Appendix D

ADDITIONAL RESOURCE INFORMATION

This appendix contains detailed updates for the following resources:

1. Subsistence-Harvest patterns and Sociocultural Systems
2. Marine and Coastal Birds
3. Local Water Quality

4.a Bowhead Whales

4.b Polar Bears

4.c Other Marine Mammals

4.d Fish and Essential Fish Habitat

5. Environmental Justice
6. Land Use Plans and Coastal Zone Management

D.1. Subsistence-Harvest Patterns and Sociocultural Systems: Sale 202 Affected Environment.

D.1.a. Subsistence Resources and Harvests. This section updates the information on subsistence-harvest patterns, subsistence resources, and sociocultural systems that might be affected by proposed Beaufort Sea Lease Sale 202 and includes updates of information in the multiple-sale final EIS and Sale 195 EA (USDOI, MMS, 2003, 2004). The EIS and EA summarize information about subsistence and sociocultural systems in the villages of Barrow, Atqasuk, Nuiqsut, and Kaktovik that have offshore subsistence-harvest areas within the proposed Sale 202 lease-sale area. Any new information has been used to revise previous effects assessments contained in the multiple-sale EIS.

Subsistence-harvest patterns, subsistence resources that commonly occur on- and offshore, and sociocultural systems of communities in the North Slope region potentially could experience significant effects from oil and gas activities following proposed Sale 202. The entire marine subsistence-harvest areas of Nuiqsut and Kaktovik and most of Barrow's marine subsistence-harvest area lie within or near the boundary of the Beaufort Sea multiple-sale area; portions of Barrow's marine subsistence-harvest area in the Chukchi Sea lie to the west and outside the boundary of the Beaufort Sea multiple-sale area. Onshore, the caribou-hunting areas of Barrow, Nuiqsut, and Kaktovik would be most directly affected by potential pipelines and other onshore facilities associated with proposed actions. Long-term subsistence-harvest practices and subsistence cycles have not changed since the assessment provided in the multiple-sale final EIS (USDOI, MMS, 2003) and the Sale 195 EA (USDOI, MMS, 2004); nevertheless, harvest areas can be fluid and change from season to season. The BLM's Alpine Satellite Development Plan final EIS for potential expansion of Alpine field production near Nuiqsut (USDOI, BLM, 2004) has provided new information on contemporary harvest areas in some communities, particularly Nuiqsut. The primary sociocultural variables—population, social organization, cultural values, and institutional organization—have not altered since the Beaufort Sea multiple-sale EIS and Sale 195 EA were published.

Subsistence-harvest pattern information, along with new research on subsistence resources and sociocultural systems that might influence the previous effects' assessments, is summarized in the following. This summary also includes any new Native stakeholder concerns as they relate to these topics, as well as traditional knowledge updates. The discussions on subsistence-harvest patterns, subsistence resources, and sociocultural systems in MMS's Liberty Development and Production Plan final EIS (USDOI, MMS, 2002), the Bureau of Land Management's (BLM's) Northwest NPR-A final Integrated Activity Plan IAP/EIS (USDOI, BLM and MMS, 2003), and BLM's Northeast NPR-A Final Amended IAP/EIS (USDOI, BLM, 2005) also are summarized and incorporated by reference. Much of this information was updated recently in the draft Arctic seismic Programmatic Environmental Assessment (PEA) for proposed 2006 seismic operations in the Beaufort and Chukchi seas (USDOI, MMS, 2006a). The seismic PEA is available on the MMS web site at: (http://www.mms.gov/alaska/ref/EIS%20EA/DraftProgrammatic%20EA%20&%20Biological%20Eval/PEA_1.pdf).

This section will augment and summarize rather than repeat the PEA descriptive information.

D.1.a(1) Annual Cycle of Harvest Activities. Maps for the primary subsistence-harvest areas for Barrow, Atqasuk, Nuiqsut, and Kaktovik are shown on Map xx, a locator map showing the EIS or EA, and the web address for these maps. Very few Inupiat live outside the traditional communities, but the seasonal movement to hunting sites and camps for subsistence activities involves travel over and use of extensive areas around these settlements. The aggregate community subsistence-harvest areas for the primary subsistence resources of marine mammals (whales, seals, walruses, polar bears); caribou, fish, birds (and eggs); furbearers (for hunting and trapping); moose; Dall sheep; grizzly bears; small mammals; and invertebrates, as well as berries, edible roots, and fuel and structural material are extensive. Annual subsistence cycles for Barrow, Atqasuk, Nuiqsut, and Kaktovik are summarized in the following. The subsistence areas and activities of these four communities in or near the sale area could be affected by the activities evaluated in this EA.

D.1.a(1)(a) Barrow. Barrow residents (population 3,469 in 1990, 4,581 in 2000, and 4,351 in 2004 [USDOC, Bureau of the Census, 1991, 2001; NSB, 1995, 1999; State of Alaska, Dept. of Commerce, Community and Economic Development [DCED], 2005]) enjoy a diverse resource base that includes both marine and terrestrial animals. Barrow's location, at the demarcation point between the Chukchi and Beaufort seas, is unique among North Slope subsistence communities. This location offers superb opportunities for hunting a diversity of marine and terrestrial mammals and fishes. Barrow's subsistence-harvest areas are depicted in detail in maps included in MMS's Liberty Development and Production Plan final EIS (USDOI, MMS, 2002), BLM's Northwest NPR-A final IAP/EIS (USDOI, BLM and MMS, 2003), BLM's Alpine Satellite Development Plan final EIS for potential expansion of Alpine field production near Nuiqsut (USDOI, BLM, 2004), and BLM's Northeast NPR-A Final Amended IAP/EIS (USDOI, BLM, 2005). Subsistence resources used by Barrow are listed in tables provided in these same documents and in the draft seismic-survey PEA (USDOI, MMS, 2006a). No substantial changes to long-term subsistence-harvest practices, subsistence cycles, and types of resources harvested have occurred since MMS's Beaufort Sea multiple-sales EIS, Sale 195 EA, and the subsequent analyses mentioned herein.

For BLM's Alpine final EIS for potential expansion of Alpine field production near Nuiqsut (USDOI, BLM, 2004), S.R. Braund and Assocs. conducted eight interviews in August 2003. These interviews were coordinated with the Inupiat Community of the Arctic Slope and included hunters who were known to travel to the east of Barrow for their subsistence harvests. The use areas described in these eight interviews generally correlated with previously described subsistence land use areas to the east and southeast of Barrow. Some differences did surface with these hunters not going much farther east of the Itkillik River and many going father southeast than in the past to the Anaktuvuk River and into areas near the Titaluk and Kigalik rivers, 120 miles (mi) south of Barrow. Barrow hunters also described occasionally traveling to the Kalikpik-Kogru River areas for caribou, if animals were unavailable closer to Barrow. Winter snowmobile travel for caribou, wolf, wolverine, and fox as far east as Fish and Judy creeks also was reported.

D.1.a(1)(b) Atqasuk. Atqasuk, population 216 in 1990, 228 in 2000, and 247 in 2004 (USDOC, Bureau of the Census, 1991, 2001; State of Alaska, DCED, 2005), is an inland Inupiat community approximately 50 mi south of Barrow. The marine-resource areas used by Atqasuk residents include those used by Barrow residents, as explained in the Barrow subsistence discussion in the drafty seismic-survey PEA (USDOI, MMS, 2006a). Only a small portion of the marine resources used by Atqasuk residents is acquired on coastal hunting trips that are initiated in Atqasuk; most resources are acquired on coastal hunting trips initiated in Barrow or Wainwright with relatives or friends (ACI, Courtnage, and Braund, 1984). Nevertheless, the local connection with the coast and marine resources is important to the community. As one resident observed: "We use the ocean all the time, even up here; the fish come from the ocean; the whitefish as well as the salmon migrate up here" (ACI, Courtnage, and Braund, 1984). Atqasuk's subsistence-harvest areas are depicted in detail in maps included in USDOI, BLM and MMS (2003) and USDOI, BLM (2004, 2005). Subsistence resources used by Atqasuk are listed in tables provided in these same documents, as well as the seismic-survey PEA (USDOI, MMS, 2006a). No substantial changes to long-term subsistence-harvest practices, subsistence cycles, and types of resources harvested have occurred since the publication of the EIS analyses mentioned above.

D.1.a(1)(c) Nuiqsut. The Inupiat community of Nuiqsut had population figures of 354 in 1990, 433 in 2000, and 430 in 2004 (USDOC, Bureau of the Census, 1991, 2001; NSB, 1995, 1999; State of Alaska, DCED, 2005). Nuiqsut is located near the mouth of the Colville River, which drains into the Beaufort Sea. For Nuiqsut, important subsistence resources include bowhead whales, caribou, fish, waterfowl, ptarmigan and, to a lesser extent, seals, muskoxen, and Dall sheep. Polar bears, beluga whales, and walruses are seldom hunted but can be taken opportunistically while in pursuit of other subsistence species. Nuiqsut has subsistence-harvest areas in and adjacent to the Beaufort Sea multiple-sale area. Cross Island and vicinity is a crucially important region for Nuiqsut's subsistence-bowhead whale hunting. Before oil development at Prudhoe Bay, the onshore area from the Colville River Delta in the west to Flaxman Island in the east and inland to the foothills of the Brooks Range (especially up the drainages of the Colville, Itkillik, and Kuparuk rivers) was historically important to Nuiqsut for the subsistence harvests of caribou, waterfowl, furbearers, fishes, and polar bears. Offshore, in addition to bowhead whale hunting, seals historically were hunted as far east as Flaxman Island. Nuiqsut's subsistence-harvest areas are depicted in detail in maps included in USDOI, MMS (2002), USDOI, BLM and MMS (2003) and USDOI, BLM (2004, 2005). Subsistence resources used by Nuiqsut are listed in tables provided in these same documents, as well as the seismic-survey PEA (USDOI, MMS, 2006a). No substantial changes to long-term subsistence-harvest practices, subsistence cycles, and types of resources harvested have occurred since MMS's Beaufort Sea Multiple-Sale EIS, Sale 195 EA, and the subsequent analyses mentioned herein.

For BLM's Alpine final EIS (USDOI, BLM, 2004), S.R. Braund and Assocs. conducted 21 interviews in June and July 2003. These interviews included hunters of both genders and ranged in ages from young hunters to active elders. The subsistence-use area for all resources described in these interviews is similar in the most part to that described by Pedersen et al. (In prep.) for harvests conducted from 1973 thorough 1986. Some formerly used areas to the west and south were not described as presently used, although this could be due to the practices of the actual hunters interviewed. Areas in the vicinity of Prudhoe Bay are no longer used, because industrial development has rendered them inaccessible.

These interviews also included additional traditional and local knowledge testimony. In her testimony at a 2003 public hearing for the Alpine Satellite Development Plan, Nuiqsut's Mayor Rosemary Ahtuangaruak related that villagers were seeing changes in caribou and fish that left the animals with tumors and lesions; they believed these effects originated from pollution from nearby gas flares. She also noted that helicopter activity was diverting caribou away from the community. Jimmy Nukapigak related that Alpine development had contributed to fewer arctic cisco in the Fish Creek area. Frank Long, Jr. believed that developing CD-6 would threaten fishing in Niqliq Channel and other Colville River channels.

The MMS is conducting long-term environmental monitoring in the Nuiqsut subsistence-whaling area as part of its Continuation of Arctic Nearshore Impact Monitoring in Development Area (CANIMIDA) study. Part of this effort is a multiyear collaborative project with Nuiqsut whalers that describes present-day subsistence whaling practices at Cross Island to empirically verify any changes to whaling due to weather, ice conditions, and oil and gas activities. The project findings were summarized during a recent MMS Information Transfer Meeting (USDOI, MMS, 2005). Overall, the project has shown that Nuiqsut whalers have continued to obtain their quota of whales and that industry vessels have helped with the transportation of whale meat in a way that has not hindered the whale hunt. However, Nuiqsut whalers reported annually the following changes in whale behavior and whaling practices:

In 2001:

- More ice and marginal weather conditions due to ice and wind made whaling more difficult
- fewer whales in smaller groups were seen;
- the need to travel farther from Cross Island to find whales;
- whales observed were more skittish than in previous years, stayed more in the ice than in open water, spent more time on the surface, and followed more unpredictable paths underwater;
- whales were more difficult to spot, because blows were not as observable as in past years, and;
- whales appeared to be skinnier (not as round) than they had been in previous years.

Possible causes suggested by whalers for these behavioral changes were:

- Offshore seismic survey work being conducted for a natural gas-pipeline route.
- Barge traffic carrying supplies to Kaktovik for a water and sewer-construction project.
- Killer whales being present offshore and to the east of Cross island.
- Ice conditions present in Canadian waters.
- Air or water traffic located to the east of Cross Island (Galginaitis and Funk, 2004).

In 2002:

- More moderate ice conditions than 2001 contributed to not being able to follow certain whales, but not to the same extent as 2001 when ice conditions were more severe.
- More whales and in larger groups were seen in 2002 than in 2001 and, in Nuiqsut, whalers reported seeing more whales during hunting trips in 2002 than in 2001; this was reported to be more the "normal"case.
- Whales were observed closer to Cross Island, but whalers probably traveled as far on their trips in 2002 as in 2001.
- Some skittish or "spooky" whales were observed; but it seemed that crews were better able to track whales in 2002 than in 2001.
- Two whales sank after they were killed, but no consensus on why was reached by whalers.

Possible causes suggested by whalers for these behavioral changes were:

- better ice conditions and
- very little nonwhaling subsistence activity near Cross Island during the whaling season (Galginaitis and Funk, 2004).

In 2003:

- Ice conditions in 2003 were more moderate than in 2001 or 2002, but high winds and less ice to moderate the wind prevented scouting for whales more than 50%.
- Conditions were not as good as in 2000 and 2002, but they may have been better or about the same as 2001.
- More whales were observed by whalers during hunting trips in 2003 than in 2002, and quite a few more than in 2001. Whales were observed on every day that boats went scouting.
- Whalers found whales relatively close to Cross Island and were harvested closer to Cross Island in 2003 than in 2001 or 2002.
- No skittish or "spooky" whale behavior was observed.

Possible causes suggested by whalers for these behavioral changes were:

- High winds, and the lack of ice that could have moderated the effect of the wind, was a major weather factor cited by whalers (Galginaitis and Funk, 2005).

In 2004:

- Ice conditions in 2004 were even more moderate than in previous years.
- Weather prevented scouting a significant number of days but not as many days as in 2003.
- The level of whaling effort, as measured by time spent out on the water, was about twice that of 2003, but still much less than in 2002 or 2001.
- Whalers reported seeing many whales; whalers did not compare one year to another, but 2004 was probably comparable to 2003 in terms of whales sighted, and "better" than in 2002 or 2001.
- Whalers found whales relatively close to Cross Island; whales were harvested about the same distance from Cross Island in 2004 as in 2003 (which was closer than in 2001 or 2002).

- Whalers took shorter trips, both in terms of length and time duration, than in 2002 or 2001, but longer than in 2003 (which is why total effort was greater in 2004 than in 2003).
- No whaler explicitly mentioned observing skittish or "spooky" whale behavior.

Possible causes suggested by whalers for these behavioral changes were:

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

In 2005:

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

Possible causes suggested by whalers for these behavioral changes were:

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

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

The Nuiqsut subsistence-whaling area is discussed in USDOI, MMS (2004:Appendix H). Appendix H illustrates the extent of Nuiqsut whaling crew voyages for the 2001 and 2002 whaling seasons. These data were gathered as part of the ongoing MMS ANIMIDA monitoring effort in the region and have been updated in this EA based on data gathered as part of the MMS CANIMIDA (Galginaitis and Funk, 2004, 2005), which reports on recent data about the level of subsistence activity around Cross Island. The most recent report explains that during 2001, the four whaling crews on Cross Island spent more than 10 hours on each scouting trip looking for whales. The total amount of time scouting was about 600 hours (Galginaitis and Funk, 2004). Rough weather prevented scouting during about one-third of the time that the whalers were on Cross Island during 2001 (Galginaitis and Funk, 2004) and about half of the time during 2003 (Galginaitis and Funk, 2005). See Figures X1 through X3 that track Nuiqsut whaling crew voyages for the 2003, 2004, and 2005 whaling seasons; Figure X4 is a composite map of all whaling tracks for the years 2001 through 2005 (Galginaitis and Funk, 2005).

The unusually rough water that restricted scouting for whales might have been related to the unusual retreat of the summer ice cover in the Beaufort Sea during recent years (see Sec. IV.A.1). The changes in the ice cover and some of its effects on coastal erosion were summarized by Comiso (2005) and Wisniewski (2005). Comiso (2005) showed the minimum extent and minimum area for the arctic ice cover from 1979-2003 depicted in a graph, as determined by satellite. The graph illustrated that the ice cover has been decreasing and was unusually small during 2003—the year when Nuiqsut subsistence-whaling activity was cut to half of its normal time by rough water. The autumn ice cover again was unusually far from the coast during 2004 (Stroeve et al., 2005). In summary, the recent offshore subsistence-whale hunts have been affected by the retreat of the ice cover far from the coast. This contrasts with the situation decades ago when the whale hunts were sometimes limited by heavy ice covers.

D.1.a(1)(d) Kaktovik. Kaktovik is situated on Barter Island off the Beaufort Sea coast (population 224 in 1990, 293 in 2000, and 284 in 2004 [USDOC, Bureau of the Census, 1991, 2001; NSB, Dept. of Planning and Community Services, 1994, 1999; State of Alaska, DCED, 2005]). Important Kaktovik subsistence resources are bowhead and beluga whales, seals, polar bears, caribou, fishes, and marine and coastal birds. Like Barrow and Nuiqsut, much of Kaktovik's marine subsistence-harvest area is within the Beaufort Sea multiple-sale area, and the western edge of the community's terrestrial mammal, fish, and bird subsistence-harvest areas overlap a possible landfall location at Point Thompson. Kaktovik's subsistence-harvest areas are depicted in detail in maps included in USDOI, MMS (2002), USDOI, BLM and MMS (2003), and USDOI, BLM (2004, 2005). Subsistence resources used by Kaktovik are listed in tables provided in these same documents, as well as the seismic-survey PEA (USDOI, MMS, 2006a). No substantial changes to long-term subsistence-harvest practices, subsistence cycles, and types of resources harvested have occurred since MMS's Beaufort Sea multiple-sales EIS, the Sale 195 EA, and the subsequent analyses mentioned herein. All of Kaktovik's marine subsistence-harvest area is within the Sale 202 area.

In 1992, the NSB surveyed subsistence harvests in eight NSB communities. The analysis of these surveys was not published until 1997 in the Fuller and George (1997) report *Evaluation of Subsistence Harvest Data from the NSB 1993 Census for Eight North Slope Villages: For the Calendar Year 1992*. Information from this report was incorporated in USDOI, BLM and MMS (2003) for Barrow and Nuiqsut; however, this final EIS did not include an analysis for Kaktovik, as the community was out of the potentially affected area of any Northwest NPR-A leasing. Harvest data were collected only anecdotally for Kaktovik by NSB personnel, because the Alaska Department of Fish and Game was administering a subsistence survey in the village at the same time. The NSB harvest data for this season should be considered primarily as comparative to State Fish and Game data collected the same year, as the overall survey response rate was low.

Fuller and George (1997) harvest estimates for the 1992 harvest season in Kaktovik—not used in the multiple-sale EIS—include:

(1) Three bowhead whales were harvested, representing 110,000 pounds of meat. Bearded seals and beluga whales were other important marine mammals taken. Five walruses also were harvested, a rare occurrence in the eastern Beaufort Sea. Marine mammals represented 66.2% of the total edible pounds harvested.

(2) For terrestrial mammals, 136 caribou, 53 Dall sheep, and 6 muskoxen were harvested in 1992, 13.9 % of the total edible pounds harvested.

(3) For fish resources, 7,900 arctic char (actually Dolly Varden), 7,100 arctic cisco, and 2,600 grayling were harvested, 18.3 % of the edible pounds harvested.

(4) Bird/waterfowl resources included 333 Pacific brant, 180 white-fronted geese, 11 snow geese, some Canada geese, and 11 Steller's eiders, 1.4 % of the edible pounds harvested.

Fifty-percent of the households surveyed participated often in fall whaling, and more than 40% participated in caribou hunting, sheep hunting, and fishing (Fuller and George, 1997). Pedersen (2005) conducted surveys of the Kaktovik subsistence fishery in 2000-2001 and 2001-2002, with estimated community harvests of fish at 5,970.0 pounds (lb) and 9,748.3 lb, respectively. Dolly Varden, lake trout, and arctic cisco were the only fishery resources reported harvested by Kaktovik households in this study. Dolly Varden was the most commonly harvested fish in terms of numbers harvested and estimated harvest weight, with arctic cisco and lake trout ranking second and third (Pedersen, 2005).

D.1.b. Sociocultural Systems. The following discussion describes the Alaskan North Slope communities that may be affected directly by oil and gas exploration and development in the sale area. These community-specific descriptions discuss factors relevant to the sociocultural analysis of each community in relation to industrial activities, population, and current socioeconomic conditions. Following these descriptions, the social organization, cultural values, and other issues common to all the communities are discussed. The primary sociocultural variables—population, social organization, cultural values, and institutional organization—have not altered since the Beaufort Sea multiple-sale final EIS (USDOI, MMS, 2003) and the Beaufort Sea Sale 195 EA (USDOI, MMS, 2004)

Sociocultural information, along with new research on sociocultural systems that might influence the previous effects' assessments is summarized in the following. This summary also includes any new Native stakeholder concerns as they relate to these topics, as well as traditional knowledge updates. The discussions on sociocultural systems in MMS's Liberty Development and Production Plan final EIS (USDOI, MMS (2002),the BLM's Northwest NPR-A Final IAP/EIS (USDOI, BLM and MMS, 2003), BLM's Northeast NPR-A Final Amended IAP/EIS (USDOI, BLM, 2005), as well as the seismic-survey PEA (USDOI, MMS, 2006a) also are summarized and incorporated by reference.

D.1.b(1) Barrow. Barrow is the largest community on the North Slope and is its regional center. The city already has experienced dramatic population changes as a result of increased revenues from onshore oil development and production at Prudhoe Bay and in other smaller oil fields; these revenues stimulated the NSB Capital Improvements Projects (CIP) in earlier years. In the 2000 Census, Barrow's Inupiat population remained undiminished at 64.0% of the total Barrow population; its population stood at 4,351 in 2004 (USDOC, Bureau of the Census, 1991, 2001; Harcharek, 1992; NSB, 1995, 1999; State of Alaska, DCED, 2005). Barrow's social characteristics, systems, and conditions are described in detail in USDOI, MMS (2002), USDOI, BLM and MMS (2003), and USDOI, BLM (2004, 2005) as well as the Arctic seismic (USDOI, MMS, 2006a). No substantial changes to long-term social characteristics have occurred since the Beaufort Sea multiple-sale EIS, the Sale 195 EA, and the subsequent analyses mentioned herein.

D.1.b(2) Atqasuk. Atqasuk is a small, predominantly Inupiat community on the Meade River, about 60 mi south of Barrow. The total 1990 community population was 216 (92% Inupiat). In 2000, there were 228 residents, 94.3% of whom were Inupiat; in 2004, there were 247 community residents (USDOC, Bureau of the Census, 1991, 2001; State of Alaska, DCED, 2005). The community was established in the mid-1970's under the 1971 Alaska Native Claims Settlement Act (ANCSA) by Barrow residents who had traditional ties to the area. People lived in tents until NSB-sponsored housing arrived in 1977. The 1980 Census tallied 107 residents; 2 years later, a Borough census recorded 210 residents. By July 1983, the population had risen to 231, a 166% increase since the first census in 1980. Atqasuk is an inland village and its subsistence preferences follow this trend, with caribou and fish being the primary subsistence resources. Social ties between Barrow and Atqasuk remain strong, and men from Atqasuk go to Barrow to join bowhead-whaling crews. To a large degree, Atqasuk has avoided the rapid social and economic changes experienced by Barrow and Nuiqsut brought on by oil-development activities, but future change could accelerate as a result of oil exploration and development in the Northwest NPR-A Planning Area. Possible new pipeline routes could cross Atqasuk's terrestrial subsistence-harvest areas, as most of its traditional subsistence-use area is within the NPR-A (USDOI, BLM and MMS, 2003). Atqasuk's social characteristics, systems, and conditions are described in detail in USDOI, BLM and MMS (2003) and USDOI, BLM (2004, 2005) as well as the seismic-survey PEA (USDOI, MMS, 2006a).

