APPENDIX A

PETROLEUM GEOLOGY,

RESOURCE ESTIMATES,

EXPLORATION AND DEVELOPMENT ACTIVITIES

Appendix A
Petroleum Geology, Resource Estimates, Exploration and Development Activities

Petroleum Geology

The North Slope of Alaska is an area rich in petroleum. It contains the largest field ever discovered in North America—Prudhoe Bay. It also contains many satellite fields with over 100 million barrels in reserves (Fig. A-1). Production from North Slope fields, including both onshore and offshore fields, peaked in 1988, at just over 2.0 million barrels per day. Present production is 1.4 million barrels per day.

Oil from the North Slope is sent to markets on the U.S. West Coast, Gulf Coast, and in the Pacific Rim. The oil is pumped through the trans-Alaska pipeline system (TAPS) to the port of Valdez. There it is loaded onto tankers for shipment to distant markets. Gas is not produced from the North Slope, simply because there is no transportation system to carry it to market.

Exploration began on the North Slope in the 1920's, in what is now NPRA (National Petroleum Reserve–Alaska). The first lease sale was held in 1964, and the next few years saw a series of major discoveries: Prudhoe Bay (1968), Kuparuk (1969), and Milne Point (1970). Estimated reserves from these discoveries totaled 12 billion barrels. Such huge reserves made construction of the trans-Alaska oil pipeline economical. Oil production began when TAPS was completed in 1977.

Offshore lands in the Beaufort Sea were first offered in 1979, in a sale that included State and Federal lands. (Offshore, or submerged, lands belong to the State if they are close to shore, generally within 3 miles, and to the Federal Government if they lie farther out.) Since then, several large, offshore oil fields have been discovered, including: Endicott/Duck Island (610 MMbbl), Point McIntyre (590 MMbbl), Seal Island/Northstar (145 MMbbl), Niakuk (65 MMbbl), and Tern/Liberty (in appraisal phase). These fields lie close to shore, beneath State lands or on the boundary between State and Federal lands. So far, only one offshore field, Endicott/Duck Island, has been developed, and it began producing in 1987. Northstar is the second offshore field scheduled for development; production could start in 1999.

The first Federal-only offshore lease sale in the Beaufort Sea was held in 1982 (Sale 71). Since then, four more Federal sales have been held: Sale 87 (1984), Sale 97 (1988), Sale 124 (1991), and Sale 144 (1996). A total of 28 exploration wells have been drilled. Nine wells are considered capable of producing oil in paying quantities. All these discoveries, however, remain undeveloped. Three presently non-commercial fields (Sandpiper, Hammerhead, and Kuvlum) have been unitized for possible future development.

During past exploration efforts in Federal offshore areas, industry drilled wells that targeted untested plays far from shore, in remote corners of the Beaufort shelf province. More recently, exploration has targeted prospects close to shore. These prospects are in proven plays—plays that contain oil in nearby fields. The likely result of the new exploration strategy is that more, but smaller, fields will be discovered. These new fields could be more economically attractive because they lie near existing infrastructure and can be produced at lower cost.

Most of the known oil fields, both onshore and offshore, are clustered in the area surrounding Prudhoe Bay (Fig. A-1). Sale 170 offers offshore tracts near this core development area. Prospects beneath these tracts contain the same reservoir rocks that produce oil in nearby fields. The rock units include:

- *Ellesmerian sequence.* These rocks have been the

Blocks, Tracts, and Lease Sales

Blocks – Federal offshore, or outer continental shelf, areas are divided into blocks. Full outer continental shelf (OCS) blocks are about 3 miles on a side and cover 5,693 acres each.

Tracts – For lease sales, OCS blocks are reassigned into tracts, sometimes called "bidding units." Often blocks and tracts have the same boundary, but small pieces of unleased blocks are usually combined into a single tract for the lease sale.

Lease Sales – Tracts are leased at a public auction called a Lease Sale. Companies who buy leases at the auction have the right to explore for and develop oil and gas fields beneath their tracts. The companies do not own the land, only the mineral rights. The exploration leases are for 10 years, and then the companies must develop the resources or return the leases to the Federal Government. Federal lands, including OCS submerged lands, are the property of all the citizens of the United States.

Prospects, Plays, and Fields

Prospect – A prospect is a geologic feature that may have trapped oil and gas deep in the earth. We can estimate the volume of trapped oil and gas by mapping the size and thickness of the reservoir in the prospect. These are estimates of *undiscovered resources*, and there is a chance that no oil or gas is present. Only drilling will tell the true volume of recoverable resources in a prospect.

Play – A play is a *group of prospects* that share similar characteristics. These prospects may have the same reservoirs, the same oil sources, or may have formed under the same natural conditions. A play containing tested oil and gas pools is called a proven play. A play can include dozens of separate oil and gas pools tens of miles apart.

Field – A field is a prospect that has been drilled and proven to contain recoverable oil or gas. The volume of oil or gas is known with much more certainty than the estimated undiscovered resources in an undrilled prospect. However, the true reserve volume may only be known after the field is totally produced—decades in the future.

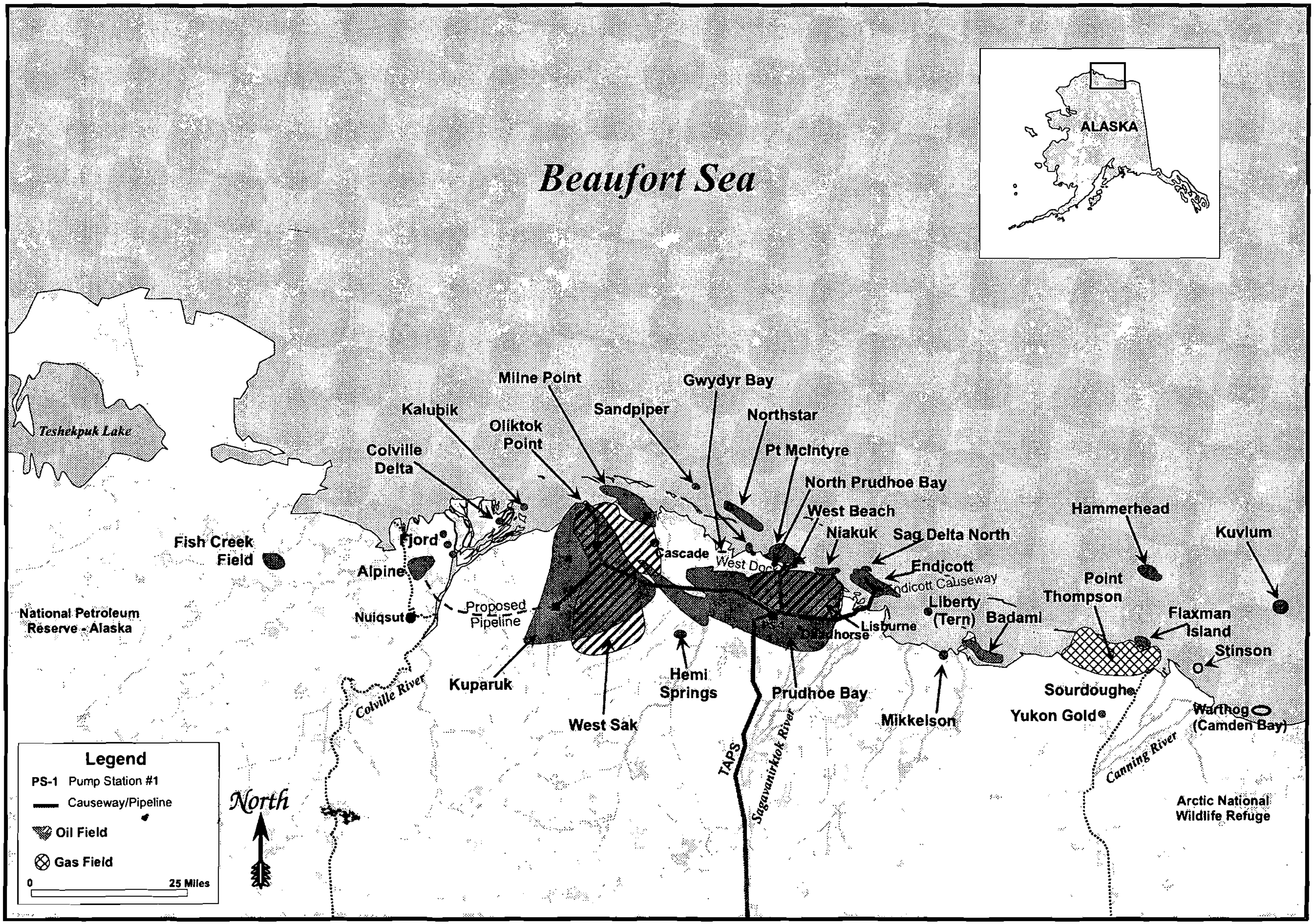


Figure A-1 North Slope Oil and Gas Fields

primary exploration target for industry. The Ivishak Formation, which forms the main reservoir of the Prudhoe oil field, is part of this sequence.

- *Rift sequence.* This rock unit has been a secondary exploration target. It contains the same reservoirs as the Kuparuk, Point McIntyre, Milne Point (Kuparuk Formation), and Niakuk oil fields.
- *Brookian sequence.* This sequence has also been a secondary exploration target. It contains the same reservoirs in the Milne Point (Schader Bluff Formation) and Badami fields.

For a more complete description of the geologic plays and their commercial potential, please see the Sale 144 Environmental Impact Statement (MMS, 1996), and the 1995 National Resource Assessment published on the Internet (Sherwood and others, 1996).

Before the environmental effects of Sale 170 can be analyzed, two sets of questions must be answered:

- *how much oil will be discovered and produced?*
- *what industry activities will occur?*—how many platforms will be constructed, how many wells will be drilled, how many pipelines will be built as companies explore for and develop the oil resources.

The rest of Appendix A addresses these questions.

Resource Estimates

To estimate oil resources, the MMS Resource Evaluation staff studies the geology of the sale area, the infrastructure (pipelines, processing plants, support facilities) needed for exploration and production, and the economics of oil marketing. Estimates of the number of geologic prospects, the future price of oil, the cost of infrastructure, and many other factors are used in computer models to simulate oil development. A computer model, PRESTO-5, processes the factors over 1,000 times, providing for a wide range in development scenarios.

PRESTO results are presented in the form of price-supply curves (Sherwood and others, 1996, section on Economic Results). These curves show how much oil could be produced profitably, if discovered, at various oil prices. Overall, these graphs show that as oil prices rise, exploration activities increase, leading to more discoveries, and eventually more fields are produced. The *market price of oil*, then, is one of the key factors in estimating how much oil will be discovered and produced following a lease sale.

Future oil prices and technological advances can have a tremendous effect on when new fields are found and which ones can be profitably developed. The prediction that future oil prices will be higher could spark industry interest and result in more leasing, drilling, and perhaps discoveries. But a series of dry wells and low oil prices could discourage industry activity.

Other factors, besides oil price, are important in determining the level of future industry activity. The *resource potential* of the area is also a key factor. The resource potential includes both developed economic reserves and undiscovered resources. Accurate assessments of undiscovered resources are difficult because of many uncertainties. The actual volume of recoverable oil will only be known when an area is thoroughly explored and all the reserves are produced—decades in the future.

To make estimates of undiscovered oil potential, the Resource Evaluation staff use seismic surveys to identify the size, number, and location of prospects that may be oil or gas fields. Then, geophysical logs from wells are used to define the properties of potential reservoir rocks, source rocks, and trapping seals. Computer models are used to calculate the total undiscovered potential, as well as the possible size and number of oil and gas fields.

Because of the many uncertainties, resource assessment results are often reported as a range of values with associated probabilities. Resource assessments for the Beaufort shelf province provide a good example. The province encompasses the entire offshore area, from 3 to 200 miles offshore, between Point Barrow on the west and Canada on the east. In a 1996 MMS report, we identified 23 plays in the province and analyzed the oil and gas potential of each (Sherwood, Craig, and Cooke, 1996). As a result, we estimated that the province contains from 6.28 billion barrels of oil (95-percent probability) to 11.96 billion barrels (5-percent probability). In other words, there is a good chance (19 out of 20) that at least 6.28 billion barrels of oil are present and a low chance (1 out of 20) that 11.96 billion barrels are present. (Large volumes of oil are much less likely to occur because large oil and gas fields are rare in nature.)

If a single number is needed for analysis, we use the statistical mean (or average) of this wide range of values. For the Beaufort shelf province, we estimated that an average of 8.84 billion barrels of oil are undiscovered and could be produced using conventional recovery methods. We further estimated that 2.27 billion barrels (or 26% of the total) are economic to produce if oil prices are at least $18.00 per barrel.

The Sale 170 area is much smaller than the Beaufort province and contains fewer geologic plays. So to estimate oil resources in the Sale 170 area, we scaled down the total province estimates. Specifically, we identified those geologic plays that extend into the proposed Sale 170 area; we assumed that oil fields are uniformly distributed within each play area; and then we used proportions, based on

Table A-1 Exploration Schedule, Sale 170, for Oil Prices Under $18 per Barrel

At prices below $18 per barrel, some exploration will occur, but no production (production would be uneconomic).

	Exploration Wells	Delineation Wells	Exploration/ Delineation Rigs	Production Platforms	Production and Service Wells	Production Rigs	Landbase Operations	Oil Production	Pipeline Miles
1998	Lease Sale								
1999									
2000	1								
2001									
2002									
2003	1	1	1						
2004									
2005									
2006	1		1						
Total	3	1	1[1]	0	0	0	0[2]	0[3]	0

Notes: [1]Maximum exploration/delineation or production drilling rigs operating in any single year. [2]Assumes exploration operations utilize existing facilities. [3]Discovered oil fields are smaller than threshold for economic viability (approx. 100 MMbbls).

Table A-2 Exploration and Production Schedule, Sale 170, for Oil Prices of at Least $18 and $30 per Barrel

At prices of $18 per barrel, we estimate that 350 million barrels of oil will be discovered and produced; at prices of $30 per barrel, 670 million barrels will be discovered and produced.

	Exploration Wells		Delineation Wells		Exploration/ Delineation Rigs		Production Platforms		Production and Service Wells		Production Rigs		Landbase Operations		Oil Production		Pipeline Miles	
MMbbl	**350**	**670**	**350**	**670**	**350**	**670**	**350**	**670**	**350**	**670**	**350**	**670**	**350**	**670**	**350**	**670**	**350**	**670**
1998	Lease Sale																	
1999	1	1			1	1												
2000	1	1	2	2	2	2												
2001	1	1			1	1												
2002	1	1	2	2	2	2												
2003	1	1			1	1							0.1	0.1				
2004	1	1	2	2	2	2	1	1	4	4	1	1	0.2	0.2				
2005		1				1		1	10	18	2	3	0.2	0.2			15	10
2006		1		2		2	1	1	18	24	3	4	0.2	0.2	9	17	10	10
2007									16	16	2	3			13	23	5	15
2008							1	1	18	24	3	4	0.1	0.1	18	32		10
2009								1	16	16	2	2			26	35	10	5
2010									5	9	1	2	0.1	0.1	31	42		10
2011															39	58		
2012															35	65		
2013															32	63		
2014															27	56		
2015															23	48		
2016															19	41		
2017															16	35		
2018															14	30		
2019															12	26		
2020															10	22		
2021															8	19		
2022															7	16		
2023															5	14		
2024															3	12		
2025															2	10		
2026															1	6		
2027													0.1	0.1				
Total	6	8	6	8	2[1]	2[1]	3	5	87	111	3[1]	4[1]	1.0		350	670	40[2]	60

Notes: [1]Maximum exploration/delineation or production drilling rigs operating in any single year. [2]Includes only new offshore pipelines.

area, to calculate the contribution of each geologic play to the resources in Sale 170.

For the Sale 170 area, we estimate that the mean (or average) volume of undiscovered, economically recoverable oil amounts to:
- 0.87 billion barrels at a price of $18 per barrel, and
- 1.11 billion barrels at a price of $30 per barrel.

The $18 price is a common benchmark representing current market conditions. The $30 price is an alternative benchmark, representing optimistic future oil prices.

Because it is unlikely that all the undiscovered fields will actually be leased and discovered—some will be overlooked—these resource estimates need to be scaled down further. Based on the history of leasing and exploration in the Beaufort province, we estimate that:
- 40 percent of the total available economic oil resources (0.35 billion barrels) will be discovered and produced if prices are at least $18 per barrel.
- 60 percent of the total available economic oil resources (0.67 billion barrels) will be discovered and produced if prices are at least $30 per barrel.

These last resource estimates are the ones used in this Environmental Impact Statement to study the activities that could result if Sale 170 is held. It is important to remember that future oil development activites are predicted to occur somewhere within this broad range, not necessarily at the end points of the range.

Exploration and Development Activities

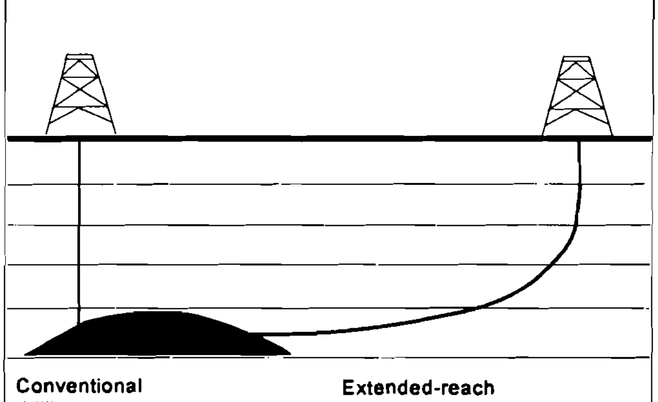
Scenarios

In this section, we look at the exploration and production activities likely to occur as a result of Sale 170. Two scenarios are examined:
- *exploration only* (Table A-1). This is the likely scenario if oil prices drop and remain *below $18* per barrel. With low prices, leasing and exploration interest will be minimal and discoveries will occur slowly. No oil field development or production will occur (as it would be uneconomic).
- *oil development* (Table A-2). This scenario assumes oil prices average between *$18 and $30 per barrel* (in constant dollars) over the life of the area's production. Driven by these prices, between *350 and 670 million barrels of oil are discovered and produced.* Higher levels of activities and oil production are possible, but much less likely, because long-term oil prices above $30 are rare.

For environmental analyses, the activities following Sale 170 are associated with **350 to 670 million barrels of oil** produced over several decades.

The development scenario does not include natural gas production and marketing. The reason is that there is no existing transportation system (like the TAPS oil pipeline) to carry gas to outside markets. Should such a multi-billion dollar system be built, it would be supplied for decades with gas from existing North Slope fields. (Existing fields have proven gas reserves of 25–35 trillion cubic feet.) Oil wells, however, typically produce gas along with oil. On offshore production platforms, any produced gas will be used for fuel or it will be pumped back into the reservoir to increase oil recovery. Decades in the future, this recycled gas could be recovered and marketed.

The following paragraphs describe anticipated industry activities during exploration and production. The timing of the activities is summarized in Tables A-1 and A-2. For development scheduling, we assumed no long-lasting legal or regulatory delays. We also made optimistic assumptions both for industry effort and for discovery rates of commercial-sized fields. Commercial offshore fields are expected to be those with over 100 million barrels of recoverable oil reserves.



Types of wells

Exploration wells are drilled to test new oil and gas prospects. *Delineation wells* are drilled after a discovery is made to define the limits of the oil field and appraise its reservoir. If an oil field is determined to be commercial, or profitable to develop, additional wells are drilled to recover oil and gas.

Production wells pump oil to the surface. They are designed and located to maximize the recovery of oil from reservoirs in a field. *Service wells* are used to reinject water or gas back into the subsurface. Reinjection helps maximize oil recovery from the field. *Disposal wells* are used to safely discard drilling mud, rock cuttings, and wastes from facilities.

Table A-3 Pipelines, Sale 170, for Oil Prices of at Least $18 and $30 per Barrel
At prices of $18 per barrel, we estimate that 350 million barrels of oil will be discovered and produced; at prices of $30 per barrel, 670 million barrels will be discovered and produced.

Resource (MMbbl)	Onshore Length (Mi)	Onshore Size (Dia)	Offshore Length (Mi)	Offshore Size (Dia)	Total Pipelines (Mi)	Landfalls
350	20	12-16 inches	40	8-12 inches	60	Oliktok Pt. Pt.McIntyre Endicott
670	100	12-16 inches	60	8-14 inches	160	Oliktok Pt. Pt. McIntyre Endicott Flaxman

Exploration Activities

During exploration, industry will drill exploration and delineation wells, install platforms from which to drill wells, and transport personnel and supplies to and from the platforms.

Exploration Platforms Water depth will determine what type of platform is used for exploration drilling. In depths less than 40 feet, gravel islands will likely be built by either barges (in summer) or gravel-hauling trucks (in winter). Artificial ice islands (constructed, like ice roads, by flooding water over the sea ice) could be used in water depths less than 20 feet. People and material will be carried to and from the platforms over ice roads (in winter) and by boats (in summer). Some leases could be drilled from existing gravel islands using extended-reach drilling methods.

In water 40 to 80 feet deep, movable platforms resting on the seafloor will likely be used for exploration. These platforms are designed to withstand winter ice forces, so drilling can occur year round. In water over 80 feet, drillships or floating platforms will be used. These floating systems can operate only in open-water and broken-ice conditions, not mid-winter pack-ice conditions. They will be supported by icebreakers and supply boats during the summer months and stored in protected inshore areas when not in use.

Timing of Exploration Activities Exploration is expected to begin in the year following Sale 170 and proceed at a rate of 1 well per year. The exploration pace would slow to 1 well every 3 years in the low-price, *exploration-only scenario*. Because of the short open-water season in the Beaufort Sea (typically late July to mid-October), only one prospect may be tested each year. In the event of a discovery, however, more delineation wells may be drilled that year using the exploration rig already on location. High oil prices could encourage more than one operator to drill separate prospects in a given year. So it is possible that as many as 2 exploration rigs may be operating at the same time in the Sale 170 area.

Production Activities

During production, industry will drill production and service wells, install platforms from which to drill wells, transport personnel and supplies to and from the platforms, and lay pipelines to connect offshore platforms with existing onshore pipelines. Larger fields will be developed using several production platforms. Smaller fields near existing platforms could be developed by extended reach wells, and they may not require their own production platform.

Production Platforms In depths less than 40 feet, gravel islands will likely be used. In waters 40 to 125 feet deep, the platforms will probably be metal or concrete structures that rest on manmade berms on the seafloor. The structures will be designed for extreme ice conditions so that they can operate through the winter pack-ice season. In deeper waters beyond 125 feet, the platforms will likely be floating concrete structures anchored to the seafloor and tied to satellite subsea wells.

Pipelines New pipelines will carry oil from offshore platforms to existing pipelines onshore. Offshore, in waters less that 150 feet deep, pipelines will be installed in trenches and then buried to prevent damage from ice keels below ice pressure ridges. At shore crossings (landfalls), pipelines will be elevated on short jetties as protection against shoreline erosion. For long distance pipelines (over 100 miles), pump stations will be needed to regulate pipeline pressure. Onshore, pipelines will be insulated and elevated on stilts. Beneath wide river crossings, pipelines will be buried (or tunneled). The construction of pipelines, pump stations, and production facilities will be coordinated with offshore platform activities as to startup time.

New offshore pipelines are likely to be routed to connect to existing onshore pipelines and then to Pump Station No. 1

of TAPS. Existing landfalls are available at Oliktok Point (near Kuparuk field), at West Dock (near Point McIntyre and Prudhoe Bay fields), and at the Endicott/Duck Island field. In the future, landfalls may be built to serve the Sandpiper unit (near Milne Point field), the Northstar unit (west of Point McIntyre), and the Badami field (east of Endicott) (Fig. A-1). Eventually, a long pipeline may be built onshore to serve fields in the Point Thomson unit. This pipeline is likely to have a landfall near Flaxman Island within the Point Thomson Unit, serving fields in the eastern Beaufort (perhaps Kuvlum and Hammerhead). A summary of new pipelines that may be built as a result of Sale 170 is given in Table A-3.

Timing of Production Activities The timing of production activities is shown in Table A-2. In this development schedule, we made optimistic assumptions both for industry effort and for discovery rates of commercial-sized fields.

Most newly discovered fields will require 2 or more years of delineation drilling, new seismic surveys, and reservoir studies before a company commits to full-scale production. Production will only begin if a field is economically viable (profitable), otherwise development will be delayed until more favorable economic conditions occur. As a rough estimate, a marginally economic field will contain oil reserves of 100 to 150 million barrels.

Platform Installation. Production platforms could be installed in 3 to 6 years following the discovery well, depending on the location. For larger fields, platforms could be installed at a rate of 1 per year. Development of smaller fields may proceed more slowly because of marginal economics.

To shorten start-up time on gravel-island platforms, two production rigs could drill development wells at the same time. Other platform types are too small to support more than one drilling rig. A drilling rig will remain on each platform for well-workover operations. Workovers are done periodically (every 5 years or so) to improve declining production rates.

Pipeline Installation. An offshore pipeline will take 1 to 4 years to complete, depending on the field location and water depth. In shallow water, pipelines could be installed year round. In water over 40 feet deep, pipeline route surveys, trenching, and laying operations will take place in the short open-water season.

If these optimistic schedules can be met, production will begin 4 to 8 years after a discovery is made. Depending on the reservoir size, individual oil fields will be active for 10 to 25 years. Discoveries will probably be staggered over a period of time, so production from fields leased in Sale 170 could last over 30 years.

A very important assumption for long-term production from the North Slope and Beaufort Sea is that *the trans-Alaska pipeline system will remain in operation* to carry oil to distant markets.

Estimates of Mud and Cuttings

As a well is drilled, a substance called *mud* is put into the wellbore. Drilling mud prevents the sides of the wellbore from caving in, and prevents oil and gas from escaping to the surface. It also brings rock *cuttings*, or small pieces of rock ground up by the drill bit, to the surface. Some portion of the drilling mud can be treated and reused in other wells. Rock cuttings are pulverized and placed in disposal wells. If strict standards are met, mud and cuttings can be discharged into the ocean.

The amount of mud and cuttings depends on the length of the wellbore. In the sale area, wells will target oil pools at various depths and at various distances from the drilling platform. So wellbore length will vary. Exploration wells will target reservoirs from 5,000 to 15,000 feet in the subsurface, so an average wellbore length would be 10,000 feet. Production and service wells will average about 13,000 feet in length because they will reach outward from a central drilling location.

An average exploration well (10,000 feet) will use 630 tons of mud and will produce 820 tons of dry cuttings. An average production well (13,000 feet) will use 150 to 680 tons of mud (assuming that 20 to 80% of the mud is recycled) and will produce 1,180 tons of dry cuttings.

The composition of the drilling mud is actually quite complex, as shown below.

Component	Weight %
Bentonite	6.5
Lignosulfonate	2.0
Lignite	1.4
Caustic	0.7
Lime	0.3
Barite	75.0
Drilled solids	13.0
Soda ash/sodium bicarbonate	0.4
Cellulose polymer	0.7
Seawater/freshwater (as needed)	
Total	100.0

Source: EPA Type 2, Lignosulfonate Mud

Deferral Options

Under the full proposal, the entire Sale 170 area would be offered for leasing and possible development. The economic resources associated with leasing the full proposal area range from 350 to 670 million barrels (MMbbl). Three deferral options are also considered as

Table A-4 Changes in Levels of Activity for the Deferral Alternatives, Sale 170

Alternative	Exploration Wells	Delineation Wells	Exploration Rigs	Production Platforms	Prod/Service Wells	Production Drilling Rigs	Production Startup	Peak Production (MMbbl/yr)	Offshore Pipelines (mi)	Total Pipelines (mi)
Full proposal area	6-8	6-8	2	3-5	87-111	3-4	Year 8	39-65	40-60	60-160
with Cross Is. deferral	5-6	4-6	2	2-4	70-89	2-3	Year 8	31-52	30-50	50-150
with Kaktovik deferral	4-6	3-5	2	2-3	61-66	2-3	Year 8	27-46	20-50	50-80
with ANWR deferral	3-5	3-5	2	2-3	52-67	2-3	Year 8	23-39	20-40	40-70

Notes:
1) Levels of activity for the full Sale 170 proposal are estimated using discovered and produced oil resources of 350 to 670 MMbbl economically recoverable at oil prices of $18 and $30 per barrel (1996$). Oil resources of 350 MMbbl are likely to represent 1 to 3 fields. Oil resources of 670 MMbbl are likely to represent 2 to 5 fields.
2) No natural gas resources will be produced and commercially marketed as a result of leasing in Sale 170.
3) Exploration wells include both discoveries and dry holes.
4) Exploration and production rigs are the maximum operating in any single year.
5) Multiple production platforms could be used to develop a single field.
6) Service wells are assumed to be 25 percent of total production/service wells.
7) Twelve months after the lease sale is the end of year 1.
8) Pipeline miles are for new tie-ins to existing infrastructure (also see Table A-3).

alternatives for Sale 170 to provide additional measures of environmental protection. Accepting one or more of these deferral options is very likely to reduce industry activities as well as future oil production resulting from Sale 170. Comparisons between petroleum-related activity levels for the full proposal and other Sale 170 alternatives are summarized in Table A-4. A brief description of each deferral option and its potential effects on petroleum-related activities is given below.

