CHAPTER III: AFFECTED ENVIRONMENT

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3.1 INTRODUCTION

This chapter provides an overview of the planning area's physical, biological, and social features that could be affected by the alternatives under consideration. Because these features have changed little since the publication of the Amended IAP/EIS, much of the information in this chapter repeats information provided in the Amended IAP/EIS. Information that has become available since the completion of the Amended IAP/EIS, such as new studies on resources, has been added to the descriptions of the affected environment. In addition, this Supplemental IAP/EIS has added a discussion of public health in **section 3.4.10** to more fully address that subject.

3.2 PHYSICAL ENVIRONMENT

3.2.1 Climate and Meteorology

The planning area is characterized as a Northern Polar Climate (also known as the Arctic Zone), dominated by a lack of sunlight in the winter and long days in the summer; therefore winters are long and cold, and summers are short and cool. The area has one of the harshest environments in North America, with relatively little precipitation. Monthly precipitation is fairly uniform, with slightly less in May and more in July/August. Because winters are long, most streams and lakes are frozen for much of the year. Snow cover is common from October through May. Summers, while short and relatively cool near the coast, are longer and warmer inland. The onset of snowmelt and subsequent runoff often begins earlier in the foothills than in the rest of the area and moves north as the summer season progresses. Similarly, freeze up usually begins first on the coastal plain and proceeds southward.

Although weather observations have been recorded west of the planning area at Barrow since 1917, there is a lack of historic monitoring within the planning area. In addition, a range of spatial and temporal variations are likely to occur, dominated by proximity to water bodies (e.g.; the Arctic Ocean and Teshekpuk Lake), as well as local slope, aspect, and terrain. Table 3.2-A provides a summary of temperature and precipitation conditions observed at Umiat (1949-2001) within the planning area, at Barrow (1949-2005) on the coast to the west, and at Kuparuk (1983-2005) within the Prudhoe Bay Oil Field to the east.

The annual mean temperature in the planning area is about 10 degrees Fahrenheit (°F), with sub-freezing temperatures occurring from mid-October into May. Construction work and oil exploration are often conducted in winter because both the ground and the streams are frozen enough to allow the use of heavy equipment on them. February is the coldest month, with average maximum temperatures of -10 to -15°F and average minimum temperatures of -25 to -30°F. July is the warmest month, with average maximum temperatures of 45 to 65°F and average minimum temperatures of 35 to 40°F. Average snow depth from December through April is 10 inches in Barrow on the coast, and 15 inches in Umiat, in the foothills. Snowfall is greatest in October but can occur during any month of the year.

Although wind measurements are rare, prevailing winds are expected to blow cold air off the frozen Arctic Ocean and are strongest during winter, often creating blizzard conditions. Southerly winds may break this pattern on occasion. The annual mean wind speed at Barrow Airport west of the planning area is approximately 12 miles per hour (mph), with a measured sustained peak of 58 mph in March 1960.

Climate Change on the North Slope

Ongoing scientific research has identified the potential effects of so-called "greenhouse gas" (GHG) emissions (including carbon dioxide, CO_2; methane; nitrous oxide; water vapor; and several trace gases) on global climate. Through complex interactions on a regional and global scale, these GHG emissions cause a net warming effect of the atmosphere, making surface temperatures suitable for life on earth, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, with corresponding variations in climatic conditions, recent industrialization and burning of fossil carbon sources have caused CO_2 concentrations to increase dramatically, and are likely to contribute to overall climatic changes, typically referred to as global warming. Increasing CO_2 concentrations also lead to preferential fertilization and growth of specific plant species.

The assessment of GHG emissions and climate change is in its formative phase, and it is not yet possible to know with confidence the net impact to climate. Observed climatic changes may be caused by GHG emissions, or may reflect natural fluctuations, but the Intergovernmental Panel on Climate Change (IPCC, 2007) recently concluded that "Warming of the climate system is unequivocal" and "Most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic (man-made) greenhouse gas concentrations."

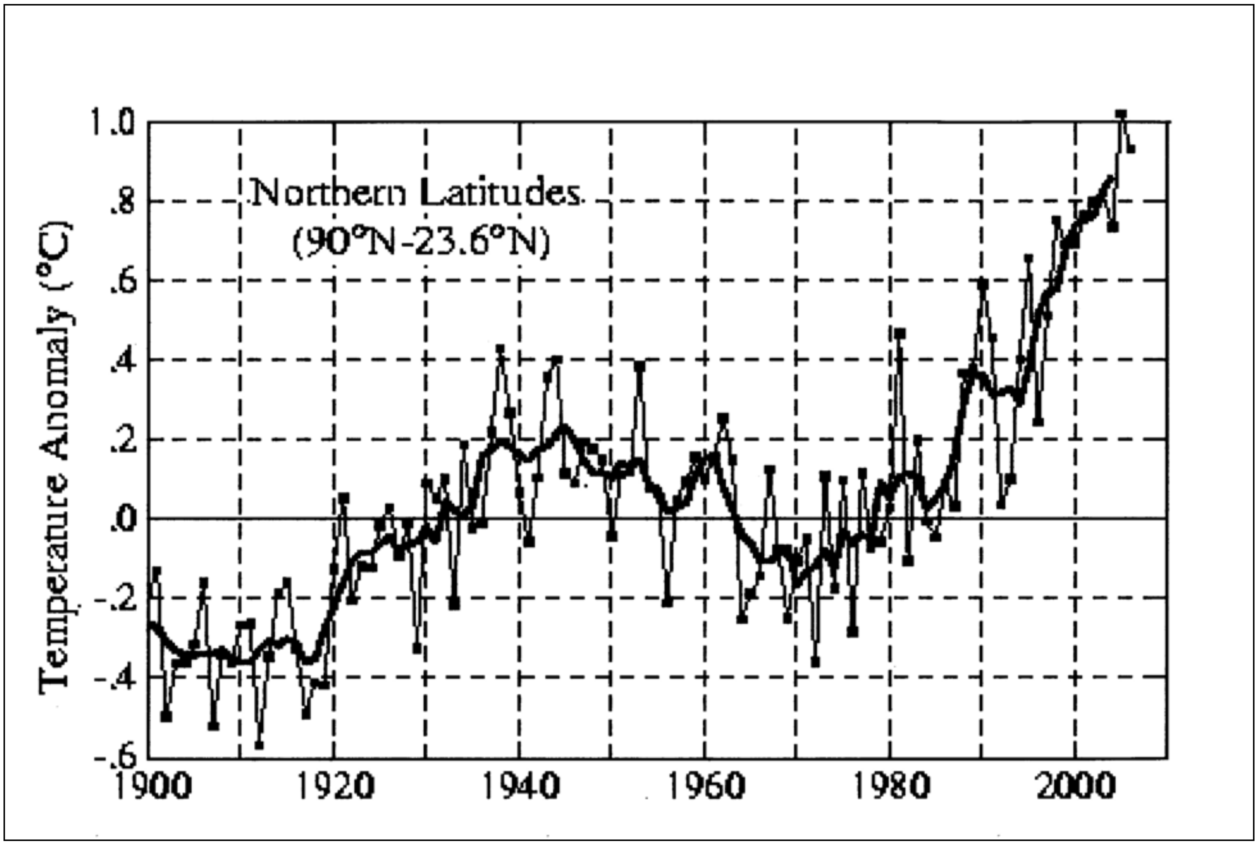
Global mean surface temperatures have increased nearly 1.0°C (1.8°F) from 1890 to 2006 (Goddard Institute for Space Studies, 2007). However, both observations and predictive models indicate that average temperature changes are likely to be greater in the Arctic. Figure 3-1 demonstrates that northern latitudes (above 24° N – which includes all of the United States) have exhibited temperature increases of nearly 1.2°C (2.1°F) since 1900, with nearly a 1.0°C (1.8°F) increase since 1970 alone. In addition, the Arctic Climate Impact Assessment (ACIA, 2005) reported that the sea ice extent has been decreasing, and that temperature increases have "…increased the frequency of mild winter days, causing changes in aquatic ecosystems; the timing of river break-ups; and the frequency and severity of extreme ice jams, flood, and low flows." Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHG are likely to accelerate the rate of climate change.

Table 3.2-A. Monthly Climate Summary

Umiat, Alaska													
	Annual	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Max Temp (°F)	20	-13	-14	-7	12	32	58	66	58	41	18	-1	-12
Min Temp (°F)	2	-29	-31	-27	-11	16	37	42	37	26	2	-17	-28
Total Precip (in)	5.5	0.38	0.26	0.16	0.21	0.07	0.68	0.79	1.06	0.47	0.68	0.38	0.33
Snow Fall (in)	32	4.5	2.4	2.3	1.9	1.2	0.2	0	0.2	2.6	8.5	5.2	4.2
Snow Depth (in)	8	14	16	17	17	9	0	0	0	0	5	9	12
Barrow Airport, Alaska													
	Annual	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Max Temp (°F)	16	-7	-11	-8	7	25	39	46	43	34	20	5	-5
Min Temp (°F)	5	-20	-23	-20	-7	15	30	34	34	28	11	-6	-17
Total Precip (in)	4.6	0.18	0.15	0.13	0.17	0.15	0.32	0.91	1.04	0.68	0.48	0.24	0.16
Snow Fall (in)	30	2.2	2.2	1.9	2.5	1.9	0.7	0.3	0.7	4.1	7.0	3.6	2.5
Snow Depth (in)	6	9	10	11	11	6	1	0	0	1	4	7	8
Kuparuk, Alaska													
	Annual	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Max Temp (°F)	18	-11	-12	-8	8	28	47	56	51	38	20	2	-6
Min Temp (°F)	5	-23	-25	-22	-7	17	33	39	37	28	9	-10	-19
Total Precip (in)	4.0	0.11	0.14	0.08	0.11	0.04	0.36	0.89	1.11	0.54	0.35	0.13	0.12
Snow Fall (in)	31	2.5	2.5	2.3	2.6	1.4	0.6	0	0.4	3.5	8.2	3.6	3.3
Snow Depth (in)	4	7	8	8	8	4	0	0	0	0	3	5	6

(Note: All figures are monthly or annual averages.)
(Source: Western Regional Climate Center, 2007)

Figure 3-1. Annual Mean Temperature Change for Northern Latitudes (24 - 90° N)



Source: Goddard Institute for Space Studies (2007)

Temperatures in Alaska and throughout the Arctic appear to have fluctuated over the last few centuries. Changes in permafrost are an important indicator of climate change. Temperature data for the permafrost in Alaska have been collected from core borings over the last 20 years. Using oil exploration wells distributed in the Arctic coastal plain and foothills, Lachenbruch and Marshall (1986) measured the temperatures of permafrost to depths of more than 600 feet and showed that the mean surface temperature is likely to have warmed 2 to 4°C (4 to 8°F) during the last century.

In 2001, the IPCC indicated that by the year 2100, global average surface temperatures will rise 1.4 to 5.8°C (2.5 to 10.4°F) above 1990 levels. The ACIA also predicted that average arctic warming (north of 60° N) would occur by the end of the 21st Century, ranging from 3°C (5.4°F) to 5°C (9°F) in autumn and winter, and 1°C (1.8°F) in summer. The IPCC (2007)also concluded the combined effects of melting glaciers, melting ice caps, and sea water expansion due to warmer ocean temperatures would cause the global average sea level to rise between 0.18 to 0.51 meters (7 to 20 inches) from 1980-1999 to the end of this century, based on several modeling analyses. The National Academy of Sciences (2006) has confirmed these findings, but also indicated there are uncertainties how climate change will affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes, such as in the Arctic, where the temperature increase may be more than double the global average. Warming during the winter months is expected to be higher than during the summer. Northern areas may also experience increased precipitation.

Global warming would negatively effect the Arctic environment, including tundra, sea ice, and changes in the permafrost depth (ACIA, 2005). Reduction in sea ice as a result of global warming would affect marine mammals (particularly polar bears), fish, and birds, with related implications for Native subsistence harvests. Species ranges are predicted to move northward. Due to loss of habitat, or from competition from other species whose ranges shift northward, the population of some Arctic species may be reduced, and extinction potentially accelerated. Vegetation is expected to move northward, with forests replacing tundra, and tundra vegetation moving into previously barren areas. Early thawing of rivers may impact caribou migrations to calving grounds. However, some Arctic fisheries may become more productive due to global warming. Global warming would also contribute to a rise in sea level, impacting estuaries and coastal wetlands, and alter regional temperature and rainfall patterns, with major implications to agricultural and coastal communities. In addition, this sea level rise and thawing of tundra could have negative effects on oil and gas-related infrastructure. However, a reduction in sea ice would likely enhance marine transportation and allow increased offshore energy development.

Many of these climatic changes have been expressed as concerns by residents of the North Slope of Alaska who utilize the area for subsistence purposes (Alaska Native Science Commission and the Institute of Social and Economic Research, 2007). The Barrow Arctic Science Consortium (2007) is constructing its Global Climate Change Research Facility to facilitate future research into climate change issues, including atmospheric, oceanic, hydrologic, and social studies.