D.1.b(3) Nuiqsut. Nuiqsut sits on the west bank of the Nechelik Channel of the Colville River Delta, about 25 mi inland from the Arctic Ocean and approximately 150 mi southeast of Barrow. The population was 433 (89.1% Inupiat) in 2000 and 430 in 2004 (USDOC, Bureau of the Census, 1991, 2001; NSB, 1995, 1999; State of Alaska, DCED, 2005). Nuiqsut is experiencing rapid social and economic change due to the development of new local infrastructure, including natural gas hookups soon to come to all community households, the development of the Alpine facility and potential Alpine Satellite development, and potential oil development in the NPR-A. Nuiqsut's social characteristics, systems, and conditions are described in detail in USDOI, MMS (2002), USDOI, BLM and MMS (2003), and USDOI, BLM (2004, 2005) as well as the seismic-survey PEA (USDOI, MMS, 2006a). No substantial changes to long-term social characteristics have occurred since the Beaufort Sea multiple-sale EIS, the Sale 195 EA, and the subsequent analyses mentioned herein.

In her testimony at a 2003 public hearing for the Alpine Satellite Development Plan (USDOI, BLM, 2004), Rosemary Ahtuangaruak, Mayor of Nuiqsut, observed that although the village ethnic makeup had not changed, and that oil-development infrastructure was creeping closer to the community and bringing with it new health issues, including an increasing number of asthma cases. Testifying at the same meeting, Bernice Kaigelak commented that the qualifications for Natives to get local oil-industry jobs had gotten more prohibitive. Testing used to be restricted to passing a urinary analysis but recently had been extended to other licensing requirements, many of which were hard to get certification for in a small community like Nuiqsut.

D.1.b(4) Kaktovik. Kaktovik, incorporated in 1971, is the easternmost village in the NSB. In 2000, Kaktovik's population was 293, and in 2004, it was 284 (84.0% Inupiat) (USDOC, Bureau of the Census, 1991, 2001; NSB, Dept. of Planning and Community Services, 1994, 1999; State of Alaska, DCED, 2005). Kaktovik is located on the north shore of Barter Island situated between the Okpilak and Jago rivers on the Beaufort Sea coast. Barter Island is one of the largest of a series of barrier islands along the north coast and is about 300 mi east of Barrow. Kaktovik abuts the Arctic National Wildlife Refuge. Kaktovik's social characteristics, systems, and conditions are described in detail in USDOI, MMS (2002) and in the seismic-survey PEA (USDOI, MMS, 2006a). No substantial changes to long-term social characteristics have occurred since the Beaufort Sea multiple-sale EIS the Sale 195 EA, and the subsequent analyses mentioned herein.

- **Summary.** The MMS is conducting long-term environmental monitoring in the Nuiqsut subsistence-whaling area and, as part of this effort, has conducted a multiyear collaborative project with Nuiqsut whalers that describe present-day subsistence-whaling practices at Cross Island to empirically verify any changes to whaling due to weather, ice conditions, and oil and gas activities. The project findings were summarized during a recent MMS Information Transfer Meeting (USDOI, MMS, 2005). Overall, the project has shown that the Nuiqsut whalers have continued to obtain their quota of whales, and that industry vessels have helped with the transportation of whale meat in a way that has not hindered the whale hunt. However, Nuiqsut whalers reported changes in whale behavior and whaling practices during 2001 and suggested possible causes for those changes.

The ongoing MMS ANIMIDA study (Galginaitis and Funk, 2004, 2005), reported on recent data about the level of subsistence activity around Cross Island. That report stated that during 2001, the four whaling crews on Cross Island spent more than 10 hours on each scouting trip looking for whales, and that the total amount of time scouting was about 600 hours. Rough weather prevented scouting during about one-third of the time that the whalers were on Cross Island during 2001 and about half of the time during 2003.

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

D.2. Marine and Coastal Birds.

This section updates new information that has become available since publication of the multiple-sale EIS, incorporating information from recent research, the 195 EA, and the seismic-survey PEA (USDOI, MMS, 2003, 2004, 2006a). The MMS also hosted an information exchange meeting October 31-November 1, 2005, (Appendix F) that included presentations by researchers on the latest information on bird species of concern in the Beaufort and Chukchi seas. The updated information includes recently obtained research results on size, status, trends, and distribution of eiders, the long-tailed duck, the yellow-billed loon, and other bird (species/guilds) populations potentially at risk of substantial effects from this action. Also included is new information on breeding biology, habitat use, and migratory patterns that may help to improve our understanding of the vulnerability of these species to oil and gas exploration and development activities. Where pertinent, this new information has been used to refine the previous assessment of potential effects contained in the EIS. The MMS recently sent a memorandum to the Fish and Wildlife Service (FWS) requesting concurrence on an updated assessment that concluded no new relevant information would necessitate reinitiation of formal consultation on listed species (Appendix E).

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

D.2.a. Species with Higher Potential for Substantial Effects. Principal bird species seasonally occurring in the Alaskan Beaufort Sea vicinity that are considered to have a high potential for substantial effects from oil and gas activities following proposed Sale 202 included spectacled eider, Steller's eider, king eider, common eider, long-tailed duck, black guillemot, and yellow-billed loon. Recent information on the yellow-billed loon range, population size, habitat requirements, and perceived threats to breeding and wintering habitat indicates that the yellow-billed loon is experiencing a population decline, and certain population segments are particularly vulnerable to impacts. Similarly, recent studies indicate certain Beaufort Sea coastal locales host large concentrations of postbreeding and juvenile shorebirds. Certain shorebird species could undergo population-level changes from a low-probability oil spill. Yellow-billed loons and shorebirds (as a group) were considered to have a greater potential for substantial effects from oil and gas exploration than was concluded by the multiple-sale EIS. Updated information for each species or species group follows.

D.2.a(1) Spectacled Eider. As explained in the USDOI, MMS (2003, 2004), the breeding population on the North Slope currently is the largest breeding population of spectacled eiders in North America. The spectacled eider was listed throughout its range as a threatened species on May 10, 1993 (58 *FR* 27474-27480). The primary reason for listing was the dramatic decline (from ~50,000 pairs in 1971 to an estimated 1,721 pairs in 1992) documented for the Yukon-Kuskokwim (Y-K) Delta breeding population as well as the apparent decline in the North Slope breeding population (Stehn et al., 1993; Ely, Dau, and Babcock, 1994). At the time of listing, the Y-K Delta breeding population was considered to represent roughly half of the world population (Stehn et al., 1993; USDOI, FWS, 1996, 1999). An estimated 363,000 (95% CI 333,526-392,532) spectacled eiders were later discovered south of St. Lawrence Island, Alaska, during late winter (March 1996 and 1997) aerial surveys in the Bering Sea (Larned and Tiplady, 1997; Petersen, Larned, and Douglas, 1999), which apparently represents the entire world population.

Spectacled eiders were surveyed in marine waters within 100 kilometers (km) of the Beaufort Sea shoreline between Barrow and Demarcation Point during the summers 1999-2001 (Fischer and Larned, 2004). Overall, spectacled eiders were observed in low densities throughout the survey area but were all seen offshore of the Colville River Delta while staging for migration during the 1999 and 2000 summers.

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

Spectacled eiders winter in the Bering Sea (Petersen, Larned, and Douglas, 1999). Bump and Lovvorn (2004) evaluated the potential for changing lead structure to alter flight costs for wintering spectacled eiders. Increased flight costs beyond a certain threshold could be a source of population change in spectacled eiders. Bump and Lovvorn concluded that there were leads available to eiders under most conditions in the Bering Sea, and that long-term trends in the extent and timing of Bering Sea pack ice may have altered food webs involving the spectacled eider.

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

D.2.a(2) Steller's Eider. When the Steller's eider was petitioned in December 1990 to be listed as endangered under the ESA, listing the species rangewide did not appear to be warranted given the relatively large number (~138,000) of Steller's observed on the wintering area(s) in southwest Alaska. However, the Alaska breeding population of Steller's was listed as threatened on June 11, 1997, based on an apparent contraction of the species' breeding range in Alaska (e.g., Kertell [1991] reported that Steller's breeding was virtually absent from 1975-1990) and due to a perceived increase in its vulnerability to extirpation (62 *FR* 31748-31757).

Qualitative information on nesting effort in Alaska has indicated apparent declines on the Y-K Delta (Kertell, 1991; Flint and Herzog, 1999) and the Arctic Coastal Plain (Quakenbush et al., 2002, 2004). The 2005 Steller's spring migration-survey estimate of 79,022 was 6% below the long-term average of 84,458 (Larned et al., 2005). For the same year, larger declines in Steller's estimates were documented during spring (22.3%; n = 41,095) and fall (50%; n = 36,373) emperor goose (*Chen canagica*) aerial surveys, respectively (Dau and Mallek, 2005; Mallek and Dau, 2005). It is likely that <5% of the world population of Steller's eider annually breeds in Alaska, with >95% of the Alaskan breeding Steller's eider occurring on the Arctic Coastal Plain near Barrow (USDOI, FWS, 1999, 2002a; Quakenbush et al., 2004).

The Steller's eider once nested across the North Slope but is suspected to have abandoned the eastern North Slope in recent decades (USDOI, FWS, 2005). It still occurs at low densities from Wainwright to at least Prudhoe Bay. The majority of sightings in the last decade have occurred west of Nuiqsut on the Colville River and within 90 km (56 mi) of the coast. Near Barrow, Steller's eiders still regularly occur but do not nest annually. Up to several dozen pairs breed in a few square kilometers (USDOI, FWS, 2005).

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

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

D.2.a(3) King Eider. Aerial surveys of king eiders conducted on the Arctic Coastal Plain during June 2005 yielded a population index of 14,934, which was 14% above the 13-year mean and contributed towards a significantly positive long-term growth rate of 1.021 (Larned, Stehn, and Platte, 2005). The index also was above the 2004 index of 13,461 (Larned, Stehn, and Platte 2005). Distributions during the 2005 surveys were similar to previous years.

Fischer and Larned (2004) surveyed king eiders in marine waters within 100 km of the Beaufort Sea shoreline between Barrow and Demarcation Point during the summers 1999-2001. King eiders were the second most abundant species counted during the survey periods. King eider densities varied according to water depth, offshore distance, and percent of ice cover. Large flocks of king eiders concentrated in the mid-depth (10- to 20-meter [m]) zone offshore of Barrow and Oliktok Point. In 1999 and 2000, these flocks were in waters >10 m deep, but were found in the shallow (<10 m) and mid-depth zone in July 2001. King eiders were unique among species surveyed by occurring in higher densities in low (<31%) and moderate (31-60%) ice cover (Fischer and Larned, 2004).

Satellite telemetry was used to determine that most king eiders spent more than 2 weeks staging offshore in the Beaufort Sea prior to migrating to molt locations in the Bering Sea (Phillips, 2005; Powell et al., 2005). Female king eiders may need to remain in the Beaufort Sea longer than males to replenish fat stores depleted during egg laying and incubation (Powell et al., 2005). Prior to molt migration, king eiders in the Beaufort Sea usually were found about 13 km offshore; however, during migration to molting areas, king eiders occupied a wide area ranging from shoreline to >50 km offshore (Phillips, 2005).

Fischer and Larned (2004) concluded that because king eiders were concentrated in mid-depth water offshore of the Colville River Delta, they could be particularly vulnerable to oil spills because of their large flock sizes, distances from shore, and the presence of moderate ice-cover conditions. For example, in midsummer 2001, they found 75% of king eiders in areas of >20% ice cover, suggesting that inefficiency or failure to clean up an oil spill in broken-ice conditions could have significant impacts to this species. Impacts could be especially severe, if oil persisted in areas of high use throughout the peak migration period.

D.2.a(4) Common Eider. Common eiders were surveyed in marine waters within 100 km of the Beaufort Sea shoreline between Barrow and Demarcation Point by Fischer and Larned (2004) during the summers 1999-2001. In general, common eiders were concentrated in shallow waters (<10 m), with the highest densities occurring in segments between Oliktok point and Prudhoe Bay and between Tigvariak Island and Brownlow Point. Common eiders were most commonly associated with barrier islands in these segments, becoming less commonly observed up to 50 km seaward. Common eider densities were highest in areas of low ice cover.

Fischer and Larned (2004) concluded that because eider densities did not vary between summer months, the eiders they observed near barrier islands were local breeders rather than molt or fall migrants. This is consistent with Petersen and Flint (2002), who showed that satellite-tagged common eider hens remained in shallow waters close to their breeding sites through September.

Petersen and Flint (2002) suggested that common eider populations that breed on the Y-K Delta and the western Beaufort Sea coast should be managed separately because while females of either group may occasionally overlap on wintering areas, fidelity to breeding areas would expose each breeding population to different environmental variables. This geographic isolation likely has resulted in subsequent differences in survival and reproduction between breeding populations.

Our most recent information still indicates that beginning in late June, male common eiders begin moving out of the Beaufort Sea. Most males are out by late August or early September, and most females were gone by late October or early November. When traveling west along the Beaufort Sea coast, approximately 90% of the common eiders migrate within 48 km of the coast; 7% migrate 13-16 km from shore, roughly along the 17- to 20-m isobath (Johnson and Herter, 1989, citing Bartels, 1973).

Common eiders nest on barrier islands, most often in close association with driftwood windbreaks (Noel et al., 2005). Arctic climate change is believed to reduce ice coverage, which allows for large wind-driven storm events and changes in tidal action. These changes result in eroded coastal vegetation and redistributes or removes driftwood. The effect of changes in the distribution of driftwood on suitability of common eider nest sites is unknown (Dau and Larned, 2004, 2005).

D.2.a(5) Long-tailed Ducks. Long-tailed ducks are abundant in and near lagoons, where they feed on the abundant food resources (Flint et al., 2003). In late June and early July, most male and nonbreeding female long-tailed ducks assemble in massive flocks in lagoons along the Beaufort Sea to molt, while a smaller number molt on large, freshwater lakes. They are flightless for a 3- to 4-week period through July and August, but the majority of birds remain in or adjacent to the lagoons as opposed to pelagic waters. Along nearshore transects, the density of long-tailed ducks decreased significantly between 1990 and 2000.

Long-tailed ducks were surveyed in marine waters within 100 km of the Beaufort Sea shoreline between Barrow and Demarcation Point by Fischer and Larned (2004) during the summers 1999-2001. The long-tailed duck was the most abundant marine bird observed during the survey. Long-tailed duck densities were highest in shallow water (<10 m) during 1999 and 2000. In July, long-tailed ducks were most numerous in shallow-water areas between Tigvariak Island and Brownlow Point. Long-tailed duck density was highest in areas with low ice cover. Overall, nearshore waters close to the Colville River Delta were particularly important to long-tailed ducks (Fischer and Larned, 2004).

Aerial breeding pair surveys have been conducted on the Arctic Coastal Plain for the past 19 years. The long-tailed duck population index for 2004 was 101,091 and was 7.8% below the previous 18-year mean of 109,618. The 19-year trend for long-tailed ducks is significantly negative, attributed primarily to a decrease in the number of grouped ducks (Mallek, Platte, and Stehn, 2005).

D.2.a(6) Black Guillemot. Our most recent information still indicates that the breeding population in Alaska is relatively small; the Chukchi and Beaufort seas have a combined total of fewer than 2,000 birds. Black guillemots were surveyed in marine waters within 100 km of the Beaufort Sea shoreline between Barrow and Demarcation Point by Fischer and Larned (2004) during the summers 1999-2001. Black guillemots were the least numerous (n=3) of all the birds (27, 517 total) observed during the surveys (Fischer and Larned, 2004).

Black guillemots remain closely associated with sea ice throughout their lifetime where they feed extensively on arctic cod (*Boreogadus saida*). The largest breeding colony in the Beaufort Sea is on Cooper Island, where breeding occurs between late June and early September. These guillemots make frequent foraging trips to the ice edge to forage on arctic cod; therefore, in the Beaufort Sea they are common within their foraging range from Cooper Island. When the sea ice is beyond their foraging range, it appears that black guillemots switch prey to other fish species for themselves and their chicks (Friends of Cooper Island, 2005).

Horned puffins appear to be expanding their breeding range to include Cooper Island. Horned puffins displace black guillemots from nesting cavities and kill guillemot chicks. Impacts to recruitment, when coupled with anticipated northward migration of the sea-ice front away from Cooper Island, could be contributing to declines in black guillemot abundance (Friends of Cooper Island, 2005). In 2005, however, the sea ice had retreated; however, weather patterns during the nesting season pushed pack ice near the island, and both species experienced high nesting success.

D.2.a(7) Yellow-Billed Loon. Aerial breeding pair surveys have been conducted in late June on the Arctic Coastal Plain for the past 19 years (Mallek, Platte, and Stehn, 2005). The yellow-billed loon population index for 2004 was 2, 262 and was 22.5% below the previous 18-year average. The 19-year growth trend is flat.

Very low numbers of yellow-billed loons were found in marine waters within 100 km of the Beaufort Sea shoreline between Barrow and Demarcation Point by Fischer and Larned (2004) during the summers 1999-2001. Most of these were found in shallow (<10 m) waters of Harrison Bay, between Cape Halkett and the Colville River Delta.

Counts of yellow-billed loons in nearshore waters and along barrier islands of the Beaufort Sea shoreline between Barrow and Demarcation Point in late June 2004 were more than double than all but one of the previous 5 years (Dau and Larned, 2004). The same survey made the following year, however, found the lowest number of yellow-billed loons counted since 1999 (Dau and Larned, 2005). Sea ice condition may influence the abundance and distribution of yellow-billed loons observed during this annual survey, which is timed to coincide with egg laying and incubation of common eiders.

The Center for Biological Diversity (CBD) petitioned the USDOI, FWS to list the yellow-billed loon as an endangered or threatened species under the ESA on March 30, 2004 (Center for Biological Diversity, 2004). The petition identifies threats to the species as oil and gas development, human disturbance, increased predation, small population size and low productivity, marine health, incidental bycatch from fishing, hunting, and the inadequacy of existing regulatory mechanisms.

The petition stated that breeding habitat for the species is threatened from potential destruction, modification, and fragmentation from oil, gas, and other development. Oil exploration, drilling, and pipeline development potentially could affect a significant portion of an already small population. Oil spills in freshwater nesting and broodrearing lakes, on rivers or streams, or in the marine environment could directly kill or injure birds or contaminate habitats and prey items (Center for Biological Diversity, 2004). The yellow-billed loon is highly vulnerable to environmental change and disturbance and exhibits a lower annual productivity rate than most waterfowl. The species is little studied, and basic biological information (such as the seasonal distribution of immature and nonbreeding yellow-billed loons) is slowly being acquired.

The FWS has not issued a 90-day finding on the CBD petition, but has worked with local, State, and Federal resource agencies to draft a Conservation Agreement for the yellow-billed loon, available for public comment in April 2006 (71 *FR* 13155-13157). The goal of the draft Conservation Agreement was to "... protect YBLO and their breeding, brood-rearing, and migrating habitats in Alaska, such that current or potential threats in these areas are avoided, eliminated or reduced to the degree that the species will not become threatened or endangered from these threats within the foreseeable future."

D.2.a(8) Shorebirds. Powell et al. (2004) monitored the movements and tenure times of shorebirds at two interior breeding sites, three coastal sites, and five staging areas along the Arctic Coastal Plain. They found that breeding shorebirds moved to adjacent coastal areas to stage prior to migration, but there was limited movement between coastal sites during the staging period. Any given staging site was likely to host birds from a wide breeding area. Aerial surveys were conducted to identify coastal "hotspots" of bird abundance. This study may help identify nearshore coastal areas that are important to shorebirds for staging prior to migration.

There appear to be coastal sites where large numbers of shorebirds congregate. For example, the Colville River Delta hosts between 41,000 and 300,000 shorebirds between July 25 and September 5 (Andres 1994; USDOI, FWS, 2004). The range of these numbers depends on how long birds remain in the area before migrating (Andres, 1994; Powell et al., 2004; Taylor et al., 2006). Results on bird tenure times from the Taylor et al. (2006) project may help clarify the anticipated range of shorebirds using the delta. At the present time, it appears that large numbers of shorebirds could be affected during this important postbreeding period should they encounter oil on shorelines through oil exposure and subsequent hypothermia, or indirectly by birds eating contaminated prey or their invertebrate food sources dying (USDOI, FWS, 2004).

D.2.b. Species with Lower Potential for Substantial Effects. The tundra swan, red-throated loon, Pacific loon, brant, snow goose, bar-tailed godwit, buff-breasted sandpiper, and other shorebird and seabird species were considered to have a lower potential for substantial effects. The yellow-billed loon (see Section D.2.a(7)), bar-tailed godwit, buff-breasted sandpiper, and arctic tern are several Beaufort Sea species considered Birds of Conservation Concern by the Fish and Wildlife Service (USDOI, FWS, 2002b).

D.2.b(1) Tundra Swan. Aerial breeding pair surveys have been conducted on the Arctic Coastal Plain for the past 19 years. The tundra swan population index for 2004 was 8,745 and was 11.8% below the previous 18-year mean of 9,916. The 19-year trend for tundra swans was significantly positive, attributed primarily to large numbers of swans observed during the 1997-2000 surveys (Mallek, Platte, and Stehn, 2005).

D.2.b(2) Red-Throated Loon. The FWS conducts an annual eider breeding-population survey on the Arctic Coastal Plain in mid-June. Numbers of other breeding waterbird species are recorded during these surveys. Results from the 2005 survey include that the red-throated loon index remained well below average, maintaining a significantly negative long-term growth rate, but a relatively stable trend for the most recent 7 years (Larned, Stehn, and Platte, 2005).

Aerial breeding pair surveys have been conducted on the Arctic Coastal Plain for the past 19 years. The red-throated loon population index in 2004 was 4,155 and was 34.2% above the previous 18-year mean. The population index has historically been highly variable, but the overall growth trend is significantly positive (Mallek, Platte, and Stehn, 2005).

Fischer and Larned (2004) found very low numbers of red-throated loons in marine waters within 100 km of the Beaufort Sea shoreline between Barrow and Demarcation Point during the summers 1999-2001. Most were observed in shallow water between Oliktok Point and Brownlow Point.

D.2.b(3) Pacific Loon. The FWS conducts an annual eider breeding population survey on the Arctic Coastal Plain in mid-June. Numbers of other breeding waterbird species are recorded during these surveys. Results from the 2005 survey include that the Pacific loon index was about average, continuing a stable trend that started in 1999 (Larned, Stehn, and Platte, 2005).

Pacific loons were surveyed in marine waters within 100 km of the Beaufort Sea shoreline between Barrow and Demarcation Point by Fischer and Larned (2004) during the summers 1999-2001. Pacific loons were found most often as singles or in pairs across the survey area in relatively low densities compared to other species. Pacific loons were associated with shallow waters (<10 m) with low ice cover. Overall, nearshore waters close to the Colville River Delta were particularly important to Pacific loons (Fischer and Larned, 2004).

Aerial breeding pair surveys have been conducted on the Arctic Coastal Plain for the past 19 years. The pacific loon population index in 2004 was 22,948 and was 15.3% below the previous 18-year mean (Mallek, Platte, and Stehn, 2005). The 19-year growth trend is flat.

D.2.b(4) Black Brant. Aerial surveys conducted during early June 2005 resulted in a population index of 14,264, a 5% decrease from the 2004 index of 15,033 (Larned, Stehn, and Platte, 2005). There are certain limitations of the survey design (brant are primarily colonial nesters), but population indices suggest that the 7-year and 14-year growth rates are 1.287 and 1.134, respectively. These data, however, were not consistent with other data from surveys designed to survey North Slope black brant colonies (Ritchie et al., 2002).

Breeding pair surveys have been conducted on the Arctic Coastal Plain for the last 19 years. The population index for black brant in 2004 was 5,305, a decrease from the 2003 index of 12,932 and well below the 1986-2003 average of 9,927. The population index between 1986 and 2003 has ranged between 1,126 and 22,042 (Mallek, Platte, and Stehn, 2005).