The **Cross Island deferral (Alternative IV.a in the FEIS)** is designed to provide a buffer (10-mile radius) around Cross Island to minimize the conflicts between petroleum activities and subsistence whaling by the residents of Nuiqsut (Figure III.C.2-6). On an areal basis, the Cross Island deferral area covers 6 percent of the overall Sale 170 proposal area. However, a disproportionate fraction of the undiscovered resource potential (approximately 20 percent) is expected to be leased, explored, and developed because of the favorable location near existing oil production infrastructure. This area contains high potential geologic plays with proven commercial importance in nearby fields. Small new oil discoveries are more likely to be commercially profitable because they could be developed as satellites from existing fields. We estimate that one oil field ranging in size from 70 to 120 MMbbl could be leased, discovered, and developed in this area if offered in Sale 170.

The **Kaktovik deferral (Alternative III)** is located in Camden Bay and is designed to provide a buffer to protect whaling activities launched from the village of Kaktovik on Barter Island (Figure III.C.2-9). On an areal basis, the Kaktovik deferral covers 20 percent of the unleased blocks in the full Sale 170 proposal area. Using a play analysis approach, this area could contain approximately 30 percent of the total undiscovered economic oil resources in the Sale 170 area. Recent leasing and proposed exploration activity (Warthog prospect) has highlighted the potential importance of Brookian geologic plays in the nearshore area. We estimate that one oil field ranging in size from 110 to 190 MMbbl could be leased, discovered, and developed in this area if offered in Sale 170.

The **ANWR deferral (Alternative V.a)** is designed to provide an expanded buffer to protect environmental resources associated with the Arctic National Wildlife Refuge on the eastern part of the North Slope. On an areal basis, the ANWR deferral covers 30 percent of the unleased blocks in the full Sale 170 proposal area. Using a play analysis approach, this area could contain approximately 40 percent of the total undiscovered economic oil resources in the Sale 170 area. The high resource potential of this area is evidenced by numerous oil and gas discoveries onshore and offshore (Fig. A-1). Nearshore (State) leases are held in the Point Thomson unit, and two OCS fields have been unitized for possible future development (Hammerhead and Kuvlum). Development activity near the coastline (Badami) will extend the North Slope pipeline system to within a few tens of miles of the deferral area and increase the likelihood that new discoveries will be developed. We estimate that 1 to 2 oil fields containing total resources of 140 to 220 MMbbl could be leased, discovered, and developed in this area if offered in Sale 170.

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APPENDIX B

ENDANGERED SPECIES ACT

SECTION 7

CONSULTATION AND COORDINATION

Appendix B

Correspondence with the National Marine Fisheries Service

Correspondence with the U.S. Fish and Wildlife Service

Biological Evaluation for Threatened and Endangered Species

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Alaska Outer Continental Shelf Region
949 E. 36th Avenue, Room 603
Anchorage, Alaska 99508-4302

IN REPLY REFER TO

OCT 22 [illegible]

Mr. Steven Pennoyer
Director, Alaska Region
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

Dear Mr. Pennoyer:

The Minerals Management Service has initiated the planning process for leasing and exploration associated with the proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale 170, Beaufort Sea. This lease sale is tentatively scheduled for April 29, 1998, in the Beaufort Sea Planning Area (see enclosure). The area offered will be no larger than that indicated as the proposed sale area.

In accordance with the Endangered Species Act Section 7 regulations governing interagency cooperation, we are providing a notification of the listed and proposed species and critical habitat that will be included in our biological evaluation.

It is our understanding that there are no proposed or designated critical habitats for any listed or proposed species in OCS regions potentially affected by activities associated with Sale 170. In our biological evaluation, we will review the following listed species that may be present in the proposed lease area.

Common Name	Scientific Name	Status
Bowhead whale	*Balaena mysticetus*	endangered

Please notify us of your concurrence or revisions and of any new information concerning these species in relation to the proposed project area. To facilitate the review, we have provided a copy of this letter to your Anchorage field office. Upon receipt of your reply, we will begin preparation of the biological evaluation reviewing potential effects of the proposed action.

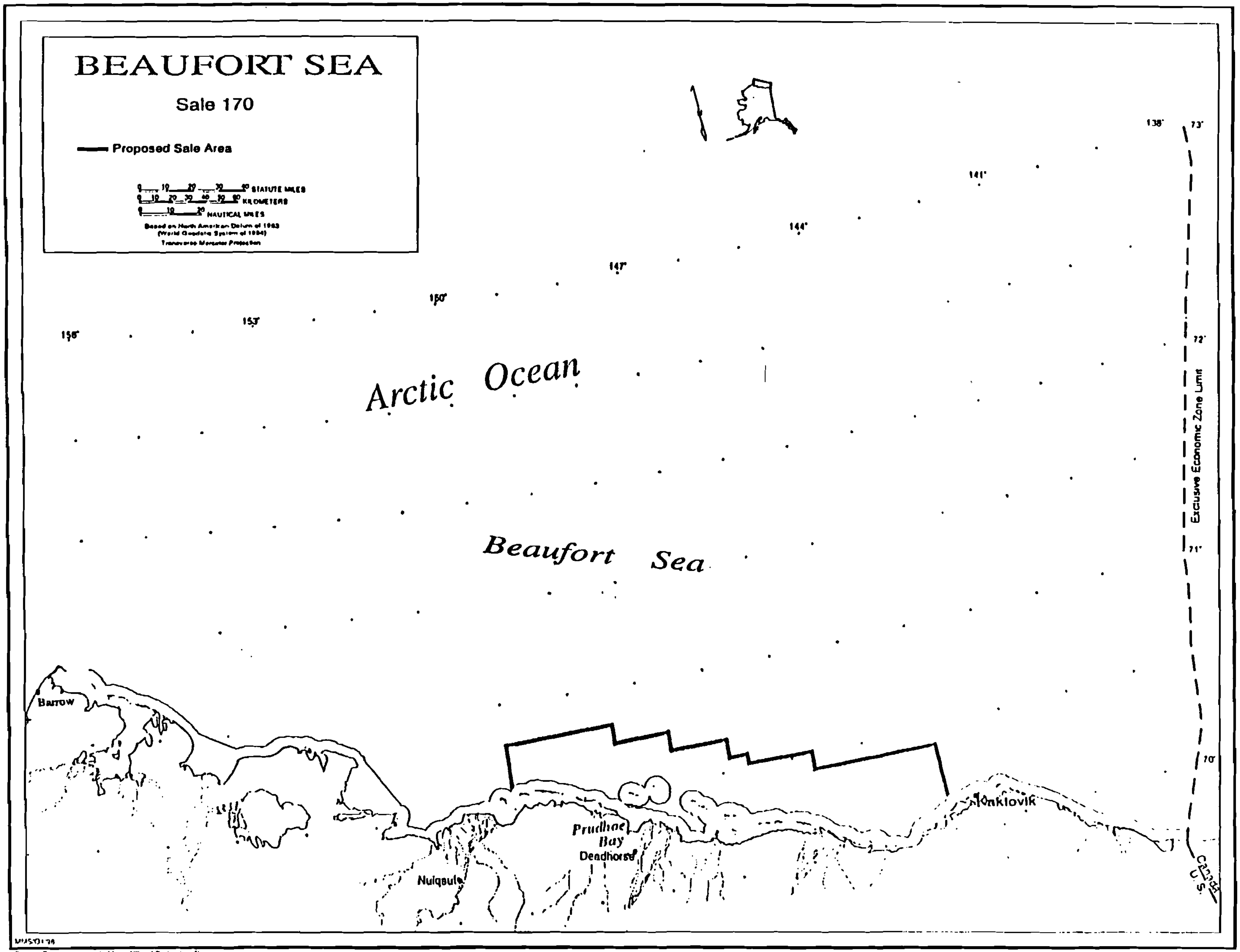
We look forward to working with you and your staff in protecting and conserving endangered and threatened species. If you have any questions concerning this proposed action, please contact Frank Wendling at (907) 271-6510 or Joel Hubbard at (907) 271-6670.

Sincerely,

for John T. Goll
Regional Director

Enclosure

MMS Minerals Management Service
Alaska OCS Region



Source: Base map compiled from Official Protraction Diagrams

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

RECEIVED
NOV 4 1996
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

October 29, 1996

John T. Goll
Regional Director
U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region
949 East 36th Avenue, Room 603
Anchorage, Alaska 99508-4302

ATTN: Mr. Frank Wendling or Mr. Joel Hubbard

Dear Mr. Goll:

Thank you for your letter concerning the presence of threatened or endangered species and critical habitat within the planning area of proposed Oil and Gas Lease Sale 170, Beaufort Sea. We concur with your identification of the bowhead whale as the only species listed under the Endangered Species Act and under the jurisdiction of the Department of Commerce, National Marine Fisheries Service, which is likely to occur in this area. No critical habitat has been designated, or is currently proposed, within the Alaskan Beaufort Sea.

Please direct any questions to Mr. Brad Smith in our Anchorage Field Office at (907) 271-5006.

Sincerely,

for Steven Pennoyer
Administrator, Alaska Region

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Washington, DC 20240

Dr. Rolland Schmitten
Assistant Administrator for Fisheries
National Marine Fisheries Service, NOAA
1315 East-West Highway
Silver Spring, Maryland 20910

MAR 04 1997

Dear Dr. Schmitten:

The Minerals Management Service (MMS) is preparing a draft Environmental Impact Statement (EIS) on the proposed Beaufort Sea Oil and Gas Lease Sale 170. This would be the seventh Federal offshore sale in the Beaufort Sea Planning Area. The sale is tentatively scheduled for April, 1998. Under Section 7(a)(2) of the Endangered Species Act (ESA), we request a formal consultation on the leasing and any exploration that may occur as a result of this sale.

The enclosed biological evaluation describes the proposed lease sale to the extent feasible, the listed species most likely to be affected, effects of proposed leasing and exploration activities, and potential mitigating measures to reduce potential adverse effects to listed species. Less detailed information is provided on development and production activities due to their uncertainty at this time. However, there is sufficient information to provide a basis for an opinion on the later steps of development and production.

Similar proposed actions in the Beaufort Sea Planning Area were addressed in the Arctic Region Biological Opinion (USDOC, NMFS, 1988), Beaufort Sea Sale 124 Biological Opinions (USDOI, FWS, 1990; USDOC, NMFS, 1990-referenced 1988 Opinion) and Beaufort Sea Sale 144 Biological Opinions (USDOI, FWS, 1996; USDOC, NMFS, 1995-referenced 1988 Opinion).

We believe there is no need for a lengthy formal consultation for Sale 170 because Sales 144 and 124 data, referenced in the biological evaluation, represent the best scientific and commercial information available. After reviewing the biological evaluation, NMFS may wish to affirm in writing the applicability of the Arctic Region Biological Opinion to Sale 170. Such an action would avoid unnecessary paperwork and time delays and is consistent with the arcticwide opinion that "Opinions on future lease sales should incorporate by reference this Opinion if it contains the best information available."

This approach is similar to confirming an early consultation's preliminary biological opinion as a final opinion (as described in 50 CFR 402.11(f)). We hope that NMFS would issue the affirmation within 45 days noted for confirming a preliminary opinion.

We recognize that NMFS may prefer to conduct a full-scale formal consultation for Sale 170 that may require the full 135-day period allowed by ESA Section 7 for consultation and delivery of a biological opinion. If during the prolonged consultation, NMFS considers a potential finding of "jeopardy," new conservation recommendations, or new incidental take measures, terms and conditions, we request that our respective staffs discuss these aspects as early as possible in the consultation. Through these discussions, MMS believes it would be possible to maximize cooperation encouraged by the Interagency ESA Memorandum of Understanding signed in 1994.

If you agree that a lengthy consultation is not necessary, we would welcome some official word from NMFS, as soon possible to that extent and when we might expect to receive a biological opinion for proposed Sale 170. This information would facilitate planning for the sale and the EIS.

We understand that by extending existing biological opinions to Sale 170, or by providing us with an entirely new opinion for this proposed sale, NMFS will not be foreclosing on opportunities to reconsider that opinion as future sales are proposed for this area.

If you have any questions on this matter, please contact Ms. Judy Wilson, Minerals Management Service, MS 4042, 381 Elden Street, Herndon, Virginia 20170-4817 (phone 703- 787-1075) or Mr. Frank Wendling, Minerals Management Service, Alaska Region, 949 East 36th Avenue, Anchorage, Alaska 99508-4302 (phone 907-271-6510).

Sincerely,

Carolita U. Kallaur

Carolita Kallaur
Associate Director for
Offshore Minerals Management

Enclosure

cc:

Regional Director
Alaska Regional Office
National Marine Fisheries Service
P.O. Box 21688
Juneau, Alaska 99802-1668

Field Supervisor
Anchorage Field Office
National Marine Fisheries Service
222 W. 7th Avenue, Box 43
Anchorage, Alaska 99513-7577

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

JUL - 1 1997

Ms. Carolita Kallaur
Associate Director
Offshore Minerals Management
Minerals Management Service
Washington, D.C. 20240

Dear Ms. Kallaur:

Thank you for your letter concerning consultation under Section 7 of the Endangered Species Act (ESA) on the potential effects of proposed Oil and Gas Lease Sale 170 (Beaufort Sea), currently scheduled for April 1998. In the Biological Evaluation for Threatened and Endangered Species with Respect to the Proposed Beaufort Sea Oil and Gas Lease Sale 170, Minerals Management Service (MMS) has recognized the similarities between Sale 170 and previous lease sales in the Alaskan arctic, including Sale BF (1979), and five subsequent lease sales held between 1982 and 1996. The implications of these sales on threatened and endangered species were considered within the 1988 Arctic Region Biological Opinion (ARBO). The National Marine Fisheries Service (NMFS) prepared the ARBO to address leasing and exploration activities in the Beaufort Sea, Chukchi Sea, and Hope Basin outer continental shelf (OCS) planning areas. The ARBO considered the potential for these activities to jeopardize the existence of the western arctic stock of bowhead whales; concluding that work outside of the spring lead system would not prevent the recovery and survival of the stock. The ARBO also addressed the gray whale, now recovered and removed from the endangered species list.

We believe the conclusions and recommendations within the ARBO which remains consistent with findings from applicable research occurring since 1988 is appropriate and applicable to Sale 170. Therefore, we find the requirements of Section 7 of the ESA are satisfied by the inclusion of the ARBO in the Sale 170 planning process. This finding assumes that MMS will continue to present mitigating measures and Information to Lessees which address such important issues as protection of biological resources, site-specific bowhead whale monitoring programs and methods to avoid or minimize disturbance.

Readers of the ARBO are reminded of the recent de-listing of the gray whale. Additionally, MMS should ensure that the Notice to Lessees specifies that no takes, including takes by harassment, are authorized through this Opinion. NMFS has issued an interim rule which establishes procedures for authorizing the harassment of marine mammals in Arctic waters under 101 (a)(5)(D) of the Marine Mammal Protection Act. These authorizations require a monitoring plan to determine the effects of OCS activities on marine mammals stocks and the availability of stocks used for subsistence purposes. This monitoring plan is then subject to an independent peer review. A cooperative plan between the applicant and the affected Alaskan subsistence community(s) would also be required. We anticipate that companies conducting operations under Sale 170 which have the potential to harass bowhead whales will apply for this authorization.

Please direct any questions in this matter to Ronald Morris or Brad Smith, NMFS, 222 West 7th Avenue, Box 43, Anchorage, Alaska 99513, (907) 271-5006.

Sincerely,

Hilda Diaz-Soltero
Acting Director
Office of Protected Resources

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Washington, D.C. 20240

NOV 4

Hilda Diaz-Soltero
Director
Office of Protected Resources
National Marine Fisheries Service, NOAA
1315 East-West Highway
Silver Spring, Maryland 20910

Dear Ms. Diaz-Soltero:

The Minerals Management Service (MMS) is including additional alternatives to the proposed Beaufort Sea Oil and Gas Lease Sale 170 final Environmental Impact Statement (EIS). These alternatives are a result of the comments on the draft EIS. The proposed action remains unchanged. The two additional alternatives, with two options each (enclosed), further the protection of environmental resources. The alternatives have no additional potential adverse impacts on listed species, and we conclude that the National Marine Fisheries Service affirmation, on July 1, 1997, of the Arctic Region Biological Opinion (USDOC, NMFS, 1988) remains valid and that there is no need to reinitiate consultation. Because the final EIS must be completed by December 15, 1997, we would welcome written notification by that time if you disagree with our conclusion that it is not necessary to reinitiate consultation.

If you have any questions on this matter, please contact Mr. Frank Wendling, Minerals Management Service, Alaska Region, 949 East 36th Avenue, Anchorage, Alaska 99508-4302 (phone 907-271-6510) or Mr. George Valiulis, Minerals Management Service, MS 4042, 381 Elden Street, Herndon, Virginia 20170-4817 (phone 703-787-1662).

Sincerely,

Robert Labelle
Chief, Environmental Division

Enclosure

cc: Regional Director
Alaska Regional Office
National Marine Fisheries Service
P.O. Box 21688
Juneau, Alaska 99802-1668

Field Supervisor
Anchorage Field Office
National Marine Fisheries Service
222 W. 7th Avenue, Box 43
Anchorage, Alaska 99513-7577

Enclosure

Additional Alternatives for Proposed Beaufort Sea Oil and Gas Lease Sale 170

- The **Cross Island** area deferral option provides a defined 10-mile buffer zone around Cross Island to minimize potential space use and noise disturbance conflicts between petroleum activities and subsistence whaling by residents of Nuiqsut.

- The **Cross Island** mitigation by stipulation option prohibits a permanent production facility within a defined 10-mile radius around Cross Island unless the lessee can demonstrate the permanent facility siting will not preclude reasonable subsistence access for hunting Bowhead whales.

- The offshore **Arctic National Wildlife Refuge** deferral option defers approximately 122 whole and partial blocks. The deferral area expands the Kaktovik Deferral Alternative III analyzed in the draft EIS for Lease Sale 170 to the west and north to approximately 146°W. longitude.

- The **Arctic National Wildlife Refuge** mitigation by stipulation option proposes three new stipulations and three new ITLs (Information to Lessees). The alternative emphasizes restrictions or prohibitions on activities within and adjacent to ANWR and requires information of lessees on measures taken to minimize effects to polar bears.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

NOV 21 1997

Mr. Robert Labelle
Chief, Environmental Division
Minerals Management Service
Department of the Interior
Washington, D.C. 20240

Dear Mr. Labelle:

Thank you for your letter regarding the final Environmental Impact Statement (FEIS) for the proposed Beaufort Sea Oil and Gas Lease Sale 170.

NMFS has concluded that the additional alternatives and mitigating measures contained in the FEIS do not change the "not likely to jeopardize" conclusion of the Arctic Region biological opinion (ARBO), as reiterated by the July 1, 1997, consultation. Therefore, the ARBO remains valid for Lease Sale 170 and there is no need for further consultation pursuant to Section 7 of the Endangered Species Act. If project plans change or new information becomes available that changes the basis for this determination, then consultation should be reinitiated.

Additionally, the Minerals Management Service should ensure that the Notice to Lessees specifies that no takes, including takes by harassment, are authorized by this letter. NMFS has issued interim rules that establish procedures for authorizing the harassment of marine mammals in Arctic waters under Section 101 (a)(5)(D) of the Marine Mammal Protection Act. These authorizations require a monitoring plan to determine the effects of outer continental shelf activities on marine mammal stocks and the availability of stocks used for subsistence purposes. This monitoring plan is then subject to an independent peer review. A cooperative plan between the applicant and the affected Alaskan subsistence community(s) may also be required. We anticipate that companies conducting operations under Sale 170 with the potential to harass bowhead whales will apply for this authorization.

Please direct any questions in this matter to Brad Smith, NMFS, 222 West 7th Avenue, Box 43, Anchorage, Alaska 99513, (907) 271-5006.

Sincerely,

Hilda Diaz-Soltero
Director
Office of Protected Resources

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Alaska Outer Continental Shelf Region
949 E. 36th Avenue, Room 603
Anchorage, Alaska 99508-4302

IN REPLY REFER TO

Memorandum

OCT 22 [illegible]

To: Regional Director, U.S. Fish and Wildlife Service

From: Regional Director

Subject: Endangered Species - Proposed Oil and Gas Lease Sale 170 (Beaufort Sea)

The Minerals Management Service has initiated the planning process for leasing and exploration associated with the proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale 170, Beaufort Sea. This lease sale is tentatively scheduled for April 29, 1998, in the Beaufort Sea Planning Area (see attachment). The area offered will be no larger than that indicated as the proposed sale area.

In accordance with the Endangered Species Act Section 7 regulations governing interagency cooperation, we are providing a notification of the listed and proposed species and critical habitat that will be included in our biological evaluation.

It is our understanding that there are no designated or proposed critical habitats for any listed or proposed species in OCS regions potentially affected by activities associated with Sale 170. In our biological evaluation, we will review the following listed, proposed, and delisted species that may be present in the proposed lease area.

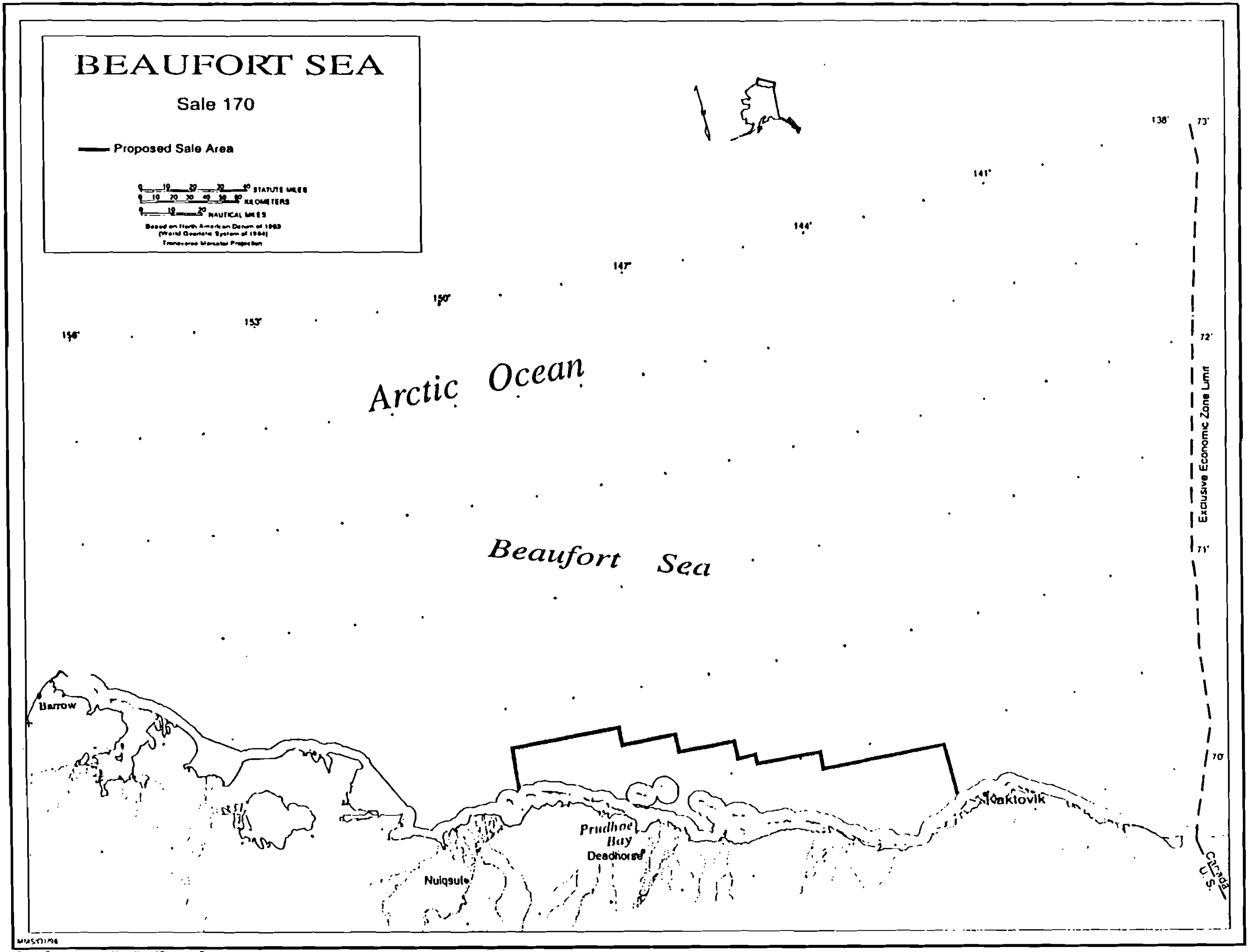
Common Name	Scientific Name	Status
Spectacled eider	*Somateria fischeri*	threatened
Steller's eider	*Polysticta stelleri*	proposed threatened
Arctic peregrine falcon	*Falco peregrinus tundrius*	delisted

Analysis of potential effects on several species that occur at more southern latitudes along the expected oil transport corridor were included in our biological evaluations for Cook Inlet Lease Sale 149 and Gulf of Alaska-Yakutat Lease Sale 158. The oil transport scenario for Sale 170 remains the same, so evaluations of species along the southern transportation corridor are incorporated by reference to the biological evaluations for Sale 149 and Sale 158.

Please review our list and notify us of your concurrence or revisions and of any new information concerning these species in relation to the proposed project area. To facilitate the review, we have provided a copy of this letter to your Anchorage Ecological Services Field Office. Upon receipt of your reply, we will begin preparation of the biological evaluation reviewing potential effects of the proposed action.

We look forward to working with you and your staff in protecting and conserving endangered and threatened species. If you have any questions concerning this proposed action, please contact Joel Hubbard at (907) 271-6670 or Frank Wendling at (907) 271-6510.

Attachment



Source: Base map compiled from Official Protraction Diagrams

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. Tudor Rd.
Anchorage, Alaska 99503-6199

IN REPLY REFER TO:

AES/ESO/NAES

NOV 26 1996

RECEIVED
DEC 3 1996
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Memorandum

To: Regional Director
Minerals Management Service, Alaska

From: Regional Director
Region 7

Subject: Call for Information and Nominations, and List of Potentially Affected Endangered and Threatened Species, Outer Continental Shelf Proposed Sale 170 (Beaufort Sea)

Recently, the Minerals Management Service made two requests to the Fish and Wildlife Service to provide information pertaining to Outer Continental Shelf Proposed Sale 170, planned for 1998. The first dated September 30, 1996, was the Call for Information and Nominations. The second, dated October 22, 1996, requested concurrence with a list of species that are listed, proposed, or delisted under the Endangered Species Act of 1973, as amended, that may be present in the proposed lease area. This memorandum provides the Service's response to both requests for information. Please note that the Service provided comments on a related sale, Beaufort Sea Sale 144, in memoranda dated July 26, 1991, February 3, 1994, and November 20, 1995, and these are still applicable.

Endangered, Threatened, and Delisted Species

In the memorandum of October 22, 1996, you provided notification of the listed and proposed species and critical habitat that will be included in your biological evaluation. We agree that there are no designated or proposed critical habitats that will be affected by Lease Sale 170. Additionally, we agree that three listed, proposed, or delisted species, the spectacled eider (*Somateria fischeri*), Steller's eider (*Polysticta stelleri*), and Arctic peregrine falcon (*Falco peregrinus tundrius*), may be present in the proposed lease area. As identified in your memorandum, Arctic peregrine falcons are no longer on the list of threatened and endangered wildlife. Therefore, it is not required that they be included in your biological evaluation. Further clarification of this point is provided below.

Spectacled eiders

This species, classified as threatened on May 10, 1993, nests in low-lying arctic and sub-arctic wetlands in three geographic regions: the Yukon-Kuskokwim Delta, North Slope of Alaska, and Arctic Russia. On the Yukon-Kuskokwim Delta, spectacled eider numbers have declined by more than 96 percent since the mid-1970s. On the North Slope, localized declines may have occurred in some areas, such as Prudhoe Bay (Warnock and Troy 1992), but data are insufficient to determine a region-wide trend in population size. The Russian population remains large, but trends in population size are unknown.