3.2.2 Air Quality

The planning area is in an area that is in attainment of current National Ambient Air Quality Standards (NAAQS) and the Alaska Ambient Air Quality Standards (AAAQS) for all criteria pollutants (Table 3.2-B). In addition, the State of Alaska has until November 2007 to recommend to EPA which portions of the state comply with the proposed 24-hour fine particulate standard. There are no federally–protected Prevention of Significant Deterioration (PSD) Class I Wilderness Areas or National Parks within 60 miles of the planning area. The air quality in the Colville River Delta is generally good as a result of few pollution sources and good dispersion created by frequent winds, and neutral to unstable conditions in the lower atmosphere. Wind blown dust tends to occur more in the summer months as sandbars dry along the riverbeds in the Colville River Delta, resulting in temporary increases in concentrations of particulate matter. Emission sources in the planning area consist mainly of diesel-fired generators in small villages, residential heating, snow machines, all-terrain vehicles, occasional small aircraft, limited local vehicle traffic, and occasional open burning. Emissions sources at the Alpine field production and drilling areas include gas–fired turbines and heaters, incinerators and flaring, diesel-fired power generators, storage tanks, fugitive hydrocarbon emissions, and mobile sources (vehicle traffic and aircraft). Regional sources of emissions consist of oil and gas production facilities east of the planning area, including Kuparuk, Milne Point, Prudhoe Bay, North Star, Endicott, and Alpine fields.

Table 3.2-B. Applicable Air Quality Standards and Monitoring Values (µg/m3)

Pollutant	Averaging Time a)	National and/or Alaska Ambient Air Quality Standard (µg/m³)	Maximum Monitored Values (µg/m³)			
			Kuparuk CPF-1	Kuparuk DS-1F	Nuiqsut 1999-2000	Nuiqsut 2004-2005 b)
Carbon monoxide	8-hour	10,000	920	575	n/a	n/a
	1-hour	40,000	1,265	1,035	n/a	n/a
Lead	Quarterly	1.5	n/a	n/a	n/a	n/a
Nitrogen dioxide	annual	100	16.0	4.9	5.6	3.8
Ozone	8-hour c)	157	n/a	n/a	n/a	80.6
	1-hour d)	235	115.6	100	n/a	n/a
PM_{10}	Annual e)	50	13.6	11.2	8.2	7.7
	24-hours	150	108	63	223 f)	54.0
$PM_{2.5}$	Annual	15	n/a	n/a	n/a	n/a
	24-hours g)	35	n/a	n/a	n/a	n/a
Sulfur dioxide	Annual	80	5.2	2.6	0.0	0.0
	24-hours	365	26.2	13.1	2.6	3.9
	3-hours	1,300	44.5	55.0	7.8	11.7
Total Reduced Sulfur	30-minutes	50	18.1	8.3	15.7	n/a

Notes:
a) Annual values are not to be exceeded; shorter averaging times allow occasional exceedances.
b) Data collected between April 2004 through March 2005and December 2002; 8-hour ozone value does not represent a complete annual period.
c) Standard became effective April 2004.
d) Standard has limited applicability (none in Alaska).
e) Standard was revoked October 2006.
f) First-maximum value caused by a natural event.
g) Standard became effective October 2006.
Sources: Phillips Alaska (2002) and SECOR International Inc. (2003 and 2006)

An Ambient Air Quality Monitoring Station has operated at Nuiqsut since 1999, originally as a State of Alaska permit condition for the Alpine field. The condition required collection of at least 1 year of ambient nitrogen oxides (NOx), sulfur dioxide (SO_2), particulate matter less than 10 microns in diameter (PM_{10}), and meteorological data. Data collected at Nuiqsut are believed to be representative of background air quality in the Alpine field area. These data indicate that air quality is in compliance with both the NAAQS and the AAAQS for all pollutants and averaging periods. Although one day of high PM_{10} concentrations occurred in 1999 as a result of wind-generated dust, this did not constitute a violation of the standards. Both Federal and State regulations exclude natural events, and even man-made events are permitted to exceed the 24-hour particulate matter standard a few days each year (18 AAC § 50.010, Title 18 Environmental Conservation Chapter 50 Air Quality Control Article 1 Ambient Air Quality Management).

In addition, trace amounts of air pollutants, including metals, have been detected in vegetation at very low levels, and arctic haze is periodically observed on the North Slope, due primarily to air pollutant emissions originating in northern Europe and Asia (and to a lesser extent, northern Alaska).

Average annual criteria air pollutant emissions for the North Slope Borough during 1996 through 2001 (USEPA, 2007) have been reported as follows (in tons per year): CO – 3,526; NOx – 345; $PM_{2.5}$ – 306; PM_{10} – 1,629; SO_2 – 29; and VOC – 520. During 1999 (the only year data were provided; EPA, 2007), emissions from all 188 hazardous air pollutants (HAP) amounted to 595,740 pounds. Seven specific HAP (benzene, toluene, ethylbenzene, xylenes, formaldehyde, hexane, and 2,2,4-trimethylpentane) accounted for 87% of these total emissions.

Local residents have expressed concerns regarding air quality impacts from fine particulate matter and hazardous air pollutants emitted during oil and gas development. However, as described by the National Research Council (2003), "Little research has been done to quantify the effects of air pollution on the North Slope or to determine how local and regional air masses interact. Air pollution monitoring has been limited to priority pollutants from 1986 through 2002 at a few sites. Not enough information is available to provide a quantitative baseline of spatial and temporal trends in air quality over long periods across the North Slope."

3.2.3 Physiography

Physiography can be described as the classification of large-scale landforms within a given area. The planning area contains two of the three primary physiographic regions of the National Petroleum Reserve – Alaska (NPR-A), the Arctic Coastal Plain and the Arctic Foothills of the Brooks Range (Wahrhaftig 1965).

3.2.3.1 Arctic Coastal Plain Province

The Arctic Coastal Plain (ACP) Province covers approximately 85% of the planning area. It extends inland from the coast of the Arctic Ocean. The coastline is irregular and contains many small bays, lagoons, spits, beaches, and barrier islands (Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope 2003). Periglacial features (e.g., thaw lakes, marshes, and polygonal patterned ground), providing little topographic relief and poor drainage, dominate the ACP. Polygonal patterned ground forms from ice wedges that freeze within contraction cracks of the soil. Throughout the year, these cracks fill with water and snow, then freeze and expand.

During the warmer months, the surface ice melts and water remains. This process repeats annually, resulting in a polygonal patterned surface. The ACP extends southward from the shoreline approximately 30 miles into the coastal lowlands. The lowlands are a vast treeless area of tundra, meandering streams, drained and undrained lagoons, and thousands of shallow thaw lakes. Freshwater lakes cover approximately 26% of the ACP lying within the planning area.

The lake-filled coastal plain fades into an area of large rounded lakes and a numerous very small lakes at an elevation of about 100 feet above mean sea level and about 40 miles inland. Dunes and ridges, such as the Pik Dunes, appear. At an elevation of 200 feet and about 60 miles inland, streams begin to replace the smallest lakes.

3.2.3.2 Arctic Foothills Province

The Arctic Foothills Province becomes evident at about 90 miles inland and south of the coast. Elevations start at about 500 feet. While the Arctic Foothills Province extends to the Brooks Range (about 180 to 200 miles inland), the planning area boundary is the Colville River, which is about 120 miles south of the coastline.

The Arctic Foothills Province consists of tundra-covered rolling hills, low east-west trending ridges, and occasional small pingos. The highest elevation within the planning area, just southeast of Square Lake, is 1,150 feet. The Colville River is the southern boundary of the planning area. It is also the longest river in the Arctic Foothills Province at 220 miles long. Although there are no glaciers, the area is underlain by continuous permafrost. Waterbodies in the Arctic Foothills Province cover approximately 7% of the area.

3.2.4 Geology and Minerals

The regional geology and minerals found in the planning area are described below. Information on the petroleum resource potential, and past oil and gas exploration efforts is provided in **section 3.2.5, *Petroleum Resources***.

3.2.4.1 Geology

Northern Alaska and the adjacent continental shelf are underlain by sedimentary rocks that represent approximately 360 million years of geologic time (Figure 3-2). Three thick stratigraphic sequences were deposited in overlapping geologic basins that now lie beneath the present North Slope. The older basin flanked a continental landmass that once lay north of the present Beaufort coastline. The Ellesmerian Sequence, deposited in the older basin, contains rock units that grade from proximal (near source terrain) facies (all the characteristics of a particular rock unit) in the north, to deepwater marine facies in the south. The youngest basin was formed as a deep trough (Colville Basin) on the north side of a mountain belt whose present expression is the Brooks Range. The Brookian Sequence, deposited in the younger basin, contains deltaic and marine deposits shed off the mountain belt into the Colville Basin. The transitional period between these two overlapping tectonic events is represented by rocks of the Beaufortian Sequence, which were deposited in a low-relief rift zone marking the southern edge of the present Arctic Ocean basin. The geologic history and stratigraphy of the planning area are discussed in detail in Gryc (1988) and previous environmental impact statements (USDOI BLM and MMS 1998, 2003).

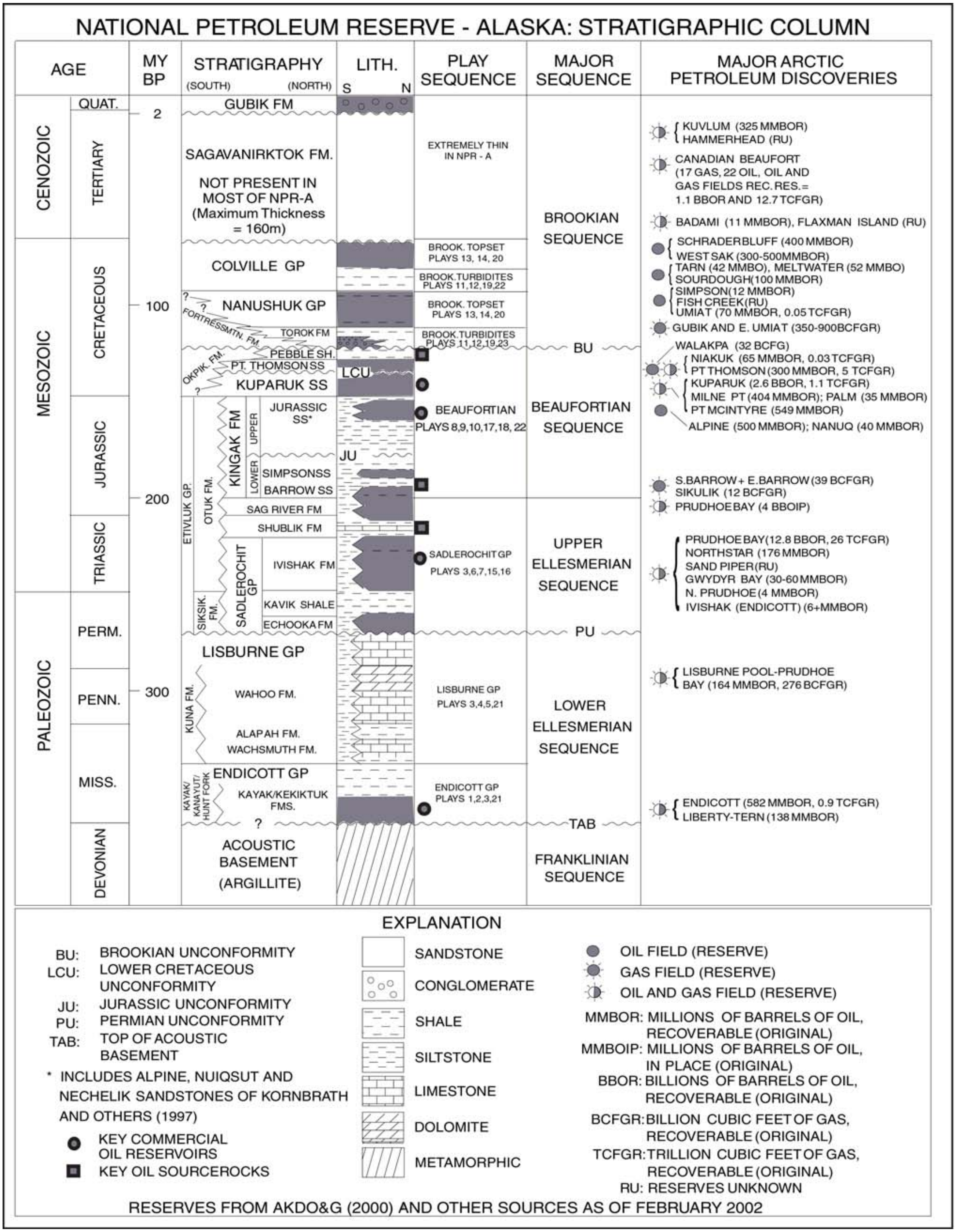


Figure 3-2. Stratigraphic Column for National Petroleum Reserve – Alaska.

The primary structural features in northern Alaska are shown in Map 3-1. Of particular importance to later discussions of petroleum potential are the Brooks Range, Colville Basin, and Barrow Arch (progressing south to north). Numerous literature references describe the stratigraphy and tectonic evolution of northern Alaska and its adjacent continental margins. For additional information, readers should refer to the following general references: Brosge and Tailleur (1971); Grantz and May (1982); Craig et al. (1985); Hubbard et al. (1987); Kirschner and Rycerski (1988); and Moore et al. (1994).

