ENDANGERED SPECIES ACT - SECTION 7 CONSULTATION

BIOLOGICAL OPINION

Action Agency: Department of the Interior; Minerals Management Service

Activity: Construction and Operation of the Liberty Oil Production Island [Consultation No. F/AKR/2001/00889]

Consulting Agency: National Marine Fisheries Service, Alaska Region, Office of Protected Resources

Approved by:

Date: 1-31-2002

This document represents National Marine Fisheries Service's biological opinion (Opinion) on the Minerals Management Service's (MMS) proposed approval of a development and production plan for the construction and operation of the Liberty project in the U.S. Beaufort Sea off Alaska's north coast, and its effects on the endangered bowhead whale, *Balaena mysticetus*, in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA) [16 U.S.C. 1531 et seq.]. Formal section 7 consultation with the MMS was initiated on March 2, 2001.

This Opinion is based on information provided by the MMS in their Draft Environmental Impact Statement (DEIS) on the Liberty Development and Production Plan released in January 2001, the biological assessment dated February 26, 2001, recent research on the effects of oil and gas activities on the bowhead whale, traditional knowledge of Native hunters and the Inupiat along Alaska's north slope, and other sources of information. A complete administrative record of this consultation is on file at the NMFS' Alaska Regional Office, Office of Protected Resources, Anchorage, Alaska [Consultation No. F/AKR/2001/00889].

Consultation History

The Minerals Management Service (MMS) initiated the Endangered Species Act (ESA) section 7 consultation process for the Liberty project on February 19, 1998, requesting information on endangered and threatened species and critical habitat. NMFS' Office of Protected Resources, Alaska Regional Office, subsequently responded to this request. On February 26, 2001, the MMS submitted a biological assessment to NMFS' Alaska

Regional Office and requested formal consultation. Formal section 7 consultation was initiated on the Liberty Project on March 2, 2001.

I. Description of the Proposed Action

British Petroleum Exploration, Alaska (BPXA), proposes to develop and produce oil and gas from the Liberty oil field and has applied to the Minerals Management Service (MMS) for approval of the Liberty Development and Production Plan. Under section 7 of the ESA, NMFS has prepared this biological opinion to evaluate the impacts of the Liberty project on the endangered bowhead whale, and to determine whether activities associated with the Liberty project are likely to jeopardize its continued existence. This biological opinion incorporates much of the information presented within the biological evaluation prepared by MMS as well as pertinent research on the bowhead whale and matters related to oil development. Traditional knowledge and the observations of Inupiat hunters are presented. This knowledge contributes, along with western science, to a more complete understanding of these issues. A reasonable assessment of potential effects can only be made by considering both these systems of knowledge.

The Liberty Prospect is in Federal Outer Continental Shelf (OCS) waters of Foggy Island Bay in the Beaufort Sea northeast of Prudhoe Bay's oil fields. In January 2001, the MMS released a draft Environmental Impact Statement (DEIS) for the proposed development (USDOI, MMS 2001). A complete description of the proposed project can be found in this DEIS, incorporated here by reference. The MMS also prepared a biological evaluation of the Liberty project which addressed the effects of this project on threatened and endangered species.

If approved, the Liberty Project would be a self-contained oil production operation with full processing facilities on a 22.4 acre manmade gravel island. A buried sub-sea pipeline would connect the island with the Trans Alaska Pipeline System. Liberty Island would be located in Foggy Island Bay in 22 feet of water. Ice roads would be built through the life of the project to provide vehicle access to the island during solid-ice conditions. During Liberty construction (starting in December of Year 1 and continuing through project startup in November of Year 3), offshore and onshore ice roads will provide winter access for constructing the island and pipeline. Up to 400 round trips over the roads are forecast daily during winter construction and 400 round trips for each season during drilling. After drilling, this number would drop to 100 each season.

Helicopters, barges or supply boats, and vehicles using ice roads would transport personnel, material, diesel fuel, and facilities to Liberty Island. Seagoing barges would carry large modules and other supplies and equipment from Southcentral Alaska.

The majority of wastes generated during construction and developmental drilling would be drill cuttings and spent muds. Some waste also would be generated during operations from well-workover activities. These drilling fluids would be disposed of through onsite injection into the disposal well or would be transported offsite to permitted disposal wells. BPXA proposes zero discharge of drilling waste to lessen discharges into the Beaufort Sea.

BPXA estimates that the target reservoir may contain 120 million barrels of recoverable oil. Production is expected to continue for about 15 years.

Following depletion of the field, wells would be plugged and abandoned, and production and other surface facilities removed. Disposition of the subsea pipeline would be based on an evaluation of the impacts of the options at the time of abandonment. At a minimum, the portion of the pipeline contained in the island would be removed. Based on the conditions at the time, including relevant permit stipulations, laws, regulations, and policies, BPXA would develop a detailed abandonment plan for agency review and approval. A likely scenario for island abandonment would involve removing island facilities and slope protection, including gravel-filled bags, and allowing the island to erode naturally. The onshore portion of the pipeline, the vertical support members, and other surface equipment would be removed. Abandonment of the landfall and Badami tie-in gravel pads would be determined at that time. Because plans for abandonment remain to be determined, additional section 7 consultation will be necessary for this related action. Additional details on specific aspects of the proposed development and production activities are given below and in the Liberty Development and Production Plan Draft EIS.

Proposed Activities

Major features associated with the development and operation of the Liberty project include:

- construction of a gravel island in 22 feet of water during the second year of development.
- construction of ice roads between the mainland and the island site.
- movement of infrastructure and process modules via sealifts to the island in July/August of Year 2 and Year 3, respectively.
- construction of a 12-inch oil pipeline in Year 3, to be buried in a trench from the island to an onshore landfall. The total pipeline length would be approximately 6.1 miles, with about 4.6 miles offshore.
- development drilling from the first quarter of Year 3 to the first quarter of Year 5.
- start production in Year 4; the economic field life currently is estimated to be approximately 15 years. Average peak production would be 65,000 barrels per day.

Action Area

The action area for purposes of this Biological Opinion is defined as the Alaskan Beaufort Sea, extending from Point Barrow to Demarcation Point and from the Alaska coastline to the edge of the continental shelf. NMFS expects the direct and indirect effects of this action on the endangered bowhead whale to be confined to the action area.

Although additional, indirect effects of the proposed action may extend beyond this action area, such as possible effects associated with vessel traffic from the port of Valdez and to ports receiving petroleum transported from Valdez, we do not believe we would be able to meaningfully measure, detect, or evaluate these effects. As such, those effects are considered "insignificant effects" (as defined in the Interagency Handbook on Section 7 Consultations; NMFS/FWS 1998) and, consequently, will not be included in the action area for the proposed action.

II. Status of Listed Species and Designated Critical Habitat (rangewide)

The MMS biological assessment considered the potential effects of the Liberty project on various species listed or proposed for listing under the ESA. That assessment concluded (for those species for which the NMFS bears responsibility) that the Liberty project was not likely to adversely affect any listed species or critical habitat other than the bowhead whale. Species which MMS determined were not likely to be adversely affected by activities associated with the Liberty project include the Steller sea lion, Upper Columbia River Spring-run chinook salmon, Central Valley California Spring-run chinook salmon, California coastal chinook salmon, Central Valley fall/late-run chinook salmon, Puget Sound chinook salmon, Lower Columbia River chinook salmon, Columbia River chum salmon, Hood Canal summer-run chum salmon, Oregon coast coho salmon, Lower Columbia River/ chinook salmon, Puget Sound/Strait of Georgia coho salmon, Central California coast coho salmon, Ozette Lake Sockeye salmon, Lower Columbia River steelhead, California Central Valley steelhead, South-Central California Coast steelhead, Southern California steelhead, Central California Coast steelhead, Middle Columbia River steelhead, Northern California steelhead, and white abalone.

These species occur in the Gulf of Alaska and/or North Pacific Ocean and were included in MMS' biological assessment because of the secondary impacts of the Liberty project; specifically marine shipment of Liberty crude oil from Valdez, Alaska to southern ports. MMS determined that these species were unlikely to be adversely affected by oil produced at Liberty and transported by tanker to ports on the U.S. west coast or in the Far East. Their determination was based on the reasoning that oil produced from the Liberty project represents a small proportion (1%) of past, present, and reasonably foreseeable future production from the North Slope and the Beaufort Sea and about 1% of potential tanker spills for oil transported by tanker from Valdez. If a spill did occur, MMS determined that it would be unlikely that the above named above named species along transportation routes would be adversely affected. Previous studies show that the chance of one or more spills occurring and contacting land along the U.S. coast adjacent to the Trans-Alaska Pipeline System tanker route is less than or equal to 3% (LaBelle et al., 1996). Based on the combined probabilities which account for the percentage of Liberty crude aboard a vessel, the chance of a spill occurring, and the chance of that spill reaching any of these species is small, MMS determined that potential impacts should be considered as discountable effects under the ESA.

NMFS has reviewed the information in MMS' biological assessment in support of their determination that the above named species are not likely to be adversely affected by the proposed approval of the Liberty Development and Production Plan. Based on this review, and other sources of information, NMFS concurs that Steller sea lions, Upper Columbia River Spring-run chinook salmon, Central Valley California Spring-run chinook salmon, California coastal chinook salmon, Central Valley fall/late-run chinook salmon, Puget Sound chinook salmon, Lower Columbia River chinook salmon, Columbia River chum salmon, Hood Canal summer-run chum salmon, Oregon coast coho salmon, Lower Columbia River/ chinook salmon, Puget Sound/Strait of Georgia coho salmon, Central California coast coho salmon, Ozette Lake Sockeye salmon, Lower Columbia River steelhead, California Central Valley steelhead, South-Central California Coast steelhead, Southern California steelhead, Central California Coast steelhead, Middle Columbia River steelhead, Northern California steelhead, and white abalone may be affected, but are not likely to be adversely affected by activities associated with the development and production of the Liberty Project. Our concurrence is based on our belief that we would not be able to meaningfully measure, detect, or evaluate indirect effects associated with the shipping activities. Since the potential for a spill occurring during shipping of Liberty crude is small and unlikely to occur, we anticipate that effects to listed species associated with the shipping of Liberty crude to be "insignificant" (as defined in the Interagency Handbook on Section 7 Consultations; NMFS/FWS 1998).

NMFS concurs that the only threatened or endangered species under its jurisdiction which may be adversely affected by the proposed Liberty development within the action area is the endangered bowhead whale (*Balaena mysticetus*). Although NMFS is currently evaluating a petition to designate portions of the Beaufort Sea as critical habitat for this species (FR Vol 66, No. 99), critical habitat for this species has not been designated within the action area. Therefore, no designated or proposed critical habitat occurs in the action area for the proposed Liberty Project, so none will be considered in this Opinion.

Status and distribution of Bowhead Whales

The bowhead whale was historically found in all arctic waters of the northern hemisphere. Five stocks are currently recognized by the International Whaling Commission (IWC, 1992:27). Three of these stocks are found in the North Atlantic and two in the North Pacific, some or all of which may be reproductively isolated (Shelden and Rugh, 1995). The Spitsbergen stock is found in the North Atlantic east of Greenland in the Greenland, Kara, and Barents Seas. Thought to have been the most numerous of bowhead stocks (Woodby and Botkin, 1993 estimate the unexploited stock at 24,000 animals), the Spitsbergen bowhead is now severely depleted, possibly in the tens of animals (Shelden and Rugh, 1995).

The Davis Strait stock is found in Davis Strait, Baffin Bay, and along the Canadian Arctic Archipelago. This stock is separated from the Bering Sea stock by the heavy ice found along the Northwest passage (Moore and Reeves, 1993). The stock was estimated to have originally numbered over 11,700 (Woodby and Botkin, 1993) but was significantly reduced by commercial whaling between 1719 and 1915. The stock is today estimated at 350 animals (Zeh et al., 1993) and recovery is described as "at best, exceedingly slow" (Davis and Koski, 1980). Canadian Inuit have recently expressed interest in resuming subsistence hunting of this stock, although the International Whaling Commission (IWC) has not acted on this request.

The Hudson Bay stock is differentiated from the Davis Strait stock by their summer distribution, rather than genetic or morphological differences (Reeves et al., 1983; Reeves and Mitchell, 1990). No reliable estimate exists for this stock, however Mitchell (1977) places a conservative estimate at 100 or less. More recently, estimates of 256-284 whales have been presented for the number of whales within Foxe Basin (Cosens et al. 1997). There has been no appreciable recovery within this stock.