Numbers of black brant have ranged between 1,319 and 3,836 during surveys of nearshore and barrier islands along the North Slope in late June 1999-2005 (Dau and Larned, 2005). Fischer and Larned (2004) reported observing small flocks of brant during nearshore surveys of the Arctic coast during June-July 1999-2001.

D.2.b(5) Snow Goose. Aerial surveys conducted in early June do not appear to adequately sample colonial-nesting snow geese, but data from Larned, Stehn, and Platte (2005) showed a long-term growth trend that was consistent with other data from surveys designed to survey North Slope snow geese colonies (Ritchie et al., 2002).

Relatively small numbers of snow geese were observed during surveys of nearshore and barrier islands along the North Slope in late June 1999-2005 (Dau and Larned, 2005). Breeding pair surveys have been conducted on the Arctic Coastal Plain for the last 19 years. The population index for snow geese in 2004 was 3,802, an increase from the 2003 index of 2,554 and greater than the 1986-2003 average of 2,444. The population index between 1986 and 2003 has ranged between 0 and 29,257 (Mallek, Platte, and Stehn, 2005). Fischer and Larned (2004) reported observing small flocks of snow geese during nearshore surveys of the Arctic Coast during June-July 1999-2001.

D.2.b(6) Bar-Tailed Godwit. The North American population of bar-tailed godwits (*Limosa lapponica baueri*) breeds in western and northern Alaska. Postbreeding bar-tailed godwits move to staging grounds along the Bering Sea coast and then apparently fly nonstop 11,000 km to New Zealand. Recent counts conducted at both breeding and nonbreeding sites provide evidence of a serious and rapid population decline (McCaffrey et al., 2006), but the cause of the decline is unknown. The abundance and distribution of bar-tailed godwits in northern Alaska and coastal areas of the Beaufort Sea are not well understood.

D.2.b(7) Shorebirds and Seabirds. Fischer and Larned (2004) observed small numbers of seabirds in deep, offshore waters, including Sabine's gulls (*Xema sabini*), black-legged kittiwakes (*Rissa tridactyla*), arctic terns (*Sterna paradisaea*), and unidentified auklets (*Aethia* spp.). Small groups of shearwaters (*Puffinus* spp.) were observed foraging 25-55 km from shore between Oliktok Point and Brownlow Point in August 2000, and jaegers (*Stercorarius* spp.) were noted up to 75 km offshore along the entire coastline.

D.3. Local Water Quality.

This section contains an update of information on local water quality that might be affected by proposed Beaufort Sea Sale 202. The section updates the information in the multiple-sale EIS, incorporating information from the 195 EA and recent research (USDOI, MMS, 2003, 2004).

Hydrocarbons in marine particulate matter and sediments were characteristic of immature bitumens, shales, or coals; the degree of anthropogenic influence on the polycyclic aromatic hydrocarbon load in the Mackenzie River delta was small; and a large amount of dissolved organic carbon was carried into the coastal Beaufort Sea during peak flows at the time of river breakup in early June (USDOI, MMS, 2004). These studies confirm the multiple-sale EIS conclusion that North Slope rivers carry hydrocarbons from peat, coal, and natural seeps into the coastal waters. The concentration of petroleum hydrocarbons in Beaufort Sea water and organisms was examined in three recent studies, one of which included samples from the Barrow subsistence-whaling area. The studies found traces of petroleum hydrocarbons, but the concentrations were relatively low in comparison with other coastal areas off Alaska, the Arctic, and the conterminous United States (Naidu et al., 2005; USDOI, MMS, 2004b, 2005b,c).

A general description of the Chukchi and Beaufort seas water quality follows; however, more detailed information about the Chukchi and Beaufort seas chemical oceanography, water quality, and sources of pollution can be found in USDOI, MMS (1998, 2002, 2003).

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

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

D.4. Bowhead Whales, Polar Bear, Other Marine Mammals, Fishes, and Essential Fish Habitat.

D.4.a. Bowhead Whales. Endangered Section 3(15) of the ESA, as amended, states: "(T)he term "species" includes any subspecies of fish or wildlife or plants, and any distinct population segment of any vertebrate fish or wildlife which interbreeds when mature" (16 U.S.C. § 1532). Thus, under the ESA, distinct population segments and subspecies are included along with biological species in the definition of "species," and such entities can be listed separately from other subspecies and/or distinct population segments of the same biological species.

Based on the best available information, and on the guidance provided by the NMFS in their letter of September 30, 2005, there are three species of cetaceans that are listed as endangered under the ESA that can occur within or near the Beaufort Sea OCS Planning Area or that could potentially be affected secondarily by activities within this planning area. The common and scientific names of these species are:

Bowhead whales (*Balaena mysticetus*)
Fin whales (*Balaenoptera physalus*)
Humpback whales (*Megaptera novaeangliae*)

It is clear both from the aforementioned September 30, 2005, letter to MMS from NMFS and from our own review that the bowhead is the species most likely to be impacted by oil and gas activities in the Beaufort Sea Planning Area. A detailed discussion of the bowhead whale can be found in the *Biological Evaluation of the Potential Effects of Oil and Gas Leasing and Exploration in the Alaska OCS Beaufort Sea and Chukchi Sea Planning Areas on Endangered Bowhead Whales (Balaena mysticetus), Fin Whales (Balaenoptera physalus), and Humpback Whales (Megaptera novaeangliae)* on our web site at: (http://www.mms.gov/alaska/ref/EIS%20EA/DraftProgrammatic%20EA%20&%20Biological%20Eval/final_be_whales.pdf).

There is no designated critical habitat for any species for which NMFS has jurisdiction that potentially could be affected by the Proposed Action.

The Marine Mammal Protection Act (MMPA) mandates management of marine mammal population stocks. Under Section 3 of the MMPA, the "...term 'population stock' or 'stock' means a group of marine mammals of the same species, or smaller taxa in a common spatial arrangement, that interbreed when mature" (16 U.S.C. § 1362 (11)). "Population stock" (usually referred to simply as "stock") designations of many groups of marine mammals have changed over the past 2 decades, in large part due to focused efforts to define the stocks coupled with the availability of relatively new tools with which to examine patterns of genetic variability from the field of molecular genetics. Thus, because of new information, many species of marine mammals that were formerly treated as if comprised of only a single stock, now may be subdivided into multiple stocks, or there may be discussion of whether multiple stocks exist. In the cases of marine mammals for which separate stocks have been delineated, we focus our description and evaluation of potential effects on those stocks that may occur within or near the Beaufort Sea Planning Area. However, we bring in information on the biological species as a whole, if it enhances the understanding of the relevant stock(s) or aids in evaluation of the significance of any potential effects on the stock that occurs within or near these areas.

D.4.a(1) Summary of Information about Bowhead Whale Status, Abundance, Distribution, Habitat Use and Ecology Relevant to Assessing Effects of the Proposed Action. There is one ESA-listed marine mammal species, the bowhead whale, which regularly seasonally occurs within the Beaufort Sea OCS Planning Area and within areas of the Chukchi Sea that could be affected by actions within the Beaufort Sea. This population stock of bowheads is the most robust and viable of surviving bowhead populations and, thus, its viability is critical to the long-term future of the biological species as a whole. There is scientific uncertainty about the population structure of bowheads that use the Beaufort and Chukchi seas. Available new information does not indicate that there has been any significant negative or other change in the population status of the Bering-Chukchi-Beaufort Sea (BCB Seas) bowhead whale population since MMS consulted with NMFS in 2003 regarding Sale 195 (USDOI, MMS, 2004) or the Beaufort Sea multiple-sale EIS (USDOI, MMS, 2003a). Data indicate that what is currently referred to as the Western Arctic stock (by NMFS) or as the BCB Seas stock (by the International Whaling Commission [IWC]) of bowheads is increasing in abundance. All recent available information indicates that the population has continued to increase in abundance over the past decade and may have doubled in size since about 1978. The estimated current annual rate of increase is similar to the estimate for the 1978-1993 time series. There are scientific analyses indicating that BCB Seas bowheads may have reached or are approaching, the lower limit of their historic population size. There is discussion in the scientific and regulatory communities regarding the potential delisting of this population. The cause of the historic decline of this species was overharvesting by commercial whalers. The primary known current human-related cause of mortality is a regulated subsistence hunt by Alaskan Natives. Conservation concerns include: the introduction of noise and related disturbance from existing, but especially potential future, oil and gas activities, shipping, other vessel traffic, and hunting in calving, migration, and feeding areas; contamination of their habitat by pollutants from planned and potential future oil and gas activity and by other local and distant pollution sources; uncertain potential impacts of climate warming; vessel strikes; and entanglement. No data are available indicating that, other than historic commercial whaling, any previous human activity has had a significant adverse impact on the current status of BCB Seas bowheads or their recovery. The uncertainty of the stock structure adds some uncertainty to summaries of the status of bowheads that may be impacted by the proposed action. Currently available information indicates that bowheads that use the Alaskan Beaufort Sea and Chukchi Sea Planning Areas are resilient at least to the level of human-caused mortality and disturbance that currently exists, and has existed since the cessation of commercial whaling, within their range. Data indicate that at least some bowheads are extremely long-lived (100+ years or more), and this longevity can affect the potential for a given individual to be exposed to a high number of disturbance and pollution events in its lifetime.

Within or near areas where the Proposed Action could occur, geographic areas of particular importance to this stock include the areas of the spring lead system in both the Chukchi and Beaufort seas and areas that are used for feeding by large numbers of individuals in some years, but not in all years. However, the significance of feeding in particular areas to the overall food requirements of the population or segments of the population is not clear. Available information indicates that most or much of the total calving of the bowheads, which comprise most of the bowhead whales in the world, occurs during the spring migration in and adjacent to especially the eastern Chukchi Sea and also the Beaufort Sea spring lead systems.

Bowheads feed in the Alaskan Beaufort Sea, but the extent and location of that feeding varies widely among years and locations. Bowheads are extremely long lived, slow growing, slow to mature, and currently have high survival rates. These features affect their vulnerability to pollution and disturbance in their environment. They are also unique in their ecology and their obligate use of lead systems to transit to summering grounds. This reliance on spring leads, and the fact that they apparently calve during the spring northward migration, also are features of their ecology that heightens their vulnerability to disturbance and oil spills in some areas.

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

D.4.a(2) Introduction. This section provides, updates and, in some cases, summarizes information from the Beaufort Sea multiple-sale EIS, the Biological Evaluation (BE) for Sale 195, and the Sale 195 EA (USDOI, MMS, 2003, 2004, 2006) and supplements this information with more recent information on the Western Arctic stock of the bowhead whale. All available information is considered in our update of our analyses of the potential effects of the Proposed Action on bowhead whales. Additionally, we provide an update of information related to evaluating potential cumulative anthropogenic impacts on this population, as defined under NEPA. As noted in the beginning of this document, we incorporate by reference all information provided previously in the Beaufort Sea multiple-sale final EIS, which provided a detailed evaluation of the bowhead whale and its habitat, the potential effects of three lease sales in the Beaufort Sea Planning Area and related activities on this stock of whales, and an evaluation of cumulative effects on this population stock.

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

D.4.a(2)(a) ESA Listing History, Current Status, and Possible Delisting of the Western Arctic Stock of Bowhead Whale. The bowhead whale was listed as endangered on June 2, 1970. No critical habitat has been designated for the species. The NMFS received a petition on February 22, 2000, requesting that portions of the U.S. Beaufort and Chukchi seas be designated as critical habitat for the Western Arctic stock (Bering Sea stock) of bowhead whales. On August 30, 2002, the NMFS made a determination not to designate critical habitat for this population of bowheads (67 *FR* 55767) because: (1) the population decline was due to overexploitation by commercial whaling, and habitat issues were not a factor in the decline; (2) the population is abundant and increasing; (3) there is no indication that habitat degradation is having any negative impact on the increasing population; and (4) existing laws and practices adequately protect the species and its habitat.

All available information (e.g., Shelden et al., 2001; IWC, 2004a,b, 2005a,b; NMFS, 2003a,b); indicates that the BCB Seas population of bowheads is increasing, resilient to the level of mortality and other adverse effects that are currently occurring due to the subsistence hunt or other causes, and may have reached the lower limit of the estimate of the population size that existed prior to intensive commercial whaling.

Shelden et al. (2001) proposed that the bowhead whale species should be listed under the ESA as five distinct population segments, based on the distinct population segment definition developed by the NMFS and FWS in 1996. The five separate stocks of bowhead whales are the Bering Sea stock (referred to in IWC documents as the BCB Seas bowhead and as the Western Arctic stock in the NMFS's Alaska Marine Mammal stock assessments), the Spitsbergen stock, the Davis Strait stock, the Hudson Bay stock, and the Okhotsk stock. Shelden et al. (2001) evaluated each proposed distinct population segment to determine whether one or more should be reclassified. The authors presented two models to evaluate the status of bowhead whale stocks, one that they developed based on World Conservation Union criterion D1 and E (World Conservation Union, 1996, as referenced in Shelden et al., 2001), and a model developed by Gerber and DeMaster (1999) for ESA classification of North Pacific humpback whales. Under each of these classification systems, the authors determined that the Bering Sea population of bowhead whales should be delisted, whereas the other four populations of bowheads should continue to be listed as endangered (see also criticism of this determination by Taylor, [2003], the response of Shelden et al. [2003] and discussion by the IWC's Scientific Committee [IWC, 2003a]).

D.4.a(2)(b) Bowhead Population Structure and Current Stock Definitions. The IWC currently recognizes five stocks of bowheads for management purposes (IWC, 1992), with one of them being the BCB Seas stock. The BCB Seas bowheads are the largest of all surviving bowhead populations and the only stock to inhabit U.S. waters. All of the stocks except for the BCB Seas bowhead stock are "comprised of only a few tens to a few hundreds of individuals" (Angliss and Outlaw, 2005:209). Thus, the BCB Seas bowheads are the most robust and viable of surviving bowhead populations. The viability of bowheads in the BCB Seas stock is critical to the long-term future of the biological species as a whole.

The Scientific Committee of the IWC previously concluded that the BCB Seas bowheads comprise a single stock (DeMaster et al., 2000, as cited in IWC, 2003a). However, after an in-depth evaluation of available data, the Scientific Committee (IWC, 2004a) concluded that there is temporal and spatial heterogeneity among these bowheads, but analyses do not necessarily imply the existence of subpopulations with limited interbreeding; it was premature to draw conclusions about the relative plausibility of any hypotheses about stock structure or to reject any of them. Subsequently, "The Bowhead Group" (USDOC, NOAA and NSB, 2005) created a set of five stock-structure hypotheses, modified this set, and currently recommends testing of the following hypotheses: (1) one stock of BCB Seas bowheads as described and previously accepted by the IWC (Rugh et al., 2003); (2) one stock with generational gene shift; (3) temporal migration—there are two stocks and two putative wintering area, with the two stocks migrating separately in the spring but together in the fall; (4) segregation of stocks; spatial segregation of stocks; and (5) Chukchi Circuit—one population migrates from the Bering Sea to the Beaufort Sea in spring and back again in the fall, whereas the second leaves the Bering Sea, heads northwest along the Chukotka coast, heads towards the Barrow Canyon and then back to the Bering Sea (see USDOC, NOAA and NSB, 2005 for detailed descriptions and discussions). After more recent information provided to the IWC Subcommittee on Bowhead, Right and Gray Whales (IWC, 2005b), the subcommittee agree that what is termed the "Oslo Bump" (a significant increase in genetic difference between pairs of whales sampled approximately 1 week apart at Barrow during the fall migration) appears to be a real pattern within the data that are available. However, additional data are needed to determine if these data actually typify the bowhead population, and there is no single hypothesis adequate to explain the pattern. Stock structure is unclear at the time of writing of this Biological Evaluation (see IWC, 2004b, 2005a,b; USDOC, NOAA and NSB, 2005 for detailed descriptions and discussions). The IWC will be conducting an Implementation Review focusing on the stock structure of the BCB Seas bowhead with the goal of completing this at the 2007 annual meeting (IWC, 2005a). Two related intersessional workshops, one that occurred in 2005 and one that will occur in spring 2006, are focusing on this topic (IWC, 2005a,b).

The uncertainty about the stock structure of bowheads that inhabit the Chukchi and Beaufort seas adds uncertainty to the analysis of potential effects. It is not currently clear whether one or more population stocks of bowheads potentially could be impacted by the proposed activities. If more than one population may be affected, it may be that the areas in which the two stocks are likely to be vulnerable to adverse effects varies. If there is more than one stock, it is not clear what the estimated population sizes of the potentially affected population stocks are.

D.4.a(2)(c) Bowhead Past and Current Population Abundance. Woody and Botkin (1993) estimated that the historic population abundance of bowheads in the Western Arctic stock was between 10,400 and 23,000 whales in 1848 before the advent of commercial whaling, which severely depleted bowhead whales. They estimated that between 1,000 and 3,000 animals remained in 1914 near the end of the commercial-whaling period.

Based on both survey data and the incorporation of acoustic data, the abundance of the Western Arctic stock of bowhead whales was estimated between 7,200 and 9,400 individuals in 1993 (Zeh, Raftery, and Schaffner, 1995), with 8,200 as the best population estimate. This estimate was recently revised by Zeh and Punt (2004) to 8,167 (CV= 0.017) and is the estimate used by the NMFS in their draft 2005 stock assessment (Angliss and Outlaw, 2005). An alternative method produced an estimate of 7,800 individuals, with a 95% confidence interval of 6,800-8,900 individuals. Data indicate that the Western Arctic stock increased at an estimated rate of about 3.1% (Raftery, Zeh, and Givens, 1995) to 3.2% (Zeh, Raftery, and Schaffner, 1995) per year from 1978-1993. The estimated increase in the estimated population size most likely is due to a combination of improved data and better censusing techniques, along with an actual increase in the population.

George et al. (2004) estimated abundance in 2001 to be 10,470 (SE = 1,351) with a 95% confidence interval of 8,100-13,500. This estimate indicates a substantial increase in population abundance since 1993 and suggests that population abundance may have reached the lower limits of the historical population estimate. Zeh and Punt (2004, cited in Angliss and Outlaw, 2005) provided a slightly revised population estimate of 10,545 CV(N) =0,128 to the IWC in 2004. George et al. (2004) estimated that the annual rate of increase (ROI) of the population from 1978-2001 was 3.4% (95% CI 1.7%-5%) and Brandon and Wade (2004) estimate an ROI of 3.5% (95% CI 2.2-4.9%). The number of calves (121) counted in 2001 was the highest ever recorded for this population and this fact, when coupled with the estimated rate of increase, suggests a steady recovery of this population (George et al., 2004). This steady recovery is likely due to low anthropogenic mortality, a relatively pristine habitat, and a well-managed subsistence hunt (George et al., 2004).

D.4.a(2)(d) Bowhead Reproduction, Survival and Non-Human Sources of Mortality. Information gained from the various approaches at aging BCB Seas bowhead whales and estimating survival rates all suggest that bowheads are slow-growing, late-maturing, long-lived animals with survival rates that are currently high (Zeh et al., 1993; see below). Female bowheads probably become sexually mature at an age exceeding 15 years, from their late teens to mid-20's (Koski et al., 1993) (Schell and Saupe, 1993: about 20 years). Their size at sexual maturity is about 12.5-14.0 meters (m) long, probably at an age exceeding 15 years (17-29 years: Lubetkin et al., 2004 cited in IWC, 2004b). Most males probably become sexually mature at about 17-27 years (Lubetkin et al., 2004 cited in IWC, 2004b). Schell and Saupe (1993) looked at baleen plates as a means to determine the age of bowhead whales and concluded that bowheads are slow-growing, taking about 20 years to reach breeding size. Based on population structure and dynamics, Zeh et al. (1993) also concluded that the bowhead is a late-maturing, long-lived animal (George et al., 1999) with fairly low mortality. Photographic recaptures by Koski et al. (1993) also suggested advanced age at sexual maturity of late teens to mid-twenties.

Mating may start as early as January and February, when most of the population is in the Bering Sea but has also been reported as late as September and early October (Koski et al., 1993). Mating probably peaks in March-April (IWC, 2004b). Gestation has been estimated to range between 13 and 14 months (Nerini et al., 1984, as reported in Reese et al., 2001; Reese et al., 2001) and between 12 and 16 months by Koski et al. (1993) (see also information and discussion in IWC, 2004b). Reese et al. (2001) developed a nonlinear model for fetal growth in bowhead whales to estimate the length of gestation, with the model indicating an average length of gestation of 13.9 months. Data indicate most calving occurs during the spring migration when whales are in the Chukchi Sea. Koski et al. (1993) reported that calving occurs from March to early August, with the peak probably occurring between early April and the end of May (Koski et al., 1993). The model by Reese et al. (2001) also indicated that conception likely occurs in early March to early April, suggesting that breeding occurs in the Bering Sea. The conception date and length of gestation suggests that calving is likely to occur in mid-May to mid-June, when whales are between the Bering Strait and Point Barrow (in the Chukchi Sea). Reese et al. (2001) said this is consistent with other observations in the region, including: (a) relatively few neonate-cow pairs reported by whalers at St. Lawrence Island; (b) many neonates seen during the whale census in late May; (c) relatively few term females taken at Barrow; (d) taken females with term pregnancies appeared close to parturition; and (e) most of the herd believed to have migrated past Barrow by late May. Females give birth to a single calf probably every 3-4 years.

Discussion during the in-depth assessment by the IWC (2004b) also indicated that differences in lipid content between females of the same length and size are attributable to pregnant versus nonpregnant females. This may imply a high biological cost of reproduction, a fact noteworthy in considering the potential impact of excluding females from feeding areas. George et al. (2004, cited in IWC, 2004b) estimated pregnancy rates of 0.333/year and an estimated interbirth interval of 3.0 years using data from postmortem examinations of whales landed at Barrow and Kaktovik in the winter.

There is little information regarding causes of natural mortality for BCB Seas bowhead whales. Bowhead whales have no known predators except, perhaps, killer whales and subsistence whalers. The frequency of attacks by killer whales probably is low (George et al., 1994). A relatively small number of whales likely die as a result of entrapment in ice (Philo et al., 1993). Little is known about the effects of microbial or viral agents on natural mortality.

The discovery of traditional whaling tools recovered from five bowheads landed since 1981 (George et al., 1995) and estimates of age using aspartic-acid racemization techniques (George et al., 1999) both suggest bowheads can live a very long time, in some instances more than 100 years. The oldest harvested females whose ages were estimated using corpora albicans accumulation to estimate female age were more than 100 years old (George et al., 2004, cited in IWC, 2004b). Discussion in the IWC (2004b) indicated that neither lifespan nor age at sexual maturity is certain. Lifespan may be greater than the largest estimates.

Using aerial photographs of naturally marked bowheads collected between 1981 and 1998, Zeh et al. (2002:832) estimated "the posterior mean for bowhead survival rate...is 0.984, and 95% of the posterior probability lies between 0.948 and 1." They noted that a high estimated survival rate is consistent with other bowhead life-history data.

D.4.a(2)(e) Migration, Distribution, and Habitat Use. As available information permits, we provide detailed summary and discussion about the migration, distribution, and habitat use of bowheads to provide insight into areas where bowheads might be exposed to oil- and gas-related activities, when they might be exposed, and what the significance of their exposure in certain geographic areas might be relative to that in other areas. We include information, as available, about female with calves. This aids our evaluation of potential effects and informs potential mitigations of effects.

The BCB Seas bowheads generally occur north of 60° N. and south of 75° N. (Angliss and Outlaw, 2005) in the Bering, Chukchi, and Beaufort seas. They have an affinity for ice and are associated with relatively heavy ice cover and shallow continental shelf waters for much of the year.

Winter and Other Use of the Bering Sea. Bowhead whales of the BCB Seas stock overwinter in the central and western Bering Sea. Most mating probably occurs in the Bering Sea. The amount of feeding in the Bering Sea in the winter is unknown as is the amount of feeding in the Bering Strait in the fall (Richardson and Thomson, 2002). In the Bering Sea, bowheads frequent the marginal ice zone, regardless of where the zone is, and polynyas. Important winter areas in the Bering Sea include polynyas along the northern Gulf of Anadyr, south of St. Matthew Island, and near St. Lawrence Island. Bowheads congregate in these polynyas before migrating (Moore and Reeves, 1993).