On the North Slope of Alaska, spectacled eiders now nest from Cape Simpson to the Sagavanirktok River, although the species' distribution appears to have originally been more extensive in this region (U.S. Fish and Wildlife Service 1996). Within this region, the species occupies river deltas, tundra with numerous lakes, and wet, coastal plain characterized by numerous shallow ponds and lakes. Based upon extensive aerial surveys, biologists estimate that a minimum of 7,000-9,000 spectacled eiders occupy the North Slope during the breeding season (Larned and Balogh 1994, U.S. Fish and Wildlife Service 1996).

Although spectacled eiders occur in the Beaufort Sea, knowledge of the importance of this area to the birds that nest on the North Slope remains incomplete. Some migrate eastward past Barrow during spring migration, which occurs during late May to early June, although observations along the Meade River suggest that others may migrate across the North Slope following inland routes (Myers 1958). Likewise, some are observed returning past Barrow during fall migration in August and September (Johnson and Herter 1989). An ongoing telemetry study initiated at Prudhoe Bay indicates that spectacled eiders use state and Alaska OCS marine waters in the Beaufort Sea during summer (M. Petersen, U.S. Geological Survey, Biological Resources Division, unpubl. data). Males depart the nesting grounds shortly after breeding (Warnock and Troy 1992, TERA 1993), and these birds likely pass through the Beaufort Sea during July (Johnson and Herter 1989). Females and young move from freshwater to marine environments shortly after the young fledge at an age of about 50 days (Dau 1974, Kistchinski and Flint 1974), and young of the year have been found migrating past Barrow and Icy Cape during August and September (Johnson and Herter 1989). In summary, although it is unknown what portion of spectacled eiders that nest on the North Slope use the Beaufort Sea during spring, summer, or fall, the species occurs in the Beaufort Sea from late May through at least late September. The telemetry study by Petersen (U.S. Geological Survey, Biological Resources Division, unpubl. data) will greatly expand what we know about use of marine waters in the Beaufort Sea by spectacled eiders.

The Service recommends that an Information To Lessees regarding spectacled eiders be adopted and offers the following language for your consideration:

ITL ( )--Spectacled Eider

Lessees are advised that the spectacled eider (*Somateria fischeri*) is listed as threatened by the U.S. Fish and Wildlife Service and is protected by the Endangered Species Act of 1973, as amended.

Spectacled eiders are present in the Chukchi and Beaufort seas during spring migration in May and June. Males return to the sea in late June, while nesting females remain on the arctic coastal tundra until late August or early September. Onshore activities related to OCS exploration, development, and production during the summer months (May - September) may affect nesting spectacled eiders.

Lessees are advised that the Service will review exploration plans and development and production plans submitted by lessees to the Minerals Management Service in order to protect spectacled eiders and their habitats.

We also would like to point out that the Spectacled Eider Recovery Plan was recently completed. We have enclosed a copy for your use. The summary of current information on the species may be helpful during preparation of the biological evaluation and ITL.

Steller's eider

The Alaska breeding population of Steller's eider was proposed for listing as a threatened species on July 14, 1994. A final determination as to whether listing is warranted has not been made, but may occur within the next few months.

The Steller's eider nests only along the northern coast of Siberia and the extreme northwest portion of the Alaskan coastal plain. Before the 1960s, the Yukon-Kuskokwim Delta was an important nesting area for Steller's eiders; however, only two nests have been observed there since 1975. Currently, the species occurs in two general areas in northern Alaska during the nesting season. In the vicinity of Barrow, several dozen pairs occur and nest during most years, although population size, breeding effort, and nesting success vary widely among years. Elsewhere on the North Slope, the species occurs at extremely low densities across much of the northwestern arctic coastal plain. In this large region the species occurs very irregularly, and virtually nothing is known of their reproductive effort and success.

Most of the world's population of Steller's eiders winters along the Alaska Peninsula from the eastern Aleutian Islands to southern Cook Inlet. Spring and fall migration routes in the Chukchi and Beaufort seas are unknown. Steller's eiders arrive in pairs on the Alaska breeding grounds in early June. Males leave the breeding grounds while females are incubating in the latter part of June (Quakenbush et al. in prep.). Small groups of males (less than 10) have been observed in July near shore in the Chukchi Sea near Barrow (L. Quakenbush, U.S. Fish and Wildlife Service, pers. obs.). A Steller's eider female with a brood was observed on a tundra pond on August 28, 1993 (L. Quakenbush, U.S. Fish and

Wildlife Service, pers. obs.). Based on this limited information, we presume that females and broods remain on the breeding grounds until late August or early September.

We recommend that an ITL for Steller's eiders be adopted if the species is listed before the final Environmental Impact Statement is approved. The Service is available to assist Minerals Management Service in developing an ITL.

Arctic Peregrine Falcons

Arctic peregrine falcons were removed from the list of threatened and endangered wildlife on October 5, 1994, following recovery of the subspecies. Arctic peregrine falcons, which nest primarily on cliffs and banks formed by stream erosion, are distributed widely across the North Slope, although only a few hundred pairs are thought to occur in Alaska. A few pairs may nest along the Beaufort Sea coast (one pair has nested on Barter Island during recent years). Additionally, some non-breeding subadult peregrine falcons have been seen on the Colville River Delta in recent years (J. Helmericks, pers. comm.), suggesting that non-breeding peregrines may utilize the highly productive wetlands near the Beaufort Sea coast during summer. However, because the subspecies has been delisted, and because the subspecies is relatively rare in the area affected by Lease Sale 170, we feel that it is unnecessary to include arctic peregrine falcons in the biological evaluation for this lease sale.

Species of Special Concern

Polar Bears

In 1993, in response to petitions from the oil and gas industry, the Service published regulations governing the incidental take of polar bears (*Ursus maritimus*) and Pacific walrus (*Odobenus rosmarus*) during specific oil and gas exploration, development, and production activities, in the Beaufort Sea and adjacent waters of Alaska (58 CFR 60402; November 16, 1993). On August 17, 1995, those regulations were extended for a total effective period of five years as authorized by the Marine Mammal Protection Act of 1972, as amended. The regulations are valid until December 15, 1998.

Polar bears may den throughout the lease sale area. Amstrup and Gardner (1994) found that polar bears commonly den on land, as well as in multi-year pack ice, and occasionally in land-fast ice. The latitudinal distribution of pack ice dens ranged from 70°12'N to 77°48'N and they drifted an average of 357 km. See Amstrup (1993) for a discussion of human disturbance of denning polar bears in Alaska.

On or near shore, polar bears excavate maternity dens in snow drifts adjacent to bluffs, barrier islands, and other areas of topographic relief (Amstrup and DeMaster 1988). Shore fast ice adjacent to barrier islands may also provide habitat for denning polar bears. Inshore of the proposed sale area, denning has been observed in bluffs along the Colville River from the delta south to the village of Nuiqsut, in the Sagavanirktok River Delta, along Marsh Creek, and along the Staines, Canning and Sadlerochit rivers. Dens have been found along the coastline at Oliktok and Beechey points. Dens also have been observed on several barrier islands including Thetis Island, Pingok Island, Cottle Island, Howe Island, and Flaxman Island.

Winter activities related to oil exploration, development and production may result in disturbance to maternity dens. Physical damage could occur to dens in the path of seismic surveys. It is highly preferable for activities in known denning areas to be suspended between October 30 and April 15. If activities must occur in the area during these months we strongly recommend that operators apply for a Letter of Authorization to conduct activities in polar bear habitat. Operators should consult with the Service prior to initiating any field activities to obtain the most recent information on possible den locations. Known dens or those encountered during the conduct of activities should be avoided by one mile and immediately reported to the Service. All barrier islands should be avoided during the denning season. Aircraft should be required to maintain a 1,500 foot minimum altitude over areas where polar bears may be present.

We recommend that the ITL regarding polar bear interactions from Lease Sale 144 be adopted for Lease Sale 170 with the following modifications highlighted in bold: "Lessees are advised that polar bears may be present in the area of operations, particularly during the solid ice period. Lessees should conduct their activities in a manner that will limit potential encounters and interaction between lease operations and polar bears. **Lessees are advised to contact the Fish and Wildlife Service regarding proposed operations and actions that might be taken to minimize interactions with polar bears. Lessees also are advised to consult "OCS Study MMS 93-0008, Guidelines for Oil and Gas Operations in Polar Bear Habitats."**

We appreciate this opportunity to provide information for your analysis. If you have any questions or desire further information, please contact Tony DeGange at (907) 786-3492.

Attachment

Literature Cited

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Amstrup, S.C., and D.P. DeMaster. 1988. Polar Bear, *Ursus maritimus*. Pages 39-56 *in*: J.W. Lentfer, ed. Selected marine mammals of Alaska: species accounts with research and management recommendations. Marine Mammal Commission, Washington, D.C.

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United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Washington, DC 20240

Memorandum MAR 04 1997

To: Director, U.S. Fish and Wildlife Service

From: Associate Director for Offshore Minerals Management Carolita U. Kallaur

Subject: Endangered Species Act Section 7 Formal Consultation for Leasing and Exploration Attendant Proposed Beaufort Sea Oil and Gas Lease Sale 170

The Minerals Management Service (MMS) is preparing a draft Environmental Impact Statement (EIS) on the proposed Beaufort Sea Oil and Gas Lease Sale 170. This would be the seventh Federal offshore sale in the Beaufort Sea Planning Area. The sale is tentatively scheduled for April 1998. Under Section 7(a)(2) of the Endangered Species Act (ESA), we request a formal consultation on the leasing and any exploration that may occur as a result of this sale.

The attached biological evaluation describes the proposed lease sale to the extent feasible, the listed species most likely to be affected, effects of proposed leasing and exploration activities, and potential mitigating measures to reduce potential adverse effects to listed species. Less detailed information is provided on development and production activities due to their uncertainty at this time. However, there is sufficient information to provide a basis for an opinion on the later steps of development and production.

Similar proposed actions in the Beaufort Sea Planning Area were addressed in the Arctic Region Biological Opinion (USDOC, NMFS, 1988), Beaufort Sea Sale 124 Biological Opinions (USDOI, FWS, 1990; USDOC, NMFS, 1990-referenced 1988 Opinion) and Beaufort Sea Sale 144 Biological Opinions (USDOI, FWS, 1996; USDOC, NMFS, 1995-referenced 1988 Opinion).

We believe there is no need for a lengthy formal consultation for Sale 170 because Sales 144 and 124 data, referenced in the biological evaluation, represent the best scientific and commercial information available. After reviewing the biological evaluation, FWS may wish to affirm in writing the applicability of the Sale 144 Biological Opinion to Sale 170. Such an action would avoid unnecessary paperwork and time delays and is consistent with the arcticwide opinion that "Opinions on future lease sales should incorporate by reference this Opinion if it contains the best information available."

This approach is similar to confirming an early consultation's preliminary biological opinion as a final opinion (as described in 50 CFR 402.11(f)). We hope that FWS would issue the affirmation within 45 days noted for confirming a preliminary opinion.

While we believe this affirmation approach has compelling merit, we recognize that FWS may prefer to conduct a full-scale formal consultation for Sale 170 that may require the full 135-day period allowed by ESA Section 7 for consultation and delivery of a biological opinion. If during the prolonged consultation FWS considers a potential finding of "jeopardy," new conservation recommendations, or new incidental take measures, terms, and conditions, we request that our respective staffs discuss these aspects as early as possible in the consultation. Through these discussions, MMS believes it would be possible to maximize cooperation encouraged by the Interagency ESA Memorandum of Understanding signed in 1994.

If you agree that a lengthy consultation is not necessary, we would welcome some official word from FWS, as soon possible to that extent and when we might expect to receive a biological opinion for proposed Sale 170. This information would facilitate planning for the sale and the EIS.

We understand that by extending existing biological opinions to Sale 170, or by providing us with an entirely new opinion for this proposed sale, FWS will not be foreclosing on opportunities to reconsider that opinion as future sales are proposed for this area.

If you have any questions on this matter, please contact Ms. Judy Wilson, Minerals Management Service, MS 4042, 381 Elden Street, Herndon, Virginia 20170-4817 (phone 703-787-1075) or Mr. Frank Wendling, Minerals Management Service, Alaska Region, 949 East 36th Avenue, Anchorage, Alaska 99508-4302 (phone 907-271-6510).

Attachment

cc: Regional Director
U. S. Fish and Wildlife Service
1011 E. Tudor Road
Anchorage, Alaska 99053

FILE COPY

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. Tudor Rd.
Anchorage, Alaska 99503-6199

IN REPLY REFER TO:

AES/ESO/NGARD/NAES

OCT 10 1997

Memorandum

To: Regional Director, Alaska OCS Region
Minerals Management Service

From: Acting Regional Director
Region 7

Richard A. Pospahala

Subject: Section 7 Consultation for Proposed Beaufort Sea Oil and Gas Lease Sale 170 Biological Opinion

This responds to your March 4, 1997, request for formal section 7 consultation pursuant to the Endangered Species Act of 1973, as amended, for Lease Sale 170 and associated exploration activities in the Beaufort Sea Planning Area. A chronology of the consultation actions up to the present regarding Lease Sale 170 is provided in Attachment 1. Although this is an "incremental step" consultation on leasing and exploration, information was also provided by your office on potential development and production scenarios so that the U.S. Fish and Wildlife Service could evaluate the likelihood of the entire action proceeding without violation of section 7(a)(2) of the Act.

The Service reviewed the Biological Evaluation for Threatened and Endangered Species and other relevant information to evaluate the effects of the proposed leasing and exploration actions. This memorandum represents the Service's Biological Opinion on the effects of that action on the threatened spectacled eider (*Somateria fischeri*) and threatened Steller's eider (*Polysticta stelleri*) (Alaska breeding population only) in accordance with section 7 of the Act. The Service also evaluated the effects of the proposed action on the recently delisted Arctic peregrine falcon (*Falco peregrinus tundrius*).

In the first step of an incremental consultation, the Service must evaluate not only the proposed action, but also the potential entire action in order to determine the likelihood of the entire action violating section 7(a)(2) of the Act. In this case, leasing and exploration are the proposed actions. Development and production are actions that may occur at a later date and will require separate consultation. In determining the likelihood of the entire action violating section 7(a)(2) of the Act, an evaluation of these increments is provided with this Biological Opinion. Based on the information provided on the proposed and potential activities, and the information currently available on listed and proposed species, the Service has determined that it is unlikely that the entire action, including development and production, will violate section 7(a)(2) of the Act.

BIOLOGICAL OPINION FOR LEASING AND EXPLORATION

Description of the Proposed Action

The activities considered in this consultation are oil and gas lease sales and subsequent exploratory drilling, testing, and surveying. Separate consultations for development and production activities will be conducted if oil is discovered and development plans are proposed. Lease Sale 170 is tentatively scheduled for April 1998. If held, Lease Sale 170 would be the seventh Federal offshore sale in the Beaufort Sea Planning Area. The proposal would offer for lease 362 blocks encompassing about 688.6 hectares (1.7 million acres). The blocks that comprise the proposed action are approximately 4 to 40 kilometers offshore in water depths that range from approximately 7.6 to 36.6 meters.

Three exploration wells and one delineation well are expected to be drilled during the period 1998 through 2006 for the mid-point base case. A maximum of two drilling rigs would be operable in any one exploratory year. If each of the four exploration and delineation wells were covered by site-specific shallow-hazard seismic surveys, the total area covered by seismic surveys could equal 69.15 km^2. An additional 12 to 16 exploration or delineation wells eventually leading to development and production could result in a total area covered by seismic surveys ranging from 138.4 to 184.4 km^2. A typical exploratory and delineation well will use about 630 tons of drilling mud and produce about 820 tons of dry rock cuttings.

Gravel islands will likely be used as drilling platforms in near shore areas where water depths are $\leq$ 12 meters. Artificial ice islands or gravel islands may be used as drilling platforms in shallow water areas (<6 meters) near shore. Shallow water operations would have ice road support in winter and barge support in summer. Bottom-founded platforms with supply boat support would likely be used during the open water season in intermediate water depths of 12 to 24 meters. Floating drilling rigs (drill ships or floating concrete platforms) with icebreaker support would likely be used in deeper water depths with open-water and broken ice conditions. Drilling operations at these sites far offshore would be supported during the open-water season by at least one supply-boat trip/drilling unit/week and one helicopter flight/drilling unit/day. Onshore support facilities would be those currently existing such as Prudhoe Bay and Kuparuk.

Activities interrelated and interdependent to the proposed action include construction of onshore support facilities, construction of onshore and offshore pipelines, and oil spills originating from platforms, pipelines, or tanker and supply vessels.

STATUS OF LISTED AND DELISTED SPECIES

Spectacled Eider

The spectacled eider was designated as a threatened species in 1993. Currently, primary nesting grounds are the Yukon-Kuskokwim Delta, the North Slope (Cape Simpson to the Sagavanirktok River) of Alaska, and in the Chaun Gulf and the Kolyma, Indigirka, and Yana river deltas of Arctic Russia. Post-breeding flocks of staging and molting spectacled eiders have been observed in Mechigmenan Bay, on the eastern coast of Russia's Chukotsk Peninsula (W. Larned, pers. comm.); Alaska's Ledyard Bay, southwest of Point Lay (W. Larned, U.S. Fish and Wildlife Service, pers. comm.); Peard Bay (Laing and Platte 1994); Norton Sound (Larned and McCaffery 1993); and 80 km south of Saint Lawrence Island (W. Larned, pers. comm.). Spectacled eider winter locations were discovered in the Bering Sea in 1995. Information from a single satellite transmitter signal from a female spectacled eider directed biologists to an area 110 km NNE of Saint Matthew Island in the north central Bering Sea. In March, biologists found large, dense flocks of spectacled eiders in small openings in the nearly-continuous sea ice (Larned et al. 1995). Larned et al. (1995) estimated the population size to be 148,059 spectacled eiders with 95 percent CI = 137,136 to 158,982. While most evidence indicates that the primary winter range of spectacled eiders is located in the north central Bering Sea, scattered sightings have been recorded in near shore waters of Alaska and British Columbia (AOU 1983).

Migration routes of spectacled eiders between wintering, breeding, and molting areas are not well-documented. Leads in ocean ice are important pathways for marine bird and mammal species migrating along the Beaufort Sea coast in Alaska and Canada. All species of eiders use this lead system as well, flying at altitudes that are usually less than 30 meters. Very little is known about the migratory pathway east of Barrow, but the definitive lead system transforms into numerous branches varying in location and extent from year-to-year. Migration of eiders (the majority of which are king and common eiders) along Alaska's northern coast has been described by Thompson and Person (1963), Johnson (1971), and Woodby and Divoky (1982). Spectacled eiders are observed in mixed flocks of king, common, and sometimes Steller's eiders, but the percentage of both spectacled and Steller's eiders is quite small (R. Suydam, North Slope Borough, Dept. of Wildlife Management, pers. comm.). Currently, studies are underway to document the timing of migration, the magnitude of eider migration past Barrow, and the relationship of various environmental conditions with migration (R. Suydam, pers. comm.).

Spectacled eiders arrive on the breeding grounds paired, often in small flocks, at breeding areas in mid-May on the Yukon-Kuskokwim Delta, and in late May to early June on the North Slope. Male spectacled eiders begin leaving breeding areas during incubation, which coincides with mid-June on the Yukon-Kuskokwim Delta and late June on the North Slope. On the North Slope, the number of pairs peaks in mid-June (Smith et al. 1994) and the number of males declines 4-5 days later (Anderson and Cooper 1994; Anderson et al. 1995).

Incubation lasts 20-25 days (Dau 1974; Kondratev and Zadorina 1992; Harwood and Moran 1993; Moran and Harwood 1994; Moran 1995). Most eggs on the Yukon-Kuskokwim Delta hatch between 25 June and 5 July, but may depend on the timing of snow melt and the synchrony of nest initiation (C. Dau, U.S. Fish and Wildlife Service, pers. comm.; C. Harwood, U.S. Fish and Wildlife Service, pers. comm.). Hatching on the North Slope occurs up to 2 weeks later than on the Yukon-Kuskokwim Delta, from mid- to late July (Warnock and Troy 1992).

Predators of spectacled eider eggs include gulls, jaegers, and foxes. In Arctic Russia, apparent nest success has been calculated to be as low as <2 percent in 1994 and 27 percent in 1995; foxes, gulls, and jaegers are suspected to have depredated most of the nests (D. Esler, National Biological Service, pers. comm.). On Kigigak Island in the Yukon-Kuskokwim Delta, nest success ranged from 20 percent to 95 percent in 1991-1995 (Harwood and Moran 1991, 1993; Moran and Harwood 1994; Moran 1995; Moran 1996). Nest success may have been higher in 1992 than in other years of observation, because foxes were eliminated from the island prior to the nesting season that year. Nest success at Hock Slough, also on the Yukon-Kuskokwim Delta, ranged between 30 percent and 80 percent in 1991-1995 (J.B. Grand, National Biological Service, pers. comm.). Nest success in 1991 and 1993-1995 in the Kuparuk and Prudhoe Bay oil fields on the North Slope was between 25 percent and 40 percent (Warnock and Troy 1992; Anderson and Johnson in press).

Spectacled eider hens may move their brood up to 14 km from the nest site by the time young fledge (J.B. Grand, pers. comm.). However, most broods are raised within 5 km of where they hatch (Dau 1974; Harwood and Moran 1993; Moran and Harwood 1994; TERA 1995). Studies tracking hens with broods through the brood-rearing period on the Yukon-Kuskokwim Delta (J.B. Grand, pers. comm.) and on the North Slope (TERA 1995) suggest that broods rarely move more than 1.5 km during any 24-hour period.

Fledging occurs approximately 50 days after hatching At this time, females with broods move directly from freshwater to marine habitats (Dau 1974; Kistchinski and Flint 1974).

On the nesting grounds, spectacled eiders feed by dabbling in shallow freshwater or brackish ponds, or on flooded tundra (Dau 1974; Kistchinski and Flint 1974). Food items include molluscs; insect larvae such as craneflies, trichopterans, and chironomids; small, freshwater crustaceans; and plants or seeds (Cottam 1939; Dau 1974; Kistchinski and Flint 1974, Kondratev and Zadorina 1992). Little information exists on the diet of spectacled eiders at sea. Cottam (1939) found amphipods and molluscs in 2 birds collected at Saint Lawrence Island in January. Foods in spectacled eiders shot by subsistence hunters in May and June near Saint Lawrence Island were molluscs and crabs (M.R. Petersen, National Biological Service, pers. comm.).

An estimated 1,700-3,000 pairs currently nest on the Yukon-Kuskokwim Delta, representing a 96 percent decrease from the late 1970s (Stehn et al. 1993). On the North Slope, the mean numbers of breeding spectacled eiders estimated from aerial surveys between 1993 and 1996 ranged from a high of almost 9,300 in 1993 to approximately 5,800 birds in 1996. While possibly not indicative of all of northern Alaska, limited data from the Prudhoe Bay area suggest that the spectacled eider population may have declined by approximately 80 percent between 1981 and 1992 (Warnock and Troy 1992). Native elders from Wainwright suggested local population declines on the North Slope have occurred (U.S. Fish and Wildlife Service 1994).

Factors known or suspected to affect survival of spectacled eiders have been identified, however, the relative importance of these factors to the species' decline and to recovery are not known. The extent and causes of population declines or extirpations on the breeding grounds are difficult to assess because historical data are lacking for many locations. Several of the following factors are known to affect survival during the nesting season, but it is not clear whether they will be implicated in the decline of the spectacled eider population.

Lead deposition in foraging habitat on breeding grounds in the Yukon-Kuskokwim Delta has been confirmed to cause mortality of eiders that ingested lead shot. Franson et al. (1995) diagnosed the cause of death of four spectacled eiders in 1992, 1993, and 1994 to be ingestion of lead shot as grit. Blood lead levels in adult females with already elevated lead levels increased throughout the breeding season from 13 percent to 34 percent (Petersen et al. 1994). It is possible that exposure to lead occurs in small, localized hunting areas on the North Slope as well, however there are no site-specific data on lead contamination in this region.

Predation pressure on spectacled eider eggs, young, and adults may have increased in recent decades. Predators include Arctic foxes (*Alopex lagopus*), red foxes (*Vulpes fulva*), large gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), and snowy owls (*Nyctea scandiaca*). Native elders on the North Slope believe that fox numbers have increased in recent decades as a result of reduced trapping (R. Suydam, pers. comm.). Population sizes of large gulls on the North Slope may have increased as a result of increased food supplies from anthropogenic wastes. Wastes made available from the commercial fishing industry in the Bering Sea and North Pacific, along with an increase in the garbage generated by coastal communities, have increased the year-round food supply for gulls (R. Suydam, pers. comm.).

Subsistence harvest of spectacled eider eggs and adults is another potential factor in the decline of the spectacled eider population. Alaska Natives have traditionally harvested eiders and their eggs in coastal villages during spring and fall. Although human population on the Yukon-Kuskokwim Delta and in North Slope communities has grown substantially, changes in the numbers of hunters are unknown. In addition, improved technology for hunting has allowed greater efficiency, but the actual effects of these improvements on harvest levels are unknown.

There are other sources of take such as avicultural egg collecting (until 1991), research activity, and loss of habitat in growing communities and oilfields. Their overall impacts or relative role in the decline of the spectacled eider population is unknown.

Other potential factors that may affect spectacled eider survival have been suggested but not investigated. These include changes in the community structure in their winter habitats, bioaccumulation of contaminants in the marine environment, human harvest for sport and subsistence outside their breeding grounds, disease, parasites, and accidental strikes and/or disturbance of benthic feeding areas by commercial fishing outfits.

Steller's Eider

Since the Service provided the November 26, 1996, species list to MMS on Lease Sale 170, the final rule to list the Alaska breeding population of Steller's eider was published in the Federal Register (June 11, 1997).

The current breeding distribution of Steller's eiders encompasses the Arctic coastal regions of northern Alaska from Wainwright to Prudhoe Bay up to 90 km inland, and Russia from the Chukotsk Peninsula west to the Taimyr, Gydan and Yamal Peninsulas. The majority of Steller's eiders nest in Arctic Russia. After nesting, Steller's eiders return to marine habitats to molt. Concentrations of molting Steller's eiders have been noted in Russia, near Saint Lawrence Island in the Bering Sea, and along the northern shore of the Alaska Peninsula. During winter, most of the world's Steller's eiders concentrate along the Alaska Peninsula from the eastern Aleutian Islands to southern Cook Inlet in shallow, near-shore marine waters. They also occur in the western Aleutian Islands and along the Pacific coast, occasionally to British Columbia. A small number also winter along the Asian coast, from the Commander Islands to the Kuril Islands, and some are found along the north Siberian coast west to the Baltic States and Scandinavia. In spring, large numbers concentrate in Bristol Bay before migration; in 1992, an estimated 138,000 Steller's eiders congregated before sea ice conditions allowed movement northward (Larned et al. 1994).

Historically, Steller's eiders nested in Alaska in two general regions: western Alaska, where the species has been nearly extirpated, and the North Slope, where the species still occurs. In western Alaska, Steller's eiders occurred primarily in the coastal fringe of the Yukon-Kuskokwim Delta, where the species was common at some areas in the 1920s, was still present in the 1960s, but is virtually absent as a breeder today (Kertell 1991). On the North Slope, Steller's eiders historically occurred from Wainwright east, nearly to the United States-Canada border (Brooks 1915). The species may have abandoned the eastern North Slope in recent decades, but it still occurs at low densities from Wainwright to at least as far east as Prudhoe Bay. Near Barrow, Steller's eiders still occur regularly, though not annually. In some years, up to several dozen pairs may breed in a few square kilometers. Evidence of nesting elsewhere from Barrow has been documented only twice in recent years; females with young were seen in 1993 near Prudhoe Bay (M. Johnson, U.S. Fish and Wildlife Service, pers. comm.), and in 1987 along the lower Colville River (T. Swem, U.S. Fish and Wildlife Service, pers. comm.). Steller's eiders have been observed recently near Prudhoe Bay during intensive eider searches conducted from the ground. A few pairs were seen each year between 1992 and 1994 (D. Troy, Troy Ecolocical Research Associates, pers. comm.), and one lone male was observed in Deadhorse in 1996 (Randy Horner, Alaska Department of Transportation and Public Safety, pers. comm.).

Steller's eiders arrive in pairs at Barrow in early June. Males typically depart the breeding grounds after females begin incubating the eggs. Based on observations in the Barrow area, males depart breeding grounds for molting and wintering areas around the end of June or early July (Quakenbush et al. 1995). Small groups of males (less than 10) have been observed in July near shore in the Chukchi Sea near Barrow (L. Quakenbush, U.S. Fish and Wildlife Service, pers. comm.), and a flock of 28 females, presumably failed breeders, was observed flying between the Chukchi Sea and a near shore inlet south of Barrow in early August (C. Donaldson, U.S. Fish and Wildlife Service, pers. comm.). Females and fledged young depart the breeding grounds in early to mid-September.