The Okhotsk Sea stock occurs in the North Pacific off the western coast of Siberia near the Kamchatka Peninsula. The pre-exploitation size of this stock may have been 3,000 to 6,500 animals (Shelden and Rugh, 1995), and may now number somewhere in the 300-400 range, although reliable population estimates are not currently available. It is possible this stock has mixed with the Bering Sea stock, although the available evidence indicates the two stocks are essentially separate (Moore and Reeves, 1993).

The Bering Sea stock of the bowhead whale is the only listed species under the jurisdiction of the National Marine Fisheries Service which is known to occur in the action area and which is likely to be adversely affected by the proposed Liberty project. There is no designated critical habitat in the action area. The bowhead whale was listed as a Federal endangered species on June 2, 1970 (35 FR 8495). The Bering Sea stock of bowhead is hunted by native Alaskans of the Alaskan Beaufort Sea coast for subsistence. In 1964, the IWC began to regulate commercial whaling worldwide (Burns et al., 1993:7). The bowhead gained further protection when the ESA and the Convention on International Trade in Endangered Species of wild flora and fauna were passed in 1973. Since 1978, the IWC has imposed a quota on the number of bowheads landed and/or struck by Alaskan natives. The IWC recently allocated the subsistence take of bowheads from the Alaska stock, establishing a 5-year block quota of 280 whales landed. For each of the years 1998-2002, the number of bowheads struck may not exceed 67, except that certain unused quotas may be carried over to subsequent years. Additionally, an annual quota of five bowheads has been granted to the Russian Federation for the Natives of Chukotka.

The Bering Sea stock of bowhead whales was reduced greatly by commercial whaling in the late 19th and early 20th centuries, from an estimated original population of 10,400 to 23,000 (Woodby and Botkin, 1993:403) to a few thousand by about 1910. Whales taken by commercial whaling in the Bering Sea may have been representatives of a population that did not migrate (Bockstoce and Botkin, 1983; Bockstoce, 1986). Shore-based visual surveys conducted at Point Barrow from 1978 through 1983 yielded a population estimate for that period of about 3,500 to 5,300 animals (Zeh et al., 1993:479). The IWC Scientific Committee now recognizes the current population estimate to be 7,992 whales

(95% C.I.: 6,900-9,200) (IWC, 1995). A refined and larger sample of acoustic data from 1993 has resulted in an estimate of 8,200 animals, and is considered a better estimate for this stock (IWC, 1996). An annual rate of increase of 3.1% was computed for the Bering Sea stock.

Bowhead whales are seasonal and transient in the western Beaufort Sea, migrating from west to east in spring and back in fall. Most of the population winters along the ice front and in polynyas (irregular areas of open water) of the central and western Bering Sea (Moore and Reeves, 1993:410). About April or May, whales begin moving north past St. Lawrence Island and through Bering Strait into the southern Chukchi Sea, then north through nearshore lead systems to Point Barrow (Moore and Reeves, 1993:336). Some bowhead whales also move north along the Chukotka coast of Russia. Behavior and timing are fairly consistent with bowheads passing Point Barrow in several "pulses:" the first between late April and early May, a second about mid-May, and a third from late May through early June (Moore and Reeves, 1993:337; A. Brower in USDOI, 1986:49; B. Rexford in MBC, 1997:80). Whaling crews have observed that the migrating whales appear to have 'scouts' which check ice conditions in advance of the main migration (C. Nageak in NSB 1981:296; W. Bodfish in NSB, 1981:297; L. Kingik in NSB, 1981:297). Whaling crews also have noticed that not all bowhead whales migrate into the Chukchi or Canadian Beaufort Seas, but that some bowheads remain near Barrow in summer (H. Brower, Jr. in USDOI, MMS, 1995:40).

Most whales move eastward from Point Barrow through offshore lead systems of the central Beaufort Sea (W. Bodfish in NSB, 1981:295). They appear in leads offshore of the Alaskan Beaufort Sea by early May (W. Bodfish in NSB, 1981:295), but apparently do not stop along the spring migration route (V. Nauwigewauk in NSB, 1981:295; A. Oenga in NSB, 1980:182). However, Shelden and Rugh (1995:13) report some whales feed opportunistically during spring migration, and that the lead system may serve as an important feeding area when oceanographic conditions are favorable. The bowheads arrive in the Canadian Beaufort Sea from about mid-May through mid-June (Moore and Reeves, 1993:314). During migration, bowheads may swim under the ice for several miles, and can break through relatively thin ice (approximately 7 inches [18 cm] thick), to breathe (George et al., 1989:26). It is possible that bowheads use ambient light cues and possibly echos from their calls to navigate under ice and to distinguish thin ice from thick, multi-year floes (MMS, 1995). The spring migration ends at Herschel Island in the Canadian Beaufort Sea (V. Nauwigewauk in NSB, 1981:295).

Most of the bowhead population is concentrated in the Canadian Beaufort Sea between Herschel Island and Amundsen Gulf during summer (Moore and Reeves, 1993:319). Whales begin moving back westward between late August and early October (Richardson et al., 1987:469-471; Miller et al., 1996:18; I. Akootchook in USDOI, MMS, 1995:12). The fall migration, extending into late October some years (Moore and Clarke, 1992:29), also seems to occur in pulses, although the pattern is not as clear as in the spring migration (Ljungblad et al., 1987:53-54; Treacy, 1988:39, 1989:15-35, 1990:13-35; Moore and Reeves, 1993:342). These pulses may constitute age segregations with smaller whales migrating earlier, followed by larger adults and females with young. The first pulse has been observed to consist of hundreds of bowheads in schools like fish (T. Napageak - Pers. Comm., Nuiqsut Whaling Captains Meeting, August 13, 1996:23). These whales are not accompanied by calves (J. Tukle in USDOI, MMS, 1986:21). The second pulse is thought to consist of females with calves (J. Tukle in USDOI, MMS, 1986:20; T. Napageak - Pers. Comm., Nuiqsut Whaling Captains Meeting, August 13, 1996:22). Fall migration generally occurs south of the pack ice and closer inshore than the spring migration (Moore and Reeves, 1993:342). Bowhead whales 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 for social reasons (W. Bodfish in NSB, 1981:296; S. Akootchook in USDOI, MMS, 1995:18).

Fall surveys show that the median water depth at bowhead whale sightings (1982-1995) between 141˚W to 146˚W longitudes is 138 ft (42 m) (Treacy, 1991:53, 1992:55, 1994:65, 1996:55). During fall migration, whales are found close inshore east of Barter Island and from Cape Halkett to Point Barrow (Moore and Reeves, 1993:335), generally in water depths less than 164 ft (50 m) (Treacy, 1991:49-53; 1992:55; 1994:65). Bowheads take about 2 days to travel from Kaktovik to Cross Island, reaching the Prudhoe Bay area by late September (T. Napageak - Pers. Comm., Nuiqsut Whaling Captains Meeting, August 13, 1996:23; A. Oenga in NSB, 1980:182). From Cross Island it takes the whales another 5 days to reach Point Barrow (T. Napageak - Pers. Comm., Nuiqsut Whaling Captains Meeting, August 13, 1996:22). Inupiat believe that whales follow the ocean currents carrying food organisms. If the currents go close to Cross Island, whales migrate near there (T. Napageak - Pers. Comm., Nuiqsut Whaling Captains Meeting, August 13, 1996:13). In the region immediately east of the project area, bowheads reportedly travel on the inshore side of Cross Island (V. Nageak in Shapiro and Metzner, 1979:A-II-23). It has also been reported that whales are seen inside the barrier islands near Cross Island practically every year and are sometimes seen between Seal Island and West Dock (F. Long, Jr. - Pers. Comm., Nuiqsut Whaling Captains Meeting, August 13, 1996:14-15). During years when a fall storm pushes ice up against the barrier islands in the Beaufort Sea, bowheads may migrate on the shoreward (lagoon) side of Cross Island, the Midway Islands, and No Name Island. Also, crews looked for whales inside the barrier islands during the years of commercial whaling (T. Brower, Sr., in NSB, 1980:107). However, aerial surveys from 1980 to 1995 have not documented that bowheads migrate inshore of Cross Island (Miller et al., 1996:3-12).

Bowhead whales may swim very close to shore on some occasions (Rexford, 1996; I. Akootchook in USDOI, MMS, 1979:6). Bowheads have been observed feeding not more than 1,500 ft (457 m) offshore in about 15 to 20 ft (4.6 to 6 m) of water (A. Brower in USDOI, MMS, 1979:6; H. Rexford in USDOI, MMS, 1979:16). Smaller whales may swim in water depths of 14 to 18 ft (4.3 to 5.5 m) (T. Brower in NSB, 1980:107). Inupiat whaling crews have noticed that whale migration appears to be influenced by wind patterns, moving when winds start up and stopping when they are slow (P. Tukle in USDOI, MMS, 1986:24). From Point Barrow, whales migrate back southward through the Chukchi Sea to wintering grounds in the Bering Sea (Moore and Clarke, 1992:31-32).

Fall surveys conducted in the Northstar project area (near Cross Island) from 1979 through 1995 recorded the occurrence of bowheads from the barrier islands to about 75 miles (120 km) offshore, with most sighted 6.2 to 37.2 miles (10 to 60 km) offshore in water depths of 33 to 328 ft (10 to 100 m) (Miller et al., 1996:14-33). In general, bowhead whales seemed to migrate closer to shore in light ice years and farther offshore in heavy ice years, with distributions peaking at 19 to 25 miles (30 to 40 km) and 37 to 43.5 miles (60 to 70 km), respectively (Miller et al., 1996:35). From 1979 to 1986, Ljungblad et al., (1987:136-137) observed that fall migration extended over a longer period, and sighting rates were larger and peaked later in the season in years of light ice cover compared to years of heavy ice cover (Moore and Reeves, 1993:342).

It is difficult to survey spring-migrating bowhead whales effectively, because usually no well defined lead system is present east of the Colville River (Moore and Reeves, 1993:319). Therefore, only occasional observations of bowhead whales have been made during spring, usually in small cracks or holes (Moore and Reeves, 1993:317). However, the spring lead system is generally north of the Liberty project area.

In contrast, fall migration routes in the Beaufort Sea have been reasonably well documented. Aerial surveys conducted by MMS across the Beaufort Sea during fall migration suggest that bowhead whales only seldom migrate through or near the project area. Inupiat whalers question the results of aerial censuses of bowhead whales conducted by MMS in the Beaufort Sea. For example, whaling crews sighted 23 bowheads in the Kaktovik region during the fall of 1983 in contrast to 5 whales sighted by MMS aircraft (J. George in USDOI, MMS, 1983:58-59).

Little is known regarding age at sexual maturity or mating behavior and timing for bowheads. It is assumed that mating takes place in late winter and spring (Koski et al., 1993:248), perhaps continuing through the spring migration (Koski et al., 1993:228). Most calves are born from April through early June during the spring migration, with a few calves born as early as March and as late as August (Koski et al., 1993:250). Calves are about 13 to 15 ft (4 to 4.5 m) at birth and reach 42 to 66 ft (13 to 20 m) as adults. Females produce a single calf, probably every 3 to 4 years (Koski et al., 1993:254).

Bowheads are filter-feeders, sieving prey from the water by means of baleen fibers in their mouth. They feed almost exclusively on zooplankton from the water column, with primary prey consisting of copepods (54%) and euphausiids (42%), as indicated from stomach analyses of whales taken in the Alaskan Beaufort Sea (Lowry, 1993:201-238). Other prey include mysids, hyperiid and gammarid amphipods, other pelagic invertebrates, and small fish. Bowheads feed heavily in the Canadian Beaufort Sea and Amundsen Gulf area during summer, and feeding is also known to occur during the fall migration through the Alaskan Beaufort Sea (Alaska Clean Seas, 1983:27; Ljungblad et al., 1987:53; Lowry, 1993:222). In surveys conducted from 1979 through 1987, concentrations of feeding bowheads were observed east of Point Barrow and just north of

Harrison Bay during some years (Ljungblad et al., 1987:53). The majority of whales harvested during fall at Barrow have had food in their stomachs. Observations of feeding bowheads in 1998 found the whales feed primarily along the Alaskan coast near Kaktovik, but that feeding locations vary among years (Richardson and Thomson, 1999). The area near and east of Kaktovik is another area where feeding is frequently seen during September, though not in all years. Most bowheads harvested at Kaktovik have food in their stomachs. Specific feeding areas near Kaktovik may vary between years. Most feeding observed during studies in the eastern Beaufort Sea occurred over the continental shelf, often in the inner shelf (ibid). However, a study on the importance of the eastern Beaufort Sea to feeding Bowhead whales indicated that, for this stock, food resources consumed there did not contribute significantly to the whales' annual energy needs (Richardson, 1987). The Science Advisory Committee of the North Slope Borough reviewed this study, and found the study design was insufficient to properly address the stated hypothesis; that food resources in the Eastern Beaufort Sea do not contribute significantly to the energy requirements of the Western Arctic bowhead stock (NSB, 1987). The Advisory Committee found that, while this research contributed to a growing understanding of the environment of the Eastern Beaufort Sea, it did not constitute an irrefutable evaluation of the importance of the region to the stock as a whole or to selected members of the population. Much of the concern identified was due to the short duration of this study. Additional research on the importance of the eastern Beaufort as feeding habitat is currently being done by the Minerals Management Service. Carbon isotope analysis has indicated that a significant amount of feeding may occur in wintering areas of the Chukchi and Bering Seas (Schell et al., 1987; Schell, 1998). The barrier islands all along the Beaufort Sea coast are considered by local residents an important resource to the bowhead whale for use as staging and feeding areas (M. Pederson in USACE, 1996:51).