Observations by Mel'nikov, Zelensky, and Ainana (1997) from shore-based observations of waters adjacent to the Chukotka Peninsula in 1994-1995 indicate that bowheads winter in the Bering Sea along leads and polynyas adjacent to the Asian coastline. Mel'nikov, Zelensky, and Ainana (1997) summarized that in years when there is little winter ice, bowheads inhabit the Bering Strait and potentially inhabit southern portions of the Chukchi Sea.

During their southward migration in the autumn, bowheads pass through the Bering Strait in late October through early November on their way to overwintering areas in the Bering Sea. Large numbers of bowheads were taken in June and July during commercial whaling over large portions of the northwestern and northcentral Bering Sea (Figure 1b in Dahlheim et al., 1980, from Townsend, 1935).

Spring Migration. Some, or nearly all (see stock discussion above), of the bowheads that winter in the Bering Sea migrate northward through the Bering Strait to the Chukchi Sea and through the Alaskan Beaufort Sea to summer feeding grounds in the Canadian Beaufort Sea. The bowhead northward spring migration appears to coincide with ice breakup and probably begins most years in April (possibly late March depending on ice conditions) and early May. It is thought to occur after the peak of breeding, which is believed to occur in March-April (C. George, cited in IWC, 2004b).

Bowheads congregate in the polynyas before migrating (Moore and Reeves, 1993; Mel'nikov, Zelensky, and Ainana, 1997). Large numbers of bowheads were taken in June and July during commercial whaling over large portions of the northwestern and northcentral Bering Sea (Figure 1b in Dahlheim et al., 1980, from Townsend, 1935). Bowheads migrate up both the eastern and western sides of the Bering Strait in the spring (Mel'nikov, Zelensky, and Ainana, 1997; Mel'nikov et al., 2004). They pass through the Bering Strait and eastern Chukchi Sea from late March to mid-June through newly opened leads in the shear zone between the shorefast ice and the offshore pack ice. During spring aerial surveys in the late 1980's, bowheads were documented to be migrating in shorefast leads and polynyas up the coast of northwestern Alaska (see Figures 4 and 5 in Mel'nikov, Zelensky, and Ainana, 1997).

Based on shore-based surveys in 1999-2001, Mel'nikov et al. (2004) observed that the start of spring migration from the Gulf of Anadyr varies between cold and mild years by up to 30 days, but in both instances, continues at least until June 20. Mel'nikov et al. (2004) also reported that weather influenced migration, with migration seeming to stop when there were storms or high winds in the western Bering Strait or at the exit from the Gulf of Anadyr.

The migration past Barrow takes place in pulses in some years (e.g., in 2004) but not in others (e.g., 2003) (Koski et al., 2004, cited in IWC, 2004b). At Barrow, the first migratory pulse is typically dominated by juveniles. This pattern gradually reverses and by the end of the migration, there are almost no juveniles. Currently, the whales are first seen at Barrow around April 9-10. In later May (May 15-June), large whales and cow/calf pairs are seen (H. Brower, in USDOC, NOAA and NSB, 2005; IWC, 2004b). Koski et al. (2004b) found that females and calves constituted 31-68% of the total number of whales seen during the last few days of the migration. Their rate of spring migration was slower and more circuitous than other bowheads. Calves had shorter dive duration, surface duration, and blow interval than their mothers. Calf blow rate was nearly three times that of their mothers. Most calving probably occurs in the Chukchi Sea. Some individuals or subset of the population may summer in the Chukchi Sea.

Several studies of acoustical and visual comparisons of the bowhead's spring migration off Barrow indicate that bowheads also may migrate under ice within several kilometers of the leads. Data from several observers indicate that bowheads migrate underneath ice and can break through ice 14-18 centimeters [cm] (5.5-7 inches [in]) thick to breathe (George et al., 1989; Clark, Ellison, and Beeman, 1986). Bowheads may use cues from ambient light and echoes from their calls to navigate under ice and to distinguish thin ice from multiyear floes (thick ice). After passing through Barrow from April through mid-June, they move easterly through or near offshore leads. East of Point Barrow, the lead systems divide into many branches that vary in location and extent from year to year. The spring-migration route is offshore of the barrier islands in the central Alaskan Beaufort Sea.

Summer. Bowheads arrive on their summer feeding grounds near Banks Island from mid-May through June (July: IWC, 2005b) and remain in the Canadian Beaufort Sea and Amundsen Gulf until late August or early September (Moore and Reeves, 1993). Bowhead whales are seen also in the central Chukchi Sea and along the Chukotka coast in July and August. They may occupy the northeastern Chukchi Sea in late summer more regularly than commonly believed (Moore, 1992; USDOC, NOAA, and NSB, 2005), but it is unclear if these are "early-autumn" migrants or whales that have summered nearby (Moore et al., 1995) or elsewhere. Bowhead whales have been observed near Barrow in the mid-summer (e.g., Brower, as cited in USDOI, MMS, 1995). Eight bowheads were observed near Barrow on July 25, 1999, 2 at 71° 30' N., 155° 40'W. to 155° 54' W. from a helicopter during a search, and six at 71° 26' N., 156° 23' W. from the bridge of the icebreaker *Sir Wilfrid Laurier* (Moore and DeMaster, 2000). Moore and DeMaster (2000:61) noted that these observations are consistent with Russian scientist suggestions that "...Barrow Canyon is a focal feeding area for bowheads and that they 'move on' from there only when zooplankton concentrations disperse (Mel'nikov et al. 1998)" and consistent with the time frame of earlier observations summarized by Moore (1992.)

Some biologists conclude that almost the entire Bering Sea bowhead population migrates to the Beaufort Sea each spring and that few whales, if any, summer in the Chukchi Sea. Incidental sightings suggest that bowhead whales may occupy the Chukchi Sea in the summer more regularly than commonly believed. Moore (1992) summarized observations of bowheads in the northeastern Chukchi in late summer. Other scientists maintain that a few bowheads swim northwest along the Chukotka coast in late spring and summer in the Chukchi Sea. Observation by numerous Russian authors (cited in Mel'nikov, Zelensky, and Ainana [1997:8]) indicates that bowheads occur in waters of the Chukchi Sea off the coast of Chukotka in the summer.

Harry Brower, Jr. observed whales in the Barrow area in the middle of the summer, when hunters were hunting bearded seals on the ice edge (Brower, as cited in USDOI, MMS, 1995). The monitoring program conducted while towing the single steel drilling caisson to the McCovey location in 2002 recorded five bowhead whales off Point Barrow on July 21.

Recent systematic data about bowhead distribution and abundance in the Chukchi Sea OCS Planning Area are lacking. The MMS funded large-scale surveys in this area when there was oil and gas leasing and exploration, but while surveys in the Beaufort Sea have continued, the last surveys in the Chukchi Sea were about 15 years ago. These data were summarized by Mel'nikov, Zelensky, and Ainana (1997), Moore (1992), Moore and Clarke (1990), and Moore, DeMaster, and Dayton (2000). We have plotted counts of bowheads observed in the Chukchi Sea during those surveys (Figure 3), because they visually provide limited insight into areas where bowheads may be exposed to oil and gas activities should they occur in the Chukchi Sea Planning Area. However, we caution against over-interpretation of these data out of context of survey effort, because these data were collected between 1979 and 1991. They should not be interpreted as indicating current use of the Chukchi Sea by bowhead whales. However, they are the best data that are available.

Bowheads found in the Bering and Chukchi Seas in the summer may be part of the expanding Western Arctic stock (DeMaster et al., 2000, as referenced in Angliss, DeMaster, and Lopez, 2001).

Evidence indicates that the number of bowheads that inhabit the BCB Seas has increased substantially since the time of the surveys (Brandon and Wade, 2004, cited in IWC, 2004b). Temporal and spatial patterns of distribution also may be modified. Conversely, earlier information may have inferred less variability in distribution than actually existed.

Fall Habitat Use and Migration. Those bowheads that have been summer feeding in the Canadian Beaufort Sea begin moving westward into Alaskan waters in August and September. While few bowheads generally are seen in Alaskan waters until the major portion of the migration takes place (typically mid-September to mid-October), in some years bowheads are present in substantial numbers in early September (Greene and McLennan, 2001; Treacy, 1998). In 1997, Treacy (1998) reported sighting 170 bowheads, including 6 calves, between Cross Island and Kaktovik on September 3 during the first flight of the survey that year. In 1997, Treacy (1998) observed large numbers of bowheads between Barrow and Cape Halkett in mid-September. Large numbers were still present between Dease Inlet and Barrow in early October (although they may not have been the same individuals).

There is some indication that the fall migration, just as the spring migration, takes place in pulses or aggregations of whales (Moore and Reeves, 1993). Eskimo whalers report that smaller whales precede large adults and cow-calf pairs on the fall migration (Braham et al., 1984, as reported in Moore and Reeves, 1993). During the autumn migration Koski and Miller (2004, cited in IWC, 2004b) found decreasing proportions of small whales and increasing proportions of large whales as one moved offshore. "Mothers and calves tended to avoid water depths less than (<) 20 m." (Koski and Miller, cited in IWC, 2004b:14). These authors also found that in the Central Beaufort Sea in late August, the vast majority of the whales were subadults and this percentage declined throughout the autumn to about 35% by early October. They reported that mother/calf pairs "arrived in September and were common until early October" (Koski and Miller, 2004, cited in IWC, 2004b).

Inupiat whalers estimate that bowheads take about 2 days to travel from Kaktovik to Cross Island, reaching the Prudhoe Bay area in the central Beaufort Sea by late September, and 5 days to travel from Cross Island to Point Barrow (T. Napageak, 1996, as cited in NMFS, 1999).

Individual movements and average speeds (approximately 1.1-5.8 kilometers per hour [km/h]) vary widely (Wartzog et al., 1990; Mate, Krutzikowsky, and Winsor, 2000). Much faster speeds (e.g., up to 9.8 ± 4.0 km/h) were estimated for bowheads migrating out of the Gulf of Anadyr during the northward spring migration (Mel'nikov et al., 2004).

Wartzog et al. (1989) placed radio tags on bowheads and tracked the tagged whales in 1988. One tagged whale was tracked for 915 km as it migrated west at an average speed of 2.9 km/h in ice-free waters. It traveled at an average speed of 3.7 km/h in relatively ice-free waters and at an average speed of 2.7 km/h through eight-tenths ice cover and greater. Another whale traveled 1,291 km at an average speed of 5.13 km in ice-free waters but showed no directed migratory movement, staying within 81 km of the tagging site. Additional tagged whales in 1989 migrated 954-1,347 km at average speeds of 1.5-2.5 km/h (Wartzog et al., 1990). Mate, Krutzikowsky, and Winsor (2000) tagged 12 juvenile bowhead whales with satellite-monitored radio tags in the Canadian Beaufort Sea. The whale with the longest record traveled about 3,886 km from Canada across the Alaskan Beaufort Sea to the Chukchi Sea off Russia and averaged 5.0 km/h. This whale's speed was faster, though not significantly faster, in heavy ice than in open water.

Oceanographic conditions can vary during the fall migration from open water to more than nine-tenths ice coverage. The extent of ice cover may influence the timing or duration of the fall migration. Miller, Elliot, and Richardson (1996) observed that whales within the Northstar region (long. 147°-150° W.) migrate closer to shore in light and moderate ice years and farther offshore in heavy ice years, with median distances offshore of 30-40 km (19-25 miles [mi]) in both light and moderate ice years and 60-70 km (37-43 mi) in heavy ice years. Moore (2000) looked at bowhead distribution and habitat selection in heavy, moderate, and light ice conditions in data collected during the autumn from 1982-1991. This study concluded that bowhead whales select shallow inner-shelf waters during moderate and light ice conditions and deeper slope habitat in heavy ice conditions. During the summer, bowheads selected continental slope waters and moderate ice conditions (Moore, DeMaster, and Dayton, 2000). Interseasonal depth and ice-cover habitats were significantly different for bowhead whales. Ljungblad et al. (1987) observed during the years from 1979-1986 that the fall migration extended over a longer period, that higher whale densities were estimated, and that daily sighting rates were higher and peaked later in the season in light ice years as compared to heavy ice years.

Fall aerial surveys of bowhead whales in the Alaskan Beaufort Sea have been conducted since 1979 by the Bureau of Land Management and the MMS (Ljungblad et al., 1987; Treacy, 1988-1998, 2000). Over a 19-year period (1982-2000), there were 15 years with some level of offshore seismic exploration and/or drilling activity and 4 years (1994, 1995, 1999, and 2000) in which neither offshore activity took place during September or October. The parametric Tukey HSD test was applied to MMS fall aerial-transect data (1982-2000) to compare the distances of bowhead whales north of a normalized coastline in two analysis regions of the Alaskan Beaufort Sea from 140-156° W. longitude (see USDOI, MMS, 2003:Map 7). While the Tukey HSD indicates significant differences between individual years, it does not compare actual levels of human activity in those years nor does it test for potential effects of sea ice and other oceanographic conditions on bowhead migrations (Treacy, 2000). Treacy (2000) showed in a year-to-year comparison that the mean migration regionwide in fall 1998 was significantly closer to shore in both the East and West Regions than in 1999, a year with no offshore seismic or drilling activity during the fall season in the Alaskan Beaufort Sea.

While other factors may have dominating effects on site-specific distributions, such as prey concentrations, seismic activities, and localized vessel traffic, broad-area fall distributions of bowhead whale sightings in the central Alaskan Beaufort Sea may be driven by overall sea-ice severity (Treacy, 2001). Treacy (2002) concluded that:

> Bowhead whales occur farther offshore in heavy-ice years during fall migrations across the Central Alaskan Beaufort Sea (142° W to 155° W longitudes). Bowheads generally occupy nearshore waters in years of light sea-ice severity, somewhat more offshore waters in moderate ice years, and are even farther offshore in heavy ice years. While other factors...may have localized effects on site-specific distributions, broad-area distributions of bowhead whale sightings in the central Alaskan Beaufort Sea are related to overall sea-ice severity.

Further evidence that bowhead whales migrate at varying distances from shore in different years also is provided by site-specific studies monitoring whale distribution relative to local seismic exploration in nearshore waters of the central Beaufort Sea (Miller et al., 1997; Miller, Elliot, and Richardson, 1998; Miller et al., 1999). In 1996, bowhead sightings were fairly broadly distributed between the 10-m and 50-m depth contours. In 1997, bowhead sightings were fairly broadly distributed between the 10-m and 40-m depth contours, unusually close to shore. In 1998, the bowhead migration corridor generally was farther offshore than in either 1996 or 1997, between the 10-m and 100-m depth contours and approximately 10-60 km from shore.

Aerial surveys near the proposed Liberty development project in 1997 (BPXA, 1998) showed that the primary fall-migration route was offshore of the barrier islands, outside the proposed development area. However, a few bowheads were observed in lagoon entrances between the barrier islands and in the lagoons immediately inside the barrier islands, as shown in Figures 4-4 and 4-5 of the Environmental Report submitted by BPXA for the Liberty development project (BPXA, 1998). Because survey coverage in the nearshore areas was more intensive than in offshore areas, maps and tabulations of raw sightings overestimate the importance of nearshore areas relative to offshore areas. Transects generally did not extend south of the middle of Stefansson Sound. Nevertheless, these data provide information on the presence of bowhead whales near the then-proposed Liberty development area during the fall migration. Probably only a small number of bowheads, if any, came within 10 km (6 mi) of the area.

Some bowheads may swim inside the barrier islands during the fall migration. For example Frank Long, Jr. reported that whales are seen inside the barrier islands near Cross Island nearly every year and are sometimes seen between Seal Island and West Dock (U.S. Army Corps of Engineers, 1999). Crews from the commercial-whaling ships looked for the whales near the barrier islands in the Beaufort Sea and in the lagoons inside the barrier islands (Brower, 1980). Whales have been known to migrate south of Cross Island, Reindeer Island, and Argo Island during years when fall storms push ice against the barrier islands (Brower, 1980). Inupiat whaling crews from Nuiqsut also have noticed that the whale migration appears to be influenced by wind, with whales stopping when the winds are light and, when the wind starts blowing, the whales started moving through Captain Bay towards Cross Island (Tuckle, as cited in USDOI, MMS, 1986). Some bowhead whales have been observed swimming about 25 yards from the beach shoreline near Point Barrow during the fall migration (Rexford, as cited in USDOI, MMS, 1996). A comment received from the Alaska Eskimo Whaling Commission on the Liberty draft EIS indicated that Inupiat workers at Endicott have, on occasion, sighted bowheads on the north side of Tern Island. No specific information was provided regarding the location of the whale.

Data are limited on the bowhead fall migration through the Chukchi Sea before the whales move south into the Bering Sea. Bowhead whales commonly are seen from the coast to about 150 km (93 mi) offshore between Point Barrow and Icy Cape, suggesting that most bowheads disperse southwest after passing Point Barrow and cross the central Chukchi Sea near Herald Shoal to the northern coast of the Chukotka Peninsula. However, sightings north of 72° N. latitude suggest that at least some whales migrate across the Chukchi Sea farther to the north. Mel'nikov, Zelensky, and Ainana (1997) argued that data suggest that after rounding Point Barrow, some bowheads head for the northwestern coast of the Chukotka Peninsula and others proceed primarily in the direction of the Bering Strait and into the Bering Sea. Mel'nikov (in USDOC, NOAA, and NSB, 2005) reported that abundance increases along northern Chukotka in September as whales come from the north. More whales are seen along the Chukotka coast in October. J.C. George (cited in IWC, 2004b) noted that bowheads pass through the Bering Strait into the Bering Sea between October and November on their way to overwintering areas in the Bering Sea.

The timing, duration, and location of the fall migration along the Chukotka Peninsula are highly variable and are linked to the timing of freezeup (Mel'nikov, Zelensky, and Ainana, 1997). Whales migrate in "one short pulse over a month" in years with early freezeup, but when ice formation is late, whales migrate over a period of 1.5-2 months in 2 pulses (Mel'nikov, Zelensky, and Ainana, 1997:13.

Summary and Evaluation of Known Use of the Beaufort Sea by Bowheads. Bowhead whales may occur in the portions of the Beaufort Sea Planning Area from spring through late fall. Spatial distribution, length of residency, habitat use, and timing of use is variable among years. Currently, the whales are first seen at Barrow around April 9-10, and this early pulse is dominated by juveniles. The size/age composition of whales entering the Beaufort gradually switches so that by later in May (May 15-June) large whales and cow/calf pairs are seen. Most of the herd is believed to have migrated past Barrow by late May. After passing Barrow, whales travel in spring leads through heavy pack ice, generally in a northeasterly direction, eventually heading east toward the southeastern Beaufort Sea, reaching the Canadian Beaufort by July. The number of bowheads observed feeding in Canadian waters is variable as is the distribution and behavior of whale observed there. They range through the Beaufort Sea in the summer. Large numbers of whale have been observed in early September in western portions of the planning area. It is not clear whether these whales migrated west early or did not migrate into the eastern Beaufort. The extent and locations of feeding in portions of the Beaufort Sea Planning Area varies considerably among years. In late summer (typically early September, but sometimes beginning earlier), bowhead whales migrate west. Data indicate that bowheads occupy inner and outer shelf habitat in light and moderate ice years but occur in outer shelf and slope habitat in years of heavy ice.

Summary and Evaluation of Known Use of the Chukchi Sea by Bowhead Whales. The Chukchi Sea OCS Planning Area is an integral part of the total range of BCB Seas bowhead whales, and portions of this planning area are either part of or are primary calving ground during the spring for these whales. During the spring (widely bracketed as mid-March to approximately mid-June), bowheads migrate through leads on their way to summer feeding grounds. This lead system is an apparently obligate pathway for this population. Most calving apparently occurs during the spring migration between April and early June. In some years, parts of the spring lead system in the Chukchi Sea west, northwest, and southwest of Barrow are used as feeding areas over extended periods of time during the spring migration, but this use is inconsistent. Bowhead whales have been observed throughout the summer in waters along the northeastern Chukchi Peninsula of Russia (and along the southeastern portion of the Chukchi Peninsula in the Bering Sea). In the autumn, bowheads are in the Chukchi Sea as part of their autumn migration back to the Bering Sea from about mid-September through October, passing through Bering Strait to the Bering Sea between October and November. Some of the bowheads whales are very far north (e.g., 72° N. latitude) in the Chukchi. After passing Barrow, some of the whales head towards Wrangell Island and then follow the Asian coast southeast to the Bering Sea. Observations indicate bowheads feed along the Russian coast in the autumn. Lee et al. (2005) summarized that both bulk body tissue and baleen isotopic values indicate that the Bering and Chukchi sea regions are the predominant feeding areas for adults and subadults. Some of the feeding in the western Alaskan Beaufort Sea (e.g., west of Harrison Bay) is on prey advected from the Chukchi Sea.

Recent systematic data about bowhead seasonal patterns of distribution, abundance, and habitat use in the Chukchi Sea OCS Planning Area are lacking. The MMS funded large-scale surveys in this area when there was oil and gas leasing and exploration, but the last surveys were about 15 years ago. Since that period, data indicate that the bowhead population has increased substantially (about 3.3-3.4%/year), there have been significant reductions in sea-ice extent and a great decline in average sea-ice thickness ice (see the section on climate warming in the Baseline section). For these reasons, we acknowledge considerable uncertainty about the extent of current use of the Chukchi Sea by bowhead whales, especially during the summer months and the fall migration.

D.4.a(2)(f) Bowhead Feeding. The importance of the Alaskan Beaufort Sea as a feeding area for bowheads is an issue of great concern to Inupiat whalers and is a major issue in evaluating the potential significance of any effect that may occur as a result of oil and gas activities in the Beaufort Sea and Chukchi Sea Planning Areas. Both MMS and the NSB believe that, with regards to understanding bowhead feeding within the Alaskan Beaufort Sea, there are major questions that remain to be answered (Stang and George, 2003).

Because of the importance of this topic in past discussions and evaluations, we provide considerable detail about available information.

Bowheads are filter feeders, filtering prey from the water through baleen fibers in their mouth. They apparently feed throughout the water column, including bottomfeeding as well as surface skim feeding

(Würsig et al., 1989). Skim feeding can occur when animals are alone and conversely may occur in coordinated echelons of over a dozen animals (Würsig et al., 1989). Food items most commonly found in the stomachs of harvested bowheads include euphausiids, copepods, mysids, and amphipods. Euphausiids and copepods are thought to be their primary prey. Lowry, Sheffield, and George (2004) documented that other crustaceans and fish also were eaten but were minor components in samples consisting mostly of copepods or euphausiids.

Available data indicate that bowhead whales feed in both the Chukchi and Beaufort Sea Planning Areas and that this use varies in degree among years, among individuals, and among areas. It is likely that bowheads continue to feed opportunistically where food is available as they move through or about the Alaskan Beaufort Sea, similar to what they are thought to do during the spring migration.

Observations from the 1980's documented that some feeding occurs in the spring in the northeastern Chukchi Sea, but this feeding was not consistently seen (e.g., Ljungblad et al., 1987; Carroll et al., 1987). Stomach contents from bowheads harvested between St. Lawrence Island and Point Barrow during April into June also indicated it is likely that some whales feed during the spring migration (Carroll et al., 1987; Shelden and Rugh, 1995, 2002). Carroll et al. (1987) reported that the region west of Point Barrow seems to be of particular importance for feeding, at least in some years, but whales may feed opportunistically at other locations in the lead system where oceanographic conditions produce locally abundant food. Lowry (1993) reported that the stomachs of 13 out of 36 spring-migrating bowheads harvested near Point Barrow between 1979 through 1988 contained food. Lowry estimated total volumes of contents in stomachs ranged from less than 1 to 60 liters (L), with an average of 12.2 L in eight specimens. Shelden and Rugh (1995) concluded that "In years when oceanographic conditions are favorable, the lead system near Barrow may serve as an important feeding ground in the spring (Carroll et al., 1997)." Richardson and Thomson (2002) concluded that some, probably limited, feeding occurs in the spring.