3.2.4.2 Minerals

As stipulated in the NPRPA, lands within the NPR-A are reserved and withdrawn from all forms of entry and disposition, including mining and mineral leasing and extraction. However, Congress has authorized the leasing of oil and gas, and the NPRPA does allow the Secretary of the Interior to grant mineral material (salable minerals) permits as necessary to carry out his responsibilities. Clay, which is classified as mineral material, can be removed at the discretion of the Secretary. Other minerals (hardrock, uranium, and coal) are not available for resource exploitation unless authorized by Congress.

Hardrock Mineral Potential
The northeast corner of the NPR-A ACP contains no identified hardrock mineral potential. This area was included as part of the Colville Mining District Mineral Assessment study conducted by the U.S. Bureau of Mines from 1991 to 1993 (Meyer 1995). All of the hardrock mineral potential of the NPR-A occurs south of the Colville River into the northern flank of the Brooks Range and includes the Drenchwater and Story Creek deposits.

Clay Potential
Three deposits of bentonite clay are located in the Umiat quadrangle on the south-southeastern side of the Colville River. Bentonite is used in drilling muds, civil engineering and sealing applications, pet absorbents, and iron-ore palletizing.

Uranium Potential
Potential uranium deposits may occur along the entire North Slope of Alaska, including the ACP of the NPR-A. Sampling and analysis of rock, soil, and sediment within the planning area has indicated that small amounts of uranium are present; approximately 4,289 parts per million (USGS 2004).

Coal Resources
Coal in the northeastern NPR-A occurs within the eastern extent of the Northern Alaska coal province, the largest coal province in Alaska. This coal province contains the largest coal resource in the United States and ranks within the top two or three coal provinces in the world. The resource is estimated to range from 120 to 150 billion short tons of coal (Flores et al. 2003; ADNR 1983). In the planning area, coals occur in two formations. Subbituminous to bituminous coal is found in the lower Cretaceous Nanushuk Formation which outcrops in the southern portion of the planning area (Mull et al. 2003). Another coal bearing unit, the Prince Creek Formation (Mull et al. 2003), contains relatively thin seams of subbituminous coal beds, but these coals have not been studied extensively. The Prince Creek Formation coals are best exposed along the banks of the Colville River and its eastern tributaries in the northern part of the planning area. The coal and potential coalbed methane resources in the planning area are not well defined.

3.2.4.3 Seismicity

The NPR-A is not located near any tectonic plate boundaries where the relative motion between plates may generate earthquakes (USDOI BLM 1978a). Most earthquake activity in Alaska occurs along an arc extending east from the western edge of the Aleutian Islands, through south-central Alaska and into the central part of Interior Alaska. From 1960 to 2000, no earthquakes of 4.0 magnitude or greater (Modified Mercalli Intensity Scale of 1931) have been reported in the NPR-A. Areas east and south of the NPR-A have reported many earthquakes of 4.0 magnitude or greater (Alaska Earthquake Information Center 2003).

3.2.5 Petroleum Resources

3.2.5.1 Petroleum Geology

The North Slope is an incredibly rich petroleum province, with an estimated in-place endowment of 63 Bbbl of oil and proven commercial oil reserves of 7.4 Bbbl. The oil-in-place estimate is based on the total oil estimated to be present in discovered producing and non-producing fields of the North Slope. Undiscovered onshore resources are approximately 12.7 Bbbl (ADNR 2006), while offshore, namely the Chukchi and Beaufort shelves, may contain an additional 23.6 Bbbl of oil (USGS 2006). Gas resources may be as much as 100 trillion cubic feet (Tcf). Of the proven commercial reserves, about 16.6 Bbbl have been produced through 2005 (ADNR 2006). Exploration in northern Alaska has located 35 or more oil and gas fields, but most reserves are located in a few very large oil fields near Prudhoe Bay (Map 3-2). The key oil source-rocks and reservoir sequences present in these commercial oil fields extend across much of the North Slope, including the NPR-A. Because of these geologic trends and the abundance of untested potential traps, northern Alaska and the adjacent continental shelf are considered to hold high potential for new oil and gas fields (Map 3-3).

3.2.5.2 Petroleum Activities in Northern Alaska

Past Exploration Efforts

Petroleum exploration in northern Alaska began in the early 1900s with field parties sponsored by the USGS. From 1944 to 1952, the U.S. Navy drilled exploration wells near oil seeps and on surface anticlines, resulting in several oil and gas discoveries. Umiat was the first oil field discovered in northern Alaska (1946). However, it remains undeveloped because development costs are prohibitive. The South Barrow gas field was the first significant gas discovery (1949) on the North Slope, and it was developed in 1958 by the Federal government to supply fuel to the village of Barrow.

A second phase of NPR-A exploration started in the 1970s. It began under the auspices of the U.S. Navy, but was later coordinated by the USGS, with the passage of the Naval Petroleum Reserves Production Act in 1976. This exploration effort resulted in 28 exploration wells (Husky Oil Company) and 14,800 miles of seismic data (Geophysical Services, Inc.). Numerous oil and gas shows were reported, but no commercial fields were discovered. Gas fields near Barrow (Barrow and Walakpa) were developed through government subsidies and currently are produced for local use.

The discovery of the Alpine field in the Colville River Delta has helped renew exploration interest in the NPR-A. The Alpine field was discovered by ARCO and partners in the winter of 1994-1995 (Alaska Report 1996). Development and appraisal drilling has confirmed its reserve potential of 429 MMbbl, and in the fall of 2003 the Alpine field recorded 100 MMbbl of production (Alaska Oil and Gas Reporter 2003). The field may even have economically recoverable reserves as high as 500 MMbbl (Gingrich 2001). The Alpine field is the largest field discovered in Alaska since the discovery of the Point Mclntyre field in 1988 and is one of the largest fields discovered in the U.S. in recent decades. Of particular significance is that the Alpine field discovery has revealed a new geologic play in previously unknown sands in the Jurassic section. An oil and gas play has been defined by the USGS (1995) National Oil and Gas Assessment Team as “a set of known or postulated oil and (or) gas accumulations sharing similar geologic, geographic, and temporal properties, such as source rock, migration pathway, timing, trapping mechanisms, and hydrocarbon traps.” The new Jurassic play is likely to extend westward into the National Petroleum Reserve – Alaska and will be a principal target for future exploration on the western North Slope (Kornbrath et al. 1997). Although the Alpine field discovery and development was outside of the planning area, the Alpine field-play type has been the principal target for exploration on leases acquired in the Northeast NPR-A planning area. (USDOI BLM and MMS 2003).

To date, 22 exploration wells and one sidetrack well have been drilled in the planning area on leases acquired since 1999 (Map 3-4). At least seven of these 22 wells encountered oil or gas and condensate. The delineation of these reservoirs in the NPR-A has resulted in a proposal to build satellite production sites that tie back to the Alpine field facilities (USDOI BLM and MMS 2003). Long-term flow testing at the Spark 1A well produced 1,550 barrels of liquid hydrocarbons and 26.5 million cubic feet per day (MMcfd) of gas after fracture stimulation. Long-term flow testing at the Rendezvous “A” well produced 360 barrels per day of liquid hydrocarbons and 6.6 MMcfd of gas. Flow tests at the Lookout 2 well recovered 4,000 barrels per day of liquid hydrocarbons and 8 MMcfd of gas. Drill stem tests from the Carbon #1 appraisal well indicated 1,250 barrels of Condensate Per Day(bcpd) and 24 MMcfd of gas. All of these exploration wells targeted the Alpine field reservoir formation, which occurs within the “Beaufortian” play group. These wells are located 15 to 25 miles southwest of the Alpine field that is producing nearly 130,000 barrels (bbl) of oil per day (Petroleum News 2006).

Leasing and Development

Leasing Activities

Petroleum leasing activities began in northern Alaska shortly after statehood in 1959. In the years following the 1968 Prudhoe Bay discovery, the State of Alaska has had many lease sales (USDOI BLM and MMS 1998). BLM conducted four lease sales between 1981 and 1984. These sales offered tracts across the entire NPR-A; on the coastal plain, the foothills, and mountain front. Approximately 1.3 million acres were leased with bonus bids of about $83.5 million. Only one well was drilled before all the leases expired.

In 1999, BLM offered 425 tracts (approximately 3.9 million acres) for lease within the planning area. A total of 133 tracts (867,000 acres) were leased, with successful bids totaling $104,635,728. Six oil companies (British Petroleum [BP], Anadarko Petroleum, Chevron, Phillips Petroleum, Atlantic Richfield Company [ARCO] Alaska, and R3 Exploration Corp) submitted 174 bids that concentrated in the northeast corner of the planning area. The highest bid for a single tract (5,756 acres) was $3,655,100, offered by ARCO Alaska and Anadarko Petroleum.

BLM conducted another lease sale in June 2002 in the planning area. The 2002 lease sale generated winning bids totaling $63,811,496 on 60 tracts totaling 579,269 acres. Phillips Alaska and Anadarko Petroleum, the companies that have been most active in NPR-A, were awarded 34 tracts, with successful bids of $9.6 million. Two companies that have not been active in the National Petroleum Reserve – Alaska to date also submitted winning bids. TotalFinaElf E&P USA was awarded 20 tracts with successful bids totaling $53,532,000. TotalFinaElf submitted the six highest bids of the sale, bidding more than $10 million on each of two tracts and more than $7 million on a third. EnCana Oil and Gas (USA) Inc. also submitted successful bids for leases in the 2002 sale.

BLM held an oil and gas lease sale on June 2, 2004 for 484 tracts in the Northwest NPR-A, and for 22 tracts that combine lands from the Northwest and Northeast NPR-A along the Ikpikpuk River that had not been offered to date. About 5.8 million acres were offered. Bonus bids were received on 123 of the tracts, totaling 1,403,561 acres.

In 2006, an oil and gas lease sale was held September 27 for 478 tracts in the Northwest NPR-A. The 478 tracts encompassed 5.4 million acres. Bonus bids were received on 81 tracts totaling roughly 940,000 acres.

Since 2004, 57 leases encompassing approximately 500,000 acres have been returned to the Federal government within the Northeast NPR-A. In September 2007, ConocoPhillips relinquished 41 leases totaling approximately 300,000 acres. The decision was made to hand over these leases as a result of high logistics cost and uneconomic results (Petroleum News 2007). Prior to 2007, EnCana and TotalFinaElf relinquished 16 leases in the western portion of the planning area.

Leasing and exploration activities in the Outer Continental Shelf (OCS) areas in the Beaufort Sea are summarized in USDOI BLM and MMS (2003). Nine lease sales have yielded 35 exploratory wells, which were drilled in Arctic Federal waters between 1980 and 2003 (30 Beaufort Sea wells and five Chukchi Sea wells). Encana drilled the 35th exploration well in the winter of 2002-2003 at the McCovey prospect in the Beaufort Sea. The U.S. Department of Interior, Minerals Management Service (MMS) classifies eleven of these wells as capable of producing paying quantities (sufficient to pay for operating costs; not necessarily sufficient for commercial development). Wells not favorable to production and field economics, have been plugged and abandoned. Five prospects have been unitized for development (Northstar, Sandpiper, Hammerhead, Kuvlum, and Liberty; however Hammerhead and Kuvlum have lapsed without development). Northstar began oil production in October 2001 and has produced nearly 109 Mmbbl of oil (ADNR 2006). In January 2002, BP-Amoco postponed commercial development at Liberty (Tern) pending project design changes. The latest sales in the Beaufort Sea, Sale 195 and 202, were held in September 2005 and April 2007, respectively.

Historical leasing patterns offer a perspective on the possible scale of activities associated with future NPR-A lease sales. In the NPR-A lease sales beginning in 1999, approximately 3.79 million acres were leased. Currently, private companies have drilled 20 exploratory wells in the planning area. In the OCS, 35 exploration wells were drilled from a lease inventory of 5.5 million acres (averaging one well per 27 leased tracts). There have been significantly higher levels of drilling on state leases, where it is estimated that approximately half of all the offered tracts have been leased during the more numerous state sales (Kornbrath 1994). Approximately 10% of the available prospects have been tested. Historically, the success rate for commercial fields on the North Slope has been slightly less than 5%.

Alpine Field

The Alpine field is on the Colville River Delta between the Nigliq and Sakoonang channels and approximately 8 miles north of Nuiqsut. Production pads Colville Delta-1 (CD-1) and CD-2 began oil production in November 2000 and 2001, respectively. Two additional satellite fields, CD-3 and CD-4, began oil production in 2006.

Infrastructure at CD-1 pad fully supports the ongoing drilling and production operations, including activities at the other CD sites (CD-2, CD-3, and CD-4). Facilities and equipment currently installed include processing facilities, production wells, camp facilities, sanitation utilities (water and wastewater), drilling mud plant, airstrip, maintenance complex, warehouse buildings, disposal wells, emergency response center, communications, power generation, and various mobile equipment (USDOI MMS 2004c).

The CD-2 production pad is a satellite approximately 3 miles to the west of CD-1. Access to the site is by a gravel road, of which approximately 5,000 feet nearest CD-1 is coincident with the edge of the airstrip. A temporary camp provides support for ongoing drilling operations.