The summer distribution of bowheads within the Beaufort Sea is determined primarily by prey density and distribution, which in turn are responsive to variable current and upwelling patterns (LGL and Greene ridge. 1987:2-3). Sub-adult bowheads were observed to feed in water depths less than 164 ft (50 m) in the Canadian Beaufort Sea (Richardson et al., 1987:468-469). However, little is known about adult feeding behavior in the Canadian Beaufort.

Bowheads have extremely sensitive hearing. For example, they are capable of detecting sounds of icebreaker operations at a range of up to 31 miles (50 km) (Richardson, 1996:108). It has been suggested that such sensitive hearing also allows whales to use reverberations from their low frequency calls to navigate under the pack ice and to locate open water polynyas where they surface (Ellison et al., 1987:332). Bowheads exhibit avoidance behavior at many manmade sounds, but there is still considerable debate regarding their range of sound detection (Richardson et al., 1995a:263). It is well known among Inupiat hunters that bowhead whales are extremely sensitive to noise (H. Rexford in USDOI, MMS, 1979:13; R. Ahkivgak in NSB, 1980:103; H. Ahsogeak in NSB, 1980:104; T. Brower in NSB, 1980:107; H. Brower in USDOI, MMS, 1990:10). Communications among whales during migration and in response to danger also has been observed to alter migration patterns (A. Brower in USDOI, MMS, 1986:49; T. Napageak in USDOI, MMS, 1995:13). Whaling crews have observed that disturbances to migration as a result of a strike are temporary (J.C. George in USACE, 1996:64).

Generally, the vocalizations of bowhead whales are low, less than 400 hertz (Hz) frequency-modulated calls; however, their call repertoire also includes a rich assortment of amplitude-modulated and pulsed calls with energy up to at least 5 kilohertz (Wursig and Clark, 1993:176). Calls and songs have been suggested to be associated with different contexts and whale behavior. Observations have been made that support the theory that calls are used to maintain social cohesion of groups. For instance, loud frequency-modulated calls were heard as a mother and a calf rejoined after becoming separated during summer feeding (Wursig and Clark, 1993:189). Once the two were together again, calling stopped (Wursig and Clark, 1993:189). During spring migration off Point Barrow, there have been several instances when individual whales repeatedly produced calls with similar acoustic characteristics (Clark et al., 1987:345). Bowhead whales have been noted to produce signature calls lasting for 3 to 5 minutes each and continuing up to 5 hours (Wursig and Clark, 1993:189). Different whales produce signature calls as they counter call with other members of their herd. It has been suggested that calling among bowhead whales may aid in migration of the herd and that the surface reverberation of the sound off the ice may allow these whales to discriminate among areas through which they can and cannot migrate (Ellison et al., 1987; Wursig and Clark, 1993:190).

It has been speculated that bowheads are able to locate leads and open water along the marginal ice zone in winter by using acoustics (Moore and Reeves, 1993:353). Although bowheads are morphologically adapted to their ice-dominated environment and can break holes in the ice to breathe, they may use vocalization to assess ice conditions in their path. For example, the intensity of reflected calls is as much as 20 decibels (dB) higher from ice floes with deeper keels than from relatively flat, thin ice (Ellison et al., 1987:329). Bowheads may use such differences in intensity of reflected calls to differentiate between deep keel ice floes and flat, thin ice.

Bowhead whales have no known predators in the Bering Sea, except perhaps killer whales (*Orcinus orca*). Such attacks in the Bering Sea have occurred, but their frequency is reported as low. The frequency of attacks by killer whales in the Beaufort Sea is not well documented (George et al., 1994). Little is known about naturally occurring disease and death among bowhead whales. While certain viral agents are present in this stock, it is unknown how much they may contribute to natural mortality or reduced reproduction (Philo et al., 1993).

Bowheads are harvested by Inupiat in the Alaskan Beaufort, Bering, and Chukchi Seas. The total Alaskan subsistence harvest of bowheads between 1978 and 1991 ranged from 8 in 1982 to 30 in 1990, averaging 18 per year. From 1991 to 1995, a combined average of 19.4 bowhead whales per year were taken by the communities of Barrow, Nuiqsut, and Kaktovik (USDOI, MMS, 1996:Table III.C.3-4). The combined spring and fall harvest for 1998 was 41 whales landed and 12 struck and lost. In addition to the subsistence harvest, other man-induced impacts may contribute to morbidity and mortality. Commercial fishing occurs in the Bering Sea and elsewhere within the range of this stock. Interaction with fishing gear is rare, however whales with ropes caught in their baleen and with scarring caused by rope entanglement have been reported (Philo et al., 1993; NMML, unpubl. data). No incidental takes of bowheads have occurred in U.S. waters (Small and DeMaster, 1995). George et al., (1994) report three documented ship strike injuries observed among 236 bowheads taken in subsistence hunts. Man made noise in the marine environment is increasing with industrialization of the Alaskan arctic, and may impact these whales to an unknown degree. Presently there is insufficient evidence about cumulative and long-term effects of anthropogenic noises (Richardson and Malme, 1993). Exposure to oil spills may have direct adverse consequences to bowheads, or predispose some whales to infection or injury.

III. Environmental Baseline

The environmental baseline considers the status and habitat of a species within the action area. The occurrence, numbers, and habitat use of the bowhead whale within the Alaskan Beaufort Sea (the action area) has been described in the previous section. This section will provide an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including any designated critical habitat), and ecosystem, within the action area.

Aerial surveys near the Liberty project site in 1997 (BPXA, 1998) showed that the primary fall migration route was offshore of the barrier islands, outside the development area. However, a few bowheads were observed in lagoon entrances between the barrier islands and in the lagoons immediately inside the barrier islands. Because survey coverage in the nearshore areas was more intensive than in offshore areas, maps and tabulations of raw sightings may overestimate the number of whales seen in nearshore areas relative to offshore areas. Nevertheless, these data provide information on the presence of bowhead whales near Liberty during the fall migration. A review of MMS bowhead aerial survey data for 1987-1999 found that effort had not observed bowhead whales in the Liberty project area; most sightings in the general locale being outside the barrier islands. From these data, few whales would be expected to be found within 10 kilometers (6 miles) of the proposed Liberty Island location.

There are several anthropogenic factors which may affect the bowhead whale within the action area. These include oil and gas exploration and/or production activity within Federal and State of Alaska waters and along the Alaskan North Slope, shipping and vessel traffic, and Inupiat subsistence hunting.

The Northstar Project is an offshore field in that includes both Federal and State of Alaska leases. The Northstar reservoir contains an estimated 260 million barrels of oil and has an estimated operational life of 15 years. A Final EIS has been completed for the Northstar Project, the second offshore field scheduled for development and production in the Beaufort Sea. Construction activities for Northstar began during the 1999-2000 winter season. Northstar is being developed on a gravel island as a self-contained development/ production facility, similar to Liberty. The gravel production island was constructed during the winter in 39 feet of water on the remains of Seal Island, which is on a State lease about 6 miles offshore of Point Storkersen. A buried pipeline between Northstar and Point Storkersen was constructed during the winter from ice roads. BPXA intends to drill 15 production wells, 7 injection wells, and 1 disposal well initially, with 14 additional well slots to allow for reservoir uncertainties. Additional information about Northstar can be found in the Final EIS, which is incorporated here by reference (USACE, 1999). Most-probable estimates of the annual level of incidental take of bowhead whales due to the Northstar project are 173 whales, with a maximum of 1,533 (FR 34014, May 25, 2000). These takes would be by harassment due to noise, and are described in the NMFS's Biological Opinion for that action (USDOC, 1999).

The Endicott project, in Prudhoe Bay, is the first offshore production facility developed in the Beaufort Sea. Endicott has been producing oil since 1987. Endicott is located on a manmade gravel structure inside the barrier islands in relatively shallow water. Support traffic is over a gravel causeway that also contains the pipeline to shore. There are no estimates of potential takes of bowhead whales due to noise from this facility, nor are there data on the noise levels Endicott may introduce into the Beaufort Sea.

Marine-based geophysical exploration occurs in the Beaufort Sea during ice-free periods, normally from July to October. High energy and low energy (resolution) seismic studies occur. Low-resolution seismic, such as on-bottom cable (OBC) or 3-D employs a towed array of airguns which fire bursts of compressed air downwards in short, discontinuous pulses. Cables containing hydrophones are placed on the seafloor and detect reflected pulses which indicate underlying strata. Seismic exploration using OBC technologies has occurred annually in the Beaufort since 1996. Monitoring studies of 3-D seismic exploration (6-18 airguns totaling 560-1500 cubic inches) in the nearshore Beaufort Sea during 1996-1998 have demonstrated that nearly all bowhead whales will avoid an area within 20 km of an active seismic source, while deflection may begin at distances up to 35 km. Sound levels received by bowhead whales at 20 km ranged from 117-135 dB re 1 μPa rms and 107-126 dB re 1 μ Pa at 30 km. The received sound levels at 20-30 km are considerably lower than have previously been shown to elicit avoidance in bowhead or other baleen whales exposed to seismic pulses. As many as 800 bowheads may have migrated within 20 n. mi. of the seismic operation in 1997, and may have been exposed to seismic sounds. Inupiat whalers have observed the effects of seismic on bowhead whales for years, and have testified that whales begin to deflect from normal migratory paths at distances of 35 miles from an active seismic operation, and are displaced from their normal migratory path by as much as 30 miles (USDOI, MMS, 1997). Currently, only a single geophysical seismic program is conducted in the Beaufort during the open water period. The NMFS has authorized this activity to incidentally take bowhead whales, by harassment due to noise. NMFS estimates this OBC program may take 1,300 bowheads annually, based on the 20 km criterion. This is the most probable estimate of take, while the maximum estimate would be 2,630.

NMFS has also received application for a small take authorization concerning a shallow hazards survey in the Beaufort Sea during the 2001 open water season. This survey is associated with route alternative selection for a proposed gas pipeline between Alaska and the lower 48 states. The work would employ two source vessels working between Prudhoe Bay and the Canadian McKenzie. The vessels would use low power, high frequency equipment to characterize the sediments along the route. Most of this work should occur at times when bowhead whales are not present in the U.S. Beaufort Sea, although work in Canadian waters will occur during periods of summer residency by bowheads. The work may be detectable to bowhead whales, and NMFS estimates the most probable level of annual take as 285 whales (20 km criterion), with a maximum take estimated at 1,601.

The State of Alaska is currently leasing State lands for oil and gas exploration and production. There has been one State sale in the Beaufort Sea (Sale 86 Central in 1997), while three area wide sales are planned for 1999 through 2001.

The Marine Mammal Protection Act and Endangered Species Act provide an exemption to Alaskan Natives for the subsistence harvest of bowhead whales. Bowheads are taken in the northern Bering Sea and in the Chukchi Sea during their northern migration, and in the Beaufort Sea during their return in the fall. The harvest quota for this hunt is established by the International Whaling Commission (IWC), and is currently set at 67 strikes per year through 202, with a 5-year block quota numbering 280 animals. The number of whales actually struck each year varies, with 1995, 1996, and 1997 totals of 57, 44, and 60 whales, respectively. The IWC's Scientific Committee determined a limit of 75 bowhead strikes per year would allow the population to increase at a rate of 1.46 per cent, or 120 animals. While struck and lost animals are considered as mortalities under quota, evidence exists of whales surviving strikes. Additionally, the Alaska Eskimo Whaling Commission reports strike efficiency has improved in recent years (Suydam et al., 1997).