It is known that bowhead whales feed in the Canadian Beaufort in the summer and early fall (e.g., Würsig et al, 1985), and in the Alaskan Beaufort in late summer/early fall (Lowry and Frost, 1984; Ljungblad et al., 1986; Schell and Saupe, 1993; Lowry, Sheffield, and George, 2004; summarized in Richardson and Thomson, 2002). Available information indicates it is likely there is considerable inter-annual variability in the locations where feeding occurs during the summer and fall in the Alaska Beaufort Sea, in the length of time individuals spend feeding, and in the number of individuals feeding in various areas in the Beaufort Sea.

In at least some years, some bowheads apparently take their time returning westward during the fall migration, sometimes barely moving at all, with some localities being used as staging areas due to abundant food resources or social reasons (Akootchook, 1995, as reported in NMFS, 2001). The Inupiat believe that whales follow the ocean currents carrying food organisms (e.g., Napageak, 1996, as reported in NMFS, 2001). Bowheads have been observed feeding not more than 1,500 feet (ft) offshore in about 15-20 ft of water (Rexford, 1979, as reported in NMFS, 2001). Nuiqsut Mayor Nukapigak testified at the Nuiqsut Public Hearing on March 19, 2001, that he and others saw a hundred or so bowhead whales and gray whales feeding near Northstar Island (USDOI, MMS, 2002). Some bowheads appear to feed east of Barter Island as they migrate westward (Thomson and Richardson, 1987).

Interannual variability in the use of areas of the Beaufort Sea by bowheads for feeding also has been observed during aerial surveys by MMS and others. Ljungblad et al. (1986) reported that feeding bowheads comprised approximately 25% of the total bowheads observed during aerial surveys conducted in the Beaufort Sea from 1979 through 1985. Miller, Elliott, and Richardson (1998) reported observing many aggregations of feeding whales in nearshore waters near or just offshore of the 10-m depth contour during late summer/autumn 1997. In some years (e.g., 1997) (Miller, Elliot, and Richardson, 1998; Treacy, 2002), many aggregations have been seen feeding (e.g., between Point Barrow and Smith Bay), whereas in other years very little feeding was observed. Bowheads occasionally have been observed feeding north of Flaxman Island.

Treacy (2002) summarized data regarding the frequency of feeding and milling of bowhead whales observed on transect during aerial surveys conducted by MMS in the Beaufort Sea between 1982 and 2001.

Because whales exhibiting milling behavior also may be feeding whales, whales with milling behavior were included with whales with apparent feeding behavior, even though some milling whales may have been engaged in other forms of social behavior. Feeding and milling whales observed per unit effort for each fall season (1982-2001) were mapped for visual comparison of relative occurrence of these behaviors in the Alaskan Beaufort Sea. Treacy (2002) summarized that a greater relative occurrence of feeding and/or milling behavior in bowhead whales was detected on transect near the mouth of Dease Inlet during aerial surveys of bowhead whales in the Beaufort Sea in 6 out of 20 years (1984, 1989, 1997, 1998, 1999, and 2000). In 4 of those years (1989, 1997, 1998, and 1999), Treacy also reported that a similar frequency of feeding and/or milling behavior was observed on transect near Cape Halkett, Alaska. During this 20-year period, there were 9 years when feeding and/or milling behaviors were noted on transect, but not in or near either Dease Inlet or Cape Halkett (1982, 1983, 1985, 1986, 1988, 1990, 1993, 1995, and 1996). In 1987, 1991, 1992, 1994, and 2001, Treacy (2002) reported that neither feeding nor milling behaviors were noted on transect at any location in the study area. Interannual and geographic variation in prey availability likely accounts for opportunistic feeding aggregations in particular years and locations (Treacy, 2002).

Of 245 whales observed during 2003 during MMS BWASP, 31% were classified as milling but none as feeding (Monnett and Treacy, 2005). Monnett and Treacy (2005) reported concentrations of milling whales nearshore north and northwest of Oliktok Point on September 20, 2003. In 2004, 29% of 253 bowheads observed were classified as feeding and 10% as milling. Locations of feeding whales included northeast of Barrow, in Smith Bay, and to the west of Kaktovik. Milling whales were in the far eastern portions of the study area.

Data from MMS's BWASP surveys (e.g., Treacy, 1998, 2000) shows high numbers of whales, many of which were feeding, in some areas over relatively long periods (e.g., weeks) of time in some years (e.g., 1997) in areas in the western Alaskan Beaufort) but not in others.

In the years that feeding whales are seen in a given area over a period of time, if the same individuals are staying in the areas and feeding, for these lengths of time, in those years they could be deriving a higher than typical percentage of their yearly energetic requirements from the Alaskan Beaufort Sea.

Based on stomach content data supplemented by behavioral evidence, far more than 10% of the bowheads that passes through the eastern Alaskan Beaufort Sea during late summer and autumn feed there. Based on examination of the stomach contents of whales harvested in the autumn between 1969-2000, Lowry, Sheffield, and George (2004) found that there were no significant difference in the percentages of bowheads that had been feeding between those harvested near Kaktovik (83%), Barrow (75%), or between subadults (78%) versus adults (73%). Twenty-four out of 32 whales taken during the fall at Kaktovik from 1979-2000 and included in this analysis were considered to have been feeding (Lowry and Sheffield, 2002). The status of three other whales was uncertain. Copepods were the dominant prey species by volume. Seventy-seven out of 106 whales harvested during the fall near Barrow from 1987-2000 and included in this analysis were considered to have been feeding. The status of two other whales was uncertain. There was no estimate of stomach contents for 61 whales. Of the 77 whales classified as feeding whales, there were estimates of stomach volume for 16 autumn-feeding whales. Euphausiids were the dominant prey species by volume.

Stomach volumes are reported for 34 of 90 whales harvested in the autumn at Kaktovik and Barrow. The stomach of the harvested whales contained highly variable amounts of food (range=2-150 L at Kaktovik, with 39% containing with >20 L and 11% containing >100 L; n=18) (range =1-189 L at Barrow, with 56% containing with >20 L and 31% containing >100 L; n=16) (Table 6 in Lowry, Sheffield, and George, 2004:219). Four out of five whales taken during the fall at Cross Island from 1987-2000 were considered to have been feeding (at least 10 items or 1 L of prey). Length-girth relationships show that subadult bowheads, and possibly adults, gain weight while in the Beaufort Sea in summer and lose weight while elsewhere. Lipid content of blubber, at least in subadults, is higher when they leave the Beaufort in fall than when they return in spring. This evidence suggests the importance of feeding in the Beaufort Sea during summer and early autumn. They do not show what fraction of the annual feeding occurs in the eastern and central Beaufort Sea. Lowry, Sheffield, and George (2004:221) concluded that:

...Bowhead whales feed regularly in the nearshore waters of the eastern, central and western Alaskan Beaufort Sea during September and October...this entire region should be considered an integral part of the summer-autumn feeding range of bowhead whales. Results of stomach contents analysis, aerial observations, and traditional knowledge suggest that reference to the passage of bowhead whales through this region as a 'westward autumn migration' is misleading...it is a very incomplete description of their activities in the region. Second, feeding near Barrow during the spring migration is not just occasional, but rather a relatively common event...However, the amount of food in the stomachs tends to be lower in spring than in autumn....

However, examination of stomach contents only showed whether or not bowhead whales had fed and what prey were eaten, and it does not directly address the relative significance of feeding in various regions...This unresolved issue remains important in the evaluation of possible cumulative effects of oil and gas development on bowhead whales.....

Because the standard for classifying a whale as feeding is set so low, but prey volumes are rarely reported, we find it difficult to critically evaluate these findings relative to the issue of assessing the importance of various areas as bowhead feeding area, either to the population as a whole or to segments of the population. As pointed out by Thomson, Koski, and Richardson (2002), there is a large difference between a stomach with a small amount of prey (10 prey items) and one that is full.

It is unclear how important this feeding is in terms of meeting the annual food needs of the population or to meeting the food needs of particular segments of the population (e.g., see discussion in Richardson and Thomson, 2002). Many assumptions, such as those about residence time and approximations, influence current conclusions. Because marked individuals have not been studied, it is unclear how much variability also exists among classes of individuals or individuals within a class in habitat residency times, or what factors influence residency times.

Richardson and Thomson (2002) pointed out that bowhead activity throughout the year needs to be considered when evaluating the importance of feeding in the eastern Alaskan Beaufort Sea in late summer and autumn.

Although numerous observations have been made of bowheads feeding during both the spring migration north to the Beaufort Sea and the fall migration west across the Alaskan Beaufort Sea, quantitative data showing how food consumed in the Alaskan Beaufort Sea contributes to the bowhead whale population's overall annual energy needs is fairly limited.

A study by Richardson (1987) concluded that food consumed in the eastern Beaufort Sea contributed little to the bowhead whale population's annual energy needs, although the area may be important to some individual whales. The study area for this 1985-1986 study extended from eastern Camden Bay to the Alaska/Canada border from shore to the 200-m depth contour for the intensive study area, and beyond this contour only for aerial survey data (Richardson and Thomson, 2002). The conclusion was controversial. The NSB's Science Advisory Committee (1987) believed the study was too short in duration (two field seasons, one of which was limited by ice cover), suboptimal sampling designs, and difficulties in estimating food availability and consumption. The Committee did not accept the conclusion that the study area is unimportant as a feeding area for bowhead whales.

Richardson and Thomson (2002) finalized the report from the MMS-funded feeding study entitled *Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information*, which compiled and integrated existing traditional and scientific knowledge about the importance of the eastern Alaskan Beaufort Sea for feeding by bowhead whales. The project was an extension, with additional fieldwork (mainly in September of 1998, 1999, and 2000), of the previous study conducted in 1985 and 1985. The primary study area for this study extended the westward boundary about 1° longitude from that of the 1985-1986 study. Thus the boundary for the latter study was near the middle of Camden Bay (145° W. longitude). With the concurrence of the NSB Scientific Review Board, efforts in deep offshore areas were de-emphasized in this latter study so as to concentrate efforts in shallow areas of particular concern to Kaktovik hunters and, potentially, to oil industry. Boat-based zooplankton sampling in 1998-2000 was limited to areas seaward of the 50-m contour. Aerial surveys extended to the 200-m contour, and MMS surveys extended further.

Griffiths (1999) noted that the average zooplankton biomass in the study area was higher in 1986 than in 1998. Habitat suitable for feeding appears to have been less common in the eastern Alaskan Beaufort Sea in 1998 than it was in 1986. In 1998, the principal feeding area within the eastern study area appeared to have been near Kaktovik. Griffiths, Thomson, and Bradstreet (2002) discussed zooplankton biomass samples collected in the Canadian Beaufort Sea during the 1980's and in the Alaskan Beaufort Sea in 1986, 1998, and 1999, where bowhead whales were either observed feeding or where whales had been observed feeding the previous day. Bowhead whales feed in areas with a higher than average concentration of zooplankton. The distribution of biomass values at locations with feeding bowheads indicates that the feeding threshold for bowheads may be a wet biomass of ~800 milligrams per cubic meter (mg/m^3).

Most whales observed where zooplankton were sampled were subadults. "Adult bowheads tend to feed where large copepods predominate" (Richardson and Thomson, 2002:xxv.

Koski (2000) summarized that the most common activity of bowheads in the eastern Alaskan Beaufort Sea during late summer and autumn was feeding. Bowhead use of the eastern Alaskan Beaufort Sea during late summer and autumn can be highly variable from year to year, with substantial differences in the numbers, size classes, residence times, and distributions of bowheads recorded there during 1985, 1986, 1998, and 1999.

Although various types of evidence (with the exception of isotope ratios) (see below) indicate that the eastern Beaufort Sea as a whole, including the Canadian Beaufort, is important to bowhead whales for feeding, the eastern Alaskan Beaufort Sea is only a small fraction of that area (Richardson and Thomson, 2002.

Similarly, data indicate that the amount of time bowheads spend feeding in the fall in the eastern Alaskan Beaufort Sea is highly variable among years. Available evidence indicates that in many years, the average bowhead does not spend much time in the eastern Alaskan Beaufort Sea and, thus, does not feed there extensively. Bowhead whales moved quickly through the area in 1998 and did not stop to feed for any great period of time. In contrast, during 1986, subadult whales stopped to feed in the study area for periods of at least several days. In 1999, adult whales stopped to feed in the Flaxman-to-Herschel zone for extended periods (Koski et al., 2002). In 1999, the main bowhead feeding areas were 20-60 km offshore in waters 40-100 m deep in the central part of the study area east and northeast of Kaktovik, between Kaktovik and Demarcation Bay (Koski, Miller, and Gazey, 2000). In 1999, one bowhead remained in the study area for at least 9 days, and 10 others remained for 1-6 days. Their mean rate of movement was about one-eighth of the rate observed in 1998.

Koski et al. (2002) used six calculation methods to estimate residence time for whales in the eastern Alaskan Beaufort Sea area, from Flaxman Island to Herschel Island. The annual residence time varied from 2.1-8.3 days and averaged 5.1 days. Of the individual bowheads that traveled through this portion of the Alaskan Beaufort Sea, some spent at least 7 days.

Miller et al. (2002) pointed out that it is difficult to recognize feeding behavior during typical aerial surveys. More focused observations are usually needed to obtain evidence of feeding below the surface.

Baleen from bowhead whales provides a multiyear record of isotope ratios in prey species consumed during different seasons, including information about the occurrence of feeding in the Bering Sea and Chukchi Sea system. The isotopic composition of the whale is compared with the isotope ratios of its prey from various geographic locations to make estimates of the importance of the habitat as a feeding area.

Carbon-isotope analysis of bowhead baleen has indicated that a significant amount of feeding may occur in wintering areas (Schell, Saupe, and Haubenstock, 1987).

Carbon-isotope analysis of zooplankton, bowhead tissues, and bowhead baleen indicates that a significant amount of feeding may occur in areas west of the eastern Alaskan Beaufort Sea, at least by subadult whales (Schell, Saupe, and Haubenstock, 1987). Subadult whales show marked changes in the carbon isotope over the seasons, indicating that carbon in the body tissues is replaced to a large extent from feeding in summer and feeding in the autumn-winter months. In contrast, adult animals sampled show very little seasonal change in the carbon isotope and have an isotopic composition best matched by prey from the western and southern regions of their range, implying that little feeding occurs in summer (Schell and Saupe, 1983).

The importance of the Alaskan Beaufort Sea as a bowhead feeding area also may have changed, or be changing, due to changes in prey availability elsewhere in their range. Isotope data indicate that primary productivity in the Bering and southern Chukchi seas is declining. Schell (1999a) looked at baleen from 35 bowheads that were archived, in addition to whales from the recent harvest, and constructed an isotopic record that extends from 1947-1997. He inferred from this record that seasonal primary productivity in the North Pacific was higher over the period from 1947-1966, and then began a decline that continues to the most recent samples from 1997. Isotope ratios in 1997 are the lowest in 50 years and indicate a decline in the Bering Sea productivity of 35-40% from the carrying capacity that existed 30 years ago. If the decline in productivity continues, the relative importance of the eastern Beaufort Sea to feeding bowheads may increase (Schell, 1999b).

Lee and Schell (2002) analyzed carbon isotope ratios in bowhead whale muscle, baleen, and fat, and in bowhead food organisms. They found that the isotopic signatures in zooplankton from Bering and Chukchi waters, which sometimes extend into the western Beaufort Sea, are similar and cannot be differentiated from one another. Zooplankton from the eastern Beaufort Sea (summer and early autumn range) has an isotopic signature that is distinct from that in Bering/Chukchi zooplankton. Lee and Schell compared these isotopic signatures in zooplankton to isotopic signatures in bowhead tissues.

Lee and Schell (2002) found that carbon isotopes in the muscle sampled in the fall were not significantly different from those in muscle sampled in the spring. Carbon isotopes in the muscle during both seasons closely matched the isotope ratios of zooplankton from the Bering and Chukchi waters, indicating most of the annual food requirements of adults and subadults are met from that portion of their range. Based on the comparison of carbon isotopes in the zooplankton and in bowhead tissues, they estimate that 10-26% of the annual bowhead feeding activity was in the eastern and central Beaufort Sea waters, roughly east of Prudhoe Bay.

Isotope data from baleen showed different feeding strategies by adult and subadult whales. Subadults acquired sufficient food in the eastern Beaufort Sea to alter the carbon isotope ratios in baleen relative to baleen representing feeding in Bering and Chukchi waters. Baleen plates from subadults showed a wider range in isotope ratios than those from adults, suggesting active feeding over all parts of their range.

Much of the isotopic evidence seems to indicate that especially adult bowhead whales feed primarily on prey from the Bering and/or Chukchi Sea (Schell, Saupe, and Haubenstock, 1987; Schell and Saupe, 1993; Lee and Schell, 2002). Hoekstra et al. (2002) found seasonal values were consistent for all age classes of bowhead whales and suggested that the Bering and Beaufort seas are both important regions for feeding.

In contrast, Hoekstra et al. (2002) concluded that seasonal fluctuations in carbon isotope values was consistent for all age classes of bowhead whales and suggests that the Bering and Beaufort seas are both important regions for feeding. Hoekstra et al. (2002) included data on isotope ratios in tissue subsamples from some of the same individual bowheads from Kaktovik and Barrow that were analyzed by Lee and Schell. There was an apparent discrepancy in the data from these two studies and somewhat different conclusions. The source of the discrepancy related to differences in the results from the Kaktovik whale-muscle samples. Hoekstra et al. (2002) suggest the percentage of annual feeding activity in the eastern Beaufort Sea could be on the order of 37-45% (compared to 10-26%). This discrepancy was considered critical in assessing the importance of feeding in the eastern Beaufort Sea. Lee and Schell subsequently repeated their isotopic analyses on additional subsamples from the same Kaktovik whales and obtained the same results they obtained initially (Lee and Schell, 2002). These re-analyses confirm the accuracy of the measurements reported by Lee and Schell in their draft report. Hoekstra et al. have not repeated their isotopic analyses at this time; therefore, the reason for the discrepancy between the two sets of data remains uncertain.

Recently, Lee at al. (2005) published data from isotope ratio analyses of bowhead baleen from whales all of whom except one had been harvested in the autumn of 1997-1999 (Barrow: n=4; Kaktovik: n=10) and muscle (Barrow: n=14; Kaktovik: n=10). Results of these samples were compared to data from baleen collected in past studies from both spring (predominantly) and autumn whales in 1986-1988 (see Table 1 in Lee et al., 2005:274). Lee et al. (2005:285) concluded that the new data continue to indicate that the BCB Seas "bowhead whale population acquires the bulk of its annual food intake from the Bering-Chukchi system.... Our data indicate that they acquire only a minority of their annual diet from the eastern and central Beaufort Sea...although subadult bowheads apparently feed there somewhat more often than do adults."

Thomson, Koski, and Richardson (2002) tried to reconcile the low estimates of summer feeding, as indicated by the isotope data of Lee and Schell, with other data: behavioral observations showing frequent feeding in the eastern Beaufort Sea during the summer and early autumn; zooplankton sampling near bowheads feeding in those areas shows that whales concentrate their feeding at locations with much higher than average biomasses of zooplankton; frequent occurrence of food in the stomachs of bowheads harvested in the Alaskan Beaufort Sea during late summer and autumn; and length-girth relationships show that subadult bowheads, and possibly adults, gain weight while in the Beaufort Sea in summer and lose weight while elsewhere; and lipid content of blubber, at least in subadults, is higher when they leave the Beaufort in fall than when they return in spring. Although some of this evidence suggests the importance of feeding in the Beaufort Sea during summer and early autumn, those types of data on summer and early fall feeding in the Beaufort Sea do not specifically show what fraction of the annual feeding occurs in the eastern and central Beaufort Sea. No comparable data on feeding, girth, or energy content have been obtained during and after the whales feed in the Chukchi sea in mid- to late fall.

They concluded that bowheads fed for an average of 47% of their time in the eastern Alaskan Beaufort Sea during late summer and autumn. A substantial minority of the feeding occurred during travel. Among traveling whales, feeding as well as travel was occurring during a substantial percentage of the time, on the order of 43%.

Assumptions about residence times influence these energetics-related estimates. As noted, available data indicate there is variability in habitat use among years. Because marked individuals have not been studied, it is unclear how much variability also exists among individuals in habitat residency times or what factors influence residency times.

Estimated food consumption by bowheads in the eastern Alaskan study area (Flaxman Island to the Alaska/Canada border) was expressed as a percentage of total annual consumption by the population (Thomson, Koski, and Richardson, 2002). This was done separately for each year of the study and averaged for the 5 years of the study.

The amount of feeding in the Chukchi Sea and Bering Strait in the fall is unknown as is the amount of feeding in the Bering Sea in the winter (Richardson and Thomson, 2002). Richardson and Thomson (2002:xxxviii) concluded that: "...behavioral, aerial-survey, and stomach-content data, as well as certain energetics data...show that bowheads also feed widely across the eastern and central Beaufort Sea in summer and fall."

They also concluded (Richardson and Thomson, 2002:xliii) that:

> In an average year, the population of bowhead whales derives an estimated 2.4% of annual energetic requirements" in the eastern part of the Alaskan Beaufort Sea studied.
>
> In 1 of 5 years of study, the population may have derived 7.5% or more of annual energetic requirements from the area. Utilization of the study area varies widely in time and space depending on zooplankton availability and other factors. In 4 of 5 study years, the bowhead

population was estimated to consume <2% of its annual requirements within the eastern Alaskan Beaufort Sea during late summer and autumn....

Sensitivity analysis indicated that the upper bound of the 95% confidence interval was below 5% in four of the years. This upper bound was 16.5% in 1999, when the best estimate was 7.5%. Richardson and Thomson (2002) stated that they suspected the whale-days figure for 1999 was overestimated, and that the 16.5% upper bound on that confidence interval was unrealistically high. Richardson and Thomson (2002:xliv) concluded that: "It is implausible that the population would consume more than a few percent of its annual food requirements in the study year in an average year."

One source of uncertainty that affected the analyses related to bowhead energetics is that the amount of feeding in the Chukchi Sea and Bering Strait in the fall is unknown as is the amount of feeding in the Bering Sea in the winter (Richardson and Thomson (2002). In mid to late fall, at least some bowheads feed in the southwest Chukchi. Detailed feeding studies have not been conducted in the Bering Sea in the winter.

Thomson, Koski, and Richardson (2002) offered a feeding scenario, parts of which are speculative, that might be consistent with all these data. In this scenario, feeding occurs commonly in the Beaufort Sea in summer and early autumn, and bowheads gain energy stores while feeding there. However, zooplankton availability is not as high in the Beaufort Sea during summer as in the Chukchi and northern Bering seas during autumn. Also, feeding in the western Beaufort in autumn effectively may be on Chukchi prey advected to that area. Thus, bowheads might acquire more energy from Bering/Chukchi prey in autumn than from eastern and central Beaufort prey in summer/early autumn. Given this, plus an assumed low turnover rate of body components, the overall body composition of bowheads may be dominated by components from the Bering/Chukchi system, even at the end of the summer when leaving the Beaufort. Energy gained in the Beaufort and Chukchi seas during summer and fall presumably is used during winter when food availability is low, resulting in reduced girth and energy stores when returning to the Beaufort Sea in spring than when leaving in autumn.

Richardson and Thomson (2002) pointed out that the isotopic and behavioral and stomach content data might not be in conflict, if prey availability in the Chukchi and/or Bering Sea were "notably better" than in the eastern Beaufort Sea. However, they also point out that: "...it is difficult to understand why bowheads would migrate from the Bering-Chukchi area to the Beaufort Sea if feeding in the Beaufort Sea were unimportant."

Richardson and Thomson (2002) note that while the study has provided many new data about bowhead feeding ecology and related biology, "...there are still numerous approximations, assumptions, data gaps, and variations of opinion regarding the interpretation of data. This is inevitable.... The authors do not claim that the project has resolved all uncertainty about the importance of the eastern Alaskan Beaufort Sea for feeding by bowhead whales...."

Thus, the aforementioned study acknowledges certain limitations and the results of this study confirmed that the eastern Alaskan Beaufort Sea is used by bowhead whales for feeding (Stang and George, 2003). Richardson and Thomson (2002) summarized that this use varies widely in degree among years and individuals.