Causes of the observed decline are not known. Possible causes currently being examined include community dynamics of nesting avian populations in the Barrow area, artificial increases in predator populations on the North Slope, and lead contamination on breeding grounds in the Yukon-Kuskokwim Delta. It is not apparent that loss of breeding habitat resulting from such activities as oil extraction or human population growth on the North Slope or the Yukon-Kuskokwim Delta caused their decline. Steller's eiders are not a target subsistence species on the North Slope, however they may be unintentionally taken during subsistence activities.

In northern Alaska, aerial surveys indicate that as many as 1,000 pairs of Steller's eiders may nest in northwestern Alaska (Brackney and King 1993), however, the only confirmed nesting area used currently in North America is in the vicinity of Barrow (Quakenbush and Cochrane 1993). Only small numbers have been observed between Barrow and the Colville River (Brackney and King 1993). Elsewhere, recent surveys along the entire western Alaska coast have detected no Steller's eiders in suitable nesting habitat; and only two nests have been found on the Yukon-Kuskokwim Delta despite extensive waterfowl research; this represents a substantial contraction of their former breeding range (Kertell 1991, Larned et al. 1993).

Arctic Peregrine Falcon

The Arctic peregrine falcon was removed from the list of endangered and threatened wildlife on October 5, 1994 (FR pp. 50796-50805). Information on this subspecies is provided for your information only. Based on recent surveys, the population of Arctic peregrine falcons in Alaska is estimated to be about 200-250 pairs and increasing. Productivity from 1980-1992 varied between 1.3-2.0 young per pair, which has been sufficient to support a growth rate of about 12 percent per year (unpubl. U.S. Fish and Wildlife Service data, Fairbanks, AK).

Beginning in the late 1940s, the use of toxic organochlorine pesticides in agricultural regions of North and South America, and the subsequent bioaccumulation of the pesticides within the food chain, resulted in a decline in productivity of the migratory Arctic peregrine falcon and other birds of prey. The toxicity of these pesticides caused peregrines to lay thin-shelled eggs which often failed to hatch. In Alaska, the Arctic peregrine falcon population declined to approximately 20 percent of historical levels by 1972, at which time the United States restricted the use of organochlorine pesticides. The population remained stable for the next 6 years and, in 1978, began to increase. In 1984 the Service, prompted by improved population levels of Arctic peregrine falcons, changed their status from endangered to threatened.

In Alaska, Arctic peregrine falcons nest north of the Brooks Range and on the Seward Peninsula. On the North Slope, nesting occurs primarily 20-80 km inland although some nesting occurs on the coast. The major nesting areas occur along the Colville and Sagavanirktok rivers with scattered nest sites along other North Slope rivers. Arctic peregrine falcons usually are present in Alaska from about mid-April to mid-September. Egg laying begins in mid-May on the North Slope and the young fledge from about the end of July to mid-August (U.S. Fish and Wildlife Service 1982).

Arctic peregrine falcons are known to migrate great distances between summer breeding grounds in northern Alaska and Canada to warmer winter climates in the southern United States and Central and South America. During spring and fall migration, they often occur along the coastal areas of Alaska, British Columbia, Washington, Oregon, and California.

ENVIRONMENTAL BASELINE

The environmental baseline is the current status of listed or proposed species or their habitat as a result of past and ongoing human and natural factors *in the area* of the proposed action.

Spectacled Eiders and Steller's Eiders

Possible human and natural factors leading to the current status of both spectacled and Steller's eiders on the North Slope include, but are not limited to, loss of habitat, toxic contamination of habitat or prey species, increase in predator populations, and over-harvest.

Breeding habitat for both eider species on the North Slope is largely unaltered and uninhabited by humans. A relatively small portion of the species' potential breeding range has been altered by oil and gas development. Impacts include construction, accidental spills of toxic materials, off-road vehicle use, filling of wetlands, and indirect effects of human presence in areas previously uninhabited. Human population growth in the vicinity of Barrow and other North Slope communities has also potentially resulted in localized areas of habitat loss due to construction activities and off-road vehicle use.

Lead or other sources of contamination of habitat or prey with lead or other toxins is possible in localized areas within the range of spectacled and Steller's eiders on the North Slope. Such contamination would be possible in areas where subsistence hunting with lead shot, oil and gas development, and where past U.S. military activities (e.g., Distant Early Warning line sites) have taken place.

Along with increases in human presence, there is often a concomitant increase in predator populations such as gulls, ravens, and foxes. While these opportunistic species primarily scavenge disposed human waste, they also depredate nests of birds such as spectacled and Steller's eiders. Residents of Barrow have observed an increase in populations of gulls and Arctic foxes, and the North Slope Borough has taken an active role in reducing the populations of those species. Common ravens are new to the Barrow area and present a new threat to nesting Steller's eiders. Adult ravens have been observed forcing female Steller's eiders off their nests and taking eggs.

Harvest of eiders, including sport and subsistence hunting, may have contributed to the decline of spectacled and Steller's eiders on the North Slope. The Service is addressing this concern through hunting closures and an outreach program in coastal villages.

All of the factors discussed here may have influenced populations of spectacled and Steller's eiders in northern Alaska. However, at this time, it is unclear how significant each of these factors has been to the population dynamics of these species. These factors will be addressed during recovery activities and research.

Arctic Peregrine Falcon

Past and current impacts to this recently delisted species that have occurred within the area of the proposed action include toxic contamination, reduced populations of prey species, and increased human disturbance associated with oil and gas exploration and development. The effects of these activities on Arctic peregrine falcons in northern Alaska have been negligible compared to the effects resulting from the use of organochlorine pesticides, which occurred primarily outside Alaska.

EFFECTS OF THE ACTION ON LISTED AND DELISTED SPECIES

Leasing and exploration may result in some disturbance to staging, nesting, migrating and molting birds, and may alter migration routes and use of established molting areas, primarily due to disturbance caused by aircraft and boat traffic. Additionally, some loss of habitat due to construction of facilities could occur as a result of the proposed actions.

Leasing and exploration may also result in increased contamination of marine habitats, due to the disposal of drilling muds and cuttings, or accidental eruption of oil from test wells during a blowout. Such contamination may adversely affect populations of spectacled and Steller's eiders, and peregrine falcons either directly as they come in contact with oil spilled in marine habitats, or indirectly as a result of detrimental impacts to prey species. If there is accidental discharge of oil (i.e., a blowout), there would likely be lasting adverse impacts to marine habitats used by spectacled and Steller's eiders. As this consultation progresses through its future increments, we request that the MMS provide information on contingency planning for minimizing the long-term effects of oil spills on listed species.

The Lease Sale 170 base-case scenario developed by MMS, which this Opinion will assume, indicates that one or two drilling units will drill up to three exploration wells and one delineation well from 1998 through 2006 during the exploration phase. Twelve to 16 exploration and delineation wells are expected to be drilled between 1999 and 2006 during the possible development and production phases. Discharges as a result of these wells are regulated by the Environmental Protection Agency through a National Pollutant Discharge Elimination System. The EPA initiated consultation with the Service in January 1994 to determine the likelihood that the proposed discharges associated with exploratory drilling would not adversely affect listed species. The Service concurred (in a letter dated April 27, 1994) with the EPA that the proposed NPDES permit issuance would not adversely affect listed species. Therefore, the EPA and MMS have already satisfied the requirements of the Endangered Species Act regarding effluent discharges associated with oil and gas exploration in the Beaufort and Chukchi Seas (State and Federal waters).

Effects on Spectacled Eiders and Steller's Eiders

Nesting spectacled and Steller's eiders could be disturbed by aircraft overflights related to exploration activity (1-2 trips/drilling site/day). Adverse effects include flushing staging birds from preferred habitats, altering normal migration paths, and startling females on nests (which could potentially cause them to leave the nest quickly and break eggs as well as alert predators to a nest location). Overflights could also force females with broods from preferred habitat for feeding and predator avoidance. Based on the relatively small number of helicopter trips estimated to occur, it is unlikely that aircraft overflights will adversely affect spectacled or Steller's eiders nesting in the vicinity of the proposed action.

If exploration occurs between October and May, the probability of exploratory activities (other than the discharge of contaminants) in the Beaufort Sea resulting in encounters with spectacled or Steller's eiders would be zero. This probability increases, however, if the action occurs between May and October because of the presence of spectacled and Steller's eiders migrating across the Chukchi and Beaufort seas to reach breeding grounds.

Encounters between supply boats and/or icebreakers and spectacled and Steller's eiders at sea is also a possibility. However, eiders typically avoid such encounters by diving or flying away from such disturbance. The effects of this avoidance behavior on the condition of the birds is unknown, although the Service presumes that there is not likely to be substantial adverse effects of supply boat or icebreaker activities on spectacled or Steller's eiders in the vicinity of the proposed area of the action.

Incidental take of spectacled eiders will be addressed in a subsequent section titled "Incidental Take Statement." No incidental take of Steller's eiders is expected through the leasing and exploration increments.

Effects on Arctic Peregrine Falcons

Nesting peregrine falcons could possibly be disturbed by aircraft overflights related to the proposed sale especially if these flights occur inland from the coast. The extent of such disturbance would also depend on locations of support facilities. Barrow and Deadhorse are the most likely support facilities, and since both are located on the coast, aircraft would not typically fly over a significant portion of peregrine falcon nesting habitat. Thus, significant disturbance of nesting peregrine falcons during the exploration phase is unlikely.

Cumulative Effects

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

State or private actions reasonably certain to occur within or near the proposed sale area would include: State of Alaska oil and gas lease sales, exploration, development, and production; gravel mining, support facility and road construction to support these activities as well as pipelines and related oil and gas transport facilities, including feeder lines, Trans-Alaska Pipeline operation and maintenance, and oil tanker traffic from the Valdez terminal to points in the lower 48 states; possibly some future Canadian Beaufort Sea oil and gas activities; subsistence harvest activities; commercial fishing; marine shipping; and recreational activities.

BIOLOGICAL OPINION FOR LEASING AND EXPLORATION

After reviewing the proposed action, the current status of spectacled and Steller's eiders, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's Biological Opinion (for listed species) that Beaufort Sea Oil and Gas Lease Sale 170 and associated activities, as proposed, is not likely to jeopardize the continued existence of the spectacled and Steller's eider. There is no designated critical habitat for spectacled eiders nor Steller's eiders; therefore, none will be affected.

The Service recommends that agencies and applicants avoid impacts to Arctic peregrine falcons as they have recently recovered from threatened status. Monitoring of index population areas will continue for 5 years after delisting, and the species could be emergency listed at any time if survey data indicate a reversal in recovery. After reviewing the proposed action, the current status of Arctic peregrine falcons, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's Opinion that the Beaufort Sea Oil and Gas Lease Sale 170 and associated activities, as proposed, is not likely to adversely affect Arctic peregrine falcons.

Incidental Take Statement

Sections 4(d) and 9 of the Act, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. 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 a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The Service does not anticipate that activities associated with the leasing and exploration of proposed Lease Sale 170 will result in the incidental take of spectacled eiders or Steller's eiders. No incidental take is anticipated and, accordingly, no incidental take is authorized. Should any incidental take occur, MMS must reinitiate formal consultation with the Service.

While the incidental take statement provided in this consultation satisfies the requirements of the Act, as amended, it does not constitute an exemption from the prohibitions of take of listed migratory birds under the more restrictive provisions of the Migratory Bird Treaty Act.

Conservation Recommendations

Section 7(a)(1) of the Act 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 actions conceived to minimize or avoid adverse effects of a proposed action on listed or proposed species or critical habitat, or to help implement recovery plans. We recommend the following actions be implemented during the leasing and exploration phase of this lease sale:

1. We recommend that the MMS work with the Service and other Federal and State agencies in implementing recovery actions identified in approved recovery plans. Research to determine important habitats, migration routes, and wintering areas of spectacled and Steller's eiders would be an important step toward improving our ability to minimize conflicts with current and future oil and gas development activities.

2. From May to October, aircraft should maintain an altitude over land that is greater than 1,500 feet above ground level to avoid disturbing nesting and brood-rearing spectacled and Steller's eiders and Arctic peregrine falcons.

3. We recommend that the MMS encourage leasing oil companies to produce wallet-sized information cards with descriptions and pictures of spectacled and Steller's eiders for company and contracted employees. Recognizing the presence of a listed or proposed species during activities associated with exploration would alert the employee to take measures to minimize disturbance, and most importantly, avoid unauthorized incidental take. The most useful format of such a card would provide descriptions and pictures of various stages and sexes of all four species of eiders (spectacled, Steller's, king, and common). Correctly identifying different eider species is often difficult because of their similarity in appearance depending on their life history stage and sex.

Additional conservation recommendations may be proposed during subsequent incremental steps of this lease sale. For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of implementation of conservation recommendations.

EVALUATION OF POTENTIAL DEVELOPMENT AND PRODUCTION ACTIONS

Under the regulations governing incremental step consultations, an agency action cannot proceed until the Service determines there is a reasonable likelihood that the entire action (in this case, leasing, exploration <u>and</u> development and production) could proceed without violation of section 7(a)(2) of the Act. For the development and production phases of this action, this determination must be founded on assumption-based scenarios and our current understanding of natural conditions, both of which are subject to change prior to initiation of development and production. An accurate evaluation of impacts from development and production is not possible because these are still only foreseeable actions. However, an evaluation of a reasonable scenario is provided below.

<u>Description of Potential Development, Production, and Transportation</u>

A projected oil volume of 1,200 million barrels (mid-point base case of proposal) was used to project the future development and production activities. Interrelated, interdependent, and cumulative effects are the same as those identified previously in the description of the proposed actions related to exploration.

The Biological Evaluation describes a base-case development and production scenario, which is based on a composite of feasible options developed through discussions within your agency, other agencies, and industry. The locations of existing infrastructure, sites with potential as support facilities, area-resource estimates, and scenarios developed for the previous Outer Continental Shelf sales in the Beaufort Sea were all considered in developing the scenario. It was developed for the purpose of evaluating the potential effects of the entire action associated with Lease Sale 170.

Three to five production platforms are projected to be installed between 2004 and 2009. An estimated 87 to 111 production/service wells are expected to be drilled between 2004 and 2010. Gravel islands will probably be constructed for production facilities in water depths less than 12 meters, bottom-founded structures designed for extreme ice conditions would likely be used in water depths between 12 and 38 meters, and floating concrete structures anchored to the sea floor would likely be used in water depths greater than 38 meters. The average production/service well will use approximately 150 to 680 short tons of dry mud and produce an average 1180 short tons of dry rock cuttings. Seismic surveys would cover an estimated area of 276 to 460 km^2. Onshore support would probably be from Prudhoe Bay. Support for operations on production islands in near-shore shallow waters is expected to be by ice roads during the winter. Drilling operations farther offshore would be supported during the open-water season by barge and one helicopter flight/drilling unit/day. There may also be one standby vessel for each drilling unit.

The transportation scenario for the base-case is assumed to be: (1) subsea pipelines to transfer oil from the production platforms to existing pipeline systems within the Prudhoe Bay/Kuparuk field areas and transported to the TAPS Pump Station No. 1; (2) pipeline configuration would be a combination offshore/existing onshore infrastructure; and (3) landfalls that utilize Oliktok Point (using Kuparuk field infrastructure), Point McIntyre/West Dock area (using Prudhoe Bay infrastructure), and Endicott will be used. Pipelines will likely be trenched in water less than 45 meters and at landfall pipelines will be elevated on gravel structures.

It is assumed that all products would be loaded onto tankers in Valdez for trans-shipment to processing facilities on the coast of the western United States (rather than Far East ports). No particular receiving ports along the West Coast were specified; however, those currently in use are located in Puget Sound, San Francisco Bay, and Long Beach.

In a previous consultation (proposed Lease Sale 149), the Service expressed its concern that the potential future transportation of oil to ports along the Pacific Coast might result in a violation of section 7(a)(2) of the Act, in regard to southern sea otters (*Enhydra lutris nereis*) and marbled murrelets (*Brachyramphus marmoratus*). The MMS subsequently coordinated with the U.S. Coast Guard to obtain the most recent information on that agency's progress toward reducing the threat of tanker-related oil spills. Much of the current momentum centers around provisions of the Oil Pollution Act of 1990 (OPA 90), which mandate adoption of new regulations for improved tanker safety, pollution prevention, and response preparedness. The measures identified in the OPA 90 address the Service's concerns relating to the potential for spills during oil transport regulated by the U.S. Coast Guard. Although some important measures will not be phased in entirely until as late as 2015, most of the measures will be in effect before the onset of oil production from Lease Sale 170.

Because the OPA 90 requires regulatory agencies such as the USCG to adequately address tanker passage routes, navigation equipment and safety procedures, and other precautions, the potential for oil spills should decrease, and the ability for rapid containment of spills to limit their effect on coastal wildlife should increase. Additionally, the USCG and the National Oceanic and

Atmospheric Administration are conducting a study to evaluate the need for vessel routing measures in the approaches to California ports and the regulation of vessel traffic in offshore marine sanctuaries (58 FR 44634).

ENVIRONMENTAL BASELINE

In addition to the species discussed earlier, the Service considered other listed species that may be affected by the development, production and transportation phases of Lease Sale 170. Those species are Aleutian Canada goose (*Branta canadensis leucopareia*), American peregrine falcon (*Falco peregrinus anatum*), short-tailed albatross (*Diomedea albatrus*), southern sea otter, brown pelican (*Pelecanus occidentalis*), California clapper rail (*Rallus longirostris obsoletus*), light-footed clapper rail (*R. l. levipes*), western snowy plover (*Charadrius alexandrinus nivosus*), California least tern (*Sterna antillarum browni*), marbled murrelet, and bald eagle (*Haliaeetus leucocephalus*). The Service concentrated its evaluation on the Aleutian Canada goose, short-tailed albatross, spectacled eider, Steller's eider, southern sea otter and marbled murrelet, species which would be most directly affected by an undersea pipeline- or tanker-related oil spill. In-depth analysis of the brown pelican, California clapper rail, western snowy plover, California least tern, bald eagle, and American peregrine falcon may be necessary during the consultation phase for development, production, and transportation.

Aleutian Canada Goose

Although the Gulf of Alaska transportation corridor is generally outside the current range of Aleutian Canada geese, migrating birds have been reported as close as the Kalsin Bay area on Kodiak Island. It is also likely that other areas of the Kodiak Archipelago are visited occasionally during migration. The Semidi Islands are the location of an Aleutian Canada goose breeding population consisting of 132 birds with at least 28 nesting pairs (Anderson et al. 1993). It is possible that a large oil spill in the Prince William Sound area or in the Gulf of Alaska could contact the Semidi Islands. Although Aleutian Canada geese normally use only upland habitats during the nesting season, molting geese have been observed to fly from an island and alight on the sea surface when alarmed. Individual birds would likely be harmed if they come into contact with floating oil or fuel leaked from support vessels or rigs.

Short-tailed Albatross

Several sightings of this species have recently been reported from the northern Gulf of Alaska and Kodiak Island continental shelf. It is reasonable to assume that low numbers of this wide-ranging seabird may occasionally be present in the vicinity of oil tanker traffic. Like other albatrosses, shearwaters, and petrels, the short-tailed albatross is a surface-feeder. Hasegawa and DeGange (1982) report that much surface-feeding occurs at night when squid are close to the surface. Individual birds could potentially be harmed if they come into contact with floating oil or fuel leaked from support vessels or rigs.

Spectacled Eiders and Steller's Eiders

The environmental baseline for spectacled and Steller's eiders discussed previously is also applicable to the development, production, and transportation components. Spectacled and Steller's eiders may potentially be susceptible to oil spills in the Beaufort Sea, Prince William Sound, and in the Gulf of Alaska.

Southern Sea Otter

The southern sea otter occurs in transportation corridors along the west coast of Canada and the contiguous United States. This species is very vulnerable to hypothermia if its pelage is oiled. Depending on the size, location, and other factors, an oil spill could result in injury or death to a significant proportion of the southern sea otter population (U.S. Fish and Wildlife Service 1993).

Marbled Murrelet

Marbled murrelets are very susceptible to mortality from oil spills because they tend to spend most of their time swimming on the sea surface and feeding in local concentrations close to shore. Marbled murrelets occur during the nesting season and winter within transportation corridors. Depending on the location, extent, and season of an oil spill, significant adverse effects could occur to local or regional populations of marbled murrelets. Local populations were adversely affected by the Exxon Valdez oil spill in 1989, and marbled murrelets suffered higher mortality than other seabirds inhabiting Prince William Sound (Piatt et al. 1990).

Reasonable Likelihood Determination for Development and Production

Given the rarity of major oil spills associated with oil tanker activities between Alaska and the West Coast of the United States, and OPA 90 activities to prevent and/or effectively respond to oil spills, the Service believes that there is a reasonable likelihood that the entire action associated with Lease Sale 170 (leasing, exploration, production, development, and transportation) could proceed without violation to Section 7(a)(2) of the Act.

SUMMARY

This concludes formal consultation and conferencing on the actions outlined in the MMS's letter dated March 4, 1997. Reinitiation of formal consultation is required if: (1) there is any incidental take; (2) new information reveals effects of the action that may affect listed or proposed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the action is subsequently modified in a manner that causes an effect to listed or proposed species or critical habitat that was not considered in this Opinion; or (4) a new species is listed or proposed or critical habitat designated or proposed that may be affected by the action. If incidental take occurs, operations causing such take must cease pending reinitiation of consultation.

Thank you for your concern for endangered species and for your cooperation in the development of this Biological Opinion. If you have any comments or require additional information, please contact Cathy Donaldson at (907) 456-0354, Northern Alaska Ecological Services, Fairbanks, Alaska.

Attachment

cc: Regional Director, Region 1

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ATTACHMENT 1

OCS Oil and Gas Lease Sale 170, Beaufort Sea
Consultation History

10/22/96 -	MMS requests concurrence for species list from Service.
11/26/96 -	Service transmits requested species list to MMS.
03/04/97 -	MMS requests formal consultation from Service for Lease Sale 170, and transmits Biological Evaluation.
04/01/97 -	Service' Region 7 requests species list from Service' Region 1.
06/26/97 -	Service' Region 7 receives species list from Service' Region 1.
07/24/97 -	Service transmits Biological Opinion to MMS.

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Washington, D.C. 20240

NOV 4

Memorandum

To: Regional Director, Alaska, U.S. Fish and Wildlife Service

From: Chief, Environmental Division, Minerals Management Service

Subject : Endangered Species Act Biological Opinion for Proposed Beaufort Sea Oil and Gas Lease Sale 170

The Minerals Management Service (MMS) is including additional alternatives to the proposed Beaufort Sea Oil and Gas Lease Sale 170 final Environmental Impact Statement (EIS). These alternatives are a result of the comments on the draft EIS. The proposed action remains unchanged. The two additional alternatives, with two options each (attached), further the protection of environmental resources. The alternatives have no additional potential adverse impacts on listed species, and we conclude that the Biological Opinion issued on October 10, 1997, remains valid and that there is no need to reinitiate consultation. Because the final EIS must be completed by December 15, 1997, we would welcome written notification by that time if you disagree with our conclusion that it is not necessary to reinitiate consultation.

If you have any questions on this matter, please contact Mr. Frank Wendling, Minerals Management Service, Alaska Region, 949 East 36th Avenue, Anchorage, Alaska 99508-4302 (phone 907-271-6510) or Mr. George Valiulis, Minerals Management Service, MS 4042, 381 Elden Street, Herndon, Virginia 20170-4817 (phone 703-787-1662).

Attachment

Attachment

Additional Alternatives for Proposed Beaufort Sea Oil and Gas Lease Sale 170

- The **Cross Island** area deferral option provides a defined 10-mile buffer zone around Cross Island to minimize potential space use and noise disturbance conflicts between petroleum activities and subsistence whaling by residents of Nuiqsut.

- The **Cross Island** mitigation by stipulation option prohibits a permanent production facility within a defined 10-mile radius around Cross Island unless the lessee can demonstrate the permanent facility siting will not preclude reasonable subsistence access for hunting Bowhead whales.

- The offshore **Arctic National Wildlife Refuge** deferral option defers approximately 122 whole and partial blocks. The deferral area expands the Kaktovik Deferral Alternative III analyzed in the draft EIS for Lease Sale 170 to the west and north to approximately 146°W. longitude.

- The **Arctic National Wildlife Refuge** mitigation by stipulation option proposes three new stipulations and three new ITLs (Information to Lessees). The alternative emphasizes restrictions or prohibitions on activities within and adjacent to ANWR and requires information of lessees on measures taken to minimize effects to polar bears.

Biological Evaluation for Threatened and Endangered Species with Respect to the Proposed Beaufort Sea Oil and Gas Lease Sale 170

Prepared for Initiation of Section 7 Consultation in Accordance with Endangered Species Act of 1973, as Amended

Minerals Management Service
Alaska OCS Region
February 1997

TABLE OF CONTENTS

I. BACKGROUND

The United States Department of the Interior (USDOI), Minerals Management Service (MMS), has initiated the presale process for the Beaufort Sea Oil and Gas Lease Sale 170, tentatively scheduled for April 1998. Sale 170, if held, would be the seventh Federal offshore sale in the Beaufort Sea Planning Area. The Joint Federal and State of Alaska Oil and Gas Lease Sale (Sale BF) held on December 11, 1979, was the first sale in the area. Five subsequent sales followed in the Planning Area: Diapir Field Sale 71 (October 1982), Diapir Field Sale 87 (August 1984), Beaufort Sea Sale 97 (March 1988), Beaufort Sea Sale 124 (June 1991), and Beaufort Sea Sale 144 (September 1996). Of 660 leases issued in various Beaufort Sea sales, 80 are still active, and a total of 28 wells have been drilled.

This evaluation document describes the proposed lease sale to the extent feasible, the listed species most likely to be affected, effects of proposed leasing and exploration activities, and potential mitigating measures to reduce potential adverse effects to listed species. Because the purpose of this document is to provide information for an incremental-step consultation on Sale 170 leasing and exploration phases, we provide the most detailed information on these phases. The evaluation provides less detail on development and production activities due to their uncertainty at this time. However, we have included sufficient information on development and production to provide an adequate basis for an opinion regarding the reasonable likelihood of the entire action violating Section 7(a)(2) of the Endangered Species Act (ESA), as amended. Should commercially producible quantities of oil be discovered and development and production be proposed, we would evaluate the need for further consultation regarding these activities. We also would consider the need for further consultation if additional species were listed or critical habitat designated, if the proposed action were substantially modified, or if significant new effects-related information were developed.

A detailed description of the endangered and threatened species within the Beaufort Sea Planning Area and effects analyses of similar proposed actions have been addressed in the following previously issued Environmental Impact Statements (EIS's) and biological opinions:

Beaufort Sea Joint Federal/State Oil and Gas Lease Sale (Sale BF), Final EIS (USDOI, BLM, 1979)
Diapir Field Lease Sale 71 Final EIS (USDOI, MMS, 1982)
Diapir Field Lease Sale 87 Final EIS (USDOI, MMS, 1984)
Beaufort Sea Sale 97 Final EIS (USDOI, MMS, 1988)
Beaufort Sea Sale 124 Final EIS (USDOI, MMS, 1991)
Beaufort Sea Sale 144 Final EIS (USDOI, MMS, 1996)
Chukchi Sea Sale 109 Final EIS (USDOI, MMS, 1987)
Chukchi Sea Sale 126 Final EIS (USDOI, MMS, 1991)
Joint Federal/State Sale BF Biological Opinions (USDOI, FWS, 1978; USDOC, NMFS, 1980)
Joint Federal/State Sale BF Biological Opinion Revised (USDOC, NMFS, 1982)
Diapir Field Sale 71 Biological Opinions (USDOI, FWS, 1981; USDOC, NMFS, 1982)
Diapir Field Sale 87 Biological Opinions (USDOI, FWS, 1983; USDOC, NMFS, 1983)
Beaufort Sea Sale 97 Biological Opinions (USDOI, FWS, 1985; USDOC, NMFS, 1987)
Arctic Region Biological Opinion (USDOC, NMFS, 1988)
Beaufort Sea Sale 124 Biological Opinions (USDOI, FWS, 1990; USDOC, NMFS, 1990-referenced 1988 Opinion)
Beaufort Sea Sale 144 Biological Opinions (USDOI, FWS, 1995; USDOC, NMFS, 1995-referenced 1988 Opinion)

II. PROPOSED ACTIVITIES

This section describes the proposed action for Beaufort Sea Oil and Gas Lease Sale 170. It also contains resource estimates for the proposed sale area and our basic assumptions and estimates of levels of activity associated with exploration (summarized from the Exploration and Development Report, Appendix A).

A. Resource Estimate: The exploration scenario reflects a reasonable range for resource development and activity levels in the Sale 170 area from 350 to 670 million barrels (MMbbl) of recoverable oil.