IV. Effects of the Proposed Action on Bowhead Whales

Development and Production activities associated with offshore oil and gas activities on the Alaska OCS may create the potential for some disturbance and harassment of endangered bowhead whales. Those activities associated with the offshore development and production of the Liberty project in the Beaufort Sea include the expected production of noise from construction, drilling, and use of aircraft and support vessels. Although not expected, the development and production of the Liberty project could result in an accidental oil spill. This section examines these activities, and assesses their potential to adversely effect endangered bowhead whales.

A. Potential effects associated with Noise and Disturbance

There is concern that manmade noise affects bowheads by raising background noise levels, which could interfere with detection of sounds from other bowheads or from important natural sources, or by causing disturbance reactions, which could cause the migration route to be displaced farther from shore.

Sound is transmitted efficiently through water. Hydrophones often detect underwater sounds created by ships and other human activities many kilometers away, far beyond the distances where human activities are detectable by senses other than hearing. Sound transmission from noise-producing sources is affected by a variety of things, including water depth, salinity, temperature, frequency composition of the sound, ice cover, bottom type, and bottom contour. In general terms, sound travels farther in deep water than it does in shallow water. Sound transmission in shallow water is highly variable, because it is strongly influenced by the acoustic properties of the bottom material, bottom roughness, and surface conditions. Ice cover also affects sound propagation. Smooth annual ice cover may enhance sound propagation compared to open-water conditions. However, as ice cracks and roughness increases, sound transmission generally becomes poorer than in open water of equivalent depth. The roughness of the under-ice surface becomes more significant than bottom properties in influencing sound-transmission loss (Richardson and Malme, 1993).

Marine mammals use calls to communicate and probably listen to natural sounds to obtain information important for detection of open water, navigation, and predator avoidance. Baleen whale hearing has not been studied directly. There are no specific data on sensitivity, frequency or intensity discrimination, or localization (Richardson et al., 1995). For each species, the frequency range of reasonably acute hearing in baleen whales likely includes the frequency range of their calls. Most baleen whale sounds are concentrated at frequencies less than 1 kilohertz, but sounds up to 8 kilohertz are not uncommon (Richardson et al., 1995). Most calls emitted by bowheads are in the frequency range of 50-400 Hertz, with a few extending to 1,200 Hertz. The frequency range in songs can approach 4000 Hertz (Richardson et al., 1995). Based on indirect evidence, at least some baleen whales are quite sensitive to frequencies below 1 kilohertz but can hear sounds up to a considerably higher but unknown frequency. Most of the manmade sounds that elicited reactions by baleen whales were at frequencies below 1 kilohertz (Richardson et al., 1995). Some or all baleen whales may hear sounds at frequencies well below those detectable by humans. Even if the range of sensitive hearing does not extend below 20-50 Hertz, whales may hear strong infrasounds at considerably lower frequencies. Based on work with other marine mammals, if hearing sensitivity is good at 50 Hertz, strong infrasounds at 5 Hertz might be detected (Richardson et al., 1995).

There also is speculation that, under some conditions, extremely loud noise might cause temporary or permanent hearing impairment of bowheads (Kryter, 1985, as cited in Richardson and Malme, 1993). According to Richardson and Malme (1993), there is no evidence that noise from routine human activities (aside from explosions) would permanently cause negative effects to a marine mammal's ability to hear calls and other natural sounds. Given their mobility and avoidance reactions, it is unlikely that whales would remain close to a noise source for long. Also, baleen whales themselves often emit calls with source levels near 170-180 decibels re 1 microPascal (dB re 1µPa) comparable to those from many industrial operations. It is unknown whether noise pulses from nonexplosive seismic sources, which can be much higher than 170-180 decibels, are physically injurious at any distance. The avoidance reactions of bowheads to approaching seismic vessels normally would prevent exposure to potentially injurious noise pulses.

The zone of audibility is the area within which a marine mammal can hear the noise. The ability of a mammal to hear the sound, such as from seismic operations, depends upon its hearing threshold in the relevant frequency band and the level of ambient noise in that band. The radius of the zone of audibility also depends upon the effective source level of the seismic pulse for horizontal propagation and on the propagation loss between the source and the potential receiver. The zone of responsiveness around a noise source is the area within which the animal would react to the noise. This zone generally is much smaller than the zone of audibility. The distance at which reactions to a particular noise become evident varies widely, even for a given species. A small percentage of the animals may react at a long distance, the majority may not react unless the noise source is closer, and a small percentage may not react until the noise source is even closer still. The activity of a whale seems to affect how a whale will react. In baleen whales, single whales that were resting quietly seemed more likely to be disturbed by human activities than were groups of whales engaged in active feeding, social interactions, or mating (Richardson et al., 1995). Habitat or physical environment of the animal also can be important. Bowhead whales whose movements are partly restricted by shallow water or a shoreline sometimes seem more responsive to noise (Richardson et al., 1995).

There is little information regarding visual or olfactory effects to bowhead whales. Richardson et al., (1995) stated that Inupiat whalers hunting from the ice-edge find that bowhead whales are alarmed by the sight or sound of humans or human activities (Carroll and Smithhisler, 1980, as reported in Richardson et al., 1995). They also commented that gray whales probably would react to visual cues as well as sound when very close to an actual industrial site, indicating that bowheads may react similarly. Based on this information, we believe it is unlikely that bowheads' olfactory or visual senses would be affected by activities associated with the Liberty project, considering that its location is shoreward of the barrier islands, well removed from the bowhead migration route, and the fall migration route is through a relatively open Beaufort Sea compared to a fairly confined lead system during the spring migration.

1. Potential effects of noise associated with from Drilling Activities

Although underwater sounds from drilling on some artificial islands and caissons have been measured, we have little information about reactions of bowheads to drilling from these structures. Underwater noise levels from drilling operations on natural barrier islands or artificial islands are low and are not audible beyond a few kilometers (Richardson et al., 1995). Noise is transmitted very poorly from the drill rig machinery through land into the water. Even under open-water conditions, drilling sounds are not detectable very far from the structure. Noise associated with drilling activities varies considerably with ongoing operations. The highest documented levels were transient pulses from hammering to install conductor pipe. Stationary sources of offshore noise (such as drilling units) appear less disruptive to bowhead whales than moving sound sources (such as vessels). Some bowheads in the vicinity would be expected to respond to noise from drilling units by slightly changing their migration speed and swimming direction to avoid closely approaching these noise sources. Miles et al., (1987) predicted that the zone of responsiveness of bowhead whales to continuous noise sources from drilling from an artificial-island drilling site where roughly half of the bowheads are expected to respond to noise is a radius of 0.02-0.2 kilometers (0.012-0.12 miles) when the signal-to-noise ratio (S:N) is 30 decibels. (The S:N is the ratio of industrial noise to ambient noise. In this example, the industrial noise is drilling at an artificial island). A smaller proportion would react when the S:N is about 20 decibels (at a greater distance from the source), and a few may react at an S:N ratio even lower or at a greater distance from the source. By comparison, the authors predicted that roughly half of the bowheads are expected to respond at a distance of 1-4 kilometers (0.62-2.5 miles) from a drillship drilling when the S:N is 30 decibels.

Richardson and Malme (1993) point out that the data, although limited, suggest that bowheads react less dramatically to stationary industrial activities producing continuous noise, such as stationary drillships, than to moving sources, particularly ships. Most observations of bowheads tolerating noise from stationary operations are based on opportunistic sightings of whales near ongoing oil-industry operations, and it is not known whether more whales would have been present without those operations.

In Canada, bowhead use of the main area of oil-industry operations within the bowhead range was low after the first few years of intensive offshore oil exploration (Richardson, Wells, and Wursig, 1985), suggesting perhaps cumulative effects from repeated disturbance may have caused the whales to leave the area. In the absence of systematic data on bowhead summer distribution until several years after intensive industry operations began, it is arguable whether the changes in distribution in the early 1980’s were greater than natural annual variations in distribution, such as responding to changes in the location of food sources. Ward and Pessah (1988) concluded that the available information from 1976-1985 and the historical whaling information do not support the suggestion of a trend for decreasing use of the industrial zone by bowheads as a result of oil and gas exploration activities. They concluded that the exclusion hypothesis is likely invalid.

The activity of a whale seems to affect how a whale will react. In baleen whales, single whales that were resting quietly seemed more likely to be disturbed by human activities than were groups of whales engaged in active feeding, social interactions, or mating (Richardson et al., 1995). Migrating bowhead whales in the fall may be slightly more responsive to noise from drilling operations than summering bowheads. This may be due in part to greater variability of noise from the drill site in the fall, including variable activities of icebreakers and other support vessels. Habitat or physical environment of the animal also can be important. Bowhead whales whose movements are partly restricted by shallow water or a shoreline sometimes seem more responsive to noise (Richardson et al., 1995).

Greene (1997) measured underwater sounds under the ice at Liberty from drilling operations on Tern Island in Foggy Island Bay (approximately 2.4 kilometers east of the proposed location of Liberty Island) in February 1997. Sounds from the drill rig were generally masked by ambient noise at distances near 2 kilometers. The strongest tones were at frequencies below 170 hertz, but the received levels diminished rapidly with increasing distance and dropped below the ambient noise level at ranges of about 2 kilometers. Drilling sounds were not evident at frequencies above 400 hertz, even at distances as close as 200 meters from the drill rig.

Greene noted that if production proceeds at Liberty, the types and frequency characteristics of some of the resulting sounds would be similar to those from the drilling equipment in this study. Electric power generation, pumps, and auxiliary machinery again would be involved, as would a drill rig during the early stages of production. However, the production island also would include additional processing and pumping facilities. If the production equipment requires significantly more electric power, its generator sounds may be received at greater distances. These sounds would diminish rapidly with increasing distances due to high spreading losses (35 dB per tenfold change in range) plus the linear attenuation rates of 2-9 dB per kilometer (0.002-0.009 dB per meter). Sound transmission within the lagoon for activities at Liberty would be similar to the sound transmission measured for activities at Tern Island, but the barrier islands to the north and the lagoon's very shallow water near those islands should make underwater sound transmission very poor beyond the islands and into the Beaufort Sea.

Greene (1998) measured ambient noise and acoustic transmission loss underwater at Liberty Island in Foggy Island Bay during the open-water season of 1997 to complement transmission loss and ambient noise measurements made under the ice at Liberty in February 1997. The levels were consistent with other ambient noise measurements made in similar locations at similar times of the year. The measured ambient levels in winter generally were lower than those measured in summer, which means that industrial sounds would be expected to be detectable at greater distances during the winter. Bowheads are not present in the winter.

Richardson et al., (1995) summarized that noise associated with drilling activities varies considerably with ongoing operations. The highest documented levels were transient pulses from hammering to install conductor pipe. Underwater noise associated with drilling from natural barrier islands or manmade islands is generally weak and is inaudible at ranges beyond a few kilometers. Richardson et al., (1995) estimated that drilling noise generally would be confined to low frequencies and would be audible at a range of 10 kilometers only during unusually quiet periods, while the audible range under more typical conditions would be approximately 2 kilometers.

Because the bowhead whale migration corridor is 10 kilometers or more seaward of the barrier islands, we do not expect that drilling and production noise from the Liberty project will reach most of the migrating bowhead whales (BPXA, 1998). In the general Prudhoe Bay area, the southern edge of the main migration route is about 20 kilometers offshore for bowheads (Moore and Reeves, 1993; Miller et al., 1997; BPXA, 1998), although some whales do migrate closer to the barrier islands. The closest reported sighting of a bowhead whale in one of the lagoon entrances or inside the barrier island was more than 10 kilometers from the proposed Liberty site, beyond the distance that noise is likely to be audible (Davis et al., 1985; Johnson et al., 1986; Greene, 1997, 1998). Based on this information, we anticipate that few, if any, bowhead whales will be present near Liberty Island due to its location and the water depth. It is unlikely that the few individual bowhead whales which may detect noise associated with the drilling activities will respond in a way that will affect their ability to successfully maintain essential behaviors.