The CD-3 production pad is located approximately 6 miles north of CD-1 and is accessible by air. It is a roadless development in the sense that it is not connected to the rest of the alpine infrastructure. The airstrip is 3,040 feet and provides year-round access. During the winter, an ice road is built to connect CD-3, as well as the other Alpine satellite fields, to the existing infrastructure east of Alpine. A temporary camp provides support for ongoing drilling operations. This pad is located on lands owned by the State of Alaska.

The CD-4 production pad is located south of the CD-2 pad. A 3.6 mile gravel road connects the two pads. A temporary camp provides support for ongoing drilling operations. This pad is located on Kuukpik Corporation lands, the Native Corporation created under the authority of the Alaska Native Claims Settlement Act (ANCSA) for the village of Nuiqsut.

Pipelines consist of a gathering pipeline that transports unprocessed produced oil and water from CD-2, CD-3, and CD-4 to the Alpine Processing Facility at CD-1 and a 34-mile-long oil sales pipeline connects the processing facility to the Kuparuk River oil field. Pipelines are elevated above the tundra by vertical support members, except at the main channel crossing of the Colville River, where the oil sales pipeline is underground.

The USDOI BLM (2004 c,d) completed and issued a ROD in November of 2004 that analyzed a proposal to develop five new satellite pads—CD-3 and CD-4, which are currently in production, and three others in the planning area (CD-5, CD-6, and CD-7). Colville Delta-5 is on land conveyed to Kuukpik Corporation within the planning area. Colville Delta-6 and CD-7 are on lands administered by BLM in the planning area. ConocoPhillips Alaska, Inc., proposes to place 20 to 30 wells on each pad and to transport the unprocessed, three-phase (oil, gas, and water) drilling product to the existing Alpine Processing Facility at CD-1 for processing. Processed oil would be placed in the existing pipeline system for transport to the Trans-Alaska Pipeline System.

Petroleum Potential

The “total petroleum system” concept is used to assess oil and gas potential. The concept takes into account all the petroleum generated by related source rocks. The total petroleum system resides in a volume of mappable rocks and includes sources, reservoirs, seals, and overburden.

Geologic processes act upon the petroleum system and “control the generation, expulsion, migration, entrapment, and preservation of petroleum” (Charpentier et al. 2001). The most hydrocarbon prolific petroleum system of the northern Alaska is the Ellesmerian petroleum system (Map 3-1). Oil generated and trapped in the Ellesmerian petroleum system includes Prudhoe Bay and many of the other North Slope fields.

The Alaska North Slope produced 395 MMbbl of oil in 2005 (ADNR 2006). Most oil production has been associated with the Ellesmerian Sequence, largely because of the exceptional reservoir qualities in the Sadlerochit (Ivishak Formation) and Endicott (Kekiktuk Formation) sandstones in this sequence (Figure 3-2). Because of their proven performance as commercial petroleum reservoirs, Ellesmerian Sequence prospects have traditionally formed the chief exploration objectives in northern Alaska. Reservoir qualities comparable to the Ellesmerian reservoirs are rarely found in the younger Beaufortian and Brookian sequences. These younger reservoirs are typically thinner and laterally discontinuous, with lower porosity and permeability. For this reason, these sequences have been viewed as secondary objectives in the past. However, east of the NPR-A, large volumes of low-gravity oil have been discovered in the Brookian West Sak and Ugnu Formations. These discoveries and other discoveries in the Beaufortian rocks within the Colville River Delta area and Northeast NPR-A, have changed the focus of target rocks on the North Slope. Since 2000, Beaufortian Sequence reservoirs, particularly the Alpine field sandstone, have formed the chief exploration target for the wells drilled in the Northeast NPR-A (PI/Dwight’s Plus Drilling Wire 2001).

Future Petroleum Exploration

Although few geologists genuinely expect to find more Prudhoe Bay-sized fields in northern Alaska, many see a high potential for undiscovered fields of more modest sizes. Today, oil fields of 100 to 200 MMbbl are routinely developed, and satellite fields (sharing existing infrastructure) of only 30 to 50 MMbbl are seriously considered for commercial development. With the minimum commercial-field thresholds lowered to these levels because of technological advances in drilling and reservoir development, it is clear there are abundant exploration opportunities throughout northern Alaska. This perception will likely encourage exploration for decades to come.

Industry strategy has also shifted from exploring completely untested (wildcat) geologic plays in remote areas to detailed re-examination of proven plays in areas near existing infrastructure. This strategy is based on two assumptions: 1) exploration that focuses on proven plays is more likely to be successful; and 2) the economics for development are more favorable if existing infrastructure is used. Consequently, new development is likely to expand incrementally from current North Slope infrastructure rather than appear as widely scattered startup projects.

The Alpine field is a key factor in the resurgence of industry’s interest in the NPR-A. The Jurassic reservoirs constitute a new exploration play that is likely to extend over the northern third of the NPR-A. The estimated reserves for Alpine and its satellites has increased from 340 to 370 MMbbl in 1998 (Montgomery 1998) to approximately 510 MMbbl in 2006 (USGS 2006). Alpine-sized fields in remote areas might have been considered sub-economic as recently as a decade ago, but technological advances have made them more economic to develop. The new Alpine field infrastructure (processing, support facilities, and pipeline) and its proximate location to the NPR-A will undoubtedly fit into plans for future developments of commercial discoveries in the planning area.

Oil and Gas Resource Assessment

Numerous oil and gas resource assessments have been conducted for the NPR-A, the most recent of which were completed in 2002 by the USGS (Bird and Houseknecht 2002a, b; Garrity et al. 2002). The 2002 USGS assessments updated the NPR-A assessment conducted in 1995 (Attanasi and Bird 1995, Bird 1995), which included all of northern Alaska. The reader is referred to Chapter III and Appendix 7 of the Northwest IAP/EIS for a detailed discussion of the assessments (USDOI BLM and MMS 2003).

The assessment of oil or gas potential in the NPR-A evaluates two general categories of hydrocarbon resources:

- Conventionally recoverable resource potential, including pooled oil and gas accumulations recoverable by current technology without regard to economic viability; and
- Economically recoverable resource potential, including pools that could be developed and produced profitably under a given set of engineering and economic assumptions.

The 2002 petroleum resource assessment of the NPR-A focused on 22 recognized geologic plays (see Northwest IAP/EIS Maps 99-104; USDOI BLM and MMS 2003). Sixteen individual geologic plays are recognized within the planning area. One or more plays can exist within a petroleum system.

Of the 22 plays within the NPR-A, three plays consist entirely of gas reservoirs, and the remaining 19 plays consist of mixed oil and gas reservoirs. The conventionally recoverable resources amount to a total oil potential ranging from 6,817 to 11,817 MMbbl (95% and 5% probability levels), with a risked mean estimate of 9,101 MMbbl. Conventionally recoverable gas resources range from 23.00 trillion cubic feet (Tcf) to 56.21 Tcf (95% and 5% probability levels), with a risked mean estimate of 37.31 Tcf. For the planning area, the risked mean estimate of conventionally recoverable oil is 4,934 MMbbl of oil and 14.99 Tcf of gas, or 54 and 40%, respectively, of the total for the NPR-A.

The resource potential is not uniformly distributed throughout the NPR-A (see Maps 99-104 in Northwest IAP/EIS; USDOI BLM and MMS 2003). Three plays hold a majority of the undiscovered resource potential. The highest conventionally recoverable and economic potential lies in the northern third of the ACP below the Barrow Arch (Map 3-1). This structural ridge has been a focus for regional oil and gas exploration, and all currently producing fields on the North Slope are located on or near the Barrow Arch. The high oil potential of plays along the Barrow Arch in the NPR-A is recognized in this assessment as well as all previous petroleum assessments of the North Slope.

The oil and gas potential of the NPR-A is dominated by the Beaufortian (or Alpine-correlative) play that contains nearly half of the undiscovered conventionally recoverable oil resources. The geologic conditions that led to the Alpine field are expected to persist across the northern NPR-A. Stratigraphic traps similar to the Alpine field are likely to be the principal targets for future exploration in the NPR-A.

In the south, two plays are identified with significant oil and gas potential—the Brookian Foldbelt and Fortress Mountain Formation-Deep Detached Foldbelt plays. Because these plays are gas-prone, they offer modest-sized oil pools. These plays are far from existing infrastructure and therefore hold limited economic potential for oil.

3.2.6 Paleontological Resources

Most of the NPR-A is underlain by sedimentary rocks, typical of petroleum producing formations. As a result, the bedrock of the Reserve contains a wide array of plant and animal fossils. To date, the earliest fossil reported from within the NPR-A is the tooth plate of a lungfish recovered from a Middle Devonian formation which dates about 380 million years old (Lindsey, 1986). Most subsequent rock formations in the NPR-A exhibit some evidence of a fossil record.

Most of the limestone, sandstone, siltstone, conglomerate, and shale that underlies the NPR-A is marine in origin, and the fossils reflect this. The most common fossils by far are brachiopods, cephalopods, gastropods, pelecypods, sponges, bryozoans, corals, and crinoids. It is in the middle part of the Jurassic Period, roughly 160 million years ago, that the first evidence of terrestrial plant fossils are noted - an indication of at least a temporary retreat of the ancient seas that previously had covered most of the region. Following this period, seas repeatedly advanced and retreated over most or all of the NPR-A. Most of the extensive limestone bedrock exposures in the southern NPR-A contain marine and plant fossils.

One-hundred-million-year-old lower Cretaceous rocks in the NPR-A produce some of the best examples of the flora of that period found anywhere in North America (Lindsey, 1986). These plant fossils also document a change from a warm to a cool climate. It is at this time that modern conifers begin to appear on the North Slope.

Late Cretaceous vertebrate fossils dating from 70 to 65 million years ago are also common. Primary among these are the remains of three types of Hadrosaurs; *Edmontosaurus* sp., *Kritosaurus* sp. and *Lambeosaurus* sp. Hadrosaurs were moderate size (20-40 feet long, 2-4 tons) bipedial, herbivores. Also present are two types of Ceratopsians; quadrapidal herbivores, *Pachyrhinosaurus* sp. and *Anchiceratops*. *Pachyrhinosaurus* is the larger of the two at 18-20 feet in length, about six feet high and weighing about four tons. *Thescelosaurus*, a small (8-12 feet long) bipedial herbivore represents one of the most recent dinosaur species found in the region. Theropod dinosaurs (bipedial) are represented by four carnivorous types; *Albertosaurus* sp. a small version of a Tyranosaur and three wolf-size varieties, *Troodon* sp., *Dromaeosaurus* sp. and *Saurornitholestes* sp. Most of these types of fossils are found along the extensive bluffs of the Colville River downstream from Umiat. Several dinosaur track-way locales have been identified on the Awuna River and Ichthyosaur remains were located and recovered from Cutaway Creek a tributary of the Kuna River. The dinosaur remains in the NPR-A represent one of the farthest north occurrence of dinosaurs in North America.

Data gathered through paleontological research along the Colville, particularly at the Liscomb bone bed near Ocean Point, has challenged long-held theories concerning dinosaur physiology (warm blooded vs. cold blooded) as well as the causal factors leading to extinction (Brouwers et al. 1987; Paul 1988; Clemens and Nelms 1993; Gangloff 1997; Rich et al. 2002). Because of the environment of entombment (permafrost), unusual preservation offers the possibility of DNA and other biomolecular extraction heretofore unattainable in fossils this ancient (Gangloff 1997).

Tertiary (65-1.6 million years ago) fossils are represented primarily by mollusks, ostracods, brachiopods, and bryozoans, although the record is incomplete due to a period of nondeposition and/or erosion that occurred during the Late Tertiary (Lindsey, 1986).

Mammalian fossil remains from 50,000 to 10,000 years ago, the latest portion of the Pleistocene (the last Ice Age), are also abundant in Quaternary deposits across the planning area (Guthrie and Stoker 1990; Hamilton and Ashley, 1993; Matheus 1998, 2000). The bones of horses, mammoths, mastodon, antelope, bison, and lions are a resource of important data reflecting the climate, environment, and ecosystem that existed when the first humans entered the Western Hemisphere from the Old World (Kunz and Mann 1997; Kunz et al. 1999; Guthrie 2006). Mammalian fossils relating to this time period are found throughout the planning area.

Most of the paleontological resources in the NPR-A are, by virtue of their isolation and remoteness, protected from most types of impact other than those caused by natural forces. The bulk of the deposits are deeply buried and the landscape covered by snow and frozen nine months of the year; therefore, they are adequately protected by nature. However, some of the known deposits are to a degree vulnerable, because they are often exposed in an eroding bluff face. In fact, were it not for these exposures, most paleontological deposits would not be discovered. However, the circumstance that led to discovery in some cases allows unauthorized collection and the loss of valuable and important scientific and educational material. Most exposed bluff faces are formed through the erosional activity of rivers and streams. Fossils are commonly exposed or washed out of these bluff faces during annual high-water events. Even in an area as remote as the NPR-A, a river may allow access by boat or by small aircraft that can land on gravel bars. While unauthorized collection of fossil material can, but does not often occur, the potential impact cannot be dismissed. Unauthorized collection is best deterred by a visible presence such as active research rather than irregular law-enforcement patrols (Gangloff 1997).