The exploration schedule is contained in Appendix A. We also consider an exploration-only scenario (not resulting in production).

B. Exploration Scenario: The exploration scenario selected by MMS is a composite of feasible options that could be developed for the environmental analysis. The options are the result of discussions within MMS, with other Government agencies, and with industry. The locations of existing infrastructure, sites with potential as support facilities, area-resource estimates, and scenarios developed for previous Outer Continental Shelf (OCS) sales in the Beaufort Sea were all considered in developing this scenario.

The facility locations and exploration scenarios discussed represent our basic assumptions for identifying potential environmental effects that may result from routine activities. The assumptions do not represent an MMS recommendation, preference, or endorsement of any facility, site, or exploration plan. Following are summaries of the major exploration assumptions.

- We expect industry to drill up to 3 exploration wells and 1 delineation well from 1998 through 2006 for the exploration-only scenario and 12 to 16 exploration and delineation wells from 1999 through 2006 for possible development and production for the 350- to 670-MMbbl range. A maximum of 2 drilling rigs would operate in any one exploratory year. Drilling depths for exploration and delineation wells should average 10,000 feet (ft).

- A typical exploratory and delineation well will use about 630 short tons of drilling mud and produce about 820 short tons of dry-rock cuttings.

- Gravel islands are likely to be used as drilling platforms for nearshore areas where water depths are ≤40 ft, and artificial ice islands or gravel islands may be used as drilling platforms in shallow-water depths <20 ft. Shallow-water operations will be supported by ice roads in the winter and barges in the summer. Moveable bottom-founded platforms of various designs are likely drilling platforms for intermediate water depths of 40 to 80 ft. For water depths >80 ft, floating drilling rigs (drillships or floating platforms) supported by icebreakers and supply boats are likely to be used in open-water and broken-ice conditions.

- Site-specific shallow-hazard seismic surveys conducted for the 4 exploration and delineation wells under the exploration-only scenario could equal 69.15 square kilometers (km). An additional 12 to 16 exploration or delineation wells eventually leading to development and production could result in a total area covered by seismic surveys ranging from 138.4 to 184.4 km^2. The time required to complete a site-clearance survey is estimated to be 2 days.

- Onshore support would be from existing facilities, particularly from Prudhoe Bay and possibly from the Kuparuk unit. Support for shallow-water operations on ice islands or nearshore gravel islands is expected to be by ice roads. Drilling operations farther offshore would be supported during the open-water season by at least 1 supply-boat trip/drilling unit/week and 1 helicopter flight/drilling unit/day. Depending on ice conditions, 2 or more icebreaking vessels may be required to perform ice-management tasks for the floating units. There also may be 1 standby vessel for each drilling unit. The time required to drill and test an exploration or delineation well is approximately 3 months.

C. Description of the Proposal (Alternative I): The proposal offers for lease the portion of the Beaufort Sea Planning Area selected as a result of area identification (Fig. 1). The proposal contains 362 blocks encompassing about 688.6 hectares (1.7 million acres). The blocks in the proposed action are approximately 3 to 25 nautical miles (nmi) offshore in water depths that range from approximately 7.6 to 36.6 meters (m) (25-120 ft).

In addition to the proposal, two alternatives (no-sale and Kaktovik deferrals) are being considered in the Sale 170 EIS as described in Appendix B.

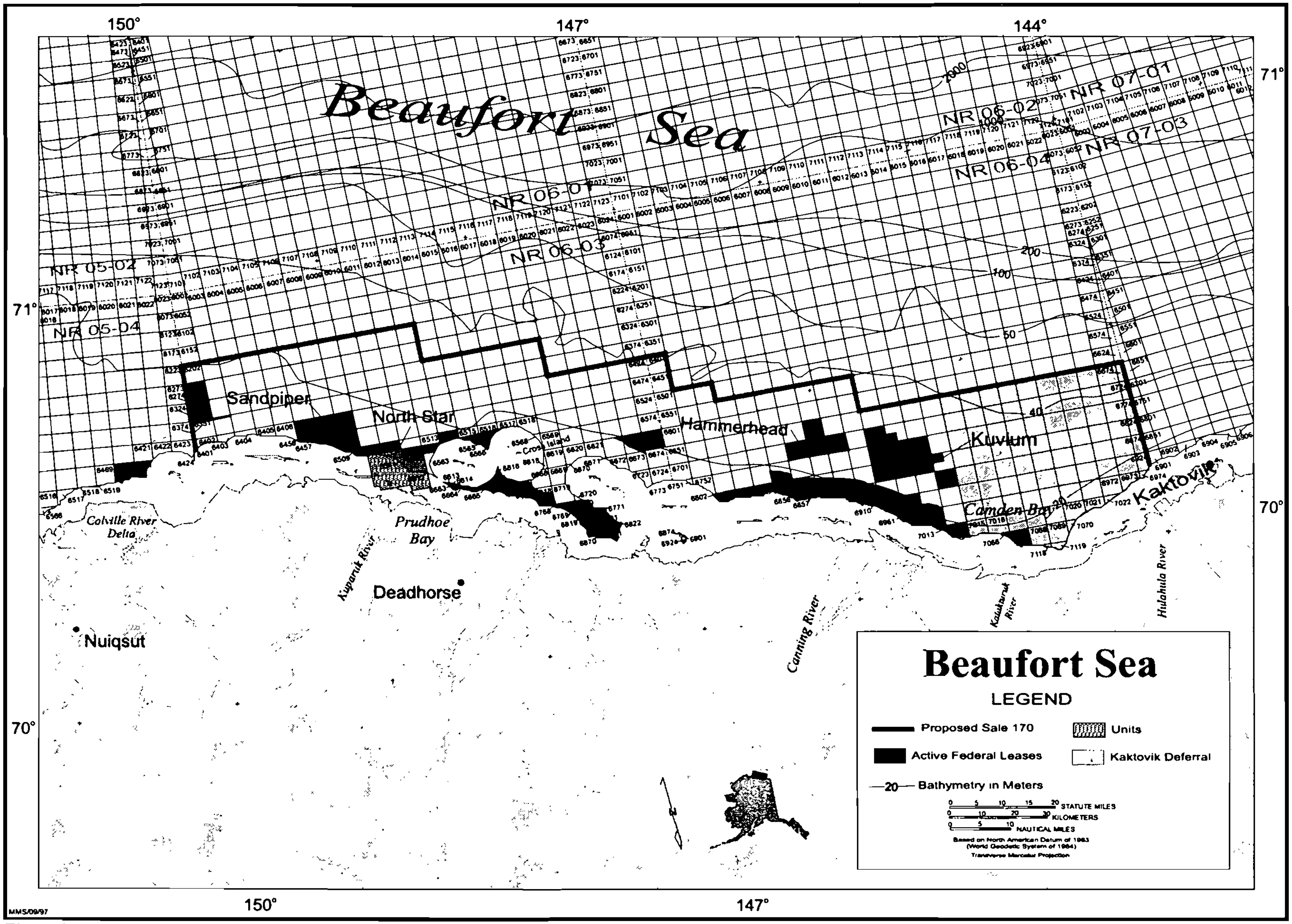
Beaufort Sea
Sandpiper
North Star
Hammerhead
Kuvlum
Kaktovik
Camden Bay
Prudhoe Bay
Colville River Delta
Kuparuk River
Deadhorse
Nuiqsut
Canning River
Kadleroshilik River
Hulahula River
Cross Island
NR 05-02
NR 05-04
NR 06-01
NR 06-02
NR 06-03
NR 06-04
NR 07-01
NR 07-03
150°
147°
144°
71°
70°
Beaufort Sea
LEGEND
Proposed Sale 170
Units
Active Federal Leases
Kaktovik Deferral
Bathymetry in Meters
STATUTE MILES
KILOMETERS
NAUTICAL MILES
Based on North American Datum of 1983 (World Geodetic System of 1984)
Transverse Mercator Projection
MMS/09/97

Figure 1

III. DESCRIPTIONS OF LISTED, PROPOSED, AND CANDIDATE SPECIES IN THE VICINITY OF THE PROPOSED LEASE-SALE AREA

A complete description of the threatened and endangered species associated with the Beaufort Sea Planning Area is provided in the final EIS's for previous lease sales and the National Marine Fisheries Service (NMFS) and the Fish and Wildlife Service (FWS) biological opinions listed on Page 2. The following summary updates this information for the proposed Sale 170 area. Species occurring along southern transportation routes and potential effects to these species as a result of an oil spill or other activities have been described in the Cook Inlet Planning Area Oil and Gas Lease Sale 149 FEIS (USDOI, MMS, 1995).

A. *Cetaceans:* The bowhead whale is the only endangered-cetacean species identified, in concurrence with NMFS, to include in this biological evaluation (Appendix C). Gray whales were recently removed from the list of endangered and threatened wildlife (59 FR 31094, June 16, 1994).

The Bering Sea stock (western arctic stock) of bowhead whales migrates through the proposed sale area semiannually as they migrate between wintering areas in the Bering Sea and summer-feeding grounds located in the Canadian Beaufort Sea.

The western arctic stock of bowhead whales was estimated to number between 7,200 to 9,400 individuals in 1993, with 8,200 as the best estimate of the population, and the estimate recognized by the International Whaling Commission. However, using an alternative method, the 1993 population size was estimated to number between 6,800 to 8,900 individuals, with 7,800 as the best estimate of the population. Zeh, Raftery and Schaffner (1996) estimate that the western arctic stock increased at a rate of 3.2 percent/year from 1978 to 1993. Population estimates have risen dramatically since 1978. The increase is likely due to a combination of improved data and better censusing techniques as well as an increasing population. The historic population has been estimated from 10,400 to 23,000 whales in 1848 prior to commercial exploitation, compared to an estimate of between 1,000 to 3,000 animals in 1914 near the end of the commercial whaling period (Woody and Botkin, 1993).

Bowhead whales have an affinity for ice and are associated with relatively heavy ice cover and shallow continental-shelf waters for much of the year. During the winter, they are associated with the marginal ice zone, regardless of where the zone is located, and with polynyas. Polynyas in the Bering Sea along the northern Gulf of Anadyr, south of St. Matthew Island, and near St. Lawrence Island, are important wintering areas for bowheads. Bowheads also congregate in these polynyas prior to the beginning of the spring migration.

The bowheads' northward spring migration appears to coincide with the ice breakup. They pass through the Bering Strait and eastern Chukchi Sea from late March to mid-June through newly opened leads in the shear zone between the shorefast ice and the offshore pack ice. Several studies of acoustical and visual comparisons of the bowhead spring migration off Barrow indicate that bowheads also may migrate under ice within several kilometers of the leads. Several observers' data indicate that bowheads migrate underneath ice and can break through ice from 14 to 18 centimeters (cm) (5.5-7 inches [in]) thick to breathe (George et al., 1989; Clark et al., 1986). 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 multiyear floes (thick ice). After passing Barrow from April through mid-June, they move through or near offshore leads in an easterly direction. East of Point Barrow, the lead systems divide into numerous branches that vary in location and extent from year to year. Bowheads arrive on their summer feeding grounds in the vicinity of Banks Island from mid-May through June and remain in the Canadian Beaufort Sea and Amundsen Gulf until late August or early September (Moore and Reeves, 1993).

Some biologists conclude that almost the entire Bering Sea bowhead population migrates to the Beaufort Sea each spring and that few, if any, whales summer in the Chukchi Sea. However, some Russian scientists maintain that some bowheads migrate through the Bering Sea in late spring, swim northwest along the Chukotka coast, and summer in the Chukchi Sea. Records of bowhead sightings from 1975 to 1991 suggest that bowheads regularly may occur along the northwestern Alaskan coast in late summer, but it is unclear whether these are "early autumn" migrants or whales that have summered nearby (Moore et al., 1995).

After summer feeding in the Canadian Beaufort Sea, bowheads begin moving westward into Alaskan waters in August and September. Generally, few bowheads are seen in Alaskan waters until the major portion of the migration occurs, typically between mid-September and mid-October. Conditions can vary during the fall migration from open water to over nine-tenths ice coverage. The extent of ice cover may influence the timing or duration of the fall migration. The medium water depth over which the greatest number of whales appears to migrate is from 20 to 50 m (66-165 ft). An analysis of median water depths of bowheads sighted during fall aerial surveys from 1982 through 1995 provides an overall median depth of 37 m (120 ft) for all years combined. Greater median depths were observed for heavy ice years, whereas whales tend to be located in shallower waters during light ice years (Treacy, 1992, 1996). The heaviest ice year, 1983, had a median depth of 347 m (1,140 ft). Miller, Elliot, and Richardson (1996) observed that whales within the Northstar region (147°-150° W. long.) migrate closer to shore in light and moderate ice years and farther offshore in heavy ice years, with medium distances offshore of 30 to 40 km (19-25 miles [mi]), 30 to 40 km (19-25 mi), and 60 to 70 km (37-43 mi), respectively.

Data on the bowhead fall migration through the Chukchi Sea before they move south into the Bering Sea are limited. Whales commonly are seen from the coast to about 150 km (93 mi) offshore between Point Barrow and Icy Cape, suggesting that most bowheads disperse southwest after passing Point Barrow and cross the central Chukchi Sea near Herald Shoal to the northern coast of the Chukotsk Peninsula. However, scattered sightings north of 72° N. latitude suggest that at least some whales migrate across the Chukchi Sea farther to the north. After moving south through the Chukchi Sea, bowheads pass through the Bering Strait in late October through early November on their way to overwintering areas in the Bering Sea.

Bowheads apparently feed throughout the water column, including bottom or nearbottom feeding as well as surface feeding. They have been observed feeding in or near the proposed sale area during their spring and fall migrations (Lowry, 1993). Food items most commonly found in the stomachs of harvested bowheads include euphausiids, copepods, mysids, and amphipods, with euphausiids and copepods being the primary prey species. Bowheads continue to feed intermittently where food is available as they migrate across the Alaskan Beaufort Sea. Areas to the east of Barter Island appear to be used by some bowheads for feeding briefly as they migrate slowly westward across the Beaufort Sea (Thomson and Richardson, 1987).

A study of the importance of the eastern Beaufort Sea to feeding bowhead whales indicated that, for the population as a whole, food resources consumed there did not contribute significantly to the whales' annual energy needs (Richardson, 1987). The North Slope Borough (NSB) subsequently requested its Science Advisory Committee to review the study. The review committee did not accept the conclusion in the report that the study area is unimportant as a feeding area for bowhead whales (NSB Science Advisory Committee, 1987). The Committee believed there were problems in study design and that the duration of the study was too short.

Carbon-isotope analysis of bowhead baleen has indicated that a significant amount of feeding may occur in wintering areas (Schell, Saupe, and Haubenstock, 1987). Bowheads occasionally have been observed feeding north of Flaxman Island and in some years, sizeable groups of bowheads have been seen feeding east of Point Barrow between Smith Bay and Point Barrow. In some years bowheads also have been observed feeding in the spring in the region just west of Point Barrow, indicating that bowheads will feed opportunistically in this area when food is available.

The mating season for bowhead whales is not known with certainty. Most bowhead mating and calving appear to occur from April through mid-June, coinciding with the spring migration. Mating may start as early as January and February, when most of the population is located in the Bering Sea, but also has been reported as late as September and early October (Koski et al., 1993). Calving occurs from March to early August, with the peak probably occurring between early April and the end of May.

B. Birds: The threatened spectacled eider and proposed threatened Steller's eider were identified, in concurrence with the FWS, as species to include in this biological evaluation (see Appendix C). Inclusion of the arctic peregrine falcon, while not required of a delisted species, was considered appropriate because the FWS will monitor its population for 5 years.

1. Spectacled Eider: An estimated 7,000 to 16,000 spectacled eiders seasonally occupy arctic Alaska; they are most abundant westward from the Sagavanirktok River (Anderson and Cooper, 1994; Balogh and Larned, 1995a,b; Larned and Balogh, 1994). Eiders nest at low density (0.13-0.20 pairs/km^2) on coastal tundra and major river deltas such as the Colville (Larned, 1996; Meehan and Jennings, 1988; USDOI, FWS, 1996; Troy Ecological Research Associates, 1995; 58 *FR* 27474). Probably 90 percent of the world population nests in arctic Russia. An estimated 1,700 to 3,000 pairs of spectacled eiders have nested recently (1990-1992) on the Yukon-Kuskokwim (Y-K) Delta (Stehn et al., 1993); this represents a 94- to 98-percent decline from the early 1970's. Substantial local declines also may have occurred on the arctic slope (e.g., 80% at Prudhoe Bay 1981-1991; Warnock and Troy, 1992), but data are insufficient to confirm a regional trend. Up to a few thousand pairs may nest in this area (58 *FR* 27474). Declines also have been reported on the Seward Peninsula, and at St. Lawrence Island (Kessel, 1989). Recent estimates from Siberia are lacking, but surveys in the 1960's indicated that numbers were dwindling at that time on the Indigirka Delta (Dau and Kistchinski, 1977).

Spectacled eiders nesting in the Arctic occupy areas up to 120 km (75 mi) inland (Dau and Kistchinski, 1977; Warnock and Troy, 1992). Nest sites are associated with pond areas containing emergent vegetation, the latter probably helping to reduce predation on ducklings (Warnock and Troy, 1992). Nesting density of 0.13 pairs/km^2 has been observed in the Prudhoe Bay area, substantially below the 0.20 pairs/km^2 on the Y-K Delta (Stehn, Wege, and Walters, 1992; Warnock and Troy, 1992). Nest success is relatively high both in the Prudhoe Bay area (40%) and on the Y-K Delta, suggesting that the population decline is caused by factors operating outside the nesting period.

Satellite-tagged postbreeding birds have been relocated in Ledyard Bay, the primary Alaskan molting area, and several other coastal areas from the Beaufort Sea to the Y-K Delta and Russian Far East, and scattered localities near St. Lawrence Island (Petersen, Douglas, and Mulcahy, 1995). A large proportion of the world spectacled eider population (about 140,000) was observed wintering in pack ice between St. Matthew and St. Lawrence Islands in the central Bering Sea in April of 1995; this is assumed to be the previously undocumented wintering area (Larned and Balogh, 1995, unpublished data).

2. Steller's Eider: Holarctic population estimates for the Steller's eider range from 150,000 to 200,000; an estimated 50-percent decline in the population has occurred since the early 1970's (59 *FR* 35896). Most of the 70,000 to 100,000 Steller's eiders wintering in Alaska nest in northern Siberia (57 *FR* 19852; Kertell, 1991). Approximately 1,000 pairs nest in northwestern Alaska, primarily within 100 km (62 mi) south and southeast of Barrow (Quakenbush and Cochrane, 1993). Recent population estimates for the arctic coastal plain (these include a substantial correction-factor error) range from 2,000 to 7,000 (Brackney and King, 1993); only small numbers have been observed between Barrow and the Colville River. Recent surveys along the entire western Alaska coast and extensive searching on the Y-K Delta have detected no Steller's eiders in suitable nesting habitat; this represents a substantial contraction of their former breeding range in Alaska (Kertell, 1991; Larned et al., 1993).

Males depart the nesting areas in late June; females with broods remain until late August or early September. Reproductive success generally is low with occasional good years, suggesting that productivity is dependent primarily on adult survival.

Most of the population molts along the Alaskan coast from Nunivak Island to Izembek Lagoon and winters from the eastern Aleutian Islands to lower Cook Inlet. Winter surveys in this region since 1983 have counted fewer than 65,000 individuals (USDOI, FWS, 1991). Recent Christmas count and other survey information suggest that as many as 6,000 occupy the Kodiak Island area (MacIntosh, 1994, pers. comm.; Zwiefelhofer, 1993).

3. Arctic Peregrine Falcon: The arctic peregrine falcon was delisted on October 5, 1994 (59 *FR* 50796); however, this species will be monitored by the FWS for 5 years. Based on 1993 surveys, the population of arctic peregrine falcons now stands at about 200 to 250 pairs—annual recruitment into the breeding population is about 12 percent (Ambrose, 1995, pers. comm.).

Peregrine falcons usually are present in Alaska from about mid-April to mid-September. Egg laying begins in mid-May on the arctic slope (USDOI, FWS, 1982). Known arctic peregrine falcon nest sites nearest the Beaufort coast occur about 32 km (20 mi) inland (Ambrose, 1995, pers. comm.). Only a few active nest sites are suspected near the coast between Barrow and Demarcation Point (one pair has nested on Barter Island recently; USDOI, FWS, 1996). The major nesting areas occur along the Colville and Sagavanirktok Rivers, with scattered nest sites along other arctic slope rivers. Some nonbreeding subadult birds have been observed on the Colville River delta in recent years (Helmericks, pers. comm., as cited in USDOI, FWS, 1996), suggesting that nonbreeding peregrines may use the productive wetlands near the Beaufort Sea coast during summer and prior to migration.

IV. EVALUATION OF EFFECTS FROM LEASING AND EXPLORATION

Leasing and exploration may result in noise and disturbance and altered habitat effects on behavior, distribution, and abundance of individuals or populations occurring in or adjacent to the lease-sale area. Contaminants such as drilling muds and cuttings released during exploration activities may cause adverse effects on individuals either through direct contact or indirectly as a result of effects on prey populations or important habitats. Based on industry's record on the OCS, the probability of crude-oil release during exploration is assumed to be zero. Under the exploration-only scenario, 3 exploration wells and 1 delineation well are expected to be drilled during the period 1998 through 2006. The Sale 170 reasonable range scenario (350-670 MMbbl resource range) assumes that 1 to 2 drilling units will drill from 1 to 3 exploration wells and delineation wells each year between 1999 and 2006 (12-16 total wells). It is possible that as many as 2 exploration rigs may operate simultaneously in the Sale 170 area. Information on drilling operations and logistical support for drilling operations is discussed in Section II.B. Information derived from traditional sources of knowledge is included in the proposed Beaufort Sea Oil and Gas Lease Sale 170 Draft EIS.

A. Effects on the Bowhead Whale: Noise-producing exploration activities, including aircraft traffic, icebreaking or other vessel traffic, geophysical-seismic surveys, and drilling are the activities most likely to affect bowhead whales.

Most offshore aircraft traffic in support of the oil industry involves turbine helicopters flying along straight lines. Data on reactions of bowheads to helicopters are limited. 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. Observations of bowhead whales exposed to helicopter overflights indicate that most bowheads exhibited no obvious response to helicopter overflights at altitudes above 150 m (492 ft). If bowheads were overflown at lower altitudes, some probably would dive quickly in response to the aircraft noise (Richardson and Malme, 1993). However, this noise 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. Underwater sounds from aircraft are transient. According to Richardson et al. (1995a), the angle at which a line from the aircraft to the receiver intersects the water's surface is important. At angles >13° 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° cone above the receiver. Usually, an aircraft can be heard in air well before and after the brief period while it passes overhead and is heard underwater. Fixed-wing aircraft overflights at low altitude (≤300 m [984 ft]) often cause hasty dives. Reactions to a circling aircraft are sometimes conspicuous if the aircraft is below a 300 m (984 ft) altitude, uncommon at 460 m (1,509 ft), and generally undetectable at 600 m (1,968 ft) (Richardson and Malme, 1993). The effects from such an encounter are brief, and the whales should resume their normal activities within minutes.

Bowheads react to the approach of vessels at greater distances than they react to most other industrial activities. According to Richardson and Malme (1993), most bowheads begin to swim rapidly away when vessels approach rapidly and directly. Avoidance usually begins when a rapidly approaching vessel is 1 to 4 km (0.62-2.5 mi) away. A few whales may react at distances from 5 to 7 km (3-8 mi), and a few whales may not react until the vessel is <1 km (<0.62 mi) away. Received noise levels as low as 84 decibels relative to 1 microPascal (dB re 1 μPa) or 6 dB above ambient may elicit strong avoidance of an approaching vessel at a distance of 4 km (2.5 mi). In the Canadian Beaufort Sea, bowheads observed in vessel-disturbance experiments began to orient away from an oncoming vessel at a range of 2 to 4 km (1.2-2.5 mi) and to move away at increased speeds when approached closer than 2 km (1.2 mi) (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. Fleeing from a vessel generally stopped within minutes after the vessel passed, but scattering may persist for a longer period. In some instances, bowheads have returned to their original locations.

Bowhead whales probably would encounter a few vessels associated with Sale 170 activities during their fall migration through the Alaskan Beaufort Sea. Vessel traffic generally would be limited to routes between the exploratory-drilling units and the shore base. Each floating drilling unit probably would have one vessel remaining nearby for emergency use. Depending on ice conditions, floating drilling units may have two or more icebreaking vessels standing by to perform ice-management tasks. It is likely that vessels actively involved in ice management or moving from one site to another would be more disturbing to whales than vessels idling or maintaining their position. In either case, bowheads probably would adjust their individual swimming paths to avoid approaching within several kilometers of vessels attending a drilling unit and probably would move away from vessels that approached within a few kilometers. Vessel activities associated with the sale are not expected to disrupt the bowhead migration, and small deflections in individual bowhead-swimming paths and a reduction in use of possible bowhead-feeding areas near exploration units should not result in significant adverse effects on the species. During their spring migration (April through June), bowheads are expected to encounter few, if any, vessels along their migration route because, ice at this time of year typically would be too thick for drillships and supply vessels to operate in. Furthermore, the Sale 170 area is not near the spring migration route.

Sound from seismic exploration is another potential source of noise disturbance to bowhead whales. Marine seismic exploration uses underwater sounds with source levels exceeding those of other activities discussed here. Seismic surveys are of two types: low-resolution, deep-seismic and high-resolution, shallow-seismic surveys. Deep-seismic surveys emit loud sounds, which are pulsed rather than continuous, and can propagate long distances from their source. Overall source levels of noise pulses from airgun arrays are very high, with peak levels of 240 to 250 dB relative to 1 microPascal at one m (dB re 1 μPa-m). However, most energy is directed downward, and the short duration of each pulse limits the total energy. Received levels within a few kilometers typically exceed 160 dB re 1 μPa (Richardson et al., 1995a).

Richardson and Malme (1993), while synthesizing data on the effects of noise on bowheads, concluded that collectively scientific studies have shown that when an operating seismic vessel approaches within a few kilometers, most bowheads exhibit strong avoidance response and specific changes in surfacing, respiration, and dive patterns and may temporarily change their individual swimming paths. These short-term responses are not likely to preclude a successful migration or to significantly disrupt feeding activities. Strong pulses of seismic noise are often detectable 25 to 50 km (15.5-31 mi) from seismic vessels, but most bowheads exposed to seismic sounds from vessels more than about 7.5 km (4.7 mi) away rarely show avoidance. Strong avoidance occurs when received levels of seismic noise are 150-180 dB re 1 μPa (Richardson and Malme, 1993). Besides avoidance, whales may exhibit significant tendencies for reduced surfacing and dive durations, fewer blows per surfacing, and longer intervals between successive blows. Bowheads' surface-respiration-dive characteristics appeared to recover to pre-exposure levels within 30 to 60 minutes following the cessation of the seismic activity.

High-resolution seismic surveys, which are much lower energy, are generally conducted on leases following the lease sale to evaluate potential shallow hazards to drilling. Shallow-hazard seismic surveys for exploration or delineation well sites would most likely be conducted during the ice-free season. Because high-resolution seismic surveys are lower energy and tend to be relatively quiet, these activities are not likely to have significant effects on endangered whales. Bowheads appear to continue normal behavior at closer distances to high-resolution seismic surveys than for low-resolution. Richardson, Wells, and Wursig (1985) found that bowheads sometimes continued normal activities (skim feeding, surfacing, diving, and travel) when a single 40 cubic inch (in^3) (0.66-liter) airgun began firing 3 to 5 km away (received noise levels at least 118-133 dB re 1 μPa).

Seismic surveys are not expected to be conducted in or near the spring lead system through which bowheads migrate because (1) degraded ice conditions would not allow on-ice surveys, (2) insufficient open water is present for open-water seismic surveys, and (3) the Sale 170 area does include the spring lead system.

Another source of noise would be from the exploration drilling units. Under the exploration-only scenario, 3 exploration and 1 delineation wells are expected to be drilled during the period 1998 through 2006. However, under the expected resource range (350-670 MMbbl), an estimated 12 to 16 exploration and delineation wells would be drilled within the Sale 170 area between 1999-2006. Fall-migrating bowheads could be exposed to drilling operations on 1 to 3 exploration or delineation wells per year with a maximum of 2 drilling units operating concurrently as a result of Sale 170. Spring-migrating bowheads are not expected to be exposed to drilling noise.