2. Potential Effects of Noise and Disturbance from Vessel Traffic

Vessel traffic could affect bowhead whales. According to Richardson and Malme (1993), most bowheads begin to rapidly swim away when vessels approach rapidly and directly. Avoidance usually begins when a rapidly approaching vessel is 1-4 kilometers (0.62-2.5 miles) away. In one instance, seven interaction incidents between bowhead whales and vessels were observed from a circling aircraft. The vessels ranged from a 13-meter diesel-powered fishing boat to small ships. A few whales may react at distances from 5-7 kilometers (3-4 miles), and a few whales may not react until the vessel is less than 1 kilometer (less than 0.62 miles) away (Richardson and Malme, 1993). Received noise levels as low as 84 decibels re 1 µPa or 6 decibels above ambient noise may elicit strong avoidance of an approaching vessel at a distance of 4 kilometers (2.5 miles) (Richardson and Malme, 1993).

In the Canadian Beaufort Sea, bowheads observed in vessel-disturbance experiments began to orient away from an oncoming vessel at a range of 2-4 kilometers (1.2-2.5 miles) and to move away at increased speeds when approached closer than 2 kilometers (1.2 miles) (Richardson and Malme, 1993). Vessel disturbance under experimental conditions caused a temporary disruption of activities and sometimes disrupted social groups, when groups of whales scattered as a vessel approached. Reactions to slow-moving vessels, especially if they do not approach directly, are much less dramatic. Bowheads are often more tolerant of vessels moving slowly or in directions other than toward the whales. Fleeing from a vessel generally stopped within minutes after the vessel passed, but scattering may persist for a longer period.

Observations made in the central Beaufort Sea during the fall were similar. Koski and Johnson (1987) reported that bowheads 1-2 kilometers to the side of the track of an approaching oil-industry supply vessel swam rapidly away to a distance of 4-6 kilometers from the vessel's track. After some disturbance incidents, at least some bowheads return to their original locations (Richardson and Malme, 1993). Koski and Johnson (1987) reported some individually recognizable bowheads returned to feeding locations within 1 day after being displaced by boats. Whether they would return after repeated disturbances is not known. Some whales may exhibit subtle changes in their surfacing and blow cycles, while others appear to be unaffected. Bowheads actively engaged in social interactions or mating may be less responsive to vessels. Bowheads that are actively migrating may react differently than bowheads that are engaged in feeding or socializing.

There will be annual marine-vessel traffic transporting supplies between Prudhoe Bay or Endicott and Liberty during the open-water season from July through September. This vessel traffic likely will occur shoreward of the barrier islands between Prudhoe Bay or Endicott and Liberty Island and is not likely to affect bowhead whales. An estimated 150 local round trips by marine vessels could occur during the summer construction period. An estimated four to five trips per year by marine vessels could occur during the drilling and production period. Vessel traffic outside the barrier islands is likely to be minimal. The process modules and permanent living quarters would be transported to the site on seagoing barges during the open-water season, after the island is constructed. Two sealifts are planned. Infrastructure would be sealifted to the island in Year 2 and process modules in Year 3. This barge traffic is likely to be part of the sealift and probably would be the only vessel traffic associated with the project that will occur outside the barrier islands east of Prudhoe Bay. Movement of these barges around Point Barrow is limited to a short period from mid-August through mid- to late September. This barge traffic likely will remain shoreward of the barrier islands between Prudhoe Bay and Liberty Island and is not likely to affect bowhead whales. Unless severe ice conditions are encountered, the transport of equipment by barge should be completed prior to the bowhead whale migration. If the barge traffic continues during the whale migration, individual bowheads may be disturbed by vessel traffic as described above. Any disturbance is likely to be temporary and unlikely to result in more than minor disruptions of any essential behaviors. Non-emergency vessel traffic outside the barrier islands would be scheduled to avoid interference with subsistence whaling.

3. Potential Effects of Noise and Disturbance from Aircraft Traffic

Most offshore aircraft traffic in support of the oil industry involves turbine helicopters flying along straight lines. Underwater sounds from aircraft are transient. According to Richardson et al., (1995), the angle at which a line from the aircraft to the receiver intersects the water's surface is important. At angles greater than 13 degrees from the vertical, much of the incident sound is reflected and does not penetrate into the water. Therefore, strong underwater sounds are detectable for roughly the period of time the aircraft is within a 26-degree cone above the receiver. Usually, an aircraft can be heard in the air well before and after the brief period it passes overhead and is heard underwater.

Observations indicate that most bowheads are unlikely to react significantly to occasional single passes by low-flying helicopters ferrying personnel and equipment to offshore operations at altitudes above 150 meters (500 feet) (Richardson and Malme, 1993, as cited in USDOI, MMS, Alaska OCS Region, 1996a). At altitudes less than 150 meters (500 feet), some whales probably would dive quickly in response to the aircraft noise. Noise from aircraft generally is audible for only a brief time (tens of seconds) if the aircraft remains on a direct course, and the whales should resume their normal activities within minutes (Richardson et al., 1995). Patenaude et al., (1997) found that most reactions by bowheads to a Bell 212 helicopter occurred when the helicopter was at altitudes of 150 meters or less and lateral distances of 250 meters or less. A total of 64 bowhead groups were observed near an operating helicopter. Most (47 groups) were observed during a single helicopter overflight or within 2 minutes after landing or during takeoff (9 groups). Immediate dives occurred during 5 of 46 overflights, when the helicopter approached altitudes 150 meters or less. In one case at 150 meters or less, a bowhead breached three times, possibly in response to the helicopter, commencing 30 seconds after the helicopter passed at an altitude of 180 meters and a lateral distance of 1600 meters. Based on 52 bowhead observations at known lateral distances, reactions did not occur significantly more often when the helicopter was operating at a lateral distance of 250 meters or less. The most common reactions were abrupt dives and shortened surface time and most, if not all, reactions seemed brief. However, the majority of bowheads showed no obvious reaction to single passes, even at those distances. The helicopter sounds measured underwater at depths of 3 meters and 18 meters showed that sound consisted mainly of main rotor tones ahead of the aircraft and tail rotor sounds behind the aircraft; more sound pressure was received at 3 meters than at 18 meters; and peak sound levels received underwater diminished with increasing aircraft altitude.

Year-round helicopter access is planned for the Liberty Project, weather permitting. During the construction phase, there may be an average of 10-20 flights per day during the first year. An estimated three helicopter trips per week would be required to transport personnel during drilling and production operations except during breakup, when there would be one flight per day. Aircraft traffic would be limited to the area between Prudhoe Bay and Liberty Island, well south of the migration corridor and inside the barrier islands. Helicopters will fly at an altitude of at least 1,500 feet, except for takeoffs, landings, and adverse weather conditions. Because of these factors, we would not expect this helicopter traffic to significantly affect bowhead whales.

The only fixed-wing aircraft proposed for this project would be for pipeline surveillance. Fixed-wing aircraft overflights at low altitude (300 meters or less [1,000 feet]) often cause hasty dives. Reactions to circling aircraft are sometimes conspicuous if the aircraft is below an altitude of 300 meters (1,000 feet), uncommon at 460 meters (1,500 feet), and generally undetectable at 600 meters (2,000 feet). Repeated low-altitude overflights at 150 meters (500 feet) during aerial photogrammetry studies of feeding bowheads sometimes caused abrupt turns and hasty dives (Richardson and Malme, 1993). Aircraft on a direct course usually produce audible noise for only tens of seconds, and the whales should resume their normal activities within minutes (Richardson and Malme, 1993).

Patenaude et al., (1997) found that few bowheads (2.2%) were observed to react to Twin Otter overflights at altitudes of 60-460 meters. During the four spring seasons, 11 bowhead whale groups were observed to react overtly to a Twin Otter. Reactions consisted of two immediate dives, one unusual turn, and eight brief surfacings, representing 2.2 % of the bowhead groups (507 groups) sighted from the aircraft. Most observed reactions by bowheads occurred when the Twin Otter was at altitudes of 182 meters or less and lateral distances of 250 meters or less. Eight groups out of 218 groups reacted to the Twin Otter at altitudes of 182 meters or less. There was little, if any, reaction by bowheads when the aircraft circled at an altitude of 460 meters and a radius of 1 kilometer. These data suggest that any effects from disturbance by aircraft associated with the Liberty project will be brief, and the whales should resume their normal activities within minutes. As with helicopters, this traffic would be well south of the migration corridor and not expected to result in more than minor disturbances to individual bowhead whales.

4. Potential Effects of Noise and Disturbance from Construction Activities

Island and pipeline construction activities, including placement of fill material, installation of sheetpile, trenching for the pipeline, and pipelaying, would cause noise that could disturb bowhead whales. Placement of fill material and slope protection materials for island construction will occur during the winter months, when bowhead whales are not present. Some minor adjustments to side slope protection may occur during the open-water season before operations start. These activities would generally be completed by mid-August, before the bowhead whale migration. Placement of sheetpile would generate noise during the open-water period for one construction season but should be completed in early to mid-August, before the whales migrate. Even if these activities are ongoing during the migration, noise produced is expected to be minor and is not expected to affect bowhead whales, because the island is well shoreward of the barrier islands and whales infrequently go there. Offshore pipeline-construction activities between the production island and onshore facilities also would be constructed during the winter and are not likely to affect whales. Bowhead whales are not likely to be affected by placing fill for island construction, island reshaping before placing slope-protection material, or pipeline trenching or backfilling, or the sediment or turbidity as a result of those activities.

Recently, construction noise was measured at Seal Island for the Northstar project (Blackwell and Greene, 2001). Activities included pile driving, generators, heavy equipment working on the island, aircraft (helicopters), and vessels. Nearly all the noises recorded from the island were at frequencies below 400Hz. Overall broadband levels of underwater sound from activities on or around Northstar ranged from 112 to 139 db re 1 µ Pa, at range of 1/4 nautical mile, from 92 to 121 db re 1 µ Pa at 1 n.mi., and from 92 to 113 db re 1 µ Pa at 5 n. mi. Received levels were variable, and reached their highest levels of 135-139 db re 1 µ Pa at a distance of 451 meters from the island. Broadband received levels of underwater noise were at least 11 dB above ambient levels (98 dB db re 1 µ Pa) at a range of 5 n. mi. on one day. Island noise degraded to ambient within 10 n.mi. of the island on one day during this study, and within 1 n.mi. during another day (no vessels operating). Some noises were detected out to a range of 15 n. mi. High levels of noise were correlated with the presence of a self-powered barge which was often pushing against the island due to the absence of mooring facilities.

Since most of these activities are not expected to occur during the migration season when whales are present, we believe that any noise and disturbance associated with the construction of the Liberty project is unlikely to be detected by bowhead whales. If these activities extend into the migration period, we do not anticipate that more than a few individual whales may detect these noises due to the infrequent occurrence of whales shoreward of the barrier islands where the Liberty project is located. Individual whales which may detect these noises are unlikely to experience more than minor disruptions to normal behaviors.

B. Potential Effects from an Accidental Oil Spill

A number of studies have attempted to model the probability that bowhead whales in the Beaufort Sea would contact oil in the event of a >1,000 barrel spill (Reed et al., 1987; Neff, 1990:49; Bratton et al., 1993:733). The models suggest that only a small number (0-2%) of the Beaufort Sea bowhead population would be affected by a large spill. One model calculated a probability of 51.8% that at least one bowhead whale could encounter oil should a spill occur in the Beaufort Sea OCS planning area. There was a 40% probability of 1-200 whales encountering oil if a spill occurred (Bratton et al., 1993:734). Whether or not bowhead whales would come into contact with oil would depend on the timing and magnitude of the spill, the presence or absence of shorefast and broken ice, and the effectiveness of the cleanup. Potential impacts of oil on bowheads are discussed below.

