be expected.

At the same time, revenues from NSB taxation on oil development have produced positive cumulative impacts that include increased funding for infrastructure, higher incomes (that can be used to purchase better equipment for subsistence), better health care, and improved educational facilities. Nevertheless, we may see increases in social problems, such as rising rates of alcoholism and drug abuse, domestic violence, wife and child abuse, rape, homicide, and suicide. Because Nuiqsut is relatively close to oil-development activities on the North Slope, cumulative effects chronically could disrupt sociocultural systems in the community—a significant effect; however, overall effects from these sources are not expected to displace ongoing sociocultural systems, community activities, and traditional subsistence practices. Such chronic disruption could affect subsistence-task groups and displace sharing networks, but it would not tend to displace subsistence as a cultural value. The same potential impacts could occur in the communities of Barrow, Atqasuk, and Kaktovik, as Beaufort Sea areawide leasing, exploration, and development proceed on- and offshore.

Even as an optimistic scenario, projects for Sale 202 represents a small proportion, 2-4%, of the total past, present, and reasonably foreseeable oil and gas development in the Beaufort Sea and the North Slope area. While the most likely number of oil spills $\geq$500 bbl from all past, present, and future activities onshore is estimated to be 0.65, the most likely number of offshore spills is estimated to be one. Sale 202 is estimated to contribute about 17% of the estimated mean number of cumulative offshore spills, with a most likely number of spills of zero.

In the event of a spill from Sale 202, many harvest areas and some subsistence resources would be unavailable for use. Some resource populations could suffer losses and, as a result of tainting, bowhead whales could be rendered unavailable for use. Whaling communities distant from and unaffected by potential spill effects are likely to share bowhead whale products with impacted villages. Harvesting, sharing, and processing of other subsistence resources should continue but would be hampered to the degree that these resources were contaminated. The contribution from Sale 202 to cumulative effects on the communities of Barrow, Atqasuk, Nuiqsut, and Kaktovik could come from disturbance from oil-spill-cleanup activities; small changes in population and employment; disruption of subsistence-harvest patterns from oil spills and oil-spill cleanup; and increased seismic survey activities. Disturbance effects periodically could disrupt, but not displace, ongoing social systems; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources. On the other hand, such traditional practices could be seriously curtailed in the short term, if there are concerns over the tainting of bowhead whales from an oil spill. Only in the event of a large spill, which is a low likelihood event, would disproportionate, high adverse effects be expected on Alaska Natives from Sale 202.

Conclusion. Potential significant impacts to subsistence resources and harvests and consequent significant impacts to sociocultural systems would indicate significant cumulative environmental justice impacts—disproportionate, high adverse environmental and health effects on low-income, minority populations in the region. We still conclude that potential environmental justice effects would focus on the Inupiat communities of Barrow, Atqasuk, Nuiqsut, and Kaktovik within the NSB; such cumulative impacts would be considered disproportionately high adverse effects on Alaska Natives. Any potential effects are expected to be mitigated substantially, although not eliminated.

Potential impacts on human health from contaminants in subsistence foods and long-term climate change impacts on marine and terrestrial ecosystems in the Arctic—affecting subsistence resources, traditional culture, and community infrastructure of subsistence-based indigenous communities on the North Slope—would be an expected and additive contribution to cumulative environmental justice impacts.

IV.E.2.j. Overall Summary of Cumulative Effects. The level of cumulative effects has changed mainly for polar bears. Due primarily to increased concentrations of bears on parts of the coast, the relative and cumulative oil-spill risk to the population has increased since preparation of the multiple-sale EIS. The existing MMS operating regulations, the standard mitigation measures, and the proposed new ITL's in Section III.C.2, would moderate the cumulative risk to polar bears. The level of cumulative effects on other marine mammals, subsistence-harvest patterns, marine and coastal birds, local water quality, fish and Essential Fish Habitat, archaeology, and other resources would be the same as assessed in the multiple-sale

EIS. Thus, there would be no new significant cumulative effect for the proposed lease sale that already had not been analyzed in the multiple-sale EIS.

IV.F. Overall Summary of Section IV.

The assessment in the multiple-sale EIS concluded that proposed Sales 186, 195 and 202 would results in significant effects on subsistence-harvest patterns, marine and coastal birds, and local water quality. The potential for significant effect on water quality was due partly to the difficulty of responding to possible, but highly unlikely, large oil spills in broken ice, in spite of the required spill-contingency plans. The assessment of cumulative effects noted concerns about several resources.

The effects of proposed Sale 195, which also would offer leasing incentives at prices below current levels, were updated in an EA that concluded there would be no new significant effect that already had not been assessed in the multiple-sale EIS, partly because projections of future operations could be handled with the standard mitigation. The assessment of cumulative effects, which covered the effects of the sale in the context of climate change, noted some additional concerns, especially with the retreating summer ice cover and ice-dependent fauna. For example, the assessment examined the effects of the sale in the context of additional polar bears around onshore support facilities.