These paleontological resources are nonrenewable and contain a wealth of information about life forms, geography, and environments of the past, and they must receive adequate protection. Most of the paleontological resources of the NPR-A are yet to be located, and work toward that end is another important step in the protection of this resource.

3.2.7 Soil Resources

Soils in the planning area are underlain by permafrost, or permanently frozen ground, of varying thickness and as a result are continuously cold and water saturated. Except for the active layer, which lies between the top of the permafrost and the ground surface and thaws each summer, the ground is permanently frozen to about 660 to 2,130 feet on the North Slope (NRC 2003). Snow and ice typically cover soils for most of the year. Decomposition rates are slow under these environmental conditions and organic matter tends to accumulate over the mineral soil parent materials as thick peat layers, particularly in low-lying areas (Nowacki et al. 2001). Cold temperatures and frozen conditions slow the process of soil formation, resulting in little profile development (Brady and Weil 1999). During summer, the permafrost thaws to varying depths within the active layer (the depth of seasonal thaw), which typically occurs within a few feet of the soil surface. The presence of permafrost inhibits internal water drainage during the summer thaw, resulting in soils that are poorly drained and continuously wet.

Soil information, and the associated map for the NE NPR-A planning area (Map 3-5), is based on the Exploratory Soil Survey of Alaska (Rieger et al. 1979). This survey was developed to provide general soil information for land-use planning. A primary purpose of soil surveys is to predict soil behavior, hazards, and impacts for selected land uses. Exploratory survey and field mapping was initiated by the Soil Conservation Service (now Natural Resources Conservation Service) in 1967 and completed in 1973. Field mapping was done at a scale of 1:500,000.

Largely derived from existing soil maps and reports, supplemental field observations were made from the air to identify and map distinctive landscape patterns. Soils within each landscape segment were described and classified, and relationships between the soils, the native vegetation, and landforms were noted. The proportion of the area occupied by each major type of soil was estimated. It is important to recognize that this exploratory survey does not provide the level of information required for intensive use of a particular area, as would be available in a more detailed soil survey.

The survey identified five major soil map units within the planning area. Delineations are based on the dominant soils in the landscape; however, other dissimilar soils are present within delineations. Refer to the Exploratory Soil Survey of Alaska for an in depth description of individual soils and soil associations.

3.2.7.1 Map Unit IQ6

This soil map unit occupies most of the eastern part of the ACP in the Northeast planning area. Soils are typically shallow over permafrost and are constantly wet and cold. Soils are poorly drained and have developed principally in deep, loamy sediment under a thick cover of sedge tussocks, low shrubs, forbs, mosses, and lichens. Very poorly drained fibrous peat soils occupy broad depressions, shallow drainageways, and lake borders, commonly under a thick cover of sedges.

3.2.7.2 Map Unit IQ21

This unit occupies most of the western part of the ACP in the planning area. There are many undulating and rolling sand dunes, especially in areas bordering the floodplains of major streams and some of the larger lakes. Most of the soils in the association consist of sandy eolian, alluvial, and marine deposits, but a few formed in loamy material. Poorly drained soils with a shallow permafrost table occupy most of the nearly level areas and the broad swales between dunes. The soils on dunes consist of eolian sand, and although they are perennially frozen below a depth of 30 to 40 inches, they seldom retain enough moisture for large ice crystals to form.

3.2.7.3 Map Unit IQ2

This unit occupies most of the southern part of the planning area in the northern part of the Arctic Foothills Province. Soils vary depending on the landform and landscape features, but all are underlain by continuous permafrost. Most of the soils consist of silty colluvial and residual material weathered from fine-grained, nonacid sedimentary rocks.

3.2.7.4 Map Unit IQ8

This unit occupies a relatively small area in the southern part of the planning area on the hills and ridges of the Arctic Foothills Province north of the Brooks Range. The dominant soils in valleys and on long foot slopes formed in loamy colluvial sediment. On hills and ridges, most of the soils consist of very gravelly material weathered from sedimentary rock. A few soils near the Brooks Range formed in very gravelly glacial drift.

3.2.7.5 Map Unit IQ22

This unit occupies the floodplain of the Colville River through both the Arctic Foothills Province and ACP along the eastern boundary of the planning area. The dominant soils consist of very gravelly stream deposits underlain by permafrost. A general decrease in grain size is evident along the topographic gradient descending from the Brooks Range, extending laterally from fluvial systems and radially inward from lake shores to center (Jorgenson and Pullman 2002).

3.2.8 Sand and Gravel Resources

Oil and gas development activities require granular mineral materials, such as gravelly sand or sandy gravel, for use in the construction of roads, pads, and airfields. Generally, the high cost of obtaining aggregates (sand and gravel) in the Arctic makes them useful for permanent facilities, whereas other, less expensive options, such as ice techniques, are used for temporary or seasonal needs. Whether to use ice, sand and gravel transported over some distance, or enhanced local materials as construction materials is an economic decision. Mineral materials along beaches are a source used in the past and, depending on the specific needs and location, extraction may occur with minimal concern.

Roads in the Kuparuk River Unit and Prudhoe Bay Unit have had the benefit of good-quality gravel sources that have been relatively inexpensive to develop. West of the Colville River, however, the Planning Area is characterized by an apparent scarcity of suitable gravel for road, pad, and airstrip construction (Peratrovich, Nottingham, and Drage, Inc. 2002). The sand and gravel resources and construction techniques relevant to oil and gas exploration and other construction projects in the NPR-A are described in the following documents: Engineering Considerations for Gravel Alternates in NPR-A (USDOI BLM 1981); An Environmental Evaluation of Potential Petroleum Development of the National Petroleum Reserve in Alaska (USGS 1979); The National Petroleum Reserve in Alaska, Earth Science Considerations (Gryc 1985); and Geology and Exploration of the National Petroleum Reserve in Alaska, 1974-1982 (Gryc 1988).

3.2.8.1 Sand and Gravel Deposits

The surface materials of the planning area include marine silts, sands, and clays; beach and deltaic deposits; thaw lake deposits; alluvium and fluvial-lacustrine deposits; eolian sands and upland silts; as well as sandstones and shales. Gravels are found specifically in active and inactive floodplains and low terraces (USDOI BLM and MMS 1998).

Deposits in the ACP are composed of marine sands and silts with depths of 20 to 180 feet. The marine deposits are of two types: silts and clays, or sand over silts and clay, both with high ice content. Beach deposits contain gravely sand and sand with areas of high organic content (wood and peat), that may be well drained when found along low beach ridges. Active ice wedges are well developed, and fossil ice wedges occur locally at depths of a few feet. Alluvium, which consists of deposits of fine to medium sand, silty sand, gravel, and gravelly sand, is probably no more than 15 feet thick along modern channels, and includes floodplain and alluvial terrace deposits up to 24 feet above modern streams. The entire planning area is in a zone of continuous permafrost except for an unfrozen area 6 to 18 feet thick beneath larger channels and lakes. It is typical for deposits to be frozen 2 to 3 feet beneath the active layer during the summer months, while the lower depth of permafrost is measured in hundreds of feet.

The surficial deposits of the Arctic Foothills Province of the planning area are composed of eolian sand and upland silts and an undifferentiated bedrock of sandstones, shales, and conglomerates. Alluvium is found along the river systems as in the ACP. Eolian sand and upland silts (also wind blown) are the most widespread unconsolidated sediments in the entire NPR-A. A band of upland silt stretches from east to west across the NPR-A. The material may contain a high amount of interstitial ice. Locally, the deposits may liquefy when thawed.

3.2.8.2 Gravel Mine Sites

Existing and potential gravel sites within the planning area include the Arctic Slope Regional Corporation (ASRC) Mine Site and the Clover Potential Gravel Source. The ASRC Mine Site is approximately 9 miles southeast of Alpine field site CD-1, on the east side of the Colville River across from Nuiqsut. The site contains sandy gravel to gravelly sand with interbedded layers of silt.

Development of the Alpine field (CD-1, CD-2, CD-3, CD-4) has relied upon material extraction from the ASRC Mine Site. Approximately 5 million cubic yards of sand and gravel has been permitted, with a footprint of up to 150 acres. Development of CD-1 and CD-2 used approximately 889,000 cubic yards of gravel (covering 94 acres), while CD-3 and CD-4 used roughly 566,947 cubic yards of gravel (covering 60 acres). An additional 110,000 cubic yards of gravel are anticipated to expand the CD-2 pad to accommodate the development of Qannik. Material extracted will add an additional 7.75 acres to the existing CD-2 pad (Rothwell, Pers. comm. 2007).

Through 2006, the remaining gravel in-place at the ASRC Mine Site is estimated at approximately 2.4 million cubic yards. The total acreage mined through spring 2005 was 46 acres (Rothwell, Pers. comm. 2007).

The Clover Potential Gravel Source is on the western edge of the Colville River Delta. The initial site was identified from exploratory well cuttings and was further investigated during the winter seasons of 2000–2001 and 2001–2002. It was delineated in 2004 and encompasses about 60 acres projected to yield roughly 1.8 million cubic yards of gravel. Exploratory borings identified sandy gravel and gravelly sand beneath approximately 5 to 20 feet of overburden soils (silts and silty sands). A northern expansion area was identified and delineated in 2005. The expansion area is approximately 100 acres with about 3 million cubic yards of gravel (Rothwell, Pers. comm. 2007).

3.2.8.4 Regulatory Environment

Sand and gravel in the NPR-A are treated as subsurface-mineral resources. Unlike other states, Alaska's mineral-material resources are not conveyed with the surface lands. Until the recent transfers of subsurface estate (i.e., Nuiqsut subsurface to ASRC), the Federal government controlled all mineral materials in the NPR-A. BLM has issued mineral-material permits to the four villages/cities of the NSB for dredging sand and gravel as part of the NSB's Capital Improvement Projects in the 1980s. Nuiqsut dredged material from the Colville River bottom, while Atqasuk used material from the Meade River and the bottom of an adjacent lake. River and ocean-beach materials were used in the 1970s to 1980s for wellsite pad, road, and airfield construction.

3.2.9 Water Resources

Water resources in the planning area consist mainly of rivers, shallow discontinuous streams, lakes, and ponds. Springs are absent in the planning area, and useable groundwater is limited to shallow resources beneath rivers and lakes. Deep groundwater is saline and not potable. Climate and permafrost are the dominant factors limiting water availability. The coastal waters off the NPR-A have pristine water quality in the estuaries (Arctic Monitoring and Assessment Programme 1997). Most freshwaters in the planning area are also pristine. The distribution of fish within the freshwater environment of the planning area varies with season. See the wildlife, fish, and subsistence sections for more detail on human, fish, and wildlife associations with water resources.

3.2.9.1 Surface Water Resources

While hydrologic data for the planning area section of the North Slope is limited, streams and rivers for which data are available share flow characteristics that are somewhat unique to the region (Brabets 1996). Flow is generally nonexistent or so low as to not be measurable most of the winter. River flow begins during breakup in late May or early June as rapid flooding that, when combined with ice and snow, can inundate extremely large areas in a matter of days. More than half of the annual discharge for a stream can occur during a period of several days to a few weeks (Sloan 1987). Most streams continue to flow throughout the summer, but at relatively lower discharges. Runoff is confined to the upper organic layer of soil, as mineral soils are saturated and frozen at depths of 2 to 3 feet (Hinzman et al. 1993). Rainstorms can increase streamflow, but they are seldom sufficient to cause flooding within the ACP. Streamflow rapidly declines in most streams shortly after freeze up in September. Streams on the North Slope are generally divided into three types, based on the physiographic province of their origin: those that originate 1) on the ACP, 2) in the Arctic Foothills, or 3) in the Brooks Range (Map 3-6 and Table 3.2-C).

Table 3.2-C. Summary of Peak Streamflow Data for Select Rivers in the Northeast NPR-A

Stream Location	Headwaters	Drainage Area (mi^2)	Peak Flow (cfs)[1]	Year Flow Recorded	Period of Record
Colville River (near Nuiqsut)	Brooks Range	20,670	580,000	2000	[2]1992-2006
Colville River (Umiat)	Brooks Range	13,830	261,000	2004	2003-2006
Ikpikpuk River blw. Fry Creek	Foothills	1,697	23,00 0	2005	2005-2006
Fish Creek (mile 32)	Coastal Plain	787	3,700	2001	2001-2002, 2005-2006
Miguakiuk River	Coastal Plain	1,460	1,600	1977	1977
Judy Creek (mile 7)	Foothills, Coastal Plain	639	7,100	2002	2001-2002, 2004-2006
Tingmiaksiqvik River (mile 6.8)	Coastal Plain	222	5,300	2003	2001-2006

[1] Cubic feet per second. [2]also 1962, 1964, 1971, 1973, 1977. **Sources:** Arnborg et al. (1967); Childers et al. (1979); Shannon and Wilson Consultants (1996); USDOI BLM (2004c); USGS 2006.

3.2.9.1.1 Rivers and Streams

Arctic Coastal Plain (ACP)
The ACP is a mosaic of tundra wetlands with extremely low relief. Because the permafrost prevents water from entering the ground and the low relief limits runoff, the ACP is covered with lakes, ponds, and generally slow-moving streams. Shallow water tracks may result from snowmelt draining through the permafrost features, often conveying significant discharge where surface relief is limited (Hinzman et al. 1993). Streams originating in the ACP generally have the latest breakup and earliest freeze up and generally cease flowing by December. The most significant coastal rivers and streams in the planning area are the Miguakiak, Kalikpik, and Tingmiaksiqvik rivers and the Fish, Kealok, and Inigok creeks.