It is difficult to accurately predict the effects of oil on bowhead whales (or any cetacean) because of a lack of data on the metabolism of this species and because of inconclusive results of examinations of baleen whales found dead after major oil releases (Bratton et al., 1993:736; Geraci, 1990:167-169). Nevertheless, some generalizations can be made regarding impacts of oil on individual whales based on present knowledge. Oil spills that occurred while bowheads were present could result in skin contact with the oil, baleen fouling, ingestion of oil, respiratory distress from hydrocarbon vapors, contaminated food sources, and displacement from feeding areas (Geraci, 1990:181-192). Actual impacts would depend on the extent and duration of contact, and the characteristics (age) of the oil (Albert, 1981:946). Bowhead whales could be affected through residual oil from a spill even if they were not present during the oil spill. Most likely, the effects of oil would be irritation to the respiratory membranes and absorption of hydrocarbons into the bloodstream (Geraci, 1990:184). If an oil spill were concentrated in open water leads, it is possible that a bowhead whale could inhale enough vapors from a fresh spill to affect its health. Inhalation of petroleum vapors can cause pneumonia in humans and animals due to large amounts of foreign material (vapors) entering the lungs (Lipscomb et al., 1994:269). It is unclear if vapor concentrations after an oil spill in the Arctic would reach levels where serious effects, such as pneumonia, would occur in bowhead whales. Although pneumonia was not found in sea otters that died after the *Exxon Valdez* oil spill, inhalation of vapors was suspected to have caused interstitial pulmonary emphysema (accumulation of bubbles of air within connective tissues of the lungs). Some northslope oil, such as Northstar crude, are light-weight with a relatively high evaporation rates, although rates of evaporation in the Arctic are decreased due to low temperatures (Engelhardt, 1987:104-106). Therefore, evaporation rates and exposure to oil may be an important factor to the impacts bowheads may experience from inhalation of vapors. Bratton et al., (1993:722) reviewed the available literature on potential impacts of hydrocarbons on whales and theorized that impacts on the respiratory system of a bowhead whale confined by ice to a small, oil-contaminated area would be limited to: "*... irritation of the mucous membranes, .. irritation of the respiratory tract, and .. absorption of volatile hydrocarbons into the bloodstream through the bronchial tree with rapid excretion by the same route*."

Whales may also contact oil as they surface to breathe, but the effects of oil contacting skin are largely speculative. Experiments in which *Tursiops* were exposed to petroleum products showed transient damage to epidermal cells, and that cetacean skin presents a formidable barrier to the toxic effects of petroleum (Bratton et al., 1993:720). Bowhead whales have an exceedingly thick epidermis (Haldiman et al., 1985:397). The skin of bowhead whales is characterized by hundreds of rough, skin lesion areas. "*These rough areas are variable in size and shape, often 1 to 2 inches in diameter and 1 to 3 mm deep with numerous 'hair-like' projections extending upward 1 to 3 mm from the depths of the damaged skin surface*." (Albert, 1996:7). Blood vessels are located just beneath the epidermis of these skin lesions (Albert, 1981:947; Haldiman et al., 1985:391), and large numbers of potentially pathogenic (disease-causing) bacteria have been documented in these areas (Shotts et al., 1990:358). Many of these bacteria produce enzymes that are capable of causing tissue necrosis (tissue death) (Haldiman et al., 1985:397; Shotts et al., 1990:351). The ultrastructural nature of these areas of damaged epidermis has recently been documented (Henk and Mullan, 1996). The origin of these rough areas is unknown, but oil is likely to adhere at these sites. Haldiman et al., (1981:648) documented that Prudhoe Bay crude oil adheres to isolated preserved skin samples of bowhead whales and that, "*The amount of oil adhering to the surrounding skin and epidermal depression appeared to be directly proportional to the degree of 'roughness' of the [skin]*." The authors concluded that these results were, "*indicative of the possible adherence to the live skin of an active bowhead whale*". Geraci and St. Aubin's (1985) investigations found that exposure to petroleum did not make a cetacean vulnerable to disease by altering skin microflora or by removing inhibitory substances from the epidermis on several species of toothed whales, including *Tursiops* with superficial wounds of the epidermis, found only temporary effects which they described as secondary to the potential effects from inhalation and ingestion (Geraci and St. Aubin, 1990) . Bratton et al., (1993:721) concludes "bowhead whale encounters with fresh or weathered petroleum most likely present little toxicologic hazard to the integument." Engelhardt (1987:106) found oil contacting whale skin may inflame the epidermis, "*particularly if the oil is light and aromatic, therefore more reactive*". Albert (1981:948) concludes such inflammation ultimately may lead to ulcer formation, severe inflammation of the skin, and possibly blood poisoning.

Bowhead whale eyes may be particularly vulnerable to damage from oil on the water due to their unusual anatomical structure. The presence of a large conjunctival sac associated with the bowheads' eyes was recognized by Dubielzig and Aguirre (1981). The conjunctival sac is a mucous membrane that lines the inner surface of the eyelid and the exposed surface of the eyeball (Zhu, 1996, 1997; Zhu et al., 1998, 1999). This sac likely aids in providing mobility of the eyeball (Zhu, 1996:62). It has been suggested that if oil gets onto the eyes of bowhead whales it would enter the large conjunctival sac (Zhu, 1996:61) and move "inward" 4 to 5 inches (10 to 13 cm) and get "behind" most of the eye (Albert - Pers. Comm., 1997). The consequences of this event are uncertain, but some adverse effects are expected. Detailed study of the anatomy of the bowhead eyes (Zhu, 1996:61) supports speculation that impacts of oil on the eyes of bowhead whales would include irritation, reduced vision due to corneal inflammation, and corneal ulceration potentially leading to blindness (Albert, 1981:947; Zhu, 1996:61).

Bowhead whales may ingest oil encountered on the surface of the sea during feeding, resulting in fouling of their baleen plates. Engelhardt (1987:108) noted that, "*baleen whales are vulnerable to ingesting oil when their baleen structures are coated,"* but the impacts on bowhead whales due to ingestion of oil are unclear. The baleen plates of bowhead whales are fringed with hair-like projections up to 1-ft (0.3 m) long made of keratin (Lambertsen et al., 1989:29-31). These baleen filaments eventually break off and some are swallowed by the whales (Albert, 1981:950; Albert, 1996:7). Filaments also are often observed tangled into 'ball-like' structures while still attached to the baleen of bowheads harvested by Inupiat Eskimos from Barrow (Albert, 1996:7). A laboratory study showed that filtration efficiency of bowhead whale baleen is reduced by 5% to 10% after contact with Prudhoe Bay crude oil (Braithwaite et al., 1983:41). It appeared that when baleen was fouled, viscous crude oil caused abnormal spacing of hairs which allowed increased numbers of plankton to slip through the baleen mechanism without being captured (Braithwaite et al., 1983:42). This loss of baleen filtration efficiency lingered for approximately 30 days. It was uncertain how such reduction would affect the overall health or feeding efficiency of individual whales. In contrast, another study concluded that the most severe effects of baleen fouling are short-lived and interfere with feeding for approximately 1-day after a single exposure of baleen to petroleum (Geraci and St. Aubin, 1983:269; 1985:134). The latter study tested baleen from fin, sei, humpback, and gray whales, but not from bowhead whales. Lambertsen et al. (1989) cautioned against the use of surrogate species in assessing the susceptibility of the bowhead whale to oil, and found that definitive analysis of the impact of oil on bowhead feeding mechanisms should not be based on the effects of hydraulic pressure alone in powering baleen function.

Thick sludge (tar balls) typically appear in the late stages of an oil spill due to an increase in the specific gravity of oil as evaporation progresses (Meilke, 1990:11). Anatomical evidence suggests that potential impacts of oil and tar balls on the baleen apparatus may be serious. If oil were ingested accidentally during feeding, baleen filaments could be sites of oil adherence, as demonstrated by an oil adherence study conducted on bowhead whale baleen in the laboratory (Braithwaite et al., 1983:41). When dislodged, tarballs likely would be swallowed with other food (Albert, 1981:950). Broken off baleen filaments and tar balls are of concern because of the structure of the bowhead's stomach. The connecting tube between two parts of the bowhead stomach, the fundic chamber and the pyloric chamber, is only about 1.5 inches (3.8 cm) in diameter (Tarpley et al., 1987:303). Everything the whale ingests must pass through this tube, and blockage could pose a major threat to the whale (Albert, 1981:950). Because tar balls may persist in the marine environment for up to 4 years (Meilke, 1990:12), bowhead whales would not have to be present during an oil spill to be adversely affected. Impacts could continue for years.

Consequences of bowhead whales contacting oil have not been well documented. Geraci (1990:169) reviewed a number of studies pertaining to the physiologic and toxic impacts of oil on whales and concluded there was no evidence that oil contamination had been responsible for the death of a cetacean. Cetaceans observed during the *Exxon Valdez* oil spill in Prince William Sound made no effort to alter their behavior in the presence of oil (Harvey and Dahlheim, 1994:263; Loughlin, 1994:366). Following the *Exxon Valdez* oil spill, daily vessel surveys of Prince William Sound were conducted from April 1 through April 9, 1989, to determine the abundance and behavior of cetaceans in response to the oil spill (Harvey and Dahlheim, 1994:263). During the nine surveys, 80 Dall's porpoise, 18 killer whales, and 2 harbor porpoise were observed. Oil was observed on only one individual, which had oil on the dorsal half of its body and appeared stressed due to its labored breathing pattern. However, many cetaceans were observed swimming in the area of the oil slick. A total of 37 cetaceans were found dead during and after the *Exxon Valdez* oil spill, but cause of death could not be linked to exposure to oil (Loughlin, 1994:368). Dahlheim and Matkin (1994) reported 14 killer whales missing from a resident Prince William Sound pod over a period coincident with the EXXON *Valdez* oil spill. Matkin et al., (1994) notes it is likely nearly all of the resident killer whales in Prince William Sound swam through heavily oiled areas, and that the magnitude of that loss was unprecedented. That study concluded there was a correlation between the loss of these whales and the *Valdez* spill, but could not identify a clear cause and effect relationship. Bratton et al., (1993:721) concluded that petroleum hydrocarbons appeared to pose no present harm to bowheads, but also noted that this conclusion was less than definitive because of disagreement over the degree of toxicological hazard posed by hydrocarbons.

Albert (1981:950) warned that exposure to oil could pose a major threat to individual bowhead whales based on their anatomy. Engelhardt (1987:104) stated that bowhead whales are particularly vulnerable to effects from oil spills due to their use of ice edges and leads where spilled oil tends to accumulate. This author proceeded to suggest ten criteria for assessing whether a given marine mammal species would be vulnerable to the effects of an oil spill. This assessment indicates the bowhead whale is vulnerable to effects of oil because an oil spill could occupy an area of the sea when bowheads were present and the bowhead whale is an endangered species and that damage to the population could be critical to species survival (Engelhardt, 1987:111). In addition, individuals are not expected to avoid oil exposure, based on the limited data discussed previously. The author concluded that: "*population significant impact of oil on marine mammals is likely only in special circumstances, restricted to localities which may, at a certain time of year, host a large proportion of a sensitive population. Species which are considered as threatened and endangered species are additionally vulnerable to oil spills*" (Engelhardt, 1987:112).

Toxicity of crude oil decreases with time as the lighter, more harmful, aromatic hydrocarbons such as benzene evaporate. Acute chemical toxicity (lethal effects) of the oil is greatest during the first month following a spill. Sublethal effects may be observed in surviving birds, mammals, and fish for years after the spill. Sublethal and chronic effects include reduced reproductive success, blood chemistry alteration, and weakened immunity to disease and infections (Spies et al., 1996:10).

Contaminated food sources and displacement from feeding areas also may occur as a result of an oil spill. Rapid recovery of plankton would be expected due to the wide distribution, large numbers, rapid rate of regeneration, and high fecundity of plankton (USDOI, MMS, 1997B:IV-cj-52). However, regeneration may not be rapid as some plankters, such as certain copepod species, may produce only one generation per year and breed for short periods of time. Nonetheless, it is unlikely that the availability of food sources for bowheads would be affected given the abundance of plankton resources in the Beaufort Sea (Bratton et al., 1993:723).

The impacts of oil exposure to the bowhead whale population would also depend upon how many animals contacted oil. If oil found its way into leads or ice-free areas frequented by migrating bowheads, a significant proportion of the population could be affected. Albert (1981:950) postulated that if spilled oil got into the leads during the spring migration, the oil would pose a grave threat to the bowhead whale by putting nearly the entire population at risk, because most of the bowhead population migrates through the same lead system during a relatively short period. Based on acoustic and visual data, it was estimated that 665 bowheads passed Point Barrow in only 4 days (George et al., 1989:26), and 90% of bowheads passed through an area only 2.5 miles (4 km) wide (George et al., 1995:371). However, several models have considered the probability of bowhead whales encountering a spill, should it occur. By assuming a spill occurred, and factoring in components of 1) an oil spill model, 2) a whale migration model, and 3) a diving-surfacing model, Bratton et al., (1993) concluded a 48.2% chance of 0 whale/oil encounters, a 40% chance of 1-200 encounters, and an 8.9 % chance of 201-400 encounters. Model results indicated a 99% probability that 15 or fewer of every 100,000 surfacings would be in an oil spill if one is present (spills greater than 1,000 barrels).