Another recent summary of bowhead whale information is available on the MMS website (http://www.mms.gov/alaska/ref/EIS%20EA/DraftProgrammatic%20EA%20&%20Biological%20Eval/PEA_1.pdf). It is entitled Draft Programmatic Environmental Assessment – Arctic Ocean Outer Continental Shelf Seismic Surveys – 2006.

D.4.b. Polar Bear. This section contains an update of information on polar bears that might be affected by proposed Beaufort Sea Sale 202. The section updates the information in the multiple-sale EIS and the 195 EA by incorporating information from the PEA for seismic operation and recent research. Section IV.B.2.d(2) of this EA contains a one-page summary of the updated information. Because of the current uncertainty regarding the future status of the polar bear (see below), a more thorough review of the species' ecology, incorporating previously published material, is provided as well.

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).

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

Polar bears are the apical predators of the arctic marine ecosystem (Amstrup, 2003) and are specialized predators of phocid seals in ice-covered waters (Derocher, Lunn, and Stirling, 2004). Polar bears have a circumpolar distribution throughout the Northern Hemisphere, and the global population was last estimated at 21,500-25,000 (Lunn et al., 2002). There are two polar bear stocks recognized in Alaska: the southern Beaufort Sea stock (SBS) and the Chukchi/Bering Seas stock (CBS), although there is considerable overlap between the two in the western Beaufort /eastern Chukchi seas (Amstrup et al., 2005). The SBS population ranges from the Baillie Islands, Canada west to Point Hope, Alaska and is subject to harvest from both countries. The CBS population ranges from Point Barrow, Alaska west to the Eastern Siberian Sea. These two populations overlap between Point Hope and Point Barrow, Alaska, centered near Point Lay (Amstrup, 1995).

Polar bears are a classic *K*-selected species, meaning they have delayed maturation, small litter sizes, and high adult survival rates (Bunnell and Tait, 1981). Because polar bears exist in relatively small populations and have low reproductive rates, populations may be detrimentally impacted by even small reductions in their populations (Amstrup, 2000). Their low reproductive rate requires that there must be a high rate of survival to maintain population levels (Amstrup, 2003). Mating occurs from March to May, followed by a delayed implantation in the autumn (Ramsay and Stirling, 1988). Females give birth the following December or January to one to three cubs, which remain with their mother until they are at least 2 years of age (Harington, 1968; Jefferson, Leatherwood, and Webber, 1993). Females will not rebreed until they separate from their cubs. In the Beaufort Sea, female polar bears usually do not breed for the first time until they are 5 years of age (Lentfer and Hensel, 1980), which means that they give birth for the first time at age 6. The maximum reproductive age for polar bears is unknown but likely is well into their 20's (Amstrup, 2003). The average reproductive interval for a polar bear is 3-4 years. A female may produce 8-10 cubs in her lifetime, of which only 50-60% will survive (Amstrup, 2003). A complete reproductive cycle is energetically expensive for female polar bears. When nutritionally stressed, female polar bears can forgo reproduction rather than risk their own survival (Amstrup, 2003). This is possible because implantation of the fertilized egg is delayed till autumn; hence a malnourished female unable to sustain a pregnancy can terminate the process by aborting or resorbing the fetus (Amstrup, 2003).

In northern Alaska, pregnant females enter maternity dens by late November. These dens typically are located in snow drifts in coastal areas, stable parts of the offshore pack ice, or on landfast ice (Amstrup and Garner, 1994). Newborn polar bears are among the most undeveloped of placental mammals; therefore, undisturbed maternal dens are critical in protecting them from the rigors of the arctic winter for the first 2 months of their life (Amstrup, 2000). The highest density of land dens in Alaska occurs along the coastal barrier islands of the eastern Beaufort Sea and within the Arctic National Wildlife Refuge (Amstrup and Garner, 1994). Protecting these core maternity denning areas is of critical importance to the long-term conservation of polar bears.

Polar bears usually forage in areas where there are high concentrations of ringed seals, their primary prey (Stirling and McEwan, 1975; Larsen, 1985), although bearded seals, walruses, and beluga whales also are taken opportunistically (Amstrup and DeMaster, 1988). Polar bears are almost completely carnivorous, although they will feed opportunistically on a variety of foods, including carrion, bird eggs, and vegetation (Smith, 1985; Smith and Hill, 1996; Derocher, Wiig, and Bangjord, 2000). Polar bears prefer shallow-water areas, perhaps reflecting similar preferences by their primary prey, ringed seals, as well as the higher productivity in these areas (Durner et al., 2004). In spring, polar bears in the Beaufort Sea overwhelmingly prefer regions with ice concentrations >90% and composed of icefloes 2-10 km in diameter (Durner et al., 2004). In summer, bears in the Beaufort Sea select habitats with a high proportion of old ice, which takes them far from the coast as the ice melts. In fact, 75% of bear locations in the summer occurs on sea ice in waters >350 m deep, which places them outside the areas of greatest prey abundance. This is because ringed seals tend to aggregate in open-water areas in late summer and early fall, where primary productivity is thought to be high (Harwood and Stirling, 1992), placing them well out of reach of polar bears summering on the pack ice. The distribution of seals and the habitat-selection pattern by bears in the Beaufort Sea suggest that most polar bears do not feed extensively during summer (Durner et al., 2004), which is supported by reports of the seasonal activity levels of polar bears. Amstrup et al. (2000) showed that polar bears in the Beaufort Sea have their lowest level of movements in September, which correlates with the period when the sea ice has carried polar bears beyond the preferred habitat of seals. Conversely, 75% of bear observations in winter occurred in waters <130 m deep. During winter, polar bears prefer the lead system at the shear zone between the shorefast ice and the active offshore ice. This narrow zone of moving ice parallels the coastline and creates openings that are used by seals. Thus, polar bears in winter use a relatively small area of the Beaufort Sea where prey is most abundant and accessible (Durner et al., 2004). Consequently, changes in the extent and type of this ice cover are expected to affect the distributions and foraging success of polar bears (Tynan and DeMaster, 1997).

Polynas, or areas of open water surrounded by ice, are another habitat type that is extremely important to polar bears (Stirling, 1997). Polynas are areas of increased productivity at all trophic levels in arctic waters, particularly where they occur over continental shelves, and often are the sites of marine mammal and bird conentrations. The increased biological productivity around polynas is likely the key factor in their ecological significance. Polynas vary in size and shape and may be caused by wind, tidal fluctuations, currents, upwellings, or a combination of these factors (Stirling, 1997).

The preferred habitat of polar bears is the annual ice over the continental shelf and interisland archipelagos that encircle the polar basin (Derocher, Lunn, and Stirling, 2004). Recent research has indicated that the total sea-ice extent has declined over the last few decades, particularly in both nearshore areas and in the amount of multiyear ice in the polar basin (Parkinson and Cavalieri, 2002; Comiso, 2002a,b). Polar bears and ringed seals depend on sea ice for their life functions, and reductions in the extent and persistence of ice in the Beaufort and Chukchi seas almost certainly will have negative effects on their populations (USDOI, FWS, 1995). Climate change already has affected polar bears in Western Hudson Bay in Canada, where they hunt ringed seals on the sea ice from November to July and spend the open-water season fasting on shore. In a long-term study, Stirling, Lunn, and Iacozza (1999) correlated decreased body condition and reproductive performance in bears with a trend toward earlier breakup of sea ice in recent years. The earlier breakup shortens the bears' feeding season and increases the length of their fasting season. Because ringed seals often give birth to and care for their pups on stable shorefast ice, changes in the extent and stability of shorefast ice and/or the timing of breakup could reduce their productivity. Due to 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 Western Hudson Bay polar bear subpopulation confirms that it has declined by almost 20% in the last 30 years (IUCN/PBSG press release, 2005), and this decline is linked to significant reductions in the apparent survival of ringed seal pups coincident with earlier sea-ice breakup.

Climate change also may help explain why coastal communities in Western Hudson Bay 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 upon human settlements in search of alternative food sources and come into conflict with humans. Thus, the increase in polar bear-human interactions in Western Hudson Bay probably reflects an increase in nutritionally stressed bears searching for food (Amstrup et al., 2006). Similar effects may be expected to occur in Alaska, if climate change continues.

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

Polar bears are excellent swimmers and swim while actively hunting, while moving between hunting areas, and while moving between sea ice and terrestrial habitats. In June, 2005, USGS researchers identified a female polar bear which apparently swam for more than 557 km, from Norton Sound back to the retreating pack ice in the Beaufort Sea northwest of Wainwright (Amstrup et al., 2006).

Swimming is believed to be more energetically costly than walking, which helps explain why bears often will abandon the melting sea ice in favor of land when ice concentrations drop below 50% (Derocher, Lunn, and Stirling, 2004). Polar bears also may become energetically stressed when the pack ice retreats and carries them to deeper waters beyond the productive continental shelf zone. These bears eventually may choose to swim for shore, where annual food resources, such as carcasses of whales killed by Alaskan Natives, can be found along the coast. Despite being strong swimmers, energetically stressed bears are susceptible to misfortune on such long-distance swims. For example, Monnett and Gleason (2006) reported 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; they attributed this phenomenon to longer open-water periods and reduced sea-ice cover. If such events are recurrent, they easily could rise to the level of a significant impact on polar bear populations, especially considering that current human removals of the SBS population are believed to be at or near maximum sustainable levels. It could take polar bears in the SBS 4-7 years or longer to recover from such mass mortalities (USDOI, FWS, pers. commun.).

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

Sport hunting for polar bears has been banned in Alaska since 1972, although bears are still taken for subsistence, recreation, and handicrafts by Alaskan Natives. In 1988, the Inuvialuit Game Council from Canada and the North Slope Borough from Alaska implemented the Polar Bear Management Agreement for the Southern Beaufort Sea, a voluntary agreement that limited the total harvest from the SBS population to within sustainable levels (Brower et al., 2002). The stipulations contained in this voluntary agreement actually are more stringent than those contained in the Marine Mammal Protection Act (MMPA). Sustainable quotas under the agreement are set at 80 bears per year of which, no more than 27 may be female. This quota is believed to be at or near sustainable levels. Recent harvest levels (2000-2005) from the SBS stock averaged 37 individuals in the U.S. and 25 individuals in Canada, for an average harvest of 62 bears per year, well within the agreement's quotas (USDOI, FWS, unpublished data). For the same period, reported U.S. harvest levels of the CBS stock averaged 41 bears, while average Russian harvests of the CBS stock are believed to be much higher (USDOI, FWS, 2003).

A reliable estimate for the CBS stock of polar bears, which ranges into the southern Beaufort Sea, does not exist, and its current status is in question. In 2002, the IUCN/SSG Polar Bear Specialist Group estimated the size of the CBS population at 2,000+ bears, although the certainty of this estimate was considered poor (Lunn et al., 2002). Russia prohibited polar bear hunting in 1956 in response to perceived population declines; however, both sport and subsistence harvest continued in Alaska until 1972. During the 1960's, hunters took an average of 189 bears per year from the CBS population, an unsustainable rate of harvest that likely caused significant population declines. With the passage of the MMPA in 1972, which prohibited sport hunting of marine mammals, the average annual Alaska harvest in the Chukchi Sea dropped to 67 bears per year. However, with the collapse of the Soviet empire in 1991, levels of illegal harvest dramatically increased in Chukotka in the Russian Far East. While the magnitude of the Russian harvest from the CBS is not precisely known, some estimates place it as high as 400 bears per year, although the figure is more likely between 100 and 250 bears per year. Models run by the FWS indicate that this level of harvest of the CBS population most likely is unsustainable, and that an average annual harvest of 180 bears (4.5% of the starting population) potentially could reduce the population by 50% within 18 years (USDOI, FWS, 2003). This simulated harvest level is similar to the estimated U.S./Russia annual harvest for the period 1992-2006, as well as to the unsustainable harvest levels experienced in Alaska in the 1960's, indicating that the CBS stock of polar bears well may be in decline due to overharvesting. The FWS calculations were based on a starting population of 4,000 bears, which is believed to fairly characterize a healthy CBS population.

In 2001 the SBS population was estimated at ~1,800 individuals and was thought to be increasing (Lunn et al., 2002). The most recent population growth rate for the SBS population was estimated at 2.4% annually, based on data from 1982 through 1992, although the population growth rate is believed to have slowed or stabilized since 1992. However, recent information suggests that the SBS polar bear population may be smaller than previously estimated. Researchers from the U.S. Geological Survey state that:

> High recapture rates during capture/recapture studies in 2005 and 2006 suggest that the number of polar bears in the Beaufort Sea region may be smaller than previously estimated. Final analyses of these new population data will not be completed until early in 2007, but preliminary evaluations of ongoing data collection suggest that conservative management is warranted until final estimates are calculated (S. C. Amstrup and E. V. Regehr, pers. comm.).

Neither the SBS nor CBS stock is listed as "depleted" under the MMPA. The SBS is assumed to be within optimum sustainable population levels, although this new information puts this assumption in question (USDOI, FWS: http://alaska.fws.gov/fisheries/mmm/polarbear/reports.htm). The SBS currently is designated a "non-strategic stock" by the FWS. Due to the lack of information concerning the CBS population, the FWS has designated it as "uncertain" at this time.

D.4.c. Other Marine Mammals. This section contains an update of information on other marine mammals that might be affected by proposed Beaufort Sea Sale 202. The section updates the information in the multiple-sale EIS and the 195 EA, incorporating information from the PEA for seismic operation and recent research. Section IV.B.2.d(3) contains a one-page summary of the updated information.

As explained in the multiple-sale EIS, there are several species of non-ESA-listed marine mammals aside from polar bear that occur in or near the Beaufort Sea lease area; they are:

Pinnipeds:

Ringed seal (*Phoca hispida*)
Spotted seal (*Phoca largha*)
Bearded seal (*Erignathus barbatus*)
Pacific walrus (*Odobenus rosmarus divergens*)

Cetaceans

Beluga whale *(Delphinapterus leucas)*
Gray whale *(Eschrichtius robusta)*

The 195 EA concluded that ringed seals and other ice-dependent pinnipeds were resources of primary concern, partly because of climate change (USDOI, MMS, 2004:Appendix I, Sec. I.2.e(1)). For that reason, special attention has been focused on them.

D.4.c(1) Pinnipeds.

D.4.c(1)(a) Ringed Seal. No reliable estimate for the size of the Alaska ringed seal stock currently is available (Angliss and Outlaw, 2005), although past estimates ranged from 1.0 million to 3.6 million (Frost et al., 1988). Due to the absence of a reliable estimate, we summarize some background information in the following.

Ringed seals have a circumpolar distribution from approximately 35° N. latitude to the North Pole and occur in all seas of the Arctic Ocean (King, 1983). Ringed seals are year-round residents in the Chukchi and Beaufort seas. They are closely associated with ice. They have the unique ability to maintain breathing holes in thick ice and, therefore, are able to exploit the ice-covered parts of the Arctic during winter, when most other marine mammals have migrated south (Rosing-Asvid, 2006). In winter and spring, the highest densities of ringed seals are found on stable, shorefast ice. In summer, ringed seals often occur along the receding ice edges or farther north in the pack ice. Ringed seals seem to prefer large icefloes> 48 m in diameter and often are found in the interior pack ice, where sea-ice concentrations exceed 90% (Simpkins et al. 2003). Ringed seal densities in the Beaufort Sea are greatest in water with >80% ice cover (Stirling, Kingsley, and Calvert, 1981) and depths between 5 and 35 m (Frost et al., 2004). Densities also are highest on relatively flat ice and near the fast-ice edge, declining both shoreward and seaward of that edge (Frost et al., 2004). Ringed seal densities historically have been substantially lower in the western than the eastern part of the Beaufort Sea (Burns and Kelly, 1982; Kelly, 1988). The lower densities to the west appear to be related to very shallow water depths in much of the area between the shore and barrier islands. Surveys flown from 1996-1999 indicate that the highest density of seals along the central Beaufort Sea coast in Alaska occurred from approximately Kaktovik west to Brownlow Point (Frost et al., 2004). This may be due to the fact that relative productivity, as measured by zooplankton biomass, is approximately four times greater there than the average biomass in other areas of the eastern Beaufort Sea (Frost et al., 2004). Ringed seals are found throughout the Beaufort, Chukchi, and Bering seas (Angliss and Outlaw, 2005) and are the most common and widespread seal species in the area.

As stated, no reliable estimate for the size of the Alaska ringed seal stock is available (Angliss and Outlaw, 2005), although past estimates ranged from 1.0 million to 3.6 million (Frost et al., 1988). Ringed seal numbers are considerably higher in the Bering and Chukchi seas, particularly during winter and early spring (71 *FR* 9783). Recent work by Bengtson et al. (2005) reported an estimated abundance of as many as 252, 488 ringed seals in the eastern Chukchi Sea. Frost and Lowry (1981) estimated 80,000 ringed seals in the Beaufort Sea during summer and 40,000 during winter, although some authors (Amstrup, 1995) estimated the Beaufort Sea population at four times these numbers. Few, if any, seals inhabit ice-covered waters shallower than 3 m due to water freezing to the bottom and/or poor prey availability caused by the limited amount of ice-free water (71 *FR* 9785). Frost et al. (2002) reported that population-trend analyses in the central Beaufort Sea suggested a substantial decline of 31% in observed ringed seal densities from 1980-1987 to 1996-1999. However, this apparent decline may have been due to a difference in the timing of surveys rather than an actual decline in abundance (Frost et al., 2002). Spatial and temporal comparisons typically rest on the assumption that the proportion of animals visible is constant from survey to survey. However, Frost et al. (2004) cautioned against comparing survey results because of the marked between-year variation in density estimates common for ringed seal surveys. This likely is due to the timing of the surveys relative to ice conditions and the progress of the seals' annual molt (Frost et al., 2004). In fact, Kelly (2005) found that aerial surveys can underestimate ringed seal densities by factors of >13, because the proportion of seals visible during survey periods can change rapidly from day to day. Therefore, comparisons of ringed seal densities between regions and between years based on aerial surveys should account for the proportion of the population visible during each survey (i.e. appropriate correction factors should be used) (Kelly, 2005). Ringed seals are not listed as "depleted" under the MMPA, and the Alaska stock of ringed seals is not classified as a strategic stock by the NMFS.

In early summer, the highest densities of ringed seals in the Chukchi Sea are found in nearshore fast and pack ice (Bengston et al., 2005). This also appears to be true in the Beaufort Sea, based on incidental sightings of seals during aerials surveys for bowhead whales (USDOI, MMS, 2004). During summer, ringed seals are found dispersed throughout open-water areas, although in some regions they move into coastal areas (Smith, 1987; Harwood and Stirling, 1992). In late summer and early fall, ringed seals often aggregate in open-water areas where primary productivity is thought to be high (Harwood and Stirling, 1992).

Ringed seals give birth from mid-March through April to a single pup, which they nurse for 5-8 weeks (Hammil et al., 1991; Lydersen and Hammill, 1993). Pupping and nursing occur in subnivean lairs constructed on either landfast or drifting pack ice, during which time they are hunted by polar bears (Stirling and Archibald, 1977; Smith, 1980). Mating occurs shortly after pupping (~ 4 weeks), and the female delays implantation of the embryo until later in the summer (July-August). Ringed seals feed on a variety of fish and invertebrates. Diet depends on the prey availability, depth of water, and distance from shore. In Alaskan waters, the primary prey of ringed seals is arctic cod, saffron cod, shrimps, amphipods, and euphausiids (Kelly, 1988; Reeves, Stewart, and Leatherwood, 1992).

Ringed seals are an important subsistence species for Alaskan Native hunters. The number of seals taken annually varies considerably between years due to ice and wind conditions, which impact hunter access to seals. The Alaska Department of Fish and Game (ADF&G) maintains a subsistence harvest database and, as of August 2000, the mean estimate of ringed seals taken annually is 9,567 (ADF&G, 2000).

D.4.c(1)(b) Spotted Seal. No reliable estimate for the size of the Alaska spotted seal stock currently is available (Angliss and Outlaw, 2005); therefore, some background information is summarized here. Spotted seals are distributed along the continental shelf of the Beaufort, Chukchi, Bering, and Okhotsk seas, and south to the northern Yellow Sea and western Sea of Japan (Shaughnessy and Fay, 1977). They are common in the coastal Alaskan waters in ice-free seasons. They migrate south from the Chukchi Sea and into the Bering Sea in October-November (Lowry et al., 1998). Spotted seals overwinter in the Bering Sea and inhabit the southern margin of the ice during spring, moving to coastal habitats after the retreat of the sea ice (Shaughnessy and Fay, 1977; Simpkins et al., 2003). Spotted seals are not known to use the Beaufort Sea in winter. Spotted seals are closely related to, and often mistaken for, Pacific harbor seals (*Phoca vitulina richardsi*). The two species often are seen together and are partially sympatric in the southern Bering Sea (Quakenbush, 1988).

As stated, no reliable estimate for the size of the Alaska spotted seal stock currently is available (Angliss and Outlaw, 2005). An early estimate of the size of the world population of spotted seals was 370,000-420,000, and the size of the Bering Sea population, including animals in Russian waters, was estimated to be 200,000-250,000 animals (Bigg, 1981). Using telemetry data, the ADF&G corrected 1992 survey results producing a rough estimate of 59,214 animals (Rugh et al., 1993) for western Alaska and the Bering Sea. Spotted seals are not listed as "depleted" under the MMPA. The Alaska stock of spotted seals is not classified by NMFS as a strategic stock.

During spring when pupping, breeding, and molting occur, spotted seals inhabit the southern margin of the sea ice in the Bering Sea (Quakenbush, 1988; Rugh, Shelden, and Withrow, 1997). Of eight known breeding areas, three occur in the Bering Sea (Angliss and Outlaw, 2005). Pupping occurs on ice in April-May, and pups are weaned within 3-4 weeks. Adult spotted seals often are seen on the ice in female-pup or male-female pairs, or in male-female-pup triads. Mating occurs around the time the pups are weaned, and mating pairs are monogamous for the breeding season. During the summer and fall, spotted seals are found primarily in the Bering and Chukchi seas, but some range into the Beaufort Sea (Rugh, Shelden, and Withrow, 1997; Lowry et al., 1998) from July until September. In total, there probably are only a few dozen spotted seals along the coast of the central Beaufort Sea during summer and early fall (Richardson, 2000). At this time of year, spotted seals haul out on land part of the time but also spend extended periods at sea. The seals are seen commonly in bays, lagoons, and estuaries, but they also range far offshore to 72° N. latitude (Shaughnessy and Fay, 1977). Spotted seals are rarely seen on the pack ice during summer, except when the ice is very near shore.

Principal foods of adult spotted seals are schooling fishes, although the total array of foods is quite varied. In the Arctic, their diet is similar to that of ringed seals, including a variety of fishes such as arctic and saffron cod, and also shrimp and euphausiids (Kato, 1982; Quakenbush, 1988; Reeves, Stewart, and Leatherwood, 1992). Within their geographic range they are known to eat sand lance, sculpins, flatfishes, and cephalapods (mainly octopus). The juvenile diet is primarily crustaceans (shrimp).

Spotted seals are an important subsistence species for Alaskan Native hunters, primarily in the Bering Strait and Yukon-Kuskokwim regions (Lowry, 1984). The number of seals taken annually varies considerably between years due to ice and wind conditions, which impact hunter access to seals. Between 1966 and 1976, an average of about 2,400 spotted seals was taken annually (Lowry, 1984). The ADF&G maintains a subsistence-harvest database, which indicates that at least 5,265 spotted seals are taken annually for subsistence use (ADF&G, 2000).

D.4.c(1)(c) Bearded Seal. No reliable estimate currently is available for the size of the Alaska stock of bearded seals (Angliss and Outlaw, 2005); therefore, some background information is summarized in the following. Bearded seals are the largest of the northern phocids and have a circumpolar distribution ranging from the Arctic Ocean down into the western Pacific (Burns, 1981). In Alaskan waters, bearded seals occur over the continental shelves of the Bering, Chukchi, and Beaufort seas (Burns, 1981). Bearded seals predominantly are benthic feeders (Burns, 1981), feeding on a variety of invertebrates (crabs, shrimp, clams, and snails) and other food organisms, including arctic and saffron cod, flounders, sculpins, and octopuses (Kelly, 1988; Reeves, Stewart, and Leatherwood, 1992). Bearded seals also feed on ice-associated organisms when they are present, allowing the seals to live in areas with water considerably deeper than 200 m. In some areas, bearded seals are associated with the ice year-round; however, they usually move shoreward into open-water areas when pack ice retreats. During the open-water period, bearded seals occur mainly in relatively shallow areas, preferring areas no deeper than 200 m (Harwood et al., 2005; USDOI, MMS, 2004).