Stationary sources of offshore noise (such as drilling units) appear less disruptive to bowhead whales than moving sound sources (such as vessels). Bowhead whales whose behavior appeared normal have been observed on several occasions within 10 to 20 km (6.2-12.4 mi) of drillships in the eastern Beaufort Sea, and there have been a number of reports of sightings within 0.2 to 5 km (0.12-3 mi) from drillships (Richardson and Malme, 1993). On several occasions, whales were well within the zone where drillship noise is clearly detectable. 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, Malme, and Richardson (1987) predicted that roughly half of the bowheads are expected to respond at a distance of 1 to 4 km (0.62-2.5 mi) from a drillship drilling when the signal-to-noise ratio (S:N) is 30 dB. A smaller proportion would react when the S:N is about 20 dB (at a greater distance from the source), and a few may react at an S:N even lower or at a greater distance from the source. They predicted that roughly half of the bowheads are expected to respond at a distance of 0.02 to 0.2 km (0.12-1.12 mi) to drilling from an artificial-island drilling site when the signal-to-noise ratio (S:N) is 30 dB.

In playback experiments, some bowheads showed a weak tendency to move away from the sound source at a level of drillship noise comparable to that which would be present several kilometers from an actual drillship (Richardson and Malme, 1993). In one study, sounds recorded 130 m (426 ft) from the actual Karluk drillrig were used as the stimulus during disturbance test playbacks (Richardson et al., 1991). For the overall 20 to 1,000 Hz band, the average source level was 166 dB re 1 μPa in 1990 and 165 dB re 1 μPa in 1989. Bowheads continued to pass the projector while normal Karluk drilling sounds were projected. During the playback tests, the source level of sound was 166 dB re 1 μPa. One whale came within 110 m (360 ft) of the projector. Many whales came within 160 to 195 m (525-640 ft), where the received broadband (20-1000 Hz) sound levels were about 135 dB re 1 μPa. That level was about 46 dB above the background ambient level in the 20 to 1000 Hz band on that day. Bowhead movement patterns were strongly affected when they approached the operating projector. When bowheads were still several hundred meters away, most began to move to the far side of the lead from the projector, which did not happen during control periods while the projector was silent. In a subsequent phase of this continuing study, Richardson et al. (1995b) concluded that "migrating bowheads tolerated exposure to high levels of continuous drilling noise if it was necessary to continue their migration. Bowhead migration was not blocked by projected drilling sounds, and there was no evidence that bowheads avoided the projector by distances exceeding 1 km (0.54 nmi). However, local movement patterns and various aspects of the behavior of these whales were affected by the noise exposure, sometimes at distances considerably exceeding the closest points of approach of bowheads to the operating projector." Some migrating bowheads diverted their course enough to remain a few hundred meters to the side of the projector. Surfacing and respiration behavior, and the occurrence of turns during surfacings, were strongly affected out to 1 km (0.62 mi). Turns were unusually frequent out to 2 km (1.25 mi), and there was evidence of subtle behavioral effects at distances up to 2 to 4 km (1.25-2.5 mi). The study concluded that the demonstrated effects were localized and temporary and that playback effects of drilling noise on distribution, movements, and behavior were not biologically significant.

Reactions to drilling sound from artificial islands and caisson-retained islands have yet to be observed, but underwater-sound levels at various distances from a caisson-retained island (with support vessels nearby) in the Canadian Beaufort Sea were similar to those produced by a drillship. In general, it appears that bowhead avoidance is less around an unattended structure than one attended by support vessels.

If the drillships are attended by icebreakers, as is typically the case during the fall in the U.S. Beaufort Sea, the drillship noise may frequently be masked by icebreaker noise which is often louder. There are no observations of bowhead reactions to icebreakers breaking ice. Response distances would vary depending upon icebreaker activities and sound propagation conditions. Based on models, bowhead whales would likely respond to the sound of the attending icebreakers at distances of 2 to 25 km (1.24 to 15.53 mi) from the icebreakers (Miles, Malme, and Richardson, 1987). Zones of responsiveness for intermittent sounds such as an icebreaker pushing ice have not been studied. This study predicts that roughly half of the bowhead whales show avoidance response to an icebreaker underway in open water at a range of 2 to 12 km (1.25-7.46 mi) when the S:N is 30 dB. The study also predicts roughly half of the bowhead whales show avoidance response to an icebreaker pushing ice at a range of 4.6-20 km (2.86-12.4 mi) when the S:N is 30 dB. Richardson et al. (1995) found that bowheads migrating in the nearshore lead often tolerated exposure to projected icebreaker sounds at received levels up to 20 dB or more above the natural ambient noise levels at corresponding frequencies. The source level of an actual icebreaker is much higher than that of the projectors (projecting recorded sound) used in this study (median difference 34 dB over the frequency range 40-6300 Hz). Over the two-season period (1991 and 1994) when icebreaker playbacks were attempted, an estimated 93 bowheads (80 groups) were seen near the ice camp when the projectors were transmitting icebreaker sounds into the water, and approximately 158 bowheads (116 groups) were seen near there during quiet periods. Some bowheads diverted from their course when exposed to levels of projected icebreaker sound >20 dB above the natural ambient noise level in the 1/3-octave band of the strongest icebreaker noise. However, not all bowheads diverted at that S:N, and a minority of whales apparently diverted at a lower S:N. The study concluded that exposure to a single playback of variable icebreaker sounds can cause statistically but probably not biologically significant effects on movements and behavior of migrating whales in the lead system during the spring migration east of Pt. Barrow. The study indicated the predicted response distances for bowheads around an actual icebreaker would be highly variable, but for typical traveling bowheads, detectable effects on movements and behavior are predicted to extend commonly out to radii of 10 to 30 km (6.2-18.6 mi) and sometimes to 50+ km (31.1 mi). Effects of an actual icebreaker on migrating bowheads, especially mothers and calves, could be biologically significant. It should be noted that these predictions were based on reactions of whales to playbacks of icebreaker sounds in a lead system during the spring migration and are subject to a number of qualifications. (The predicted "typical" radius of responsiveness around an icebreaker like the *Robert Lemeur* is quite variable, because propagation conditions and ambient noise vary with time and with location. In addition, icebreakers vary widely in engine power and thus noise output, with the *Robert Lemeur* being a relatively low-powered icebreaker. Furthermore, the reaction thresholds of individual whales vary by at least 10 dB around the "typical" threshold, with commensurate variability in predicted reaction radius.)

Richardson and Malme (1993) point out that the data, although limited, suggest that stationary industrial activities producing continuous noise, such as stationary drillships, result in less dramatic reactions by bowheads than do 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 in the absence of those operations. Because other cetaceans seem to habituate somewhat to continuous or repeated noise exposure when the noise is not associated with a harmful event, this suggests that bowheads will habituate to certain noises that they learn are nonthreatening. However, 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 began in 1976, 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 to 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.

Concerns also have been raised regarding the effects of noise from OCS exploration and production operations in the spring lead-system and the potential for this noise to delay or block the bowhead spring migration. As stated previously, spring migrating bowheads are not likely to be exposed to drilling noise. The Sale 170 area is in the central Beaufort Sea and does not extend west to the Barrow area where the spring-lead occurs. To date, there have been no drilling or production operations in the vicinity of the spring-lead system during the bowhead migration, and none would occur as a result of Sale 170.

There also could be a number of minor alterations in bowhead habitat as a result of Sale 170 exploration. Discharge of drilling muds and cuttings during exploration or development and production activities are not expected to cause significant effects either directly through contact or indirectly by affecting prey species. Any effects would be very localized around the drill rig due to rapid dilution/deposition of these materials. Bottom-founded drilling units and/or gravel islands may cover small areas of benthic habitat, and drilling muds and cuttings may cover portions of the sea floor that support epibenthic invertebrates used for food by bowhead whales. However, the effects are expected to be negligible, because bowheads feed primarily on pelagic zooplankton and the areas of sea bottom that are impacted would be inconsequential in relation to the available habitat.

Pipeline-construction activities also could result in noise and disturbance to bowhead whales. Offshore pipelines between production platforms and onshore facilities would be installed during the open-water season and could take as long as five seasons to complete. Pipeline-construction activities would be relatively close to shore but could cause whales to avoid the area of activity.

Summary: Bowheads may exhibit temporary avoidance behavior if approached by vessels at a distance of 1 to 4 km (0.62-2.5 mi). They are not affected much by any aircraft overflights at altitudes above 300 m (984 ft). Most bowheads exhibit avoidance behavior when exposed to sounds from seismic activity at a distance of a few kilometers but rarely show avoidance behavior at distances of more than 7.5 km (4.7 mi). Bowheads have been sighted within 0.2 to 5 km (0.12-3 mi) from drillships, although some bowheads probably change their migration speed and swimming direction to avoid close approach to noise-producing activities. A few bowheads may avoid drilling noise at 20 km (12.4 mi) or more. If drillships were attended by icebreakers, as is typically the case during the fall in the U.S. Beaufort Sea, the drillship noise frequently may be masked by icebreaker noise, which often is louder. There are no observations of bowhead reactions to icebreakers breaking ice, but it has been predicted that roughly half of the bowheads would respond at a distance of 4.6 to 20 km (2.86-12.4 mi) when the S:N is 30 dB. Noise from dredging (trenching) for pipeline construction and the production operations from the platforms may cause whales to avoid the immediate vicinity of the activities; however, it is likely that the area of avoidance would be relatively small because whales appear to exhibit less avoidance behavior with stationary sources of relatively constant noise than with moving sound sources. Bowheads do not seem to travel more than a few kilometers in response to a single disturbance incident and behavioral changes are temporary, lasting from minutes (in the case of vessels and aircraft) up to 30 to 60 minutes (in the case of seismic activity).

Occasional brief interruption of feeding by a passing vessel or aircraft probably is not of major significance. Similarly, the energetic cost of traveling a few additional kilometers to avoid closely approaching a noise source is very small in comparison with the cost of migration between the central Bering and eastern Beaufort Seas. However, we do not believe these disturbance or avoidance factors will be significant, because the level of industrial activity anticipated is not sufficiently intense to cause repeated displacement of specific individuals. Reactions are less obvious in the case of industrial activities that continue for hours or days, such as distant seismic exploration, drilling, and dredging. Behavioral studies have suggested that bowheads habituate to noise from distant ongoing drilling, dredging, or seismic operations (Richardson et al., 1985), but there still is some apparent localized avoidance (Davis, 1987). There is insufficient evidence to indicate whether or not industrial activity in an area for a number of years would adversely impact bowhead use of that area (Richardson et al., 1985), but there has been no documented evidence that noise from OCS operations would serve as a barrier to migration.

Conclusion: Bowheads may exhibit temporary avoidance behavior to vessels and activities related to seismic surveys, drilling, and construction during exploration and exploration activities leading to development and production. Overall, bowhead whales exposed to noise-producing activities would most likely experience temporary, nonlethal effects.

B. Effects on the Spectacled Eider: Discharged materials from drilling operations typically disperse rapidly in the water column, and bottom deposition occurs near drill sites. Because postbreeding eiders occur in dispersed flocks, relatively few are expected to occur in or rely specifically on prey potentially buried in these local drill site areas (< 0.5% of benthic habitat available in the proposed sale area), and thus discharges are not expected to cause significant effects either through direct contact with birds or by affecting prey availability.

Routine activities (primarily helicopter flights) are not expected to disrupt significant numbers of foraging spectacled eiders staging or migrating in coastal or offshore waters. This is because of the low probability that those areas occupied by scattered flocks during the relatively brief staging/migration periods (late June/early July, late August/September) would be overflown routinely by support aircraft flying between two rigs and onshore facilities (1-2 round-trip flights/day) at Kuparuk Field or Deadhorse; also, the potential disturbance corridor produced within 1 to 2 km (0.62-1.2 mi) of two established flight paths is equivalent to <1.5 percent of the sale area. However, flocks often are large, and this suggests that any disturbance event is likely to involve substantial numbers of individuals. Thus, we expect any disturbance to cause only intermittent displacement of eiders from the vicinity of two flight corridors between platforms and shore base for the 7 years of exploration. This is not expected to increase mortality significantly, but a portion of the population may experience lowered fitness as a result of routine displacement from favored foraging sites and depletion of energy stores during the critical staging/migration period. The net result is expected to be somewhat lower survival and/or productivity, from which the population is not likely to recover while the current decline persists. Onshore, because nest sites are scattered at low density over much of the arctic slope, we expect relatively few nests to be overflown by helicopters from offshore units, and thus substantial disturbance of nesting or brood-rearing eiders is not expected to occur.

Conclusion: Routine exploration activity is expected to disturb <2 percent of the spectacled eider population. However, somewhat lowered fitness from intermittent disturbance effects may slightly lower survival and/or productivity, from which the population is not likely to recover while the current decline persists.

C. Effects on the Steller's Eider: Steller's eiders staging or migrating in coastal Beaufort Sea areas west of the proposed sale area are not expected to experience adverse effects from potentially disturbing routine activities (helicopter flights). There is an extremely low probability that the routes traveled and area covered by scattered coastal flocks of this small Alaskan breeding population during two relatively brief staging/migration intervals would be intersected by the flight paths of distant support aircraft (1-2 round-trip flights/day) between onshore facilities at Kuparuk Field or Deadhorse and rigs in the western sale area. The limited reduction of available foraging habitat from exploration activities in the western sale area, during the brief time males in late June and females with juveniles in late August occupy coastal waters (primarily in the Barrow area), would have an inconsequential effect on the small Alaskan breeding population. Also, it is unlikely that the primary Alaskan nesting area, located south and southeast of Barrow, would be overflown by helicopters from offshore units, so significant disturbance of nesting or brood-rearing eiders is not expected to occur.

Conclusion: Routine exploration activity is expected to disturb <1 percent of the Alaskan Steller's eider population. As a result, such activity is not expected to affect fitness and associated survival and productivity of the population significantly, and thus is not likely to affect its recovery from the current decline.

D. Effects on the Arctic Peregrine Falcon: Nesting peregrines could, on rare occasions, be disturbed by aircraft overflights associated with the proposed sale activities that may occur inland from the coast. Nesting sites such as those on the Colville River, about 32 km (20 mi) inland, may be vulnerable to such occasional disturbance. Aircraft based in Deadhorse typically would not fly over this area. Thus, significant disturbance of peregrine falcons associated with exploration is unlikely.

Conclusion: It is unlikely that noise and disturbance would affect the peregrine falcon population significantly; any possible disturbance would be short term and localized, with <5 percent of the population exposed to potentially adverse factors.

V. CUMULATIVE EFFECTS:

Cumulative effects are defined in 50 CFR 402.02 (Interagency Cooperation on the Endangered Species Act of 1973, as amended): "... those effects of future State or private activities not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation."

State or private actions reasonably certain to occur within or near the proposed sale area would include State of Alaska oil and gas lease sales and possibly some Canadian Beaufort Sea oil and gas activities in the future, and subsistence-harvest activities.

One State oil and gas lease sale (Sale 86) is scheduled for the Beaufort Sea in September 1997. Three Beaufort Sea areawide sales are scheduled on the State's new 5-year plan for 1999, 2000, and 2001. The State's new 5-year plan currently is scheduled to be available to the public in late January 1997. If these sales occur, additional effects similar to those described below for previous State lease sales could occur.

For reference, a total of 6 Federal lease sales have been conducted in the Beaufort Sea planning area, the most recent being Sale 144 in September 1996. A total of 660 leases have been sold totaling 1.14 million hectares, and 28 wells have been drilled on Federal leases. Currently, there are 80 active leases on Federal submerged lands in the Beaufort Sea.

For the total number of oil spills from cumulative Federal and State activities, the Oil Spill Risk Analysis (OSRA) estimates 2 to 4 spills ≥1,000 bbl from pipelines or platforms, with an estimated 87- to 98-percent chance of one or more such spills occurring over the production life of the proposed action. As a result of tankering operations from Valdez to U.S. ports south of Alaska, the OSRA estimates 3 to 7 spills ≥1,000 bbl with an estimated 97- to 99.9-percent chance of one or more such spills occurring over the production life of the proposed action. The OSRA estimates a 64- to 88- percent chance that activities on Federal offshore leases will contribute 1 to 2 spills in the Beaufort Sea for the cumulative case. Sale 170 may contribute one offshore spill, with the other Federal offshore spill likely resulting from activities from Sale 144 and leases from other previous Federal sales.

A. Cumulative Effects on the Bowhead Whale: Some effects on bowhead whales may occur from previously held State offshore lease sales. Generally, bowhead whales remain far enough offshore so as to be found mainly in Federal waters; however, in some areas (e.g., the Beaufort Sea southeast and north of Kaktovik and near Point Barrow) the whales may occur in State waters. If exploration and development and production activities occur on leases from previous or proposed State sales, noise effects on whales may occur as described previously. These effects could include local avoidance of aircraft, vessels, seismic surveys, dredging, construction activities, exploratory drilling, and production operations that occur within several miles of the whales. Whales may react briefly by diving in response to low-flying helicopters. Current State leases with production are well removed from the normal fall migration route of the bowhead whale. It is unlikely that there would be any major changes in the overall fall bowhead migration route resulting from noise associated with previous or future State lease sales.

Should an oil spill occur from State leases, effects on whales could include those discussed under Evaluation of Effects from Development and Production in Section VI.B.1, including inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency, and skin and/or sensory-organ damage.

On their summer feeding grounds in the Canadian Beaufort Sea, bowhead whales may be subject to some disturbance from activities associated with offshore oil and gas exploration and development and production at some time in the future. The main area of industry interest to date has centered around the Mackenzie Delta and offshore of the Tuktoyaktuk Peninsula, although there has been little industry activity there in recent years. This area comprises a minor portion of the bowhead's summer range. Possible disturbance to bowhead whales from helicopters, vessels, seismic surveys, and drilling would be as previously described. Bowhead whales would be exposed to the risk of oil spills from exploration, development and production, and transportation of oil from the Canadian Beaufort Sea. Oil-spill effects on the bowhead whales are described in Evaluation of Effects from Development and Production in Section VI.B.1.

The MMS expects few effects on bowhead whales during their fall migration through the Beaufort and Chukchi Seas to overwintering areas in the Bering Sea as a result of previous Federal offshore lease sales. Noise effects on bowheads under the cumulative case could be expected to result from activities associated with previous Federal offshore lease sales, including drilling exploration and delineation wells, support-vessel and helicopter activity, and shallow-hazards seismic surveys within the Beaufort Sea Planning Area. A development EIS currently is being prepared for the Northstar Project, the second offshore field scheduled for development and production with a possible startup in late 1998. (Endicott was the first offshore field developed in the Beaufort Sea with production startup in 1987.) The Northstar Project generally is outside of the normal fall-migration route, although some activities associated with this project could affect bowhead whales. Three noncommercial fields (Sandpiper, Hammerhead, and Kuvlum) have been unitized for possible future development. Two units, the Kuvlum and Hammerhead, are within the normal fall-migration route of the bowhead whale. Should development of these units proceed, production platforms would be installed and pipelines would be constructed. Some minor disturbance to bowhead whales on their fall migration might occur in the vicinity of these activities. Support traffic (helicopters and vessels) likely would travel between Prudhoe Bay and any exploration units or production platforms in the planning area. Bowheads may dive if helicopters passed low overhead, and they would seek to avoid close approach by vessels. Behavioral studies have suggested that bowhead whales habituate to noise from distant ongoing drilling, dredging, or seismic operations (Richardson, Wells, and Wursig, 1985; Richardson et al., 1985), but there still is some apparent localized avoidance (Davis, 1987). There is insufficient evidence to indicate whether or not industrial activity in an area for a number of years would adversely affect bowhead use of that area (Richardson et al., 1985). There is no documented evidence that noise from OCS operations would serve as a barrier to migration.

In the event a spill occurred during the fall bowhead migration through the Beaufort and Chukchi Seas, effects as described for the proposed action in Evaluation of Effects from Development and Production in Section VI.B.1 could occur. These effects generally would be minor and transient, unless whales were confined to an area of freshly spilled oil. After bowheads move westward past Point Barrow, they tend to fan out and cross the Chukchi Sea in a broad front. This dispersion also reduces the risk of many whales contacting a fresh spill. Of course, if the spill occurred over a prolonged period of time, more individuals could be contacted. A low number of individuals could be killed as a result of prolonged contact with freshly spilled oil, particularly if spills were to occur within ice-lead systems. The probability of an oil spill adversely affecting fall-migrating bowheads in the Hope Basin is very low, because most bowheads appear to migrate south within Soviet waters along the coast of the Chukchi Peninsula. If oil is spilled into the spring-lead system, effects may occur as described for the proposed action in Evaluation of Effects from Development and Production in Section VI.B.1. Considering the location of this proposed sale area and the distance from the spring-lead system, oil spilled into the spring-lead system is not likely to happen.

In addition to Federal Beaufort Sea Sale 170, the 1997-2002 5-Year Outer Continental Shelf Oil and Gas Leasing Program also proposed a second Beaufort Sea sale (Sale 176) in 2000 and a Chukchi Sea/Hope Basin sale (Sale 183) in 2002. However, it is highly speculative whether Sale 183 will be held. Two Federal lease sales have been conducted in the Chukchi Sea, although exploration activities resulted in no producible wells. Currently, there are no plans for future oil and gas exploration activities in the Bering Sea. Bowheads may encounter from one to several exploratory operations or production platforms in the future along their fall migration route through the Beaufort Sea, Chukchi Sea, and Hope Basin Planning Areas. Bowheads likely would make small changes in swimming speed and direction to avoid closely approaching these operations.

A non-OCS activity that affects the bowhead whale is the annual subsistence harvest by Alaska Natives. Bowheads are taken in the northern Bering Sea and in the Chukchi Sea on their spring migration and in the Beaufort Sea on their fall migration. A quota of 54 strikes or 41 whales landed per year had been authorized by the International Whaling Commission for 1992, 1993, and 1994. For 1995 through 1998, a quota of 266 strikes or 204 bowheads landed has been authorized. It is likely that many more will experience disturbance due to subsistence-whaling activities. This level of harvest was allowed under the supposition that it still would allow for continued growth in the bowhead population. It is likely the bowhead whale population will continue to be monitored and that harvest quotas will be set accordingly to maintain a healthy bowhead population level.

Whenever vessels are nearby, whales likely would try to avoid being closely approached by motorized hunting boats; however, once the whales migrate out of the Beaufort Sea, there probably would be few whales interacting with hunters during the fall season and none during the winter. As the bowheads migrate northward through northern Bering, Chukchi, and Alaskan Beaufort Seas during the spring, they are subject to being taken by subsistence whalers. A few whales also may be approached by Natives hunting seals and walruses. These whales likely would attempt to avoid being closely approached.

Conclusion: Bowheads may exhibit avoidance behavior to vessels and activities related to seismic, drilling, and construction during exploration and development and production. Some bowhead whales could be exposed to spilled oil, resulting in temporary, nonlethal effects, although some mortality might result if there were a prolonged exposure to freshly spilled oil. Overall, bowhead whales exposed to noise-producing activities and oil spills associated with the proposal and other future and existing projects within the Arctic region—combined with the other activities within the range of the migrating bowhead whale—most likely would experience temporary, nonlethal effects. However, exposure to oil spills could result in lethal effects to a few individuals, with the population recovering within 1 to 3 years. Bowheads also may exhibit avoidance behavior to subsistence hunting vessels. An average of 51 whales are expected to be killed annually during the subsistence harvest between 1995 and 1998. The contribution of the Sale 170 Proposal to the cumulative effects is expected to be of short duration and to result in primarily temporary, nonlethal effects.

B. Cumulative Effects on the Spectacled Eider: In addition to proposed Sale 170, other projects or activities that could contribute to cumulative effects on spectacled eiders include Federal and State oil and gas lease sales noted above, current and developing State oil production, subsistence harvests, commercial fishing, marine shipping, and recreational activities. These projects and activities could result in disturbance of nest sites and areas occupied during brood-rearing, molting, and migration, as well as habitat degradation and oil or other toxic pollution effects. Disease, predation, fluctuations in prey availability, and severe weather, as well as the unknown factors that have caused the spectacled eider population in Alaska to decline over the past several decades presumably would contribute to the cumulative effect or affect the intensity with which other factors operate.

Because potentially disturbing routine activities (e.g., aircraft flights, construction) associated with future Federal OCS or State oil development would infrequently occur near scattered flocks of staging or migrating spectacled eiders or in the vicinity of those nesting at low density along the western Beaufort coastline, the population is not expected to experience significantly greater effects from increases in such activities. However, a greater decline in survival and productivity than is expected in response to the proposed action may occur as a result of increased disturbance or displacement of foraging individuals and/or disturbance near nesting areas. On the arctic slope, an estimated 15 percent of available nesting habitat has been developed as oil-production fields; however, <5 percent of the tundra wetlands within the developed area has been made unsuitable for nesting (58 *FR* 27474), and this is not perceived as a significant effect. Future State onshore development could result in increased eider disturbance and habitat degradation, contributing to lowered nesting success and survival of young.

Relatively low spectacled eider mortality is expected from oil spills (low hundreds of individuals). However, recovery from cumulative spill-related losses is not expected to occur while this species' decline on the breeding grounds and their relatively low reproductive rate persists.

Subsistence harvest is estimated to remove at least 500 spectacled eiders from the Alaskan population annually (58 *FR* 27474). Effects of the other factors (e.g., fishing net entanglement, bioaccumulation of toxins in the food chain) on the spectacled eider population currently are unknown.

Conclusion: Cumulative routine effects on the Alaskan spectacled eider population are expected to affect <5 percent of the Alaskan population, not significantly different from that expected with the proposed action. Losses resulting from lowered survival and productivity are not expected to be recoverable until the current population decline is reversed. Likewise, recovery from any substantial mortality resulting from oil spills is not expected to occur while the decline persists.

C. Cumulative Effects on the Steller's Eider: In addition to proposed Sale 170, other projects or activities that could contribute to cumulative effects on Steller's eiders include past and projected Federal and State oil and gas lease sales, current and developing State oil production, subsistence harvests, commercial fishing, marine shipping, and recreational activities. These projects and activities could result in disturbance of nest sites and areas occupied during brood-rearing, molting and migration, as well as habitat degradation and oil or other toxic pollution effects. Disease, predation, fluctuations in prey availability, and severe weather, as well as the unknown factors that have caused the Steller's eider population to decline >50 percent in the past several decades, presumably would contribute to the cumulative effect or affect the intensity with which other factors operate.

Because routine activities associated with Federal OCS sales would be far removed from most Steller's eiders nesting primarily south of Barrow or migrating along the western Beaufort Sea coast, the population is not expected to experience significantly greater effects from increases in such activities. Future State onshore or NPR-A development could result in increased eider disturbance and habitat degradation, but the extent of such development will depend on economic factors. Relatively low Steller's eider mortality is expected from oil spills (<200 individuals); however, recovery from cumulative spill-related losses is not expected to occur while declining numbers on the breeding ground in recent decades and their relatively low reproductive rate persists. Effects of the other factors (e.g., fishing net entanglement, bioaccumulation of toxins in the food chain, subsistence harvest) on the Steller's eider population currently are unknown.

Conclusion: Routine cumulative effects on the Alaskan Steller's eider population are expected to be minimal, affecting <2 percent of the population. However, recovery from any substantial mortality resulting from oil spills is not expected to occur while the population continues to decline.

D. Cumulative Effects on the Arctic Peregrine Falcon: Adverse effects on peregrines primarily result from intake of pesticides and other toxic contaminants, habitat destruction, and disturbance of nest sites. The ban of DDT use in the United States has greatly reduced the DDT concentrations and reproductive failure of the peregrine falcon; however, pesticide contamination persists in peregrines because of the continued use of pesticides on their wintering areas in Central and South America. Large-scale habitat destruction in these countries (clearing of forests for agriculture), as well as habitat disruption along migration routes and disturbance near nest sites and in foraging areas, probably also have slowed recovery of the peregrine population.

Both disturbance and oiling of peregrines (as described for the resource estimate of the proposed action) are considered unlikely results. Other Federal development, and current and developing State oil production, generally are far-removed from primary areas of falcon activity and thus should have only brief occasional adverse effects. Disturbance associated with onshore activities has the greatest potential for adverse effects. Oil spills are considered a minor threat to peregrines because they are not likely to contact oil directly. However, peregrines could contact oil while feeding on oiled seabirds, waterfowl, or shorebirds and also could be affected by a reduction in prey availability if these species were oiled in large numbers. Although the cumulative effect of all lease activities throughout the arctic range of the peregrine falcon is likely to have a greater effect than the resource development scenario of the proposed action, the overall effect on the population is expected to be minimal.

Conclusion: The cumulative effect of all projects and activities within the range occupied by nesting, migrating, or wintering arctic peregrine falcons is expected to be minimal and short term, with mortality and sublethal effects on <10 percent of the population, requiring no more than one generation (3 years) for recovery to original status. The contribution of activities associated with proposed Sale 170 to the cumulative effect is not expected to represent >10 to 15 percent of the cumulative effect on the arctic peregrine falcon population.