Arctic Foothills
Streams originating in the Arctic Foothills have a steeper gradient and consequently more gravel bar and cut bank features than those on the ACP. These streams tend to break up earlier, freeze up later, and have a slightly higher average unit runoff than streams of the ACP. The Ikpikpuk River forms the western boundary of the planning area. The Chipp and Alaktak, large distributary channels that separate from the main stem and drain into Admiralty Bay, are unique features of this river. The Ikpikpuk River continues into a separate delta at Smith Bay. Other large rivers originating in the foothills of the planning area include Judy Creek, Price River and the Kikiakrorak and Kogosukruk rivers.

Brooks Range
The Colville River forms most of the southern and eastern boundaries of the planning area. It is the largest river on the North Slope and intercepts all of the streams originating in the Brooks Range that flow northward through the planning area. As the only river that includes mountainous and glacial drainage, the Colville River carries the highest sediment load and exhibits the greatest range of geomorphic features of any river in the area. Steep cut bank cliffs, deep pools, and large gravel bars are common to most of the rivers adjoining the planning area. Breakup and freezeup are more complex along the Colville River because of the extreme length and range of elevation. Flow generally persists later on the Colville River than on most other North Slope rivers.

3.2.9.1.2 Lakes

Lakes and ponds are the most common feature on the ACP. Unlike streams, which only hold large quantities of water during breakup, lakes store water year-round and are the most readily available water source on the North Slope (Sloan 1987). The origin of most lakes and ponds on the ACP is in the thawing of ice-rich sediments (Sellman et al. 1975). This thawing results in a continuum known as the thaw lake cycle, in which lakes form, expand, and then drain in response to disturbances of the permafrost. Because waterbodies typically freeze to about 6 feet in depth during winter, water depths of 7 feet or more are considered the minimum for supporting overwintering freshwater fish (Phillips Alaska, Inc. 2002; USDOI BLM and MMS 2003). Lakes can then be classified by depth, as either shallow (less than 6 feet) or deep (greater than 6 feet) lakes.

Recharge of lakes in the planning area occurs through three mechanisms: 1) melting of winter snow accumulations within a drainage basin, 2) overbank flooding from nearby streams, and 3) rainfall precipitation (Baker 2002). Some lakes are completely replenished by these processes within 1 year; water volumes in other lakes have much longer residence times, perhaps as long as 25 years (USDOI BLM and MMS 2003). Lake evaporation is also extensive in this region.

From June to August (1994 to 1996), an average of 5.6 inches (14.1 cm) of evaporation was recorded for ponds near Prudhoe Bay (Mendez et al. 1998).

Shallow Lakes and Ponds
Seasonally flooded wetlands, ponds, and shallow lakes (less than 6 feet deep) dominate the ACP of the planning area (Map 3-7). These wetlands, lakes, and ponds are thought to originate in the thawing of the shallowest, ice-rich permafrost layer. The shallow lakes and ponds freeze in mid-September and become ice-free in mid-June, about a month earlier than the deep lakes (Hobbie 1984). While ponds and shallow lakes generally lack fish because they usually freeze solid, they can provide important summer rearing fish habitat if they have a channel connecting them to a stream or deep lake that that supports overwintering fish. They also provide important habitat to emergent vegetation, invertebrates, and migratory birds due to the earlier availability of ice-free areas.

Deep Lakes (greater than 6 feet deep)
Teshekpuk Lake and the southern and western areas of the ACP contain numerous deep-lake basins (Mellor 1987). Most deep lakes are less than 20 feet deep, since the depth of thaw lakes appears to be controlled by the ice volume and porosity in the original sediments, which decrease with increasing depth (Sellman et. al. 1975). Teshekpuk Lake, the largest lake on the North Slope with an area of 212,000 acres, provides a great diversity of habitat types. Besides the central basin with a depth greater than 20 feet, the lake has complex shoreline features with bays, spits, lagoons, islands, beaches, and extensive shoal areas that support wildlife. Because they do not freeze to the bottom, deep lakes provide an overwintering area for fish and aquatic invertebrates and are the most readily available supply of water during the winter for both industry and residents.

3.2.9.1.3 Water Use

Oil field activities in the planning area use ice roads and pads for access and transportation during the winter months. The Alaska Department of Natural Resources (DNR) permits water withdrawals, typically for a period of five years. Each season, millions of gallons of fresh water are withdrawn from lakes to construct ice roads and pads. Approximately 513 million gallons (MG) of water from 126 lakes were used to drill 20 wells and construct 23 ice drill pads and roads from1999-2006. This is in contrast to a permitted volume of 2,000 MG from 376 lakes for the same period (USDOI BLM 2006). Water withdrawal begins as early as December and continues through April. Ice roads are usually completed by mid-winter; however, water withdrawals for ice road and pad maintenance continue throughout the exploration season. In addition to ice roads and pads, freshwater lakes are used as potable water supplies for temporary rig and exploration camps and as sources of make-up water for exploration drilling (Baker 2002).

Generally, DNR permits water withdrawals from lakes 7 feet deep or deeper, to 15% of the estimated free-water volume below an assumed ice thickness of 7 feet in lakes that contain sensitive species fish (i.e. fish species other than ninespine stickleback or Alaska blackfish). DNR permits up to 30% of the under ice water to be removed from lakes deeper than 5 feet, if only resistant fish species (i.e. ninespine stickleback and/or Alaska blackfish) are present, since they can survive lower dissolved oxygen levels. For non-fish bearing lakes, regardless of depth, DNR may permit up to 20% of the total lake volume as either water and/or ice aggregate equivalent. An exception to the 20% water withdrawal volume for non-fish bearing lakes may be granted if the permittee agrees to conduct a study to document lake recharge or to develop a predictive methodology to determine if a particular lake has adequate drainage area and recharge capabilities to support sustained withdrawal beyond current recommended levels.

Subsistence users also rely upon lake water resources within the planning area for fishing, boating, and drinking water at camps and cabins. The amount of fresh water withdrawn from thaw lakes and ponds as a result of subsistence activities is negligible compared to oil and gas operations. Water withdrawal for subsistence purposes occurs on a year-round basis. In the winter and spring, many camp and cabin owners harvest ice from the nearest water body for cooking, drinking, and bathing (H. Brower, Jr., pers. comm.). Ice fishing also occurs in the deeper lakes.

Rivers and major lakes also play important roles as transportation corridors to access subsistence resources and cabins. Water is utilized from these sources for drinking water, food preparation, and washing using various methods of preparation before use such as filtering and boiling. Large lakes, such as Teshekpuk Lake, play important roles as insect relief areas for caribou, due to the prevailing winds and proximity to the coast and river deltas. Yellow-billed loons have a preference for larger lakes, deeper lakes, lakes connected to streams, and lakes with complex lake shore line shapes (Stehn et al. 2005).

Estuarine Waters

The NPR-A includes several estuaries. The basic characteristics of the bays and coastal waters are summarized in reports by Barnes et al. (1984), and the OCS Environmental Assessment Program (U.S. Department of Commerce [USDOC] NOAA OCS Environmental Assessment Program [OCSEAP] 1978, 1987, 1988; USDOC NOAA OCSEAP and MMS 1984). These reports state that all of the NPR-A bays and lagoons are very shallow and are shoreward of the 33-foot (10-meter) isobath (line of equal bathymetry or water depth). The circulation in this shallow water during the summer is wind-driven and rapid. Circulation is very slow under the winter ice cover. When seawater freezes, only the water molecules form ice; the salt is cast off as brine into the underlying water column. The brine does not drain or flush out of the shallow bays. Instead, it collects on the seafloor, gradually raising the salinity level from 32 to over 100 parts per thousand in some seafloor depressions (Schell 1975, Newbury 1983). The coastal waters off the NPR-A generally have pristine water quality in the estuaries (Arctic Monitoring and Assessment Programme 1997).

Sea Ice

From November through early June, 90-100% of the Beaufort Sea off the planning area is covered with sea ice (USDOI MMS 1996a). The formation of first-year sea ice, signaling the start of freezeup along the Beaufort coast, may start as early as the beginning of September or as late as December. During the first part of freezeup, nearshore ice is susceptible to movement and deformation by modest winds and currents. Movement may be a mile or more per day and deformation may take the form of ice pileups and rideups on beaches and the formation of offshore rubble fields and small ridges. Ice rideups occur when a whole ice sheet slides in a relatively unbroken manner over the ground; rideups greater than 160 feet are not very frequent. By late winter, first-year sea ice is about 6 to 7 feet thick. In waters 6 to 7 feet deep, the ice freezes to the seafloor and forms the bottomfast-ice subzone of the landfast-ice zone. The landfast-ice zone may extend from the shore out to depths of 45 to 60 feet. The ice in water depths greater than about 6 or 7 feet is floating and forms the floating fast-ice subzone. As the winter progresses, extensive deformation within the landfast-ice zone generally decreases as the ice thickens and strengthens and becomes more resistant to deformation.

Along the Beaufort Sea coast, breakup generally begins about mid-July but may occur in mid-June or late August. River ice begins to melt before the sea ice and, during the early stages of breakup, water from rivers may temporarily flood ice that has formed on deltas.

Several recent studies have shown that arctic sea ice has been both shrinking and thinning during the past half century (ACIA 2004). As the sea ice melts, the surface water can absorb more heat from the sun. This results in a positive feedback loop that causes more rapid melting of the sea ice. Based on climate modeling, one study funded by the National Science Foundation and NASA concluded that melting could occur so rapidly that the arctic could become ice free in summer by 2040 (Holland et. al. 2006).

3.2.9.2 Surface Water Quality

Most freshwaters in the planning area are pristine and, like those of Teshekpuk Lake, are soft, dilute calcium-bicarbonate waters. Near the coast, sodium chloride (salt) concentrations predominate over bicarbonate concentrations (USDOI BLM National Petroleum Reserve – Alaska Task Force 1978a; Prentki et al. 1980). The freeze/thaw cycle in the Arctic plays a controlling role in water quality. In winter, surface waters less than 6 feet deep will freeze solid (Hobbie 1984). In such waters, major ions and other "impurities" are excluded from downward-freezing ice in autumn and forced into the underlying sediment. Most of the ions remain trapped in the sediment after the next spring's meltout, giving these waters a very low dissolved matter concentration. During the summer, dissolved matter concentrations slowly increase as ice in the bottom sediment melts and the sediments compress (Miller et al. 1980).

In waters deeper than 6 feet, ions are forced into the deeper water column with a proportionate increase in concentrations of dissolved materials. As a result, distinct off-flavor and saline taste affect the potability of water from shallower "deep-water" lakes and river pools by late winter. Table 3.2-D illustrates differences between late winter and late summer water quality values from lakes located 7 to 14 miles west of Nuiqsut.

Table 3.2-D. Water chemistry parameters for select lakes in the NPR-A

Lake	Date	pH	Sp.Cond. US/cm	D.O. mg/L	Turbidity NTU	TDS mg/L	Alk mg/L	Iron mg/L	Cl mg/L
L9807[1]	4/23/02	7.6	690	.05	77	488	330	14.6	57.2
	8/13/02	6.5	130	11.1	11.1	34	61	U	13.1
L9823[2]	4/25/02	6.6	550	0	8.6	496	144	2.3	130
	8/13/02	8.3	170	11.0	1.0	123	NA	NA	33.9
M0024[1]	4/24/02	6.9	380	3.9	5.8	390	132	.59	45.4
	8/12/02	8.2	90	11.6	1.4	71	31	.26	16.2
M9914[1]	4/23/02	7.4	570	0	27	364	220	7.0	62.4
	8/12/02	8.1	80	11.3	1.4	54	31	U	12.0

[1] approximately 7 ft deep, [2] approximately 11 ft deep (Baker 2002)

3.2.9.2.1 Potability

Ponds and local streams are highly colored from dissolved organic matter and iron; the water tastes fine but is considered marginally potable to unpotable because of iron staining and fecal contamination in areas with dense avian (Ewing 1997), caribou, and lemming populations.

Lemming fecal material generally is abundant in upper coastal tundra soils (Gersper et al. 1980). Cold temperatures, a characteristic of tundra soils and waters, tend to prolong the viability of fecal coliform, the standard water-quality measure for fecal contamination. Thus, some smaller waterbodies in the NPR-A may exceed State of Alaska standards for fecal coliform in drinking water or water recreation due to local wildlife abundance (there is no state standard applicable to growth and propagation of natural aquatic life or wildlife). Lakes and larger rivers tend to be less colored and, due to their greater volume, would be less likely to have elevated concentrations of fecal coliform. Teshekpuk Lake, the Miguakiak River, the upper Colville River, and the Ikpikpuk River may receive some human fecal coliform contamination because of the increase in unregulated long-term campsites and cabins without adequate sewage disposal; however, impacts would not significantly raise levels in these water bodies or be measurable except in very localized situations.