As stated, no reliable estimate for the size of the Alaska bearded seal stock is available (Angliss and Outlaw, 2005). Bengtson et al. (2005) conducted surveys in the eastern Chukchi Sea but could not estimate abundance from their data. Early estimates of the Bering-Chukchi seas population range from 250,000-300,000 (Burns, 1981). Bearded seals are not listed as "depleted" under the MMPA. The Alaska stock of bearded seals is not classified by NMFS as a strategic stock.

Seasonal movements of bearded seals are related directly to the advance and retreat of sea ice and to water depth (Kelly, 1988). During winter, most bearded seals in Alaskan waters are found in the Bering Sea. From mid-April to June as the ice recedes, some of the bearded seals that overwintered in the Bering Sea migrate northward through the Bering Strait. During summer, the most favorable bearded seal habitat is found in the central and northern Chukchi Sea, where they are found near the widely fragmented margin of the pack ice; they also are found in nearshore areas of the central and western Beaufort Sea during summer. Suitable habitat is more limited in the Beaufort Sea where the continental shelf is narrower and the pack-ice edge frequently occurs seaward of the shelf and over water too deep for benthic feeding. In the Beaufort

Sea, bearded seals rarely use coastal haulouts. Females pup in April-May, bearing a single pup. Breeding occurs within a few weeks after the pup is weaned, and implantation is delayed until July.

Bearded seals are an important subsistence species for Alaskan Native hunters. The number of seals taken annually varies considerably between years due to ice and wind conditions, which impact hunter access to seals. The ADF&G maintains a database, and the mean estimate of bearded seals taken annually is 6,788 (ADF&G, 2000).

D.4.c(1)(d) Pacific Walrus. No reliable estimate currently is available for the size of the Alaskan stock of Pacific walrus (Angliss and Outlaw, 2005); therefore, some background information is summarized in the following. Pacific walruses range throughout the shallow continental shelf waters of the Bering and Chukchi seas, where their distribution is closely linked with the seasonal distribution of the pack ice. Walruses are migratory, moving south with the advancing ice in autumn and north as the ice recedes in spring (Fay, 1981). Walrus specialize in feeding on benthic macro-invertebrates (Fay, 1982); as such, they generally prefer waters <200 m deep along the pack-ice margin where ice concentrations are <80% (Fay, 1982; Fay and Burns, 1988). The juxtaposition of broken ice over relatively shallow continental shelf waters is important to them for feeding, particularly for females with dependent young that may not be capable of deep diving or long-term exposure to the frigid water. Considering this, the recent observations of nine motherless calves stranded on ice floes in deep waters off of northwest Alaska are troubling (Cooper et al., 2006). Recent trends in seasonal sea-ice breakup have resulted in seasonal sea-ice retreating off the continental shelves and over deep Arctic Ocean waters. This trend poses adaptive challenges for the walrus population (Tynan and DeMaster, 1997). Females with calves are not normally observed in deep Arctic basin waters due to the depth of the water and resultant inaccessibility of food there. Considering that walrus calves are dependent on maternal care for 2 years or more before they are able to forage for themselves, the observation of motherless calves stranded on ice floes in deep waters may have implications for the Pacific walrus population (Cooper et al., 2006). These calves may have been abandoned by their mothers due to lack of food, and the authors speculate that much higher numbers than the nine observed may have been present in their study area.

Walruses are extremely social and gregarious animals, and spend approximately one-third of their time hauled out onto land or ice, usually in close physical contact with one another. Walruses rely on sea ice as a substrate for resting and giving birth (Angliss and Outlaw, 2005) and generally require ice thicknesses of 50 centimeters (cm) or more to support their weight (USDOI, FWS, pers. commun.). Pacific walruses are segregated by gender for much of the year as they migrate over vast areas of the Bering and Chukchi seas (Fay, 1982). During the summer months, the majority of the subadults, females, and calves move into the Chukchi Sea. In contrast, adult males generally abandon the sea ice in spring for coastal haulouts in Bristol Bay and the Gulf of Anadyr (Jay and Hills, 2005). The Chukchi Sea west of Barrow is the northeastern extent of the main summer range of the walrus; few are seen farther east in the Beaufort Sea (e.g., Harwood et al., 2005). Those observed in the Beaufort Sea typically are lone individuals.

Walruses are long-lived animals with low rates of reproduction. Females reach sexual maturity at 4-9 years of age, and give birth to one calf every 2 or more years. Although males become fertile at 5-7 years of age, they do not reach full competitive maturity until age 15-16. Some walruses may live to age 35-40, and they remain fertile until relatively late in life. As stated, no reliable estimate for the size of the Alaska Pacific walrus stock is available (Angliss and Outlaw, 2005), although the FWS is launching a substantial effort to produce a more precise abundance estimate of Pacific walruses. Results from these survey efforts should be available in 2007 (USDOI, FWS, 2006). Estimates of the Pacific walrus population suggest a minimum of 200,000 animals were necessary to withstand the levels of commercial harvests, which occurred in the 18^{th} and 19^{th} centuries (Fay, 1982). The population size has never been known with certainty; however, although the most recent survey estimate was approximately 201,039 animals (Gilbert et al., 1992). Pacific walruses are not listed as "depleted" under the MMPA. The Alaska stock of Pacific walrus is not classified by NMFS as a strategic stock.

In winter, pacific walrus inhabit the pack ice of the Bering Sea. Breeding occurs between January and March, and implantation is delayed until June-July. Gestation lasts 11 months, and calving occurs on the sea ice in April-May, approximately 15 months after mating. Calves are not weaned for 2 years or more after birth (Fay, 1982). By May, as the pack ice loosens, adult females and dependent young move northward into the Chukchi Sea.

In summer, walruses tend to concentrate in areas of unconsolidated pack ice within 100 km of the leading edge of the pack ice in the Chukchi Sea. By July, large groups of up to several thousand walruses can be found along the edge of the pack ice between Icy Cape and Point Barrow. When suitable pack ice is not available, walruses will haul out to rest on land, preferring sites sheltered from wind and surf. Traditional haulout sites in the eastern Chukchi Sea include Cape Thompson, Cape Lisburne, and Icy Cape. In recent years, Cape Lisburne has seen regular walrus use in the late summer (USDOI, FWS, pers. commun.). By August, depending on the retreat of the pack ice, walruses are found farther offshore, with principal concentrations to the northwest of Barrow. By September, the edge of the pack ice generally retreats to about 71° N. latitude, although it may retreat as far as 76° N. latitude in some years. In October, as the pack ice advances, large herds begin moving back down to the Bering Sea.

Walruses are benthic feeders, and prefer areas <80 m deep (Fay, 1982). In a recent study, 98% of satellite locations of tagged walruses in Bristol Bay were in water depths of 60 m or less (Jay and Hills, 2005). Walruses most commonly feed on bivalve mollusks (clams), but they also will feed on other benthic invertebrates (e.g., snails, shrimp, crabs, worms). Some walruses have been reported to prey on marine birds and small seals.

The Pacific walrus is an important subsistence species for Alaskan Native hunters. The number of walruses taken annually has varied over the years, with recent harvest levels much lower than historic highs. Based on harvest data from Alaska and Chukotka in the years 2001-2005, mean harvest mortality levels are estimated at 5,458 animals per year (USDOI, FWS, 2006).

D.4.c(2) Cetaceans.

D.4.c(2)(a) Beluga Whale. Beluga whales are found throughout arctic and subarctic waters of the Northern Hemisphere. They inhabit seasonally ice-covered waters and are closely associated with open leads and polynyas in ice-covered regions (Hazard, 1988). In summer months, they migrate to warmer coastal estuaries, bays, and rivers (Finley, 1982). In Alaska, there are five recognized stocks: (1) Eastern Chukchi Sea; (2) Beaufort Sea; (3) Cook Inlet; (4) Bristol Bay; and (5) Eastern Bering Sea (O'Corry-Crowe et al., 1997). Within the Proposed Action area, only the Beaufort Sea stock and eastern Chukchi Sea stocks are present.

The NMFS has set the minimum population estimate for the Beaufort Sea beluga whale stock at 32, 453 and the total corrected abundance estimate for the eastern Chukchi Sea stock at 3,710 (Angliss and Outlaw, 2005). Of the five beluga whale stocks, only the Cook Inlet stock is listed as "depleted" under the MMPA (65 *FR* 34590). Neither the Beaufort Sea nor the eastern Chukchi Sea stocks are listed as "depleted" or classified as a strategic stock under the MMPA.

Beluga whales of both stocks winter in the Bering Sea and summer in the Beaufort and Chukchi seas, migrating around western and northern Alaska (Angliss and Outlaw, 2005). The majority of belugas in the Beaufort stock migrate into the Beaufort Sea in April or May, although some whales may pass Point Barrow as early as late March and as late as July (Braham et al., 1984; Ljungblad et al., 1984; Richardson et al., 1995). Belugas of the eastern Chukchi stock satellite tagged in the eastern Chukchi Sea in summer traveled 1,100 km north of the Alaska coastline and to the Canadian Beaufort Sea within 3 months of tagging (Suydam et al., 2001), indicating significant stock overlap with the Beaufort Sea stock.

Belugas are rarely seen in the central Alaskan Beaufort Sea during the summer. They are strongly associated with the ice (Burns, Shapiro, and Fay, 1981), and prefer areas with moderate to high ice cover (54-66%) (Moore and DeMaster, 1997). Belugas are known to forage at ice edges and ice cracks (Bradstreet, 1982; Crawford and Jorgenson, 1990), and feeding aggregations occur primarily in nearshore areas, where dense schools of arctic cod concentrate in late summer. These coastal feeding aggregations may occur in open water as well as beneath or near ice. During late summer and autumn, most belugas migrate far offshore near the pack ice front (Frost et al., 1988; Hazard, 1988; Clarke, Moore, and Johnson, 1993; Miller et al., 1998). Moore (2000) and Moore et al. (2000) suggest that beluga whales select deeper slope water independent of ice cover. The main fall migration corridor of beluga whales is ~100+ km north of the coast; however, small numbers of belugas are sometimes seen near the north coast of Alaska during the westward migration in late summer and autumn (Johnson, 1979). Belugas can be found in large groups exceeding 500 animals (National Marine Mammal Lab, 1998). Pod structure in beluga groups appears to be along matrilineal lines, with males forming separate aggregations. Small groups often are observed traveling or resting together. Females calve in May-July, when herds are in their summer areas. Calves typically are weaned at 2 years of age. Mating occurs in March-April.

Winter food habits of belugas are largely unknown; however, during summer they eat a wide variety of prey (USDOI, MMS, 2004). In summer, they feed on a variety of schooling and anadromous fishes that are sequentially abundant in coastal zones. Principal species eaten include herring, capelin, smelt, arctic and saffron cods, salmon, flatfishes, and sculpins. Octopus, squid, shrimps, crabs, and clams are eaten occasionally. Most feeding is done over the continental shelf and in nearshore estuaries and river mouths. In the shallow waters of Alaska, most feeding dives probably are to depths of 20-100 feet (6-30 m) and last 2-5 minutes.

Beluga whales from both stocks are an important subsistence resource for Alaskan Native hunters. For the eastern Chukchi Sea stock, annual subsistence take averaged 65 animals from 1999-2003. Annual subsistence take for the Beaufort Sea stock averaged 53 animals for the same period (Angliss and Outlaw, 2005).

D.4.c(2)(b) Gray Whale. Recently, gray whale calls were recorded each month from October 2003 through May 2004 northeast of Barrow, indicating that some whales did not migrate to California as expected (Moore et al., 2004). Because of this new information, some background information is summarized in the following. Gray whales formerly inhabited both the North Atlantic and North Pacific oceans; however, they are believed to have become extinct in the Atlantic by the early 1700's. There are two stocks recognized in the North Pacific: the eastern north Pacific stock, which lives along the west coast of North America, and the western north Pacific stock, which lives along the coast of eastern Asia (Angliss and Lodge, 2005).

The latest abundance estimate for the eastern north Pacific stock is 18,178 individuals (Rugh et al., In press, as cited in Angliss and Outlaw, 2005). The NMFS has provided a minimum population estimate of 17,752 (Angliss and Outlaw, 2005). Federal protection under the ESA was removed in 1994, and further evaluation determined that the stock was neither in danger of extinction nor likely to become endangered in the foreseeable future (Rugh et al., 1999). The eastern North Pacific stock is not designated as depleted under the MMPA nor considered a strategic stock by NMFS.

During the summer months, eastern north Pacific gray whales and their calves feed in the northern Bering and Chukchi seas (Tomilin, 1957; Rice and Wolman, 1971; Braham, 1984; Nerini, 1984), particularly north of St. Lawerence Island and in the Chirikov Basin (Moore et al., 2000). Gray whales prefer areas of little or no ice cover (<5%) (Moore and DeMaster, 1997). They are a coastal species, spending most of their time in waters <60 m deep. In mid-October, the whales begin their migration to the west coast of Baja California and the east coast of the Gulf of California to breed and calve (Swartz and Jones, 1981; Jones and Swartz, 1984). The northbound migration starts in mid-February and continues through May (Rice, 1984).

Gray whales are bottom feeders, sucking sediment from the seafloor. Their primary prey is amphipods, although other food items are ingested. Although gray whales probably feed opportunistically throughout their range, they return annually to primary feeding areas in the northern Bering Sea and Chukchi Sea (e.g., Nerini, 1984; Moore, Clarke, and Ljungblad, 1986; Weller et al., 1999). During 1982-1991 aerial surveys in the Alaskan Chukchi and Beaufort seas, gray whales were associated with virtually the same habitat throughout the summer and the autumn (38-m depth and <7% ice cover) (Moore and DeMaster, 1997). It is likely that shallow coastal and offshore shoal areas provide habitat rich in gray whale prey, and their association and congregation in larger numbers with offshore shoals in the northern Chukchi Sea may indicate that these are important feeding areas for the expanding population (Moore and DeMaster, 1997).

As the population expands, it also is believed that gray whales are expanding their feeding areas in arctic Alaska.

Only a small number of gray whales enter the Beaufort Sea east of Point Barrow although in recent years, ice conditions around Barrow have become lighter, and gray whales may have become more common there. In fact, Moore et al. (2006) reported that Native hunters have noticed increasing numbers of gray whales near Barrow in the late summer and autumn, which may indicate a northward shift in the distribution of this species. Gray whale calls also were recorded each month from October 2003 through May 2004 northeast of Barrow, indicating that some whales did not migrate to California as expected (Moore et al., 2004). This extended occurrence of gray whales in the Beaufort Sea complements observations of feeding whales moving north from the Bering Sea to the Chukchi Sea in summer (Moore et al., 2003), and may be indicative of marine ecosystem changes occurring in the North Pacific. For example, Moore, Grebmeier, and Davis (2003) suggested that gray whale use of the Chirikov Basin has decreased, likely as a result of the combined effects of changing currents and a downturn in amphipod productivity. The northeasternmost recurring known gray whale feeding area is in the Chukchi Sea southwest of Barrow (Clarke, Moore, and Ljungblad, 1989).

Gray whales are taken by both Alaskan and Russian subsistence hunters; however, most of the harvest is done by the Russians. The only reported takes in Alaska in the last decade occurred in 1995, when Alaskan Natives harvested two animals (IWC, 1997). In 1997, the IWC implemented an annual cap of 140 gray whales to be taken by Russia and the U.S. (Makah Indian Tribe in Washington State). Annual subsistence take averaged 122 whales from 1999-2003 (Angliss and Lodge, 2005). The Makah Indian Tribe in Washington State is authorized to take four gray whales from this stock each year, but the last reported harvest was one animal in 1999 (IWC, 2001).

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

The information in the multiple-sale EIS and 195 EA is augmented by a summary in the Arctic seismic PEA (USDOI, MMS, 2006a). Only two parts of the updated PEA summary will be repeated here, because the entire PEA is available on the MMS website (http://www.mms.gov/alaska/ref/EIS%20EA/DraftProgrammatic%20EA%20&%20Biological%20Eval/PEA_1.pdf). The updated parts are about recent evidence of the effect of climate change on arctic fish, and about the few commercial fisheries in the Alaskan Beaufort Sea and, therefore, the few species covered by fishery-management plans in these waters.

D.4.d(1) 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 appears to be without precedent since the early Holocene.

Climate change is altering the distribution and abundance of marine life in the Arctic. For example, Berge et al. (2005) report the fist observations of settled blue mussels, *Mytilus edulis,* in the high Arctic Archipelago of Svaalbard for the first time since the Viking Age. A scattered population was discovered at a single site at the mouth of Isfjorden in August 2004. Their data indicate that most mussels settled there as spat in 2002, and that larvae were transported by the currents northwards from the Norwegian coast to

Svaalbard the same year. This extension of the blue mussels' distribution range was made possible by the unusually high northward mass transport of warm Atlantic water resulting in elevated sea-surface temperatures in the North Atlantic and along the west coast of Svaalbard. Numerous other examples are being realized in the North Atlantic, where temperate and subtropical fishes are being caught and documented for the first time off the United Kingdom and the Scandinavian countries.

While climatic warming is not distributed evenly across the Arctic, the Bering, Chukchi, and Beaufort seas clearly are experiencing a warming trend (ACIA, 2005). Over the last 50 years, annual average temperatures have risen by about 2-3 °C (Celsius) in Alaska and the Canadian Yukon, and by about 0.5 °C over the Bering Sea and most of Chukotka (ACIA, 2004). The largest changes have been during winter, when near-surface air temperatures increased by about 3-5 °C over Alaska, the Canadian Yukon, and the Bering Sea, while winters in Chukotka got 1-2 °C colder.

Climate change can affect fish production (e.g., individuals and/or populations) through a variety of means (Loeng, 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.

For example, a climate shift occurred in the Bering Sea in 1977, abruptly changing from a cool to a warm period—perhaps a reflection of the Pacific Decadal Oscillation (ACIA, 2004, 2005). The warming brought about ecosystem shifts that favored herring stocks and enhanced productivity for Pacific cod, skates, flatfishes, and noncrustacean invertebrates. The species composition of seafloor organisms changed from being crab dominated to a more diverse assemblage of echinoderms, sponges, and other sea life. Historically high commercial catches of Pacific salmon occurred. The walleye pollock catch, which was at low levels in the 1960's and 1970's (2-6 million tonnes), has increased to levels >10 million tonnes for most years since 1980. Additional recent climate-related impacts observed in the Bering Sea large marine ecosystem include significant reductions in certain seabird and marine mammal populations, unusual algal blooms, abnormally high water temperatures, and low harvests of salmon on their return to spawning areas. While the Bering Sea fishery has become one of the world's largest, numbers of salmon have been far below expected levels, fish have been smaller than average, and their traditional migratory patterns appear to have been altered.

We know that better known fish resources (e.g., abundant species) can exhibit very large interannual fluctuations in distribution, abundance, and biomass (e.g., capelin, arctic cod, Bering flounder, Pacific sand lance). Climate change experienced in the past and apparently accelerating in arctic Alaska likely is altering the distribution and abundance of their respective populations from what was known from past surveys.

The Arctic Climate Impact Assessment (ACIA, 2004, 2005) concluded (in part) that:

(1) The southern limit of distribution for colder water species (e.g., Arctic cod) are anticipated to move northward. The distribution of more southerly species (e.g., from the Bering Sea) are anticipated to move northward. Timing and location of spawning and feeding migrations are anticipated to alter;
(2) Wind-driven advection patterns of larvae may be critical as well as a match/mismatch in the timing of zooplankton production and fish-larval production, thereby influencing productivity (e.g., population abundance and demography);
(3) Species composition and diversity will change: Pacific cod, herring, walleye pollock, and some flatfish are likely to move northward and become more abundant, while capelin, Arctic cod, and Greenland halibut will have a restricted range and decline in abundance.

D.4.d(2) Commercial Fish Species and Essential Fish Habitat. Presently, Pacific salmon are the only managed species with EFH designated in the Alaskan Beaufort and Chukchi seas. All five species of

Pacific salmon occur in the Alaskan Beaufort and Chukchi seas (Craig and Halderson, 1986; NMFS, 2005); they are the pink (humpback), chum (dog), sockeye (red) salmon, chinook (king) salmon, and coho (silver) salmon. Pacific salmon in the Alaskan Beaufort and Chukchi seas are considered "rare" species in terms of abundance and range.

A significant body of information exists on the life histories and general distribution of salmon in Alaska (NMFS, 2005). Life history, general distribution, fisheries background, relevant trophic information, habitat, and biological associations are described for Pacific salmon in Appendix F.5 of NMFS (2005) and incorporated herein by reference. More information regarding the biology, ecology, and behavior of Pacific salmon is described in Augerot (2005), Quinn (2005), and the ADF&G Fish Distribution Database-Fish Profiles (http://www.sf.adfg.state.ak.us/SARR/FishDistrib/FDD_fishprofiles.cfm).

Salmon numbers decrease north of the Bering Strait, and they are relatively rare in the Beaufort Sea (Craig and Halderson, 1986). Spawning runs in arctic streams are minor compared to those of commercially important populations farther south (Craig and Halderson, 1986). Rivers south of Point Hope support comparatively large runs of chum and pink salmon, and have been basically the northern distributional limits for chinook, coho, and sockeye salmon (Craig and Halderson, 1986), although this appears no longer so. Craig and Halderson (1986) noted that only pink salmon and, to a lesser degree, chum salmon, occur with any regularity in arctic waters north of Point Hope and presumably maintain small populations in several of the northern drainages; most occurring in streams west of Barrow.

In general, information on Pacific Salmon and their EFH is limited with respect to current distribution and abundance estimates and associated trends, local and regional movements; and specifics about life history habitats.

D.4.d(2)(a) Chinook, Sockeye, and Coho Salmon. There are no known stocks of chinook, sockeye, or coho salmon in arctic waters north of Point Hope (Craig and Halderson, 1986). All three species are considered extremely rare in the Beaufort Sea, representing no more than isolated migrants (vagrants) from populations in southern Alaska or Russia (Fechhelm and Griffiths, 2001). Records of these species usually consist of single specimens. Climate change in arctic Alaska (i.e., warming) may facilitate the range expansion of chinook, sockeye, and coho salmon (e.g., Babaluk et al., 2000).

The northernmost known spawning population of chinook salmon is believed to be in Kotzebue Sound (Healy, 1991). Small numbers of chinook salmon reportedly are taken each year in the Barrow domestic fishery, which operates in Elson Lagoon (Fechhelm and Griffiths, 2001, citing George, pers. commun.). Strays have been captured in the Kuk and Colville rivers (Craig and Halderson, 1986). There also are indications of a small run of chinook salmon in the Kugrua River southwest of Point Barrow at Peard Bay in the Chukchi Sea (Fechhelm and Griffiths, 2001, citing George, pers. comm.).

Sockeye salmon have their northernmost known spawning population in Kotzebue Sound (Stephenson, 2006, citing Burgner, 1991). The northernmost known population of spawning coho salmon is near Point Hope, although coho salmon occasionally have been captured in marine waters farther east, near Prudhoe Bay (Craig and Halderson, 1986).

D.4.d(2)(b) Pink Salmon. Pink salmon are widely distributed over the northern Pacific Ocean and Bering Sea; they also occur to a lesser degree in arctic waters (Augerot, 2005). Pink salmon are the most abundant salmon species in the Beaufort Sea, although their abundance is greatly reduced compared to waters in western and southern Alaska (Craig and Halderson, 1986; Fechhelm and Griffiths, 2001). Their abundance generally increases from east to west along the Alaskan Beaufort Sea coast. Fechhelm and Griffiths (2001) state that reports of pink salmon in Canada are rare, with the last reported occurrence being that of Dymond (1940). However, Babaluk et al. (2000) report the two most recent records of range extensions of pink salmon in the Canadian Arctic: pink salmon caught in August 1993 in the Sachs River estuary subsistence fishery (Banks Island, Northwest Territories), and another caught in September 1992 in the West Channel of the Mackenzie River near Aklavik, Northwest Territories. Augerot (2005) depicts pink salmon of limited spawning distribution in the Alaskan Arctic.