VI. DEVELOPMENT AND PRODUCTION

This section describes the Sale 170 development and production scenario associated with the recovery of the 350 to 670 MMbbl of oil and the possible effects to endangered and threatened species, including species of concern. Analysis of the potential effects of an oil spill on species along transportation routes south of the proposed sale area has been addressed in the Cook Inlet Planning Area Oil and Gas Lease Sale 149 FEIS (USDOI, MMS, 1995). Analysis of the potential effects of an oil spill on species along transportation routes to ports in the Far East has been addressed in the Beaufort Sea Planning Area Oil and Gas Lease Sale 144 FEIS (USDOI, MMS, 1996). It is anticipated that most of the oil produced as a result of Sale 170 will be shipped to southern ports rather than to Far East ports. The estimated level of activity associated with the development and production of the resource range of the proposed action is summarized from the Exploration and Development Report, Appendix A.

A. Scenario: It is assumed that oil resources discovered as a result of previous lease sales and Sale 170 will be developed simultaneously. The discovery of economically recoverable oil on Sale 170 leases and/or on previously leased sale tracts would initiate the process to plan, design, and construct the production platforms, support facilities, and transportation infrastructure for petroleum exploitation in the Federal waters of the Beaufort Sea.

The development and production scenario selected by MMS represents a composite of feasible options that could be developed for the environmental analysis. It resulted from discussions within MMS, with other Government agencies, and with industry. The locations of existing infrastructure, sites with potential as support facilities, area-resource estimates, and scenarios developed for the previous OCS sales in the Beaufort Sea are all considered in developing this scenario.

Work on offshore and onshore production and transportation facilities would not begin until the engineering and economic assessments of the potential reservoirs have been completed and the conditions of all the permits have been evaluated.

The facility locations and transportation scenarios represent assumptions MMS made as a basis for identifying characteristic activities and any resulting environmental effects. The assumptions do not represent an MMS recommendation, preference, or endorsement of any facility, site, or development plan. Following are summaries of the major development and production assumptions.

- The first production platform is projected to be completed by 2004, with production well drilling beginning in 2004. Under the range of resources (350-670 MMbbl), 3 to 5 production platforms would be installed between 2004 and 2009. An estimated 87 to 111 production/service wells are expected to be drilled between 2004 and 2010 to an average target depth of 13,000 ft. Gravel islands probably will be constructed for production facilities in water depths <40 feet. Bottom-founded structures designed for extreme ice conditions likely would be used in water depths between 40 and 125 ft. Floating concrete structures anchored to the seafloor likely would be used in water depths >125 ft.

- The average production/service well will use approximately 150 to 680 short tons of dry mud and produce an average of 1,180 short tons of dry-rock cuttings.

- An estimated 276 to 460 km^2 (106.6-177.7 mi^2) of seismic surveys requiring from 21 to 35 days would be conducted under the development/production scenario.

- Onshore support probably would be from Prudhoe Bay. Support for operations on production islands in nearshore shallow waters is expected to be by ice roads during the winter. Drilling operations farther offshore would be supported during the open-water season by barge and 1 helicopter flight/drilling unit/day. There also may be 1 standby vessel for each drilling unit.

- For the transportation scenario for the 350- to 670-MMbbl-resource range: (1) pipelines would be used to transfer oil from the production platforms to existing pipeline systems within the Prudhoe Bay/Kuparuk field areas and transported to the TAPS Pump Station No. 1; (2) the configuration of the pipelines basically would be that of a combination offshore/existing onshore infrastructure; and (3) the existing landfalls at Oliktok Point (using the Kuparuk field infrastructure), Point McIntyre/West Dock area (using the Prudhoe Bay field infrastructure), and Endicott would be used. The offshore portion of the pipeline is estimated to be approximately 64 to 96.5 km long, and the onshore portion of the pipeline is estimated to be approximately 32 to 161 km long. Pipelines likely will be trenched in water <45 m (148 ft) for protection against ice damage. At landfalls, pipelines will be elevated on gravel structures to protect them against shore-erosion processes. Pipeline installation between production platforms and onshore facilities could take up to 5 years. Pipeline installation in nearshore areas could be installed either during the open-water season or during the winter. In water depths >40 feet, installation activities are likely to take place during the relatively short open-water season.

B. Evaluation of Effects from Development and Production: Activities during development and production, like those occurring during exploration, may result in noise and disturbance and altered habitat effects on behavior, distribution, and abundance of individuals or populations occurring in or adjacent to the sale area or along tanker routes. Contaminants released during development or production may cause adverse effects on individuals either through direct contact or indirectly as a result of effects on prey populations or important habitats. Contaminants, other than crude oil, such as drilling muds and cuttings, are not expected to cause significant effects, because they are likely to become rapidly diluted near the point of release and/or are not known to be harmful to species considered below. In addition, cleanup activities associated with any oil spill may result in disturbance.

Using a reasonable range of resource estimates of 350 to 670 MMbbl of oil and transportation assumptions, the OSRA estimates a 46- to 70-percent chance of one or more spills ≥ 1,000 bbl occurring over the production life of the proposed action. The average pipeline and platform spill in the Beaufort Sea is estimated at 7,000 bbl. The oil-spill-risk-analysis probabilities (Appendix D) cited in discussions below were developed from these assumptions and thus represent the expected probability of a spill occurring and contacting specific areas or biological resources, given the projected oil resource estimate range of 350 to 670 MMbbl.

1. Effects on the Bowhead Whale: The effects of an oil spill on bowhead whales are unknown. However, according to Geraci and St. Aubin (1982) and St. Aubin, Stinson, and Geraci (1984), short-term exposure to spilled oil is unlikely to have serious direct effects on baleen whales. Assuming an oil spill occurred in bowhead whale habitat while bowheads are present, some whales could experience one or more of the following: skin contact, baleen fouling, respiratory distress caused by inhalation of hydrocarbon vapors (from a fresh spill), localized reduction in food resources, consumption of some contaminated prey items, and perhaps a temporary displacement from some feeding areas. The number of whales contacted would depend on the size, timing, and duration of the spill, the density of the whale population in the area of the spill, and the whales' ability or inclination to avoid contact with oil.

Bowhead whales have not been observed in the presence of an oil spill, so it is uncertain if they can detect an oil spill or would avoid surfacing in the oil. Several investigators have observed a variety of cetaceans in the presence of spilled oil. It was noted that cetaceans, including fin whales, humpback whales, gray whales, dolphins, and pilot whales did not avoid slicks but swam through them, apparently showing no reaction to the oil. During one study humpback whales, fin whales, and a whale tentatively identified as a right whale, were observed surfacing and even feeding in or near an oil slick off Cape Cod, Massachusetts (Geraci and St. Aubin, 1990). None of the observations provide a definitive picture of whether cetaceans are capable of detecting oil and avoiding it. Some researchers have concluded that the surface vision of baleen whales is so effective that they rely upon visual clues for a variety of activities. Bowhead whales have been observed "playing" with floating logs and sheens of floating dye on the sea surface, suggesting that bowheads may be able to recognize oil floating on the sea surface (Bratton, et al., 1993).

If a bowhead came in contact with spilled oil, the skin would be the first organ to be exposed to the oil. Oil is unlikely to adhere to smooth areas of bowhead skin, but might adhere to rough areas on the skin surface. If bowheads vacate oiled areas, it is probable that most of the oil would wash off the skin and body surface within a short period of time. However, if bowheads remain in oiled areas, oil might adhere to the skin and other surface features (such as sensory hairs) for longer periods of time. Histological data and ultrastructural studies from the work of Geraci and St. Aubin showed that long exposures to petroleum hydrocarbons produced only transient damage to cells of the epidermis, with cells showing signs of recovery within 3 to 7 days after exposure. Bratton et al. (1993), in a synthesis of studies on the potential effects of contaminants on bowhead whales, stated there are no published data to prove oil fouling of the skin of any free-living whales and concluded that bowhead whale encounters with fresh or weathered petroleum most likely present little toxicologic hazard to the integument. The report concluded that cetacean skin presents a formidable barrier to the toxic effects of petroleum. Although oil adhering to sensory hairs may very well be washed away by passing water, it has been suggested that the function of these structures could be altered. Because the function of the hairs is unknown, it is difficult to assess the impact of the loss of that function to the bowhead.

Bowheads would be most likely to contact spilled oil as they surfaced to breathe. It is unlikely that they would inhale oil into the blowhole while breathing, although bowheads surfacing in a spill of lightly weathered oil could inhale some hydrocarbon vapors that might result in pulmonary distress. Perhaps the most serious situation would occur if oil were spilled into a lead from which bowheads could not escape, although the probability of such an occurrence is extremely low. In this situation, Bratton et al. (1993) theorized that whales could experience irritation of the mucous membranes or respiratory tract and possibly absorb volatile hydrocarbons into the bloodstream as a result of inhalation of toxic vapors. The volatile hydrocarbons would likely be rapidly excreted. Vapor concentrations that could be harmful to whales would be expected to dissipate within several hours after termination of a spill. Whales exposed to toxic vapors within a few hours after the spill could suffer pulmonary distress and possible mortality. Generally, only a few whales would be likely to occupy the affected lead at any given time.

Feeding bowheads sometimes skim the water surface, filtering large volumes of water for extended periods, and consequently might ingest some spilled oil if any were present. There is no evidence from observational studies or stranding records to suggest that cetaceans would feed around a fresh oil spill long enough to accumulate a critical dose of oil. It was suggested that baleen filaments and ingested oil may clump together to form a gastrointestinal obstruction, although this has never been observed in nature. It was also suggested that cetaceans may be able to metabolize ingested oil due to the presence of cytochrome p-450 in their livers, and that any oil adhering to baleen filaments causing clumping may be broken down by the digestive process.

If feeding bowheads contacted spilled oil, the baleen hairs might be fouled, resulting in a reduced filtration efficiency. Studies conducted by Geraci and St. Aubin found that 70 percent of the oil adhering to baleen plates was removed within 30 minutes after fouling, and 95 percent of the oil was removed within 24 hours after exposure. Their data suggest that the residual level of fouling of the baleen causes no compromise in the function of the baleen 24 hours after exposure to petroleum (Bratton, et al., 1993). Bowheads most likely would occupy oiled waters for only a short period of time, and zooplankton filtration efficiency would return to normal in a matter of hours as oil is flushed from the baleen. However, repeated baleen fouling over an extended period of time might result in reduced food intake and blubber deposition which, in turn, might adversely affect the health and survival of bowheads.

The population of zooplankton, the major food source of bowhead whales, likely would not be permanently affected by an oil spill. Richardson et al., 1987 (as cited in Bratton et al, 1993) stated that it was unlikely that accidental oil spills would permanently affect zooplankton or their availability to bowheads in the area studied. They postulated that if effects on zooplankton or their availability did occur, they would be most likely to occur in nearshore feeding areas. The amount of zooplankton lost in even a large oil spill would be negligible in comparison to the plankton resources available on the whale's summer feeding grounds (Bratton et al., 1993). Bowheads might ingest some oil-contaminated prey items, but it is likely these organisms would comprise only a small portion of the bowheads' food intake. Some zooplankton consumed by bowheads actively consume oil particles but apparently can excrete hydrocarbons from their system relatively rapidly as well. Tissue studies analyzing the level of naphthalene in the liver and blubber of whales indicated low levels of naphthalene in baleen whales, suggesting that prey species have low concentrations in their tissues or that baleen whales may be capable of metabolizing and excreting petroleum hydrocarbons (Geraci and St. Aubin, 1990).

Information regarding the adverse effects on the bowhead whale from materials such as petroleum products, heavy metals, and other contaminants is generally lacking, and information about cetacean metabolism also is inadequate. Based on the limited data available, Bratton et al. (1993) conclude that potential contaminants such as petroleum products appear to pose no harm to bowheads or to humans who eat them, although much more work is required to understand the significance of residue levels to both whales and humans.

In the event of an oil spill, it is likely that large numbers of personnel, vessels, and aircraft will be present and conducting cleanup operations in the Beaufort Sea. If spilled oil is present during the bowhead whale migration, it could result in disturbance and possible displacement of whales from their normal migration route. Potential effects of noise disturbance to bowhead whales is discussed in more detail earlier in this section. Disturbance effects on the bowhead whale are expected to persist for the duration of cleanup operations if the operations are conducted during the whale migration period.

Concern has been raised about the effects of oil spilled into the spring-lead system during the bowhead whale migration. The proposed Sale 170 area is a substantial distance from the spring-lead system. However, a discussion of such effects is contained on pages IV-B-78 through IV-B-82 of the Chukchi Sea Oil & Gas Lease Sale 109 FEIS (USDOI, MMS, 1987) and is hereby summarized and incorporated by reference.

The presence of ice could restrict the spread of the oil. Agitation of ice particles in combination with oil initially could increase oil dispersion into the water column; however, it would also result in a more rapid formation of a water-in-oil emulsification. Grease ice (newly formed ice) and spilled oil would be blown downwind and would accumulate in a band along the downwind edge of open leads or ice floes. When the lead closes or ice floes are blown together, the accumulated grease ice and oil would be pushed onto the adjacent ice. It is unlikely that oil would completely cover the surface of the water except in cracks and small pools sheltered from the wind. Toxic vapors would be carried away from any leads by the wind, and volatile compounds would be lost within 24 to 48 hours of weathering at the surface. Harmful concentrations of toxic vapors from spilled oil should not persist for more than a few hours after the oil has weathered at the surface. Oil spilled under winter ice would pool and freeze to the underside of the ice. First-year arctic ice—the most prevalent type in the area—can store up to 150,000 to 300,000 bbl of oil per square kilometer in under-ice relief. Consequently, oil spilled in heavy ice cover would be unlikely to spread appreciably under the ice before being frozen into the ice. The spilled oil would then move as part of the pack ice. The oil would either melt out at the southern ice edge as the pack retreated or migrate through brine channels and pool on top of the ice as melting conditions begin to occur.

Effects of oil contacting bowheads under winter or broken-ice conditions generally would be similar to those previously described. Such effects include baleen fouling, inhalation of toxic vapors, ingestion of oil or oil-contaminated prey, and irritation of skin or sensitive tissues. Bowheads may migrate through an oil-spill area without actually contacting oil because, as mentioned earlier, the oil would accumulate along the downwind edge of any open-water areas. On occasion, bowheads have been observed continually returning to the same small area of open water, presumably because there was no other readily available open water where they could surface. If a substantial quantity of fresh crude oil or an aromatic refined petroleum product were spilled into such an area of open water, it is possible that the animals trapped there could die or suffer pulmonary distress from the inhalation of toxic vapors. However, this is expected to be a very rare case that would only affect a low number of whales.

Should a large oil spill occur that covers a substantial stretch of a major spring lead used by migrating bowheads, a number of bowheads may contact oil and/or a portion of the spring bowhead migration might be delayed or temporarily blocked. Bowheads probably would not migrate through the pack-ice zone to avoid an oil spill blocking a lead unless the pack-ice zone had an adequate number of cracks or small ponds for bowhead respiration. Bowheads may migrate under the ice and avoid the oil contamination. Such a spill could affect a substantial portion of the bowhead population; but unless the spill were prolonged, its effects likely would be short lived. Within several hours to several days after cessation of the spill, the oil should have accumulated along the downwind or downcurrent edge of the lead and should no longer pose an impediment to the migration. Such a short-term delay in the migration should not result in significant effects on the population, because there is considerable natural variability in the timing of the migration due to ice conditions. A substantial number of bowheads could contact oil if individuals, driven by the migratory urge, attempt to swim through the oil-covered lead. Some of these individuals might succumb to toxic vapors if the spill were very fresh. It has been shown, however, that bowheads are quite adept at migrating beneath at least thin ice (George et al., 1989); and bowheads may migrate under the ice around the area of oil contamination.

During development/production activities, the OSRA model estimates a 46- to 70-percent chance of one or more spills ≥1,000 bbl occurring. In this analysis, it is estimated that an average oil spill (7,000 bbl) from a pipeline or platform will occur for the low end of the resource range. The threshold level at which it is assumed that contact and/or damaging effects on the resource would begin to occur, requiring more than a brief interval for recovery of the population to its original status, is 5 percent in the following analyses for combined and conditional probabilities.

For combined probabilities, the OSRA model estimates a 3- to 15-percent chance of one or more spills ≥1,000 bbl occurring and contacting bowhead whale habitat, such as Ice/Sea Segments (ISS's) 7 to 9, areas where bowheads may be present during the fall migration, within 30 days over the assumed production life of the proposed action.

For conditional probabilities, the OSRA model estimates a 5- to 66-percent chance of a spill ≥1,000 bbl contacting ISS's 7 to 9 within 30 days, during the winter season, assuming a spill occurs at launch boxes (L1-L8) and a 5- to 16-percent chance assuming a spill occurs at pipeline segments (P1-P7). The following discussion summarizes the greatest percent chance of contact for each ISS. ISS 9 had a 66-percent chance of contact from a spill occurring at L7 and a 16-percent chance of contact from a spill occurring from P4. ISS 8 had a 54-percent chance of contact from a spill occurring at L3 and a 16-percent chance of contact from a spill occurring from P2. ISS 7 had a 12-percent chance of contact from a spill occurring at L1 and a 8-percent chance of contact from a spill occurring from P1.

The OSRA model estimates a 5- to 82-percent chance of a spill ≥1,000 bbl contacting ISS's 6 to 13 within 30 days, during the summer season, assuming a spill occurs at L1-L8 and a 5- to 62-percent chance assuming a spill occurs at P1-P7. The following discussion summarizes the greatest percent chance of contact for each ISS. ISS 8 had an 82-percent chance of contact from a spill occurring at L3 and a 57-percent chance of contact from a spill occurring from P2. ISS 9 had an 81-percent chance of contact from a spill occurring at L7 and a 62-percent chance of contact from a spill occurring from P3. ISS 7 had a 51-percent chance of contact from a spill occurring at L1 and a 39-

percent chance of contact from a spill occurring from P1 and P5. ISS 10 had a 35-percent chance of contact from a spill occurring at L7 and a 28- percent chance of contact from a spill occurring from P4. ISS 6 had a 15-percent chance of contact from a spill occurring at L1 and a 14-percent chance of contact from a spill occurring from P5. ISS 11 had a 13-percent chance of contact from a spill occurring at L7 and a 13- percent chance of contact from a spill occurring from P4. ISS 13 had a 6-percent chance of contact from a spill occurring at L7 and a 6-percent chance of contact from a spill occurring from P3. ISS 12 had a <5 percent chance of contact from a spill.

If commercial quantities of oil are discovered and development and production proceed, pipeline construction activities would occur. Dredging or trenching may be used in constructing the gathering pipeline from the production platform to shore. Bowhead reactions to dredge noise have been observed to be similar to their reactions to drilling noise, including avoidance of the near vicinity of the activity. In one instance, as many as 12 bowheads were observed within 5 km (3 mi) from active dredging operations on their summer-feeding grounds. However, some bowheads were detected within 800 m (2,625 ft) of the site (Richardson and Malme, 1993). Dredge sounds were well above ambient levels up to several kilometers away (22 dB above average ambient level at 1.2 km [0.75 mi] from the dredge). In other instances, bowheads were observed at distances where they were well within the ensonified area of dredging operations. However, in playback experiments, some whales responded to the onset of similar levels of dredge noise by exhibiting weak avoidance. Bowheads seen in the vicinity of actual dredging operations may have habituated to the activity, or there may be variation among bowheads in the degree of sensitivity toward noise disturbance, so that bowheads seen in the vicinity of dredging operations may have been the more tolerant individuals.

Summary: Noise effects from development and production activities on endangered whales would be similar to those described earlier in Section IV. Whales may exhibit avoidance behavior if approached by supply vessels, barge traffic, icebreakers, or seismic-survey vessels. Some whales may temporarily interrupt their activities and swim away from the vessel's path. There would be additional noise-producing activities such as dredging (trenching) for pipeline construction and the production operations from the eight platforms. Bowhead reactions to dredge noise have been observed to be similar to their reactions to drilling noise. Noise from these activities may cause whales to avoid the immediate vicinity of the pipeline construction and platforms; however, it is felt that the area of avoidance would be relatively small, because whales appear to exhibit less avoidance behavior with stationary sources of relatively constant noise than with moving sound sources.

If oil is discovered in a commercially producible quantity within or near a bowhead-migration corridor, bowheads could be exposed to noise from production platforms during their spring or fall migration or both, depending on the location of the platform(s). For a discussion concerning effects of noise from production in the spring-lead system, see Section IV.A. If migrating bowheads react to production noise in the same manner as migrating gray whales off the California coast (Malme et al., 1984), their response to noise from production platforms would be expected to be much less than their response to drillship noise.

There is a 46- to 70-percent chance of one or more oil spills ≥1,000 bbl occurring. The OSRA model estimated a 3- to 15-percent chance of one or more spills ≥1,000 bbl occurring and contacting bowhead whale habitat such as ISS's 7 to 9, areas where bowheads may be present during the fall migration, within 30 days over the production life of the proposed action. The probability of oil actually contacting whales is considerably less than the probability of contact with bowhead habitat. If an uncontrolled, uncontained spill were to occur, a few bowheads could experience one or more of the following: skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil-contaminated prey items, and perhaps temporary displacement from some feeding areas. Some individuals may be killed or injured as a result of prolonged exposure to freshly-spilled oil; however, the number of individuals so affected is expected to be small.

Conclusion: Bowheads may exhibit avoidance behavior to vessels and activities related to seismic surveys, drilling, and construction during exploration and development and production. Some bowhead whales could be exposed to spilled oil, resulting primarily in temporary, sublethal effects. Some mortality might result if exposure to freshly spilled oil were prolonged. Overall, bowhead whales exposed to noise-producing activities and oil spills would most likely experience temporary, sublethal effects. However, prolonged exposure to oil spills could result in lethal effects to a few individuals, with the population recovering within 1 to 3 years.

2. ***Effects on the Spectacled Eider:*** Because postbreeding eiders occur in dispersed flocks, relatively few are expected to occur in or rely specifically on prey potentially buried at local drill sites (<0.5% of benthic habitat available in the proposed sale area) where discharged materials from drilling operations have been deposited. Thus, discharges are not expected to cause significant effects either through direct contact with birds or by affecting prey availability.

Spectacled eiders staging or migrating in coastal or offshore waters are not expected to experience significant disruption of foraging from routine activities (primarily helicopter flights) because of the low probability that areas occupied by scattered flocks would be overflown routinely by aircraft flying between three and five platforms and onshore facilities at Kuparuk Field or Deadhorse. Although the disturbance corridor within 1 to 2 km of 3 to 5 established flight paths represents <2.5 percent of the proposed sale area, flocks often are large, and this suggests that any disturbance event is likely to involve substantial numbers of individuals. Thus, we expect displacement of variable numbers of eiders from the vicinity of 3 to 5 flight corridors between platforms and shore bases intermittently during summer and fall periods over the 22 years of development and production. This is not expected to increase mortality significantly, but a portion of the population may experience lowered fitness as a result of routine displacement from favored foraging sites and depletion of energy stores during the critical staging/migration period. The net result is expected to be somewhat lower survival and/or productivity, from which the population is not likely to recover while the current decline persists. Onshore, we do not expect substantial disturbance of nesting or brooding eiders, because nest sites are scattered at low density over much of the arctic slope and relatively few are expected to be overflown by helicopters from offshore units.

Offshore pipeline and platform construction that occurs during summer and fall is likely to displace flocks of foraging eiders from within about 1 km of pipeline route. Such short-term and localized disturbances are not expected to cause significant population effects. Likewise, localized burial of potential prey and destruction of a few square kilometers of foraging habitat as a result of pipeline trenching is not expected to cause a significant decline in prey availability for eiders. Because few eiders would be expected to occur in the limited area occupied by construction sites, equivalent to <1 percent of habitat available in the proposed sale area, they are not expected to experience substantial adverse effects from routine construction activities.

Onshore, because nest sites are scattered at low density over much of the arctic slope, relatively few are expected to become unavailable through burial or location in areas of gravel extraction. Only small numbers of nesting eiders are likely to be displaced away from the vicinity of onshore pipeline corridors by construction activity (lasting about 2 years) and vehicle traffic disturbance. Although burial would result in permanent removal of habitat, routine disturbance effects would persist over the life of the field (potentially up to 30 yrs), and they would be localized primarily within a few km of the pipeline corridor. Positive effects may be realized from water impoundments and early season food plant growth in dust shadows along pipeline roads. Net habitat loss and disturbance effects on spectacled eider productivity are not expected to be substantial, but the population is not likely to recover such losses while the current decline persists.

The presence of substantial numbers of workers, boats, and aircraft flights following a spill is expected to displace some eiders foraging in offshore or nearshore habitats during open-water periods for one or two seasons. However, staging/migrating flocks are dispersed and thus would not necessarily occur in the vicinity of much of the cleanup activity, particularly that occurring on barrier islands. As a result, relatively few flocks are likely to be displaced from favored habitats and expend energy stores accumulating for migration. Survival and fitness of individuals may be affected to some extent, but this infrequent disturbance is not expected to result in significant population losses.

Exposure of spectacled eiders to moderate or heavy oil contact is expected to be lethal. During summer/fall periods when staging/migrating eiders occupy marine habitats, a highly variable proportion of the arctic slope population could be vulnerable to an oil spill approaching the Beaufort coastline, primarily west of the Sagavanirktok River. Probability of contact is lowered by individuals being concentrated in relatively few scattered flocks, primarily offshore, during brief summer/fall intervals; however, because such flocks contain hundreds to thousands of individuals, any contact is expected to cause substantial losses. Flocks foraging inside the barrier islands (approximately 50% of the coastline has adjacent islands) are protected to some extent from oil-spill contact. During spring migration, most migrant spectacled eiders arrive at the nesting areas via overland routes; thus, few are expected to occupy leads offshore where they would be vulnerable to oil. Spectacled eiders are essentially absent from the area from late October to May.

The probability (expressed as a percent chance) of one or more ≥1,000-bbl spills occurring and contacting offshore areas (ISS's 6-11; Fig. 4, Appendix D) occupied by eider flocks during staging and migration periods within 180 days ranges from 3 to 15 percent at the low end of the resource estimate and to 5 to 27 percent if resource recovery was at the high end (Table 10, Appendix D). Probability of contact with flocks using the area between shore and the barrier islands ranges from <0.5 to 4 percent (Simpson Lagoon to Jago Lagoon, Table 10; land segments [LS's] 33-38, Table 11, Appendix D), suggesting a relatively low level of contact risk. As a result of a relatively small temporal window during which staging and migrating flocks could be exposed to a spill, and the generally dispersed flock distribution, the arctic slope spectacled eider population is expected to experience low mortality from oil spills associated with the proposed action (<300 individuals); however, unless mortality is near the lower end of this range (e.g., <25), recovery from spill-related losses is not expected to occur while the current declining numbers of breeding individuals and low reproductive rate persists.

Conclusion: Routine development and production activity is expected to disturb <2 percent of the arctic slope spectacled eider population, potentially causing slightly lowered survival and/or productivity. Mortality from an oil spill associated with the proposed action is expected to be low (<300 individuals); however, unless mortality is near the lower end of this range, recovery from spill-related losses is not expected to occur while the current declining numbers of breeding individuals and low reproductive rate persists.

3. Effects on the Steller's Eider: Steller's eiders staging or migrating west of the proposed sale area during two relatively brief staging/migration periods are not expected to be adversely affected by routine helicopter flights between onshore facilities at Kuparuk Field or Deadhorse and platforms because of the low probability that aircraft would deviate as far west as the eiders' primary nesting or brood-rearing area near Barrow. Little significant disturbance resulting from cleanup activities following any oil spill is expected to occur because staging/migrating flocks are likely to be quite distant from the primary activity within or near the proposed sale area.

Exposure of Steller's eiders to oil is expected to be lethal. A minor proportion of the Alaskan breeding population is expected to be vulnerable to an oil spill, because the staging/migrating flocks generally are scattered along the coast for relatively brief intervals, and the oil would be well weathered and dispersed after moving considerably west of the proposed sale area. Because most spring migrant spectacled eiders arrive at the nesting areas via overland routes, few are expected to occupy leads offshore where they would be vulnerable to oil entering such habitat. Eiders are not present in the area from October to May. There is a <0.5 percent chance (combined probability) of one or more ≥1,000-bbl spills occurring and contacting areas occupied during migration periods within 180 days (Elson Lagoon, Table 10; LS's 20-25, Table 11, Appendix D). Thus, low Steller's eider mortality is expected from an oil spill (<100 individuals). However, unless mortality is near the lower end of this range (e.g., <25), recovery of the Alaska population from spill-related losses is not expected to occur if population numbers continue to decline on the breeding ground and the relatively low reproductive rate persists.