3.2.9.2.2 Turbidity

Most planning area freshwater areas have low turbidity or suspended-solid concentrations. The exceptions are the larger rivers, possibly shallow floodplain lakes, and waters from thermokarst erosional features. Thermokarst is an altering of the terrain caused by thawing permafrost that results in subsidence and water pooling.

Approximately 70% of the sediment load for the Colville River is carried during breakup, with suspended-sediment concentrations reaching 870 milligrams per liter (USDOI BLM 1978a). Later in summer, suspended-sediment concentrations decrease to as low as 3 milligrams per liter. The Colville River, with its origins in the foothills of the Brooks Range, carries a greater suspended load than rivers originating within the ACP, and it is the most turbid river in the ACP of the NPR-A. Other rivers in the NPR-A range from about 100 milligrams per liter suspended sediment at peak-flow rates down to 3 to 10 milligrams per liter at lower rates.

3.2.9.2.3 Alkalinity and pH

Alkalinity and pH are important parameters in controlling the susceptibility of freshwaters to acid rain or acid snowmelt. Alkalinity is a measure of the acid-buffering capacity of the water. The pH is a measure of the hydrogen ion concentration in the water. A pH of 7 indicates a neutral balance of acid and base in the water; and a pH between 5.0 and 6.5 indicates slightly acidic water; a pH below 4.5 indicates acidic water. The State of Alaska considers a pH range within 6.5 to 9.0 necessary to protect aquatic wildlife. Most surface waters have a pH ranging from 6.5 to 8.5. Rainwater has a pH of 5.5 due to carbon dioxide in the atmosphere. Plants and aquatic life tend to buffer the pH of surface waters and keep the pH in the range of 6.5 to 8.5.

In the NPR-A coastal tundra, freshwaters are weakly buffered (USDOI BLM 1978a; Prentki et al. 1980; Hershey et al. 1995; O'Brien et al. 1995). Lake alkalinities also are low, approximately 0.5 milliequivalents/liter (meq/l). Alkalinities in individual NPR-A coastal rivers are higher, ranging from about 0.3 to 1.6 meq/1 in summer, with higher values at lower flow rates. In ponds, pH values are often depressed to below a pH of 7.0 due to snowmelt runoff; after snowmelt, their pH values usually increase to between pH 7.0 and 7.5 (Prentki et al. 1980). The initial low pH is due to acidity of snow on the North Slope, which has a median pH of 4.9 (Sloan 1987). This low pH, lower than the pH of 5.5 expected for uncontaminated precipitation, is thought to be a result of sulfate fallout from industrially contaminated Arctic air masses. In lakes, pH values are near neutral (O'Brien et al. 1995). In tundra brown-water streams and some foothill streams, pH values can be less than 6.0, with an acidity attributable to naturally occurring organic acids (Hershey et al. 1995; Milner et al 1995; Everett et al 1996). In tundra rivers, pH values are higher, seasonally ranging between 6.4 and 8.2 in the Colville, Meade, Chipp, and Miguakiak rivers (USDOI BLM 1978a).

3.2.9.2.4 Dissolved Oxygen

Most of the world's surface waters are near saturation with dissolved oxygen due to aeration of flowing waters. The concentration of dissolved oxygen in Arctic waters tends to be higher than in other waters because the solubility of oxygen increases with decreasing water temperature. In deeper NPR-A coastal plain lakes, waters remaining beneath the ice may become supersaturated with oxygen in winter (USDOI BLM 1978a; Prentki et al. 1980; O'Brien et al. 1995). During ice formation, dissolved oxygen is excluded from the ice into the water column. Exclusion adds more oxygen than underwater respiration removes. In shallower lakes, dissolved oxygen measurements taken below ice do not show consistent results from year to year and do not generally remain saturated. Lakes sampled in the Nuiqsut area during winter were found to be stratified within the water column and levels were often no more than 1 to 2 mg/l within the bottom 1 to 2 feet of the water column (Hinzman et al 2006). Consumption of dissolved oxygen is mostly due to bacterial respiration and chemical oxidation at the sediment/water interface and fish in the water column only contribute minimally to the depletion (Stefan 1992); however, oxygen depletion, caused by overcrowding or over-demand by biological and chemical processes, can result in fish mortality (Schreier et al. 1980; Schmidt et al. 1989; Reynolds 1997).

3.2.9.2.5 Indicator Hydrocarbons

Pond waters away from development in the Prudhoe Bay area contain 0.1 to 0.2 parts per billion (ppb) total aromatic hydrocarbons, similar to concentrations in pristine marine waters (Woodward et al. 1988). Concentrations in NPR-A waters are expected to be similar. Hydrocarbons derived from the various sources are detectable as elevated levels of saturated and polycyclic aromatic hydrocarbons (PAH) in Colville River sediment and in Harrison Bay sediment (Boehm et al. 1987). Additional pyrogenic PAH compounds are present in tundra soils and form a depositional record of atmospheric fallout from tundra fires. Concentrations of indicator hydrocarbons from these multiple sources are high and chemically similar to those found in petroleum, thus making it difficult to detect or distinguish anthropogenic contamination from natural background due to fires. Similarly, high levels of hydrocarbons found in other major Beaufort Sea rivers and have been attributed to natural sources (Boehm et al. 1987; Yunker and MacDonald 1995).

3.2.9.2.6 Trace Metals

Aquatic bodies in the NPR-A are, in general, low in trace metals compared with most temperate freshwaters (Prentki et al. 1980). In measurements made in ponds near Barrow in 1971-72, dissolved copper concentrations were on the order of 1 ppb, dissolved lead 0.7 ppb, and dissolved zinc 5 ppb. Lakes sampled west of Nuiqsut during early 2002 found non-detect levels of arsenic, cadmium, chromium, lead, selenium, silver, and mercury (Baker 2002).

3.2.9.3 Groundwater Resources and Quality

3.2.9.3.1 Shallow Groundwater Sources

Lakes and rivers deeper than about 6 feet do not generally freeze to the bottom in winter. This creates a layer of unfrozen sediments, or taliks, beneath the permafrost (Sloan 1987). When the sediments are porous materials, such as sand or gravel, an aquifer suitable for pumping groundwater may exist. Shallow groundwater resources are likely in the planning area beneath the Colville River, Teshekpuk Lake, and other deep, large lakes.

Shallow groundwater is also found within permafrost as discontinuous confined water bodies. The presence of dissolved salts depresses the freezing point of water and allows for local accumulations of saline water within the permafrost. The water is unsuitable for drinking and potentially harmful to vegetation when discharged on the tundra surface (USDOI BLM and MMS 2003). The available volumes of this type of shallow groundwater are limited because of the local and restricted nature of the groundwater formation.

3.2.9.3.2 Deep Groundwater Sources

Deep wells drilled through the permafrost near Barrow have encountered highly mineralized groundwater at depths of 1,600 to 2,500 feet (Kharaka and Carothers 1988). Temperature logs from 25 wells drilled across the North Slope indicate that the depth to the base of permafrost, and consequently the sub-permafrost water, is generally shallower to the west. Deep wells drilled through the permafrost in the Prudhoe Bay area have encountered highly mineralized groundwater at depths of 3,000 to greater than 5,000 feet (Sloan 1987). Available data suggest that deep groundwater in the planning area would probably be similar to that found at Barrow and Prudhoe Bay, and would be too saline for domestic use without treatment (desalinization).

3.2.9.3.3 Recharge

Snowmelt provides the major source of water for recharge to the shallow water-bearing zones that occur below large lakes and major streams and to the annual thaw zones that occur beneath ponds and marshy areas (USDOI BLM and MMS 2003). Deeper groundwater zones beneath the permafrost, however, are not as readily recharged. Subpermafrost water may be recharged from areas to the south in the Arctic Foothills and the Brooks Range by infiltration of meltwater.

3.2.9.4 Permafrost

The NPR-A is underlain by continuous permafrost (USDOI BLM 1978a). The thickness of permafrost in the NPR-A ranges from about 650 to 1,330 feet (compared to 1,980 to 2,100 feet in Prudhoe Bay; Lachenbruch et al. 1988). Permafrost is defined as soil, sand, gravel, or bedrock that has remained below 32 °F for 2 or more years (Muller 1945). Almost continuous throughout the North Slope, permafrost can exist as massive ice wedges and lenses in poorly drained soils or as a relatively dry matrix in well-drained gravel or bedrock.

Permafrost forms a barrier that prevents infiltration of surface water, maintains a saturated layer of surface soils, and restricts groundwater sources to shallow unfrozen material beneath deep lakes and rivers or very deep wells. The limited amount of groundwater on the North Slope is due largely to the presence of permafrost (Williams 1970). Thawing ice-rich permafrost can cause surface subsidence or thermokarst, resulting in thaw lakes, ponds, or beaded stream channels.

Many permafrost soils contain significant amounts of ice, especially near the surface. A layer of surficial material overlying the permafrost (termed the active layer) thaws and freezes each year because of seasonal variations in air temperature and solar radiation. In the NPR-A, the active layer usually is 1 or 2 feet thick (USDOI BLM 1978a). In coarse-grained soils on the tops of bare ridges or on south-facing slopes with little vegetative cover, the active layer may be as much as 5 feet thick or more. In ice-rich silty soils on north-facing slopes or in marshes having thick vegetative and litter cover, the active layer may be less than 6 inches thick.

Lakes and streams in the ACP of the NPR-A influence the characteristics of the upper permafrost surface (USDOI BLM 1978a). Shallow lakes and streams that freeze completely in the winter are directly underlain by permafrost. Deep lakes greater than 7 feet in depth, and major rivers, typically do not freeze to the bottom in winter and are underlain by a thaw depression in the permafrost table.

3.2.10 Wastes, Solids, and Hazardous

In general, the planning area is large and has had relatively limited human or industrial uses, some of which introduced solid wastes and/or hazardous wastes into the environment. Industrial activity has consisted of USDOD sites, including the Distant Early Warning (DEW)-Line stations to provide military satellite and coastline surveillance; oil and gas drilling programs conducted by the U.S. Navy (1945-1977), the USGS (1977-1981), and private companies (1982-present); and winter petroleum seismic-exploration operations conducted by private companies. Other uses including overland transport, research, and land management activities has produced long term camps (Inigok, Teshekpuk Lake, Umiat) with associated incidental fuel spills or solid wastes. Subsistence hunting, fishing, and travel have resulted in very small scale localized fuel spills, debris or litter primarily around long use camp sites.

3.2.10.1 Oil and Gas Well Sites

Hazardous materials contamination and solid wastes are assumed to be associated with areas of abandoned well sites from drilling activities in the 1940s through 1980s, including the drill pad, reserve pit, and flare pit. The reserve pits are regulated by the State of Alaska as permitted solid waste facilities. In 2005, the J.W. Dalton exploratory well received final plugging and abandonment and the well piping was cut off five feet below sea level in 2005, in response to accelerated shoreline erosion which threatened the well site. The J.W. Dalton permitted reserve pit was likewise removed in 2005 and all drilling wastes removed (no solid wastes were present), thus receiving final permanent closure from ADEC. All 13 remaining reserve pits within the NE NPR-A are in “closed” status by ADEC.

In 1988, site characterizations were conducted in a joint BLM/USGS effort at 28 USGS well sites in the NPR-A; 14 sites are located in the planning area. The report concluded that no significant risks to the environment existed as a result of the 1988 conditions at the 28 sites. Detailed information concerning the contaminants found at each well site and data summarization can be found in the USDOI (1992) publication titled: Environmental Status of 28 Oil and Gas Exploration Areas of Operation in the NPR-A.

Since 1998, exploration wells have been drilled using ice pads and/or other removable material and no reserve pits. All drilling and other wastes have been backhauled out of NPR-A for disposal at permitted disposal sites or for deep well reinjection disposal.

3.2.10.2 Landfills

Solid-waste landfills have been associated with virtually all of the early USDOD drilling sites and DEW-Line sites. Site investigations have been conducted by the USDOD at 20 sites located along the ACP. Three of these sites are located within the planning area: Point Lonely (including a portion of Camp Lonely), Kogru DEW-Line Station (abandoned), and Umiat Airfield (abandoned). Contaminants including heavy metals (lead), petroleum, oils, lubricants, polychlorinated biphenols (PCBs), and pesticides (specifically dicholorodiphenyltrichloroethane [DDT]) have been identified at Umiat, Pt. Lonely, and Kogru.

Remedial actions currently being conducted by the USDOD include excavating or capping contaminated soils, and removing unsafe structures at these abandoned sites. Approximately 16,000 cubic yards of contaminated soil was removed from the sites of USDOD Umiat Wells 2 and 5 in 2002. Surface petroleum contaminated soils discovered at Kogru have been removed and surface confirmation monitoring has been performed.

Coastal erosion has impacted the Kogru DEW-Line site and the landfills at Kogru, Pt. Lonely Lagoon and Camp Lonely, resulting in waste materials being released to the Beaufort Sea. Shoreline erosion has also impacted the East Teshekpuk reserve pit, resulting in scrap metal wastes being released to the lake waters. Shoreline erosion reached the J.W. Dalton well site and reserve pit, near Pt. Lonely, in 2004. Emergency removals were conducted in 2005 to prevent potential releases to the Beaufort Sea. Shoreline erosion monitoring is continuing at additional sites, such as the Drew Point and Atigaru well sites, which are anticipated to eventually be impacted. Colville River erosion has resulted in surface exposure of Umiat landfill wastes, including a small electric transformer, discovered and removed in 2003 by the USACE.