Craig and Halderson (1986) note that available data suggest that pink salmon are more abundant in even-numbered years (e.g., 1978, 1982) than in odd-numbered years (e.g., 1975, 1983), as is the general pattern for this species in western Alaska (Craig and Halderson, 1986, citing Heard, 1986). This perceived pattern may be a manifestation of the distinctive 2-year life cycle of the pink salmon. Unlike other anadromous fish species in arctic Alaska, the pink salmon is a short-lived species that places all its reproductive effort into a single spawning event, and then dies. With its rigid 2-year life cycle, there is virtually no reproductive overlap between generations; therefore, every spawning event must be successful for the continued survival of the stock (Craig and Halderson, 1986).

Small runs of pink salmon sometimes occur in nine drainages north of Point Hope (Craig and Halderson, 1986; Fechhelm and Griffiths, 2001). Small spawning runs of pink salmon occur in the Sagavanirktok and Colville rivers, although not predictably from year to year. Among the few pink salmon collected in the Sagavanirktok River and delta were several spawned-out adults. Bendock (1979) noted pink salmon spawning near the Itkillik River and at Umiat. Two male spawners were caught near Ocean Point just north of Nuiqsut (Fechhelm and Griffiths, 2001, citing McElderry and Craig, 1981). In recent years, "substantial numbers" of pink salmon have been taken near the Itkillik River as part of a fall subsistence fishery (Fechhelm and Griffiths, 2001, citing George, pers. commun.). Pink salmon also are taken in the subsistence fisheries operating in the Chipp River and Elson Lagoon just to the east of Point Barrow (Fechhelm and Griffiths, 2001, citing George, pers. commun.). Craig and Halderson (1986) proposed that pink salmon spawn successfully and maintain small but viable populations in at least some arctic drainages; continued occurrences of pink salmon in arctic drainages indicates their suggestion is credible.

Run timings are rather inexact. Along the northeastern Chukchi Sea coast, run times in spawning streams may occur in mid-July; while along the western Beaufort coast, run times appear to commence in late July until the end of August (Craig and Halderson, 1986). Occurrence of adult salmon in spawning streams in mid- to late July indicates their presence in marine waters along the arctic coast in advance of the runs. How early salmon move into marine waters of the region is unknown, but is hypothesized to precede runs in spawning streams by as much as several weeks.

Schmidt, McMillan, and Gallaway (1983) describe the life cycle of pink salmon:

> Eggs are laid in redds [nests] dug in gravel. The eggs hatch during the winter however the alevins remain in the gravel, until the yolk sac is absorbed, emerging later in spring. After emerging from the gravel, the fry begin moving downstream. They remain in the estuary for up to a month prior to moving offshore. Little is known of the movements undertaken during the 18 months the salmon spend at sea. It is likely the North Slope populations move westerly towards the Chukchi Sea and upon maturing at the age of 2 years, the salmon then return to their natal streams to spawn in the fall.

Generally, early marine schools of pink salmon fry, often in large, dense aggregations, tend to follow shorelines and, during the first weeks at sea, spend much of their time in shallow water only a few centimeters deep (NMFS, 2005:Appendix F). It has been suggested that this onshore period involves a distinct ecological life-history stage in both pink and chum salmon. In many areas throughout their ranges, pink salmon and chum salmon fry of similar age and size comingle in both large and small schools during early life in the marine environment.

Diet studies show that pink salmon are both opportunistic and generalized feeders and, on occasion, they specialize in specific prey items (NMFS 2005:Appendix F). Young-of-the-year probably do not feed significantly during the short period spent in natal streams but feed on copepods and other zooplankton in the estuary (Schmidt, McMillan, and Gallaway, 1983). As the fish grow, larger prey species become important, including amphipods, euphausiids, and fishes (Schmidt, McMillan, and Gallaway, 1983, citing Morrow, 1980 and Scott and Crossman, 1973). Craig and Halderson (1986) state that most (adult) pink salmon caught in Simpson Lagoon had not fed recently (88% empty stomachs, n=17). The only available information on marine feeding is from Kasegaluk Lagoon, where stomachs of 17 captured adult salmon contained mostly fish (chiefly arctic cod), with some amphipods and mysids (Craig and Halderson, 1986, citing Craig and Schmidt, 1985). Studies indicate that juvenile pink salmon primarily are diurnal feeders (NMFS 2005:Appendix F).

D.4.d(2)(c) **Chum Salmon.** Chum salmon are widely distributed in arctic waters but are relatively less common than pink salmon (Craig and Halderson, 1986; Babaluk et al., 2000; Fechhelm and Griffiths, 2001). Only populations relatively small in number spawn north and east of the Noatak River, which enters the Chukchi Sea at Kotzebue, Alaska (NMFS 2005:Appendix F). In general, chum salmon spawn in the lower reaches of coastal streams <100 mi upstream from the ocean (NMFS 2005:Appendix F). Chum salmon are the Pacific salmon most frequently caught by fishermen in the lower Mackenzie River area of Canada (Babaluk et al., 2000, citing Hunter, 1974). Their long migration up the Mackenzie River (about 2,000 km) is nearly as impressive as that of chum salmon in the Yukon River (3,200 km [Craig and Halderson, 1986, citing Hart, 1973]). Despite the presence of these spawning stocks, few studies conducted in Canadian waters report catching chum salmon (Fechhelm and Griffiths, 2001).

The Pitmigea, Kukpowruk, Kuk, and Kugrua rivers along the northeastern Chukchi Sea coast are reported to support small populations of chum salmon. Individual salmon have been collected in the Kukpuk, Kokolik, and Utukok rivers; Kuchiak Creek; Kaegaluk Lagoon; and along the Wainwright Coast; however, these salmon are treated as strays (Craig and Halderson, 1986; Fechhelm and Griffiths, 2001).

Small spawning runs of chum salmon occur in the Colville River from mid-August to mid-September (Bendock, 1979). In recent years, smolts have been caught in the lower delta (Fechhelm and Griffiths, 2001, citing Moulton, 1999, 2001). Chum salmon are taken in the fall subsistence fishery but comprise a minor portion of the total catch (Fechhelm and Griffiths, 2001). Substantial numbers (undefined) of chum salmon are taken in the Chipp River and in Elson Lagoon, including adults in spawning condition, although such harvests are variable from year to year (Fechhelm and Griffiths, 2001, citing George, pers. commun.). Despite the presence of these runs, Fechhelm and Griffiths (2001) regard chum salmon as rare in Beaufort Sea coastal waters, particularly east of the Colville River.

Generally, chum salmon return to spawn as 2-7-year olds (NMFS 2005:Appendix F). Two-year-old chum are rare in North America and occur primarily in the southern part of their range (e.g., Oregon). Seven-year-old chum also are rare and occur mostly in the northern areas (e.g., Arctic). In general, chum salmon get older from south to north. Slow to rapid growth in the ocean can modify the age at maturity. Slower growth during the second year at sea causes some chum salmon to mature 1 or 2 years later.

Chum salmon fry, like pink salmon, do not overwinter in streams but migrate (mostly at night) out of streams directly to sea shortly after emergence. The timing of outmigration in the Arctic is unknown, but in more southern waters it occurs between February and June (chiefly during April and May). Chum salmon tend to linger and forage in intertidal areas at the head of bays. Estuaries are very important for chum salmon rearing during summer.

Once in coastal waters, chum salmon juveniles probably migrate southward toward the Bering Sea, thereby avoiding the cold waters of the arctic marine environment in winter. There apparently is some evidence from a few tag recoveries that chum salmon from arctic rivers may migrate as far south as the Gulf of Alaska (Craig and Halderson, 1986, citing Neave, 1964).

Juvenile chum salmon use a wide variety of prey species, including mostly invertebrates (including insects), and gelatinous organisms (NMFS, 2005:Appendix F). Chum salmon eat a variety of foods during their ocean life, e.g., amphipods, euphausiids, pteropods, copepods, fish, and squid larvae. Chum salmon also use gelatinous zooplankton for food more often than other species of salmon.

Chum salmon are subject to the same habitat concerns as other species of salmon, e.g., habitat destruction, pollution (NMFS, 2005:Appendix F). Additionally, chum salmon have two habitat requirements that are essential in their life history that make them very vulnerable: (1) reliance on upwelling ground water for spawning and incubation and (2) reliance on estuaries/tidal wetlands for juvenile rearing after migrating out of spawning streams. In the Noatak River, an arctic drainage just south of Point Hope, chum salmon spawn in areas where intragravel temperatures are 3-5 °C higher than in the mainstem (Craig and Halderson, 1986, citing Merritt and Raymond, 1983). These warmer spawning habitats provide about 1,130 temperature units (centigrade-degree days) between spawning and emergence, compared to only 215 temperature units available elsewhere in the drainage during the same period (Craig and Halderson, 1986). The hydrology of upwelling ground water into stream gravel is highly complex and poorly understood (NMFS, 2005:Appendix F).

D.4.d(3) Distribution and Abundance Trends of Pacific Salmon in the Alaskan Beaufort Sea. The literature largely treats the Beaufort Sea as a population sink for Pacific salmon, in some cases suggesting that none of the salmon species have established sustained populations in waters east of Point Barrow (Bendock and Burr, 1984). Many reports describe salmon as "straying" into the Beaufort Sea (Craig and Halderson, 1986) or comprising only a few isolated spawning stocks of pink and chum salmon (Craig and Halderson, 1986; Fechhelm and Griffiths, 2001). The occurrence of pink and chum salmon in arctic waters probably is due to their relative tolerance of cold water temperatures and their predominantly marine life cycle (Craig and Halderson, 1986, citing Salonius, 1973). The expansion of chinook, sockeye, and coho salmon into the Arctic appears restricted by cold water temperatures, particularly in freshwater environments (Craig and Halderson, 1986). However, the recent range extensions of pink, sockeye, and chum salmon in the Canadian Arctic, as described by Babaluk et al. (2000), indicate that some Pacific salmon may be expanding their distribution in arctic waters, and possibly also their abundance. Babaluk et al. (2000) also note that significant temperature increases in arctic areas as a result of climate warming may result in greater numbers of Pacific salmon in the area.

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

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

D.5. Environmental Justice.

Alaskan Inupiat Natives, a recognized minority, are the predominant residents of the North Slope Borough (NSB), the area potentially most affected by the Beaufort Sea multiple sales and Sale 202 in particular. Effects on Inupiat Natives could occur because of their reliance on subsistence foods, and exploration and development may affect subsistence resources and harvest practices.

Environmental justice is an initiative that culminated with President Clinton's February 11, 1994, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and an accompanying Presidential memorandum. The Executive Order requires each Federal Agency to make the consideration of environmental justice part of its mission. Its intent is to promote fair treatment of people of all races, so no person or group of people shoulders a disproportionate share of the negative environmental effects from this country's domestic and foreign programs.

The Executive Order focuses on minority and low-income people, but the Environmental Protection Agency (USEPA) defines environmental justice as the "equal treatment of all individuals, groups or communities regardless of race, ethnicity, or economic status from environmental hazards" (U.S. Department of Energy, 1997; USEPA, 2006). Specifically, the Executive Order requires an evaluation in an EIS or EA as to whether the proposed project would have "disproportionately high adverse human health and environmental effects...on minority populations and low income populations." The Environmental Justice Executive Order also includes consideration of potential effects to Native subsistence activities and, to this end, MMS continues to maintain a dialogue on Environmental Justice with local communities in this region.

The MMS public process for Environmental Justice outreach and for gathering and addressing Environmental Justice concerns and issues is described in detail in the Beaufort Sea multiple-sale final EIS (USDOI, MMS, 2003). Since 1999, all MMS public meetings have been conducted under the auspices of Environmental Justice. Environmental Justice-related concerns are taken back to MMS management and incorporated into environmental study planning and design, environmental impact evaluation, and the development of new mitigating measures that are incorporated into the EIS or EA.

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, requires Federal agencies to consult with tribal governments on Federal matters that significantly or uniquely affect their communities. In January 2001, a USDOI Alaska Regional Government-to-Government policy was signed by all the USDOI Alaska Regional Directors, including the MMS. In acknowledgement of the importance of consultation, the MMS invites tribal governments to participate in its environmental assessment processes.

The Inupiat People of the North Slope and the Northwest Arctic boroughs have made MMS aware of the potential burden of participating in too many planning and public meetings. Therefore, MMS has taken measures to more carefully plan the number and timing of meetings with regional tribal groups and local governments.

On October 28, 2005, MMS published a notice in the *Federal Register* requesting information for proposed Beaufort Sea Lease Sale 202 and providing a Notice of Intent to prepare an Environmental Assessment for the proposed sale. The *Federal Register* notice stated that the "environmental analysis and the [Consistency Determination] for Sale 202 will focus primarily on new issues that may have arisen since the completion of the EIS for Sales 186, 195, and 202 (February 2003) and on any changes that may have occurred in the State's coastal management plan." Many of these issues were discussed in government-to-government consultation with ICAS and Barrow, Nuiqsut, and Kaktovik tribal governments in a North Slopewide teleconference on March 9, 2006, and the tribal governments of Barrow on March 6, 2006; Nuiqsut on March 8, 2006; and Kaktovik on March 7, 2006. Public meetings with the NSB were held on December 13, 2004; February 1, 2006; and March 6, 2006. Meetings with the Alaska Eskimo Whaling Commission (AEWC) occurred on December 13, 2004, and March 6, 2006. Meetings were held with the city governments of Nuiqsut on March 8, 2006 and Kaktovik May 17, 2005, and March 9, 2006. A Memorandum of Understanding between MMS and the Native Village of Kaktovik formalizing the protocols of consultation and information exchange was signed on March 7, 2006.

Ongoing and new stakeholder issues raised since the completion of the multiple-Sale EIS and the Sale 195 EA include:

- the oil industry's continuing inability to clean up an oil spill in broken ice;
- the need to stage cleanup equipment in local communities to make spill response more timely and to give more local people response training;
- the need for improved monitoring of drilling muds disposal and flaring activities at Northstar;
- the leasing of nearshore areas by the State of Alaska off the Arctic National Wildlife Refuge 1002 area;
- present deferral areas are too small; the need for larger "Quiet Zone" deferral areas in the vicinity of Barrow, Cross Island, and Kaktovik 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;
- the need to reinstate a Cross Island deferral area;
- the need for impact funds to local communities;
- bowhead whales may be deflected from traditional hunting areas due to increased seismic activity in the Chukchi and Beaufort Seas;
- the effects of seismic noise on seals and fish;

- the need to employ monitors and observers from local communities on seismic vessels;
- bowhead whale migration may be deflected from noise caused by small vessels; the noise effects of onshore barge traffic and Canadian shipping on bowhead whales;
- the need to expand conflict avoidance agreements to other resources not considered by the AEWC, such as fishes, bearded seals, walruses, and beluga whales;
- the need for MMS to coordinate with and include the BLM, NMFS, the Coast Guard, and the State of Alaska in its public outreach process—the need for a multiagency working group or coordination team;
- the need for MMS, BLM, and the State of Alaska to coordinate their projects to recognize the linkage of onshore and offshore impacts and cumulative impacts;
- that multiple industrial operations may have a cumulative adverse impact on bowhead whale migration;
- that increased industrial noise levels in the Beaufort Sea will force hunters to travel farther to find whales, and that this may lead to reduced success and an increased struck-and-lost rate for hunters that in turn may cause the IWC to reduce the bowhead whale quota because of potential reduced hunting efficiency;
- the need to reevaluate the oil-spill-risk analysis;
- the need for MMS to revise its significance thresholds for subsistence and sociocultural systems and bring them in line with the MMPA's "no unmitigable adverse impact" definition;
- further analysis of effects on offshore bowhead whale-feeding areas;
- the need to pursue a Memorandum of Understanding with the NSB to ensure that their "Seven Points" concerns are addressed by MMS;
- the need for MMS to deal with potential impacts by instituting stronger mitigation measures and adopting bigger deferral areas;
- include a cumulative effects analysis that addresses the recommendations of the 2003 National Research Council (NRC) Report *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope*;
- the need to reconsider the multiple-sale concept—because of a quickly changing arctic environment and increasing oil and gas activity—and instead prepare a Supplemental EIS instead of an EA for each lease sale;
- the "disconnect" between MMS and the residents of the North Slope on how lease-sale decisions are made;
- the need for an Barrow-based MMS/BLM office;
- the effects of toxins and contaminants in the arctic environment on subsistence foods;
- the effects of global climate change on ice conditions, subsistence resources, and subsistence-harvesting practices in the Alaskan Arctic;
- the increasing distance needed to travel to hunt as the ice edge retreats;
- the need for a Presidential withdrawal on lease sales in the Beaufort and Chukchi seas until controversial issues are satisfactorily addressed.

These issues are addressed in Section IV.C.1.f, Updated Effects on Environmental Justice, of this EA.

D.6. Land Use Plans and Coastal Zone Management.

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

The NSBCP and NSBLMR are intended to guide decisions affecting land use, transportation, fire protection, public facilities, and the economy, as explained in the multiple-sale EIS (USDOI, MMS, 2003:Sec. III.C.5). The major goal is to support development of the villages and natural resources in a way that preserves the Inupiat way of life. Offshore policies are specifically limited to development and uses in the portion of the Beaufort and Chukchi seas that are within the boundary of the NSB. Activities on the OCS would not be subject to the NSBCP or NSBLMR.

D.6.b. Coastal Zone Management. The Federal Coastal Zone Management Act (CZMA) and the Alaska Coastal Management Act were enacted in 1972 and 1977, respectively. Through these acts, development and land use in coastal areas are managed to provide a balance between the use of and the need to protect valuable coastal resources and other uses of the coastal area. The Federal rules governing implementation of the CZMA recently were revised, effective February 2006. The revised rules provide greater transparency and predictability in implementing Federal consistency and fully maintain the authority and ability of coastal States to review proposed Federal actions that would have a reasonably foreseeable effect on any land or water use or natural resource of a State's coastal zone, as provided for in the CZMA.

D.6.c. Alaska Coastal Management Program. The State of Alaska recently amended its ACMP program and adopted new regulations under Title 11, Alaska Administrative Code (AAC), Chapters 110, 112, and 114. The state regulations became effective on October 29, 2004. On December 29, 2005, the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management (OCRM), completed its review and approved the amendments to the ACMP, finding that the amended ACMP meets all requirements of the CZMA.

Under the amended ACMP, all coastal districts including the NSB must revise their local plans to conform to the new Statewide standards. A district's existing coastal management program, including its enforceable policies, remains in effect until March 1, 2007, unless the Alaska Department of Natural Resources (ADNR) disapproves or modifies all or part of the district's program before March 1, 2007. However, any existing district enforceable policy that duplicates, restates, or incorporates by reference a statute or regulation of a Federal or State agency or addresses any matter regulated by the Alaska Department of Environmental Conservation are repealed and declared null and void under State law.

The Statewide standards that may be relevant to hypothesized sale activities are summarized in the following paragraphs under two headings: uses and activities, and resources and habitats.

D.6.c(a) Uses and Activities. Under the uses and activities category, the policies that may be relevant include: (1) coastal development; (2) natural hazard areas; (3) coastal access; (4) energy facilities; (5) utility routes and facilities; (6) sand and gravel extraction; (7) subsistence; and (8) transportation routes and facilities.

The coastal development standard gives priority to development that is water dependent or water related and uses that may be neither of these but for which there is no feasible or prudent inland alternative to meet the public need for the use or activity. The intent of the policy is to ensure that onshore development and activities that could be placed inland do not displace activities dependent upon coastal locations.

Natural hazards are defined under 11 AAC 112.990(15) as natural processes or adverse conditions that present a threat to life or property in the coastal areas from flooding, earthquakes, active faults, tsunamis, landslides, volcanoes, storm surges, ice formations, snow avalanches, erosion, and beach processes. Natural hazards also may include other natural processes or adverse conditions designated by the ADNR or by a district in a district plan. Natural hazards would be considered during review of individual projects when site-specific information is available. Development plans would need to describe natural hazards in the area, identify site-specific factors that might increase risks, and propose appropriate measures to reduce those risks.

The coastal access standard would require appropriate protection to help maintain the continued desirability of public access to, from, and along coastal waters. Minimizing conflicts between subsistence users and oil and gas activities would be a significant factor for maintaining access and use of the coastal area.

The Statewide energy-facilities standard would require that decisions on the siting and approval of energy-related facilities be based, to the extent practicable, on 16 criteria. Practicable as defined in 11 AAC 112.990(18) means feasible in light of overall project purposes after considering cost, existing technology, and logistics of compliance with the standard. The standard also recognizes that the facilities and activities authorized by the issuance of oil and gas leases in a Federal lease sale are uses of State concern.

Utility routes and facilities, unless water dependent or water related, would need to be sited inland to comply with the utility-route and -facilities standard. Utility routes and facilities along the coast would need to avoid, minimize, or mitigate: (1) alterations in surface- and groundwater drainage patterns; (2) disruption in known or reasonably foreseeable wildlife transit; and (3) blockage of existing or traditional access.

Under the Statewide standard, sand and gravel could be extracted from coastal waters, intertidal areas, barrier islands, and spits when no feasible and prudent noncoastal alternative is available to meet the public need. Approval to extract sand and gravel from these areas would require a permit from the U.S. Army Corps of Engineers.

The subsistence policy requires the designation of areas in which subsistence is an important use of coastal resources. A Federal OCS project affecting a designated subsistence-use area would need to avoid or minimize impacts to subsistence uses. An analysis or evaluation of reasonably foreseeable adverse impacts of the project on subsistence use also would be required.

Transportation routes and facilities would need to avoid, minimize, or mitigate: (1) alterations in surface and ground water drainage patterns; (2) disruption in known or reasonably foreseeable wildlife transit; and (3) blockage of existing or traditional access.

D.6.c(b) Resources and Habitats. Three ACMP policies come under the heading of resources and habitats: (1) habitats; (2) air, land, and water quality; and (3) historic, prehistoric, and archaeological resources.

Nine coastal habitats are identified in the habitat standards: (1) offshore areas; (2) estuaries; (3) wetlands; (4) tidelands; (5) rocky islands and sea cliffs; (6) barrier islands and lagoons; (7) exposed high-energy coasts; (8) rivers, streams, and lakes; and (9) important uplands. Each habitat must be managed to protect the physical characteristics, use, or resource for which the habitat is identified. Mitigation under the habitat standard involves a sequencing process:

- first, to avoid adverse impacts to the maximum extent practicable;
- second, when avoidance is not practicable, to minimize adverse impacts to the maximum extent practicable; and
- third, if neither avoidance nor minimization is practicable, to conduct mitigation to the extent appropriate and practicable.

The ACMP defers to the mandates and expertise of the Alaska, Department of Environmental Conservation (ADEC) to protect air, land, and water quality. The standards incorporate ADEC's statutes, regulations, and procedures. The ADEC standards include, but are not limited to:

- prevention, control and abatement of any water, land, subsurface land, and air pollution, and other sources or potential sources of pollution of the environment;
- prevention and control of public health nuisances;
- safeguard standards for petroleum and natural gas-pipeline construction, operation, modification, or alteration;
- protection of public water supplies by establishing minimum drinking water standards, and standards for the construction, improvement, and maintenance of public water-supply systems;
- collection and disposal of sewage and industrial waste;
- collection and disposal of garbage, refuse, and other discarded solid materials from industrial, commercial, agricultural, and community activities or operations;
- control of pesticides; and
- handling, transportation, treatment, storage, and disposal of hazardous wastes.

The policy addressing historic, prehistoric, and archaeological resources requires the designation of areas of the coastal zone that are important to the study, understanding, or illustration of national, State, or local history or prehistory, including natural processes. A project with a properly designated area would need to comply with the applicable requirements of AS 41.35.010 – 41.35.240 and 11 AAC 16.010 – 11 AAC 16.900.

Conclusion. No conflicts with the Statewide standards of the ACMP or with the enforceable policies of the NSBCMP are anticipated. A summary of this analysis is included in Section IV.B.2.f; but, otherwise, land use plans and coastal zone management are not analyzed further in this EA