The environmental information and level of effects of proposed Sale 202 were updated with this EA. It concludes in Section IV.B that parts of the Beaufort Sea environment have changed substantially since preparation of the multiple-sale EIS. There have been substantial reductions in the Arcticwide ice cover, particularly during the summer and autumn. The resources that are depended on summer and autumn ice cover, such as polar bears, also have changed. The Sale 195 EA predicted that more polar bear might be forced to stay onshore during summer, leading to increased interaction between polar bear and oil industry personnel (USDOI, MMS, 2004:Appendix I, Sec. I.2.g). Recent observations confirm that more polar bear are staying onshore during the autumn, and that more are in the water where they are vulnerable to severe storm waves. Further, storm waves during autumn 2001 and 2003 prevented subsistence whalers from scouting for whales during much of the time that they were on Cross Island. In contrast, no substantial changes have been observed in either anadromous fish or marine and coastal birds. 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. 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, although reliable stock estimates are not available.

This EA concludes in Section IV.C.2 that the likelihood of one or more large oil spills occurring and contacting a land segment is still 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 existing MMS operating regulations, the standard mitigation measures, and the following proposed new ITL's, described fully in EA Section III.C.2, would moderate the spill risk to polar bears:

> Proposed New Information to Lessees for protection of polar bears, entitled Planning for Protection of Polar Bears. It states in part that lessees are advised to consult with the Fish and Wildlife Service (FWS) and local Native communities while planning their activities and before submission of their Oil-Spill Contingency Plans.
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> Revisions to Standard Information to Lessee Clauses
> Standard ITL No. 4, entitled Bird and Marine Mammal Protection. The revision in part adds polar bears to the list of species that have been proposed for listing under the Endangered Species Act.
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> Standard ITL No. 11, entitled Sensitive Areas to Be Considered in the Oil-Spill Contingency Plans (OSCP's). The revision explains in part that coastal aggregations of polar bears during the open

water/broken ice period are particularly vulnerable to the effects of an oil spill, which lessees must account for in their OSCP's.

The levels of effect on other resources--including subsistence, marine and coastal birds, local water quality, bowheads, fish and Essential Fish Habitat, and other organisms--were similar to those levels in the multiple-sale EIS (Section IV.C.1.b and USDOI, MMS, 2003). Specifically, there still would be potentially significant effects on subsistence-harvest patterns and sociocultural systems in the unlikely event of a large oil spill. While an oil spill under certain conditions still would result in a potentially significant effect to spectacled and Steller's eiders, the coincidence of all the factors that would have to occur simultaneously to result in such an impact to spectacled eiders is improbable. A spill of 1,500 bbl or 4,600 bbl in the proposed lease area still would lead to hydrocarbon concentrations in the surface water in excess of the 1.5 parts per million (ppm) acute toxic criteria during the first day in a local area. Our reanalysis of potential effects for bowhead whales supports the conclusion that no significant impacts to this endangered species are expected due to activities associated with proposed Lease Sale 202, including the effects of an assumed oil spill. This EA concludes that no new impact to pinnipeds, belugas, or gray whales was identified for the proposed sale that was not already assessed in the multiple-sale EIS. The updated conclusion about the effects of proposed Sale 202 on fishes and EFH is that the effects of an oil spill would be considered higher than in Sales 186 and 195 but still moderate because in most cases, fishes and EFH would recover within one generation. Therefore, no new significant impact was identified for the Proposed Action that was not already assessed in the multiple-sale EIS.

Section IV.D about alternatives concludes that the effects of most of the alternatives are very similar to the effects of the Proposed Action; the effects of only subsistence-harvest patterns are changed slightly by most of the alternatives. However, the Eastern Deferral would help to moderate the level of effects on bowhead whales, polar bear, and subsistence whaling. An alternative to the Nuiqsut Subsistence Whaling Deferral would be the MMS exclusion of leasing incentives from the Nuiqsut subsistence area.

Section IV.E about cumulative effects concludes that the level of spill risk to polar bears would be greater than assessed in the multiple-sale EIS, as explained in Section IV.C. The existing MMS operating regulations, the standard mitigation measures, and the proposed new ITL's in Section III.C.2, would moderate the risk to polar bears. The level of cumulative effects on other marine mammals, subsistence-harvest patterns, marine and coastal birds, local water quality, fish and Essential Fish Habitat, archaeology, and other resources would be the same as assessed in the multiple-sale EIS. Thus, there would be no new cumulative significant effect that is not already analyzed in the multiple-sale EIS.

V. OUTREACH AND GOVERNMENT-TO-GOVERNMENT CONSULTATION

The draft Area Identification explains that the EA will analyze the comments received in response to the Request for Information (RFI). The RFI included instructions for interested parties to submit written comments by mail, email, or hand delivery.

Comments were received from ConocoPhillps Alaska, Inc. indicating their interest in opportunities to discover and develop significant oil and gas accumulations. They support efforts by the MMS to conduct sales on a regular basis within the Alaskan outer continental shelf (OCS). One public comment was received from Jean Public from New Jersey in opposition to Lease Sale 202. Comments were also received from the Chairman of the Alaska Eskimo Whaling Commission (AEWC) and Earthjustice. These comments are summarized briefly below and more detailed summaries are available from Minerals Management Service (MMS).

(1) Because of the large number of bids received in Sale 195, the AEWC requested that the MMS give greater protection to the subsistence whaling areas around Kaktovik and Barrow, and to design a deferral area around Cross Island to protect whaling activities in Nuiqsut.