There are no observations through western science whether bowheads can detect an oil spill or would avoid surfacing in the oil or whether they may be temporarily displaced from an area because of an oil spill or cleanup operations. However, Brower (1980) described the effects of a 25,000-gallon oil spill at Elson Lagoon (Plover Islands) in 1944 on bowhead whales. It took approximately 4 years for the oil to disappear. For 4 years after the oil spill, Brower observed that bowhead whales made a wide detour out to sea when passing near the Elson Lagoon/Plover Islands during fall migration. Bowhead whales normally migrated close to these islands during the fall migration. These observations indicate that some displacement of whales may occur in the event of an oil spill, and that the displacement may last for several years. Based on these observations, it also appears that bowhead whales may have some ability to detect an oil spill and avoid surfacing in the oil by detouring around the area of the spill.

Inupiat of the NSB have expressed concern that the effect on bowhead whales from an oil spill, whether it be into a lead or from the ice as it melts and goes into a lead, could be major because if there is an oil spill, not just a few bowhead whales but potentially the majority, if not the whole population, could be exposed to that oil spill (M. Philo in USDOI, MMS, 1986:14). Whales have reportedly passed within 2 miles (3.2 km) of the spring lead edge during some years and could encounter oil if it was present in a spring lead (J. George in USDOI, MMS, 1995:51-52). Increased activities of vessels and aircraft during oil spill cleanup efforts would be a source of disturbance to migrating bowhead whales. Bowhead whales would likely avoid areas of high noise levels, and the effect could therefore be a temporary change in migration routes. In fact, the potential use of seismic air guns to haze whales from an area of an oil spill may be considered for future response planning. Use of chemical dispersants and burning of oil may have adverse effects on bowheads; however, little is known about whether these activities would pose a threat to the population.

The Inupiat view that an oil spill, especially in broken ice conditions, could have serious consequences to bowhead whales derives from their knowledge that most of the bowhead whale population travels to and from the Canadian Beaufort Sea in a relatively narrow migration corridor during a fairly short time. That a large number of bowheads could be affected by even a relatively small oil spill is illustrated by observations of a whaling captain from Barrow. During a bowhead whale hunt off Barrow in 1976, about 150 to 200 whales were observed in one spot (J. Tukle in USDOI, MMS, 1987:47). Residents have recorded seeing 300 bowhead whales migrating past Barrow in a day, and in 1980, 95% of the population came through in 6 days (G. Carroll in USDOI, MMS, 1986:19). There is general agreement among Inupiat people testifying at various hearings since 1979, that an oil spill would have severe consequences to the bowhead whale population because effective cleanup methods of oil spill in ice-covered waters have not yet been developed and proven (J. Loncar in USDOI, MMS, 1983:49). Recent spill response drills in the Beaufort Sea have failed to demonstrate industry can adequately respond to spilled oil under broken ice conditions (ADEC, 2000).

Oil-spill-cleanup activities during September and October could disturb bowhead whales during their fall migration. No information is available regarding bowhead disturbance from oil-spill-cleanup operations, but noise disturbance to bowheads from vessel and aircraft traffic involved with cleanup activities likely would be similar to that already described previously. Most oil-spill-cleanup work probably would occur inside the barrier islands, because the spill model indicates that spilled oil has a relatively low probability to reach areas outside of the barrier islands. Some whales may be disturbed by vessel or aircraft traffic and temporarily displaced seaward, if cleanup activities occurred outside the barrier islands or in the channels between the barrier islands during the whale migration. Cleanup activities could continue for multiple seasons. The icebreaking barge Endeavor could be used if a spill occurred during broken-ice conditions in October. Information is not available regarding how far noise can be heard from this vessel during icebreaking operations. Icebreaking activity causes substantial increases in noise levels out to at least 5 kilometers (Richardson et al., 1995). Sounds measured from icebreaking activities by icebreakers and icebreaking supply ships in deeper water have been detected at more than 50 kilometers away (Richardson et al., 1995). The icebreaking barge likely would be operating mostly in shallow water primarily inside the barrier islands, a different environment than icebreaking activity referenced by Richardson et al., (1995). If this vessel were to be used before the end of the bowhead whale fall migration, it is possible some migrating whales could hear the noise. It is likely the shallow water with ice cover and the presence of the barrier islands would greatly reduce the amount of noise reaching migrating whales. Considering this likely reduction in noise levels, the relatively low chance of an oil spill, the estimated size of the spill, the very narrow window of time in October that icebreaking vessel could affect whales, and the relatively low chance that oil would reach bowhead habitat outside the barrier islands, there is low probability that whales would be affected by cleanup activities.

There is still considerable disagreement as to the probable effects of oil on bowhead whales in the Alaskan Beaufort Sea. This conclusion probably reflects the transitory nature of these animals in the region, as well as a lack of studies. Data on the anatomy and migratory behavior of bowhead whales suggest that a large oil spill is likely to adversely affect bowhead whales, especially if substantial amounts of oil were in the lead system during the spring migration (Albert, 1981:950; Shotts et al., 1990:358). Exposure of bowheads to an oil spill could result in lethal effects to an unknown number of individuals.

The MMS modeled several spill scenarios in the Liberty draft EIS. These included pipeline spills, a platform crude oil spill, and a 1,283-barrel diesel oil spill. All spills modeled were in excess of 500 barrels. The chance of an oil spill greater than or equal to 500 barrels from the offshore production island and the buried pipeline occurring and entering the offshore waters was estimated to be on the order of 1%. A spill of 715-2,956 barrels could contact areas outside the barrier islands where bowhead whales may be present. A spill during broken ice in the fall or under the ice in the winter would melt out during the following summer.

During the summer, the MMS estimates the chance of an oil spill *from Liberty Island* (LI) contacting habitat where bowhead whales may be found during their fall migration ranges from less than 0.5-15% over a 30-day period and less than 0.5-16% over a 360-day period, respectively. If any bowheads migrated on the shoreward side of Cross Island during an oil spill, there is an 11% and a 12% chance of contact with spilled oil over both a 30-day and a 360-day period, respectively. Although a few bowheads may be inside the barrier islands during the fall migration, this area is not their main habitat.

During the winter, the chance of an oil spill from Liberty Island contacting these habitat areas ranges from less than 0.5-2% over a 30-day period and less than 0.5-5% over a 360-day period, respectively. The model estimated there is less than a 0.5% chance of an oil spill from Liberty Island contacting the spring lead system over both a 30-day period and a 360-day period during either the summer or winter.

During the summer, the chance of an oil spill *from the offshore portion of the pipeline* reaching bowhead habitat ranges from less than 0.5-13% over a 30-day period and from 0.5-14% over a 360-day period. If any bowheads migrated on the shoreward side of Cross Island during an oil spill, there is a 9% and a 10% chance of contact with spilled oil over both a 30-day and a 360-day period, respectively.

A 1,283-barrel spill of diesel oil from Liberty Island would persist for a shorter period of time in the marine environment than a crude oil spill. Approximately 14 % of the diesel oil would remain after 3 days, and 2% would remain after 7 days if the spill occurred during the summer. The chance of a diesel oil spill during the summer contacting bowhead habitat during the fall migration range from less than 0.5-6% over a 3-day period.

V. Cumulative Effects

Cumulative effects include the "effects of future State, local, or private actions, that are reasonably certain to occur in the action area. Reasonable foreseeable future federal actions and potential future federal actions that are unrelated to the proposed action are not considered in the analysis of cumulative effects because they would require separate consultation pursuant to section 7 of the ESA. These effects differ from those that may be attributed to past and ongoing actions within the area since they are considered part of the environmental baseline.

The State of Alaska Five-Year Oil and Gas Leasing Program published in January 1999 lists five Beaufort Sea areawide lease sales scheduled beginning in October 1999 and continuing with additional sales in 2000, 2001, 2002, and 2003. The proposed sales consists of all unleased tide and submerged lands between the Canadian Border and Point Barrow as well as some upland acreage. The October 1999 sale was delayed. The most recent State sale in the Beaufort Sea was held in November 2000. Federal OCS Lease Sale 170 was held in August 1998 and there are still active leases from previous Federal lease sales. Another Federal OCS sale planned for about 2002 has been delayed. A Federal onshore sale was held in the Northeast National Petroleum Reserve-Alaska. Additional noise and disturbance from exploratory activities similar to those described below for previous Federal and State lease sales could occur if any of the scheduled sales for the Beaufort Sea area are held.

The potential for oil-industry activities outside of the Alaskan Beaufort Sea appears to be limited. Two Federal lease sales were conducted previously in the Chukchi Sea and exploration activities were conducted, but no producible wells were discovered. A Chukchi Sea/Hope Basin sale was included in the 1997-2002 OCS oil and gas leasing program, but there are currently no plans to hold the lease sale. Nor are there currently any plans for future oil and gas exploration activities in the Bering Sea. In the Canadian Beaufort Sea, the main area of industry interest has been around the Mackenzie River Delta and offshore of the Tuktoyaktuk Peninsula. Although there have been oil discoveries in these areas, there has been little industry interest in the area in recent years and we are not aware of any activities planned for the Canadian Beaufort Sea. Bowhead whales could be affected should any oil and gas activities occur in the Canadian Beaufort Sea during the summer.

Flaxman Island and Gwydyr Bay are reasonably foreseeable future offshore development projects on State leases that are considered uneconomical to develop now but may become economical during the next 15-20 years. Flaxman Island is a barrier island east of Prudhoe Bay and near the western edge of Camden Bay. Development of the Flaxman Island unit likely will share infrastructure with the Badami group. Although the Badami field is located offshore, industry will drill the Badami field from onshore. The unit likely would have its own production pads and wells and a pipeline connecting it to a past or present development project associated with Badami. The Badami field is of particular interest, because the Liberty project pipeline will tie into Badami's crude-carrier pipeline. Developmental drilling is under way for the Badami field, and pipeline construction is scheduled. Gwydyr Bay is shoreward of the barrier islands, where development activities may have less affect on bowhead whales.

The State of Alaska's Division of Oil and Gas offers State lands to be leased for oil and gas exploration and production through their lease sale program. Area wide sales of state-owned tidal and submerged land in the Alaskan Beaufort Sea, between Point Barrow and the Canadian Border, are scheduled annually through 2005. The most recent sale (2000) resulted in the leasing of 11 tracts. Hydrocarbon potential is considered low to moderate. Bowhead whales are normally found offshore of State waters, although they do occur nearshore, particularly at Pt. Barrow and near Kaktovik. Exploration and development of State-owned leases in the Beaufort Sea could subject bowhead whales to many of the same disturbances and potential impacts associated with Federal OCS leasing. Oil and gas activities here would add to the cumulative effect on bowhead whales, particularly with respect to noise and the potential for oil spills, the effects of which would be likely to extend beyond State waters. Because the main axis of the bowhead migration is well offshore of State waters, it is unlikely these activities would alter the migrational path.

Future exploration and development within the Canadian Beaufort would present concerns beyond those associated with leasing in the Alaskan Beaufort Sea. The main area of industry interest has been the Mackenzie Delta and offshore of the Tuktoyaktuk Peninsula (MMS, 1995). The large estuarine front associated with the Mackenzie Delta and upwellings near the Tuktoyaktuk Peninsula provide conditions which concentrate zooplankton (Moore and Reeves, 1993). These areas are important feeding habitat to the Bering Sea stock. There are no reported plans for oil and gas exploration or production within the Canadian Beaufort Sea at this time (D. Matthews, pers. comm.) however, and this activity would not be considered reasonably expected to occur.

Cumulative effects of offshore oil and gas leasing would include avoidance behavior and alteration of migration patterns by bowhead whales as a result of increased barge and vessel traffic during the open water season. Increased traffic also would increase the likelihood of accidental oil and fuel spills affecting bowhead whales. Impacts to bowhead whales from future oil and gas projects likely would be similar in magnitude and significance to impacts from activities associated with this project, assuming that future offshore development occurs at similar water depths (less than 60 ft [18.3 m]) and that islands are connected to shore only via subsea buried pipelines. These impacts could be magnified, however, if construction activity associated with additional development projects were to occur simultaneously, rather than consecutively. For example, construction and drilling noise from multiple drilling sites could result in a long-term, offshore shift in bowhead migration routes. The extra distance and heavier ice encountered could result in slower migration or physiological stress that may noticeably affect the whales. However, the majority of bowhead whales are generally found offshore of State waters.