Conclusion: Routine development and production activity is expected to disturb <2 percent of the Alaska Steller's eider population, potentially causing slightly lowered survival and/or productivity. Mortality from an oil spill associated with the proposed action is expected to be low (<100 individuals); however, unless mortality is near the lower end of this range, recovery from spill-related losses is not expected to occur while the current declining numbers of breeding individuals and low reproductive rate persists.

4. Effects on the Arctic Peregrine Falcon: Nesting peregrines, such as those along the Colville River, rarely are expected to be disturbed by aircraft flights based in Deadhorse associated with proposed Sale 170. Onshore pipelines for the production phase likely will be routed coastward of virtually all peregrine falcon nest sites. Gravel mining for any artificial islands is expected to occur near the Beaufort Sea coast where peregrines occur as fall transients but nest infrequently. Thus, significant disturbance of peregrine falcons associated with the development and production phases is unlikely.

Because relatively few peregrines forage in coastal areas during the summer nesting season, the probability that significant numbers would contact spilled oil or oiled prey when hunting or be affected indirectly through reduction of prey populations (seabirds and shorebirds) is low. Probability of contact during the fall season in areas such as the Colville or Canning River deltas may be somewhat greater as birds disperse. The combined probability (expressed as a percent chance) of one or more ≥1,000-bbl spills occurring and contacting potential foraging areas within 180 days (LS's 20-45; Fig. 4, Appendix D) ranges from <0.5 to 4 percent (Table 11, Appendix D). Because the actual risk (probability) of spill contact for peregrines in these areas probably is much less than suggested by these values, due to this species' transient occurrence in the areas likely to be contacted and the fact that they typically do not contact the water surface, it is very unlikely that peregrines would be significantly affected by oil spills. If oil spills affected prey populations, short-term, localized reductions in food availability for peregrines could occur.

Conclusion: Neither support aircraft nor onshore construction activities are expected to be a source of significant disturbance to nesting arctic peregrine falcons. There is a very low probability that an oil spill would contact them while infrequently foraging in coastal areas. The overall effect on peregrine falcons from oil spills and disturbance is expected to be minimal, with <5 percent of the population exposed to potentially adverse factors. No mortality is expected to result from the proposed action.

VII. GENERAL CONCLUSIONS

Considering that no oil spills are expected to occur during exploration, and that a low level of support activity is projected, we conclude that proposed lease Sale 170 will have no effect and the resulting exploration activities are likely to have a low level of effect on endangered, threatened, proposed, and candidate species that may occur in or near the proposed sale area (bowhead whale, spectacled eider, Steller's eider, and arctic peregrine falcon). In view of these projected low levels of activity and effects, we believe that exploration activities would be unlikely to adversely affect any endangered, threatened, proposed, or candidate species' population to the point of possible jeopardy, especially if proposed mitigating measures (Appendix E) are included in the proposed sale. Also, we accept the opinion of the FWS in their recent biological opinion for Beaufort Sea Sale 144 and the NMFS Arctic Region Biological Opinion wherein they conclude that reinitiation of consultation will be required for the development and production phase. Therefore, given the development and production scenario projected for Sale 170 and the uncertainty as to when, where, and if these activities will occur, we conclude there is no basis at this time for projecting jeopardy for either the development and production incremental step or the entire action.

VIII. MITIGATING MEASURES

Stipulations and Information to Lessees (ITL's) are measures that can be included in the leasing process to reduce or eliminate the identified potential effects to endangered, threatened, proposed, and candidate species. Stipulations that are included in the lease are legally binding. The ITL's advise lessees of other legal responsibilities, such as the ESA, provide the means to help them comply with these responsibilities, and help to make them aware of other protection measures. The Secretary of the Interior decides which stipulations and ITL's will be included in the sale prior to issuance of the Final Notice of Sale. Stipulations and ITL's similar to those suggested for the Beaufort Sea Sale 144 oil and gas lease sale will be developed for the Secretary's consideration for proposed Sale 170. A description of the stipulations and ITL's proposed for Sale 170 can be found in Appendix E. Several of the stipulations and ITL's were developed in response to biological opinions received from NMFS and FWS during Section 7 ESA consultation for previous Federal Beaufort Sea sales. Examples of stipulations are Industry Site-Specific Bowhead Whale-Monitoring Program and Subsistence Whaling and Other Subsistence Activities and of ITL's is Endangered Whales and the MMS Monitoring Program. These, together with the stipulations for Protection of Biological Resource and Orientation Program and the ITL's for Bird and Marine Mammal Protection, Sensitive Areas to be Considered in Oil-Spill Contingency Plans, Polar Bear Interaction, Availability of Bowhead Whales for Subsistence-Hunting Activities, Information on Spectacled and Steller's Eiders, and the Arctic Biological Task Force, if adopted, would increase the protection level for the endangered bowhead, the threatened spectacled eider, and the proposed Steller's eider and help prevent potential adverse effects from the proposed Beaufort Sea 170 oil and gas lease sale.

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APPENDIX C

OIL-SPILL-PREVENTION AND RESPONSE

PLANNING FOR SUBSEA ARCTIC PIPELINES

Appendix C
Oil-spill Prevention and Response Planning For Subsea Arctic Pipelines

OIL-SPILL PREVENTION AND RESPONSE PLANNING FOR SUBSEA ARCTIC PIPELINES

Background: Development of offshore oil and gas discoveries in the Beaufort Sea will require subsea pipelines. One offshore pipeline was constructed in the high Canadian Arctic in 1978 as a demonstration of technology. There are several onshore pipelines in the Arctic. British Petroleum Exploration (Alaska) (BPXA) proposed Northstar Development Project could include the first subsea pipeline in the Beaufort Sea. The BPXA also is pursuing the Liberty Development Project, which also will involve a subsea pipeline. Ice gouging, strudel scour, permafrost, seasonal ice cover, and other oceanographic and environmental considerations (i.e., wind, storm surges, etc.) and logistical constraints must be taken into account in designing, constructing, operating, and maintaining a pipeline in the offshore Arctic. This appendix reviews the regulatory authorities and the technical considerations for oil-spill-prevention and -response planning for a subsea pipeline in the Beaufort Sea. The relative safety of offshore pipelines compared to onshore pipelines also is reviewed.

Regulatory Authorities: The U.S. Department of the Interior (USDOI), Minerals Management Service (MMS); U.S. Department of Transportation, Office of Pipeline Safety (USDOT/OPS); and the State of Alaska, Department of Natural Resources-Joint Pipeline Office (JPO) have regulatory authorities for offshore pipelines. The MMS and the DOT/OPS administer Federal pipeline responsibilities through a 1996 Memorandum of Understanding (MOU), which delineates each agency's jurisdiction. Generally, the MMS is responsible for pipelines upstream of the sales/transfer point (i.e., trunklines connecting production facilities); the USDOT/OPS regulates transportation pipelines from production facilities to shore. The State JPO issues rights-of-way for pipelines across State submerged lands. The MMS also issues rights-of-way or rights-of-use and easements for pipelines that cross the Federal outer continental shelf (OCS).

The MMS establishes regulatory requirements for offshore pipelines under 30 CFR 250 Subpart J. The USDOT/OPS established regulatory requirements for offshore pipelines under Title 49. The State JPO establishes requirements for the design, installation, and operation of pipelines under AS 38.35.

The regulatory regimes of these three entities generally are the same and address the various aspect of quality assurance related to pipeline integrity including design, construction, installation, maintenance, repair, inspection, operation, spill prevention and safety , and environmental protection. Pressure testing of pipelines is required following installation to ensure integrity. Shutdown valves are required at both ends of the pipeline to ensure the pipeline can be isolated in the event of damage or leak. Pressure sensors that activate the automatic shutdown valves are required to ensure that in the event of a detectable leak, the pipeline is automatically shut in to prevent continued flow. Inspection and monitoring of the pipeline (visual and smart pigs) are required to identify internal and external damage (corrosion, erosion, etc.) to the pipeline or changes in the pipeline configuration (settlement) that indicated potential problems. Quality assurance programs are used to maintain and repair the pipeline to design criteria. These agencies also have approval, inspection, and oversight responsibilities for pipeline construction and operation and enforcement authorities to shut down the pipeline in the event of noncompliance or potential problems with safe operation of the pipeline.

In the event of a commercial discovery in the Beaufort Sea OCS, development probably will involve a sales/transportation pipeline from an OCS production platform to shore. As a sales- quality pipeline that crosses the OCS and State offshore land, this pipeline would fall under the jurisdiction of all three authorities providing multiple levels of technical review and oversight.

Design Considerations for Offshore Arctic Pipelines: There are many unique considerations for subsea Arctic pipelines. Permafrost, strudel scour, and ice gouging (including subgouge soil deformation) usually are considered the more significant forces acting on the subsea portion of the pipeline and will be the focus of this review. The effects of ice on a support structure for the pipeline shore approach or on the offshore production facility in which the pipeline riser would be housed also are important considerations; depending on the location and water depth of the structure, ice loads will vary based on the type of ice conditions that could exist (landfast, pack ice, shear zone). The capability to design structures to resist ice forces has been demonstrated by the Endicott production facility, numerous exploratory drilling structures that have been successfully used in the U.S. and Canadian Beaufort Sea, and through the production facilities in the upper Cook Inlet and is not reviewed here. Other major design considerations, such as external and internal corrosion, coastal erosion, and seismicity are not unique to the Beaufort; technology has been demonstrated in other offshore areas to address these types of concerns and is not reviewed in this paper.

Permafrost and strudel scour, while unique factors that must be accommodated in the design of an offshore pipeline, pose a different potential for pipeline failure compared to ice gouging. Unlike ice gouging, permafrost and strudel scour generally do not impose significant loads directly on the pipeline. Long-term heat loss can thaw permafrost, resulting in differential settlement. Strudel scour can erode sediment from under the pipeline, resulting in spans of pipeline being unsupported. In both cases, neither the cause nor resulting failure would be instantaneous, compared to damage or rupture caused by ice gouging. In many cases, the pipeline route would be selected to avoid these types of conditions. In the event the pipeline route did cross these types of conditions, designing pipelines to prevent or accommodate differential settlement from permafrost thaw, or to accommodate unsupported spans, is within current engineering capability. In addition, monitoring, and inspection practices also would be able to detect changes in a pipeline configuration and allow for remedial action in advance of potential failure.

Onshore permafrost is well preserved, continuous, and extends from near the surface to considerable depth. Subsea permafrost is discontinuous, and the depth to the surface of the permafrost is variable, generally becoming deeper with water depth. Subsea permafrost is a more significant problem for the shore approach (where the permafrost is closer to the surface) than the offshore segment of the pipeline. The degree of differential settlement depends in part on the extent and nature of permafrost. The nature and the extent of "ice" in the soil also is critical; significant differential settlement is a concern only if the soils are thaw-unstable. If widespread, the pipeline may settle uniformly, which is not a major problem. Site-specific surveys along a proposed pipeline route can determine the permafrost character of the subsoil and the potential for significant subsidence and differential settlement.

The principles of heat loss and permafrost thaw are well understood and have been applied in designing onshore pipelines. The same principles also have been well demonstrated in designing exploration and long-term development and production wells that involve flowing higher temperature fluids through casing set through permafrost. Depending on the thickness of the permafrost near the shore approach, the pipeline can be buried below the thaw unstable layer of permafrost into a competent thaw-stable layer. Insulation of the pipeline, refrigeration, and/or cooling the oil are the primary methods to protect against a significant differential settlement due to permafrost thaw. Pile-supported pipelines, backfilling a trench with thaw-stable materials, and higher strength pipe that can accommodate greater bending stresses also are options.

Strudel scour results by over-ice flooding from the spring river runoff. The hydraulic head and velocity of the water cause the water to flow through cracks in the sea ice, which can produce linear and circular strudel scours and areal depressions in the sea floor and can leave extended lengths of unsupported pipeline. In the Beaufort Sea, the areas affected by strudel scour have been observed only near the mouths of major rivers. Typical strudel depths are on the order of 3 to 20 feet (ft) with diameters of 30 to 40 ft and are found within 3 to 4 miles (mi) of the coast. In a majority of cases, the pipeline route can be located to avoid strudel scour. Where strudel scour may be present, designing pipelines to withstand unsupported lengths on the order of tens of feet is within current technology. In such cases, there also are remedial and preventive actions that can be used to minimize the risk and effect of strudel scour on subsea pipelines. Dykes and slotting to redirect overflow away from the pipeline are potential forms of mitigation. Annual visual surveys following the breakup period can identify exposed pipeline, which can be reburied.

Ice gouging, which can impose near instantaneous loading on a pipeline, is by far the most significant force to address in the offshore Arctic. Ice gouging can impose loads that are orders of magnitude greater than other loads. Unlike loads resulting from differential settlement (permafrost thaw) or unsupported spans resulting from strudel scour, which can be accommodated by the pipeline design, it may not be possible to design unprotected pipelines to resist the direct loads of significant ice gouging. In such cases, trenching/burial is the obvious mechanism to protect a subsea pipeline from ice gouging. Trench depth must be sufficient to avoid direct contact by the ice keel and the associated forces transferred through the soil. Burial can provide additional protection but would not always be necessary to protect a subsea pipeline. The type of ice (a multiyear ice keel vs. a first-year rubble pile) and the type of soil (consolidated clays vs. unconsolidated sands) affect the depth and magnitude of forces that would act on a subsea pipeline. In the early 1980's when there was considerable exploration in the U.S. and Canadian Beaufort Sea, significant research and fieldwork was conducted on the effect of ice gouging on subsea pipelines; such loads now can be quantified for pipeline design, with adequate site specific field data.

Ice gouging in the Beaufort Sea generally is concentrated along the stamukhi zone, generally between the 18- to 30-meter (m) isobath. Inshore of the stamukhi zone (water depths less than [<] 18 m), ice gouging is much less severe and has a low frequency of occurrence and shallow gouge depths (generally <3 ft). Offshore of the stamukhi zone, water depth increases and the number of ice keels large enough to reach the bottom decreases. Ice gouges generally are oriented east-west, consistent with the prevailing wind and surface current directions. The Beaufort Sea does not have large "ice islands," similar to the Grand Banks or other Arctic areas, and which can cause more significant gouging.

Where possible, offshore pipelines likely would come to shore by the most direct and shortest path. Where an onshore landfall was not available or practicable near the offshore platform, the offshore segment likely would parallel the shoreline shoreward of the stamukhi zone. This avoids the area of highest ice-gouge intensity and depth and areas of strudel scour. The bottomfounded- and landfast-ice zones provide the maximum opportunity for installation and repair during the winter season. Trenching capabilities in these water depths currently are available.

In the event a pipeline originating in deeper water will cross the stamukhi zone, the total length of pipeline within this zone will be limited (low exposure variable) and still can be trenched and buried at sufficient depth to avoid gouging forces. Similarly, that portion of the pipeline outside the stamukhi zone may be susceptible to deeper gouges from individual iceberg events; but the pipeline still can be trenched below predicted gouge depth. The combined probabilities of an ice- gouge event at the specific pipeline location and exceeding the design trench/burial depth are small.

Risk of Oil Spills: There are over 600 mi of onshore pipeline on the North Slope, which demonstrates the capability to design, construct, and operate pipelines under arctic conditions. There are more than [>] 18,000 mi of offshore pipelines in the U.S. Gulf of Mexico and >50 mi of pipeline in the Pacific OCS. Between 1964 and 1995, there have been only 13 oil spills >1,000 barrels (bbl) from an offshore pipeline. Of these incidents, 10 were caused by anchor or trawl gear snagging a pipeline on the sea floor, 2 were caused by corrosion, and 1 was caused by a hurricane. The total volume of oil spilled from these 13 incidents was about 260,000 bbl; 160,000 of this total was from a single incident in 1967. The low number of spills and the declining spill volume can be attributed to advances in technology (leak detection and "smart pigs") and increased attentiveness by industry and government to monitoring and managing pipeline operations and maintenance.

There has been over 10 billion barrels of oil produced from the OCS and transported through the 18,000 plus miles of offshore pipelines. Given the limited number and volume of oil spilled, this represents a good record.

The National Research Council's Marine Board prepared a 1981 report on Safety and Offshore Oil, which included an assessment of offshore pipelines. The report concluded that oil discharges from OCS pipeline failures have been small compared with the volume handled (approximately 12 bbl per million barrels transported). The report made recommendations to improve pipeline safety, including establishing procedures to pressure test pipelines before use. These recommendations have been effected. The report also found pipelines in frontier areas would involve engineering considerations including ice, but concluded that some operating experience is applicable to most of the technologies mentioned, and that quantum leaps in

Table C-1 Major Design Considerations for Subsea Pipelines

UNIQUE TO THE OFFSHORE ARCTIC	NOT SIGNIFICANT IN THE BEAUFORT
Strudel Scour	Anchors
Ice Gouging	Trawling Gear
Permafrost	Unstable Slopes
	Currents
	Tides
	Deepwater
	Hurricanes

technological innovation are not required.

The Marine Board prepared another report in 1994 specifically on *Improving the Safety of Marine Pipelines*. This report found that the widespread risks (from pipelines) was oil spills, mainly from pipeline damage by vessels and their gear. The report noted that these risks can be managed with available technology and without major new regulations. The report found that better coordination between operators and regulators in gathering safety data, assessing risks, and planning and implementing risk-management programs are the most fundamental requirements. These issues are being addressed in the MMS's regulatory program and through the 1996 MOU between the USDOI and USDOT and would apply to any OCS pipeline proposed in the Arctic.

Put into perspective, a subsea pipeline in the offshore Arctic has relatively fewer design considerations than most other offshore areas (Table C-1).

Oil-Spill-Response Considerations: A potential pipeline oil spill would be limited in volume. Spill volumes would be on the order of several hundreds of barrels as compared to the potential tens of thousands of barrels from a well blowout or the hundreds of thousands of barrels from a tanker spill. Potential spill volume mainly is controlled by three things—leak-detection capability, pipeline diameter, and length.

Generally, leak-detection systems can measure leaks <1 percent of the total flow volume. For leak rates at and above the threshold, response times for detecting the leak and shutting in the pipeline are on the order of minutes; spill volumes are on the order of a few tens of barrels. For leak rates that are less than the threshold, the leak could go undetected until visual inspection or a discrepancy in mass balance between production and sales was identified. Leak rates of several hundreds of barrels per day are expected to be detected from within a few hours to days. Pinhole leaks of a few barrels could continue for extended periods, possibly not discovered until breakup. In both cases, the volume of oil is on the order of magnitude of a few

Table C-2 Relative Spill Volumes From Different Sizes of Pipeline Leaks

The following summary is based on a hypothetical flow volume of 60,000 bbl per day.

Detection Method/Limit	Detection/Reaction Time	Spill Volume
Leak-Detection System: 1% of flow rate (600 bbl per day)	3 minute/30 minute	14 bbl
Production vs. Sales: <600 bbl per day	Variable, assume 48 hours	1,200 bbl
Visual Detection: Pinhole leak (1 bbl per day)	8 months	240 bbl

hundred barrels. Relative spill volumes are summarized in Table C-2.

Following shut in of the pipeline, the remaining capacity of the pipeline also is subject to leaking. However, not all the oil would "drain." Some oil will "drain" due to expansion of the oil due to pressure loss in the pipeline—on the order of a few tens of barrels. Additional oil would continue to "drain" until seawater intake eventually came into equilibrium with the oil. Undulation of the pipeline caused by natural variations in the seabed would cause high and low points, so that only the portion of the damaged pipeline between the two highest points would "drain." As an example, only about 6,000 ft of the 6-mi offshore portion of the Northstar pipeline would "drain"; about 600 bbl (the volume of oil in the pipeline will vary depending on diameter to a 10-inch pipeline; the volume is about 1 bbl of oil for every 10 ft of pipeline). By comparison, a larger portion of the onshore portion of a pipeline could be more likely to "drain" (onshore portion of the pipeline is not as likely to be restrained by topographical relief or seawater intake).

Oil-spill-cleanup technology under arctic conditions is described in the Final Environmental Impact Statement in Section IV.A. The same response strategies are applicable for a pipeline spill. Because the most likely routing of the pipeline will be in the landfast-ice zone (shoreward of the stamukhi zone), where ice conditions will be stable for extended periods, oil-spill-cleanup capabilities will be enhanced. In this area, under-ice retention of oil (on the order of 1,000 bbl per acre of ice), restricted movement (currents are insufficient to move the oil encapsulated by the rough ice bottom), encapsulation of oil into growing new ice, and the surfacing of oil to the ice surface during the early stages of breakup provide multiple and long-term opportunities to clean up a spill using mechanical response techniques. Such efforts can be labor intensive but effective and efficient, particularly given the small volumes of oil involved. In the event the spill occurred or was not detected until late in the spring and ice had deteriorated to a point that over-ice mechanical response was not possible, in situ burning would remain a viable option; oil that is encapsulated under the ice and surfaces later does not weather and still is susceptible to in situ burning. Again, given the limited spill volumes associated with a pipeline spill, a spill during the winter and early spring can be cleaned up before open water and resulting transport and spreading.

Pipelines originating in deeper water beyond the stamukhi zone have the potential for spills occurring in or beyond the shear zone, where ice conditions could be more dynamic. Depending on the ice conditions, mechanical recovery could be limited. In situ burning could be used under some conditions (provided oil can be contained by natural or manmade/enhanced barriers such as fireproof boom, and the oil hasn't weathered or emulsified). If ice conditions were too dynamic to initiate a recovery action or in situ burning, the oil could be tracked pending development of suitable ice conditions to initiate a response or unless and until the oil disperses naturally.

A spill during the open-water period would be susceptible to transportation and spreading. The potential for a significant open-water spill is lower than the winter season because of the lack of active ice conditions that generate ice gouges. Individual icebergs could continue to be a concern in deeper water but become an increasingly smaller probability of risk, based on the limited exposure of the overall pipeline length to such events (majority of pipeline route will be in shallow water), the low density of ice-gouge events, and the low combined probability that there would be contact between the pipeline and the iceberg resulting in damage. Such events, even if they were to occur, would be in deeper water and farther from shore, allowing more time for response and lowering the potential for shoreline contact.

Any OCS development and production activity would require a Development and Production Plan (DPP) and associated Oil Spill Contingency Plan (OSCP) pursuant to 30 CFR 250.34 and 254, respectively. The OSCP would have to detail the response strategies and resources for responding to a spill from the development and production activity, including a pipeline. The OSCP would have to identify the dedicated resources, including methods to detect and track a spill and the modes of transportation and timeframe to mobilize equipment to the spill site. The OSCP also would have to identify environmentally sensitive areas and the methods, resources, and strategies that would be used to protect these areas. The DPP and OSCP would be subject to full public and National Environmental Protection Act review and coastal consistency certification from the State of Alaska. Through this review process, the public and other Federal and State agencies and local authorities have the opportunity to address the adequacy of the response plan, particularly in regard to sensitive areas and protected resources.

The National Response Plan, the Alaska Regional Contingency Plan, and the North Slope Subarea Continency Plan provide the foundation for the response structure for individual lessee oil-spill-contingency plans. These plans outline Federal and State responsibilities in the event of a major oil spill and the incident- command structure and resources that would be used to monitor and, if necessary, take over the spill-response effort. More directly, the Regional Response Team (RRT) develops policies, guidelines, and protocols that control many oil-spill-response activities, including in situ burning, oiled wildlife rehabilitation, dispersant use, and natural resource damage assessment. These response plans and the RRT is the mechanism through which regulatory agencies and resource agencies have direct input during a spill event to exercise their respective authorities and responsibilities.

The North Slope Oil Spill Response Program Committee is a group of Federal and State agencies with oil-spill-response planning authority, industry, and the North Slope Borough. This committee currently is reviewing overall response capabilities for the North Slope, onshore and offshore. This committee will make recommendations to a Steering Committee, including increasing equipment inventories. This effort should be completed by the first quarter of 1998.

Response planning must provide for logistics and transportation of equipment and personnel to the spill site. Response strategies will involve prestaging of equipment at the production platform, mobilization of offsite resources, and prestaged equipment along the pipeline route on the North Slope. Helicopter-deployable equipment has been an important component of response preparedness due to logistical constraints and will play a major role for open-water response planning, in particular for facilities that are located farther away from the Prudhoe Bay area. Expanded response capabilities in local communities such as Kaktovik also would be likely, as activities move farther from the central Beaufort Sea. Response times for over-ice conditions are not as "vital" but also will involve a combination of over-ice vehicle (rollagon, hovercraft, trucks) and helicopter-supported response. In general, response times for the pipeline spills will continue to be on the order of a few hours.

Relative Risk of Subsea Versus Onshore Pipelines: In a paper included in *A Synthesis of Environmental Information on Causeways in the Nearshore Beaufort Sea, Alaska*, it was noted that "once in place, pipes buried in the seabed, in the absence of permafrost, probably are safer than pipes subject to expansion and contraction in the are and safe from accidents." However, no studies have been found that quantitatively compare the risk of offshore vs. onshore pipelines. There is no basis to assume that offshore pipelines are inherently more at risk of failure or oil spill than an onshore pipeline. As noted in the discussion under oil-spill response, the offshore portion of a pipeline could have a smaller overall spill volume than an equivalent length of onshore pipeline, as natural undulation and seawater intake into the pipeline could limit the total volume of oil that "drains" from the pipeline.

The same technical and engineering principles apply to onshore and offshore pipelines. Proper design depends on site-survey work to define the environmental conditions and potential loads. Pipeline routes are selected to avoid unfavorable conditions. Loads and design criteria are determined based on site-survey work, research, field and laboratory studies, correlations and empirical relationships, and basic engineering principles. Statistical methodologies are applied to determine risk factors and to develop safety factors to "over design" facilities to further reduce potential failure. In new areas, such as the Beaufort, higher safety factors likely would be used than comparable onshore pipelines; this has been the approach for exploratory drilling structures, where design loads were based on anticipated ice loads one to two orders of magnitude greater than now known.

Arctic onshore pipelines have to be designed to address site conditions that are not common to subsea pipelines; including frost heave, subfreezing temperatures, surface contact (trucks, snowmobiles, gunshots), and sabotage. River crossing are a significant, unique design consideration for onshore pipelines that offshore pipelines do not have; any extended pipeline onshore would have to cross multiple rivers, which increases the complexity of the pipeline design.

The single most "dramatic" difference between an onshore and offshore pipeline is ice gouging. To assume that ice gouging makes offshore pipelines more risky than onshore is unfounded. From the discussion above, the potential forces from ice gouging can be predicted and the pipeline designed to avoid the potential effects of ice gouges.

Conclusion: Existing offshore pipelines have an excellent safety and environmental record. The probability of a spill from a subsea pipeline is small.

There are multiple regulatory authorities that control the design, construction, and operation of offshore subsea pipelines and also monitor and have the authority to shut down the pipeline in the event of potential pollution or noncompliance.

Subsea Arctic pipelines must be designed against all environmental conditions and potential loads. In the offshore, these include permafrost and strudel and ice scour. Site-specific surveys allow for identifying and characterizing these conditions along the pipeline route. Avoiding areas where these conditions occur would be the primary design approach. Where these conditions cannot be avoided in total, there is sufficient experience, research, and field studies that make it possible to quantify these conditions and loads and to design the pipeline against these conditions where they exist.

Ice gouging is the most significant factor. High-density, deeper ice gouges are limited to a zone of water depth from 18 to 20 m. All or most of an offshore pipeline will be landward of the stamukhi zone, where the ice gouging is less dense and gouge depths are shallower.

Potential spill volumes are on the order of hundreds of barrels. Even in the event the offshore portion of a pipeline parallels shore for extended distance (tens of miles) prior to landfall, the portion of the pipeline subject to "drainage" will be limited by natural undulation and seawater intact and probably would be on the order of several thousand feet (or hundreds of barrels of oil).

The most likely time of a spill from an ice-gouging event is in the early winter or late spring when the ice is active. Shoreward of the stamukhi zone, where the majority of a subsea pipeline would be constructed, the oil would be contained under or within solid ice conditions that would limit the potential for shoreline contact and on-ice mechanical cleanup- response techniques could be effectively used. Given the limited volumes of oil involved, spill response would be effective. In situ burning is a viable response mechanism in the event the spill occurs in the late spring and over-ice mechanical response is restricted. Oil spills beyond the stamukhi zone, where ice conditions are less stable, may limit over-ice response and can be either burned in situ or monitored until breakup; given the limited volumes of oil involved, the oil likely would be dispersed within the active ice field before the open-water season and would not be a risk to shorelines.

There is no quantitative comparison of onshore vs. offshore pipelines. Both onshore and offshore pose unique design considerations. Adequate design is based on site surveys and proper engineering and safety factors. There is no basis to assume that a subsea arctic pipeline is inherently more risky than an onshore pipeline.

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INDEX

INDEX

Index of selected headings and keywords.

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The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.