Underwater noise levels are likely to increase locally in the Alaskan Beaufort Sea as a consequence of increased oil and gas exploration and development. Bowhead whales are likely to be affected the most from this development. At least some bowhead whales would avoid certain areas of the Beaufort Sea as a result of industrial noise. This seaward displacement would not be limited to the actual operational phase of future developments but would also occur during seismic exploration and construction. These displacement effects may last more than 15 years (i.e. for as long as the oil development activity occurs). Cumulative impacts from seismic surveys would affect bowhead whales. Bowheads exposed to noise-producing activities associated with the project, and other future projects in the Alaskan Beaufort Sea, would most likely experience temporary nonlethal effects associated with the high noise levels during shooting. Bowheads would likely avoid seismic vessels during these operations. Bowhead avoidance response due to noise and activity would result in longer travel distances for whaling activities and associated risk and reduced success. Observations by members of the whaling community suggest that exposure to high noise levels would displace bowhead whales seaward. It is also possible for the cumulative effects of longer exposure to noise to cause mechanical damage to the bowhead's inner ear, with resultant loss or reduction in hearing.

The probability of an oil spill increases as more oil fields become active. The potential effects of oil on bowhead whales have been presented. It is assumed bowhead whales would be susceptible to an oil spill during feeding and migration, particularly if they came in contact with oil in the lead system during spring migration. A number of small oil spills have occurred during oil and gas exploration in the Alaskan Beaufort Sea in past years. Only five spills have been greater than one barrel, and the total spill volume from drilling 52 exploration wells (1982 through 1991) was 45 barrels (USDOI, MMS, 1996A:IV.A-10). Based on historical data, most oil spills would be less than one barrel, but a larger oil spill could also occur. Considering the low probability that a spill would occur, the limited number of days each year that bowhead whales would be migrating through the area, and the probability for spilled oil to move into the migration corridor of the bowheads, it is unlikely that bowhead whales would be contacted by oil. Significant adverse effects would only be expected if all of the low probability events occurred at the same time.

The annual subsistence hunting of bowhead whales by Inupiat whalers is expected to continue into the foreseeable future. The IWC has established a 5-year block quota of 280 whales. The IWC's Scientific Committee has determined this level of removals will allow growth within the stock.

Private shipping activity will occur into the future, and would result in possible harassment to bowhead whales as discussed for the Northstar project. This disturbance is considered to be localized and temporary. No other private actions which would affect the bowhead whale have been identified.

VI. Summary and Synthesis of the Effects

This Opinion has considered the anticipated effects of the Liberty project on the endangered bowhead whale. Construction and operation may affect these animals due to vessel and aircraft traffic, construction noise, and drilling and operating noises from Liberty Island. Noise has been shown to alter the behavior and movements of the bowhead whale. Noise may also alter the hearing ability of these whales, causing temporary or permanent threshold shifts. There is, at present, insufficient information on the hearing ability and sensitivities of bowhead whales to adequately describe this potential. However, information presented in the DEIS for the Liberty project suggests most continuous and impulsive underwater noise levels associated with construction, development, and production activities would be at levels below those expected to injure hearing mechanisms of bowhead whales. Noise has also been shown to cause avoidance in migrating bowhead whales. The possible use of an ice-strengthened barge pushed by tugs would appear to present the highest probability for avoidance of any of the activities associated with the Liberty project. Studies have shown noise from ice breakers may be recorded at distances exceeding 50 km. The distance at which bowheads may detect or react to such noise is poorly described. The use of ice-strengthened barges may have less impact than large ice breaking vessels, however no data could be found describing noise from such activity. Davies (1997) concludes bowheads also avoided an active drilling rig at a distance of 20 km. The impacts of noise emanating from an artificial island such as

Liberty are likely to be much less than that from drilling rigs, and would be expected to have less effect on whales. Using bowhead migrational data from 1997, a year in which whales passed close to shore, and a 3.2 km radius (representing the range at which Liberty Island noise is projected to decay to a level of 115 dB re 1µ Pa), fewer than 15 bowhead whales are expected to be taken by harassment due to this project (LGL 1998).

While we do not expect that such deflections during migration will be injurious to individual animals, concern is warranted for cumulative noise and multiple disturbance; the consequences of which might include long-term shifts in migrational paths or displacement from nearshore feeding habitats. However, we do not believe it is likely that these effects would result in reductions in the distribution, reproduction, or numbers of bowhead whales which would be expected to appreciably reduce their likelihood of survival and recovery.

Because the main bowhead whale-migration corridor is approximately 10 kilometers seaward of the barrier islands, drilling and production noise from Liberty Island is not likely to reach most of the migrating whales. The few whales that may be present in lagoon entrances or inside the barrier islands may be behaviorally affected by noise. Marine-vessel traffic outside of the barrier islands is likely to be limited to seagoing barges transporting equipment and supplies from Southcentral Alaska to the Liberty location, most likely between mid-August and mid- to late September. If the barge traffic continues into September, some bowheads may be disturbed. Whales exposed to the barge traffic may exhibit avoidance behavior to the vessels at distances of 1-4 kilometers from the traffic corridors. Fleeing behavior generally stops within minutes after a vessel has passed, but may persist for a longer time. Vessel and aircraft traffic inside the barrier islands is not expected to affect bowhead whales. Much of the island and pipeline construction activities will be conducted during the winter and are well inside the barrier islands; reducing potential impact to bowhead whales. While disturbances to the few individual whales present within the barrier islands may occur, we do not believe it is reasonable to expect that these disturbances will result in more than temporary disruptions to the normal behavior of these whales. Likewise, we do not believe that whales exposed to noise and disturbances from barge traffic outside the barrier islands will experience more than temporary disruptions to normal behaviors. Overall, we do not expect noise and disturbance associated with the Liberty project is likely to reduce appreciably the likelihood of the survival and recovery of bowhead whales in the wild by reducing their reproduction, numbers, or distribution.

Consideration of the potential impacts of oil spills to the bowhead whale must assess 1) the probabilities for a spill to occur and to make contact with the whales and/or their habitat, 2) the effects of oil spills and spill responses on these whales, and 3) the ability of industry to prevent, control, and recover spilled oil. Most spill potential is attributed to the oil pipeline, as the probabilities for well blowouts and tank rupture are considerably less. The chance of an oil spill greater than or equal to 500 barrels from the offshore production island and the buried pipeline occurring and entering the offshore waters is estimated to be on the order of 1%. If spilled, oil from operations at the Liberty project would have a 16% or less chance of contacting bowhead whale habitat over a 360-day period. The physical and behavioral effects of an oil spill on the Bering Sea stock of bowhead have been described earlier in this Opinion. While it is clear additional research is needed to assess these effects and that no consensus has been reached regarding the degree to which oiling might impact bowhead whales, we believe that whales contacting oil, particularly freshly-spilled oil, could be harmed and possibly killed. Additionally, an oil spill reaching into the spring lead system has the potential to contact a significant number of whales within the Bering Sea stock. Several coincidental events would be necessary for this scenario; the spill would have to occur, the spill would have to coincide with the seasonal migration, the spill would have to be transported to the area the whales occupy (e.g. the migrational corridor or spring lead system), and clean-up or response efforts would have to have been at least partially unsuccessful. The impact of such an event could be significant, yet the statistical probability for the coincidence of these events would be low. It must also be recognized that the spring lead system is not static, as leads open and close and whales navigate not only through the leads but surrounding ice (Clark and Ellison, 1988). Because of this it is difficult to assess the potential number of whales which could be impacted. Some whales may be displaced seaward if cleanup activities occurred outside the barrier islands or in the channels between the barrier islands during the whale migration.

The ability to prevent, identify, locate, contain, and remove spilled oil is a significant concern. The NMFS believes that, while spills represent low-probability events, their biological impacts are significant and the operator should make every reasonable effort to meet these challenges. We are especially concerned with the ability to contain and recover spilled oil under broken ice conditions (i.e. 30-70% ice coverage), and to detect chronic leakage below threshold detection limits on the pipeline. Based on the low combined probability that an accidental oil spill will occur and contact bowhead whales in the action area, we do not believe it is reasonable to expect that the development and operation of the Liberty project will reduce appreciably the likelihood of the survival and recovery of bowhead whales in the wild by reducing their reproduction, numbers, or distribution.

The additive or combined impacts of all bowhead "takes", described in the Environmental Baseline, must also be considered in any assessment of this work. The annual aboriginal harvest (subsistence) quota for this stock is currently 82 strikes. This harvest has been on-going for over two decades. During the period 1978-1993, the population has increased at a rate of 3.1% (Ferrero et al. 2000), suggesting this rate of removal is not significant in terms of survival or recovery.

The small take authorizations in effect for the 2001 open water season would permit the taking of a best estimate of 1758 whales, with a maximum estimate of 5766. These estimates represent a significant portion of the Bering Sea stock of bowhead whales. However, all of these takes would be by harassment, largely due to noise, which should not pose any injurious conditions to these whales. Additionally, some of these estimates were based on the "20 km criterion" which derives from observations of bowhead whales in the Beaufort Sea exposed to high energy seismic activity. While there are few data at this time on the avoidance distance for bowheads from artificial production islands such as Liberty, it is probable that these distances would be less than those observed during seismic, with its higher source levels. Nonetheless, NMFS is concerned over the repeated exposure of migrating bowhead whales to noise. While whales may deflect around a single noise source before returning to their migratory path, continuous or repeated exposures may cause some whales to change their normal routes, possibly offshore into deeper waters. The consequences of that action are also unknown. Site specific monitoring and the on-going MMS bowhead whale aerial survey program may provide data to monitor and assess any such effect.

VII. Conclusion

After reviewing the current status of the Bering Sea stock of the bowhead whale, the environmental baseline for the action area, the effects of the construction, development and production activities associated with the proposed Liberty project, and cumulative effects, it is NMFS's biological opinion that this activity is not likely to jeopardize the continued existence of the endangered bowhead whale. No critical habitat has been designated for this species, therefore none will be affected.

VIII. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The National Marine Fisheries Service is not including an incidental take statement at this time because the incidental take of marine mammals (i.e. bowhead whales) has not been authorized under Section 101(a)(5) of the Marine Mammal Protection Act and/or its 1994 Amendments. Following issuance of such regulations or authorization, NMFS may amend this Biological Opinion to include an incidental take statement for bowhead whales.

IX. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The National Marine Fisheries Service recommends the Minerals Management Service implement the following measures for these purposes.

1. Vessel operations should be scheduled to minimize operations after August 31 of each year in order to reduce potential harassment of migrating bowhead whales. Vessel routes should be established which maximize separation with the bowhead whale migration corridor, remaining within the 18m depth contour and behind the barrier islands when practicable. During fall broken ice conditions, supply and crew changes between Deadhorse and Liberty Island should be accomplished with helicopters rather than vessels to the extent possible, especially if those vessels would employ ice breaking.

2. Agitation techniques for placement of sheetpiling and piling should be utilized instead of pile-driving whenever practicable.

3. MMS should develop and conduct an acoustic monitoring study to measure the frequency composition of noise and noise levels as a function of distance from Liberty Island during construction and initial operation.

4. MMS should conduct or support studies to describe the impact of the Liberty facility on the behavior of the bowhead whale in the Beaufort Sea. This work should be integrated, as practicable, into monitoring efforts associated with the Northstar project in order to identify and assess any combined, as well as individual, effects. Because both the Liberty and Northstar projects will require authorization under the small take provisions of the MMPA, specific monitoring plans should be developed in conjunction with the research planning process for those authorizations. This process includes peer-review meetings on study design and study results.

5. MMS should ensure that no vessels associated with the Liberty Project engage in active ice management in the Beaufort Sea between August 15 and October 15 of each year, except during spill response training exercises or in response to an actual spill event. All spill response training exercises which employ ice breaking between August 15 and October 15 should be restricted to waters inside the 15 meter (45 foot) bathymetric contour. This is intended to allow unimpeded access to Liberty Island and Endicott or West Dock facilities for spill response training exercises. No restrictions are necessary for the use of ice breaking equipment necessary for response during an actual spill event, or other bona fide emergency.

6. Island construction should provide for barge mooring facilities early in the construction sequence, to prevent the need for continuously-operating self propelled barges. Studies at the similar Northstar project found such activity produced very strong noise levels which extended out to great distances; with the potential to effect greater numbers of bowhead whales.

X. Reinitiation of Consultation

This concludes formal consultation on the Mineral Management Service's proposed Liberty Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Biological Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Biological Opinion; or (4) a new species is listed or critical habitat designated that may be affected by this action. In circumstances where the amount or extent of incidental take is exceeded, the Minerals Management Service must immediately request reinitiation of formal consultation.

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