3.2.10.3 Other Uses

Commercial, research, and field-management activities in the planning area have included winter overland transportation services along established trail corridors servicing North Slope communities, camping, and helicopter flying. Spills of fuel, oil, and other petroleum products may have occurred in the past as a result of these activities. Currently, state law requires all travelers to be responsible for adequate prevention of spills and for prompt notification and cleanup, should a spill occur.

3.2.10.4 Distribution and Numbers of Sites within the Planning Area

Three Federal facility sites (Kogru, Pt. Lonely DEW-Line site and the Formerly Used Defense site, Umiat), six solid-waste-disposal sites (Umiat, Camp Lonely, Pt. Lonely DEW Lagoon, Pt. Lonely DEW South, Kogru DEW, and West Kogru), and 13 State of Alaska permitted reserve pit waste disposal sites are found in the planning area. The sites are as listed in the following table:

Table 3.2-E. Waste Disposal Sites

Site Name	Status	Site Type	Latitude	Longitude
Atigaru Reserve Pit	1995 ADEC Closure	USGS Oil and Gas Reserve Pit Landfill debris, Petroleum-Oil-Lubricants (POLs)	70º 33'N	151º 43' W
Cape Halkett Reserve Pit	1995 ADEC Closure	USGS Oil and Gas Reserve Pit	70º 53' N	153º 54' W
Drew Point Reserve Pit	1995 ADEC Closure	USGS Oil and Gas Reserve Pit Landfill - debris, POLs	70º 53' N	153º 54' W
East Teshekpuk	1995 ADEC	USGS Oil and Gas	70º 34' N	152º 56'W

Site Name	Status	Site Type	Latitude	Longitude
Reserve Pit	Conditional Closure	Reserve Pit Landfill debris, POLs		
Ikpikpuk Reserve Pit	1995 ADEC Closure	USGS Oil and Gas Reserve Pit	70º 27'N	154º 20' W
Inigok Reserve Pit	1995 ADEC Closure	USGS Oil and Gas Reserve Pit	70º 00' N	153º 06' W
J.W. Dalton Reserve Pit	Removed; Permanent ADEC Closure	USGS Oil and Gas Reserve Pit	70º 55 N	153º 15'W
Koluktak Reserve Pit	1995 ADEC Closure	USGS Oil and Gas Reserve Pit	69º 45' N	154º 37' W
North Inigok Reserve Pit	1995 ADEC Closure	USGS Oil and Gas Reserve Pit	70º 15' N	152º 46' W
North Kalikpik Reserve Pit	1995 ADEC Closure	USGS Oil and Gas Reserve Pit	70º 31' N	152º 22' W
SeaBee Well Site	1995 ADEC Closure	USGS Oil and Gas Reserve Pit	69º 23' N	152º 11' W
South Harrision Bay Reserve Pit	1995 ADEC Closure	USGS Oil and Gas Reserve Pit Landfill debris	70º 25' N	151º 44' W
West Fish Reserve Pit	1995 ADEC Closure	USGS Oil and Gas Reserve Pit	70º 20' N	152º 04' W
Gubic		Navy Drill Site; Debris, 2500 drums, 20 tons metal	69º 25' N	151º 26' W
Mona Lisa		Navy Exploration Site; Debris 500 drums	69º 55' N	153º 22' W
Wolf Creek		Navy Drill Sites; 1950 drums, scrap metal, unused drilling muds	69º 23' N	153º 16' W
Square Lake		Navy Drill Site; debris and drums	69º 35' N	153º 15' W
Camp Lonely	2006 Site Investigation	Landfill – Husky, et al.; contaminated soils	70º 55 N	153º 16'W
Pt. Lonely DEW-Line Station with 2 landfills	2006-Fuel Tank Removals	CERCLIS Federal Facility: Formerly Used Defense Site	70º 55 N	153º 16'W
Kogru POW-B DEW-Line Station with 1 landfill	2000-Buildings Removed	CERCLIS Federal Facility: Formerly Used Defense Site	70º 03' N	154º 43' W
Umiat Airfield	On State of Alaska lands	CERCLIS Federal Facility: Formerly Used Defense Site	69º 23 N	152º 08' W
Umiat Landfill	1997-Site Characterization	Mid-1970's DOD landfill	69º 23 N	152º 07' W

3.3 BIOLOGICAL RESOURCES

3.3.1 Special Areas

The NPRPA authorized the Secretary of the Interior to identify areas in the NPR-A "containing any significant subsistence, recreational, fish and wildlife, historical, or scenic value." Any exploration in these areas shall be conducted in a manner which will "assure the maximum protection of such surface values to the extent consistent with the requirements of the Act for exploration of the reserve." (42 USC § 6504). Federal regulations state that such values may be protected by limiting, restricting, or prohibiting the use of and access to appropriate lands in the NPR-A, including, but not limited to, rescheduling activities and use of alternative routes; types of vehicles and loading; limited types of aircraft in combination with minimum flight altitudes and distances from identified places; and special fuel handling procedures (43 CFR §§ 2361.1(c) and 2361.1(e)(1).

In 1977, the Secretary of the Interior designated three areas within the NPR-A as special areas (Map 1-3) (Federal Register, June 3, 1977). The Utukok River Uplands Special Area contains critical calving habitat for caribou and covers about 4 million acres. This area is about 65 miles west of the planning area.

The Teshekpuk Lake Special Area originally contained approximately 1.7 million acres. It includes important nesting, staging, and molting habitat for a large number of waterfowl and shorebirds and critical Teshekpuk Lake Herd (TLH) caribou calving, migration, and insect-relief habitat. It also includes the 211,000-acre Teshekpuk Lake, which is the dominant lake feature in the planning area. Almost the entire area is within the planning area boundary; only a small portion lies west of the Ikpikpuk River, which is the western boundary of the planning area. Consistent with a decision of the 1998 ROD for the Northeast NPR-A IAP/EIS, roughly 10,000 acres encompassing the Pik Dunes were added to this Special Area (Federal Register, April 6, 1999). For more information on the importance of this area, especially for waterfowl and caribou, see the discussion of Teshekpuk Lake, the Goose Molting Area, the Teshekpuk Lake Caribou Habitat Area, the Pik Dunes, the Caribou Movement Corridors, and the Southern Caribou Calving Area, all of which are entirely in the Special Area, and the Coastal Area, which is almost completely in the Special Area, in **section 2.2.2,** and the discussion of waterfowl and caribou in **sections 3.3.6 and 3.3.7.1**, respectively.

The Colville River Special Area as established in 1977 encompassed 2.3 million acres, including the bluff and riparian habitats of the Colville River, which are unique both biologically and geologically in the North Slope. This area has been recognized since the 1950s as one of the most significant regional habitats for raptors in North America (Kessel and Cade 1956, 1958; Cade 1960; White and Cade 1971). The northeastern third of the Colville River Special Area is within the planning area; the remainder is primarily within the Northwest NPR-A. The lower two-thirds of the Colville River support the highest concentrations of raptors, passerines, and moose on Alaska's North Slope. More than half of the known peregrine, gyrfalcon, and rough-legged hawk territories along this reach are in the planning area. The raptors nest on bluffs adjacent to the river and are sensitive to disturbance. As a result of a decision made in the 1998 Northeast NPR-A ROD, an area extending two miles on either side the Kikiakrorak and Kogosukruk rivers, two major tributaries of the Colville, as well as several southern tributaries of the Kogosukruk River, were added to the Colville River Special Area (Federal Register, April 6, 1999).

3.3.2 Vegetation

The vegetation of the planning area consists primarily of dwarf shrubs, herbaceous plants, lichens and mosses, which grow close to the ground. Efforts to map the vegetation of Alaska's North Slope occurred as early as 1944 (Spetzman 1959). Most recently, the Circumpolar Arctic Vegetation Map Team (2003) worked to standardize techniques and map the entire Arctic region. The Circumpolar Arctic Vegetation Map (CAVM) shows the types of vegetation that occur across the Arctic. The CAVM team grouped over 400 described plant communities into 15 different physiognomic units based on plant growth forms. From this project the Alaska Arctic Tundra Vegetation Map was developed in 2006. However, there is no way to ascribe accuracy to this data as multiple data sources were combined (Raynold, pers comm, 2007).

The National Petroleum Reserve, Alaska Earth Cover Classification (USDOI BLM 2002) was developed using Landsat Thematic Mapper satellite imagery. This data is used here as it has known accuracy compared with other datasets available. The Earth Cover Classification identified seven major (85% accuracy) and 17 minor (75% accuracy) land-cover classes in the planning area. These classes were distinguished from one another based on their relative composition in terms of percent cover of water, bare ground and plant species (Table 3.3-A). The seven major land cover classes are described below and shown in Map 3-8. The subclasses are described below as well.

1. **Water**
   a. Clear - Fresh or saline waters with little or no particulate matter. Clear water areas are typically deep (> 1 meter). The clear water class generally contains less than 15% cover of pendent grass and water sedge.
   b. Turbid - Shallow water (< 1 meter) or water with particulate matter that typically occurs in shallow lake shelves, deltaic plumes and rivers and lakes with high sediment loads. Turbid water generally contains < 15% cover of pendent grass and water sedge
   c. Ice – May last into late summer on lakes and larger ponds. Ice is present year round on many larger lakes.

2. **Aquatic**
   a. Water sedge – Associated with lake or pond shorelines and composed of 50-80% clear or turbid water > 10 centimeters deep. The dominant species is Water sedge. A small percentage of pendent grass, common mare's tail, marsh fivefinger, or marsh marigold may be present.
   b. Pendent grass – Associated with lake or pond shorelines and composed of 50-80% clear or turbid water > 10 centimeters deep. The dominant species is Pendent grass. A small percentage of water sedge, common mare's tail, marsh fivefinger, or marsh marigold may be present

3. **Flooded Tundra**
   a. Low Centered Polygons – Polygon features that retain water throughout the summer. This class is composed of 25-50% water. Water sedge is the dominant species in the permanently flooded areas. The drier ridges of the polygons are inhabited mostly by cottongrass, sphagnum moss, willow, bearberry, Labrador tea and dwarf birch.
   b. Non-pattern- Continuously flooded areas are composed of 25-50% water. Water sedge is the dominant species. Other species may include common mare's tail, marsh fivefinger, and marsh marigold. Non-pattern is distinguished by the lack of polygons and associated shrub species.

4. Wet Tundra

a. Wet Tundra – Associated with areas of super saturated soils and standing water, Wet tundra often floods in early summer and usually drains excess water during dry periods, but remains saturated throughout the summer. It is composed of 10-25% water. Water sedge is the dominant species. Other species include cottongrass, other sedges, grasses and forbs.

5. Moist Tundra

a. Sedge/Grass Meadow - This class commonly consists of a continuous mat of sedges and grasses where Water sedge is the dominant species. Other dominants include cottongrass, arctic bentgrass and arctic bluegrass. Other species are arctic bell heather, Labrador tea and blueberries.
b. Tussock tundra – This class is common throughout the foothills and may be found on well drained soils. It is dominated by cottongrass tussocks with moss as the most common inter-tussock growth form. Lichen, forbs and low shrubs in varying densities are also present.
c. Moss/ Lichen – Associated with low lying lakeshores and dry sandy ridges dominated by moss and lichen species. As this type grades into the sedge type, grass-like plants such as water sedge may increase in cover forming an intermediate zone.

6. Shrub

a. Dwarf – Associated with ridges and well-drained soils and dominated by shrubs < 1 meter tall. It is the most species diverse class because of the relative dryness of the site. Major species include willow, dwarf birch, Labrador tea, Mountain avens, blueberries, bearberry, tussock cottongrass and Water sedge. This class frequently occurs on a substrate of cottongrass tussocks, and is separated from the tussock tundra subclass by having a shrub canopy cover > 40%.
b. Low – Associated with small streams and rivers but also occurring on hillsides in the southern portion of NPR-A. This class is dominated by shrubs between 30 centimeters and 1.5 meters. Major species include willow, dwarf birch, alder and Labrador tea.
Tall – Found along the Colville River and some of its major tributaries and dominated by willow species > 1.5 meters tall. This class may also contain alder > 1.5 meters tall.

7. Barren Ground

a. Dunes/Dry Sand – Associated with streams, rivers, lakes, coastal beaches and dominated by dry sand with < 10% vegetation. Plant species may include bluegrass, willow, sedge, bearberry, creeping alkali grass.
b. Sparsely Vegetated – Occurs primarily along the coast in areas affected by high or storm tides, in recently drained lake or pond basins and where there is bare mineral soil that is being re-colonized with vegetation. This class is dominated by non-vegetated material with 10-30% vegetation. The plants in these areas may include rare plants, but some of the more common plants are bluegrass, willow, starwort, milk vetch, sedge, bearberry and creeping alkali grass.
c. Other – Associated with rivers and stream gravel bars, mountainous areas and urban areas. Includes less than 10% vegetation and may include dead vegetation associated with salt burn from ocean water.

Table 3.3-A. Northeast National Petroleum Reserve – Alaska Land Cover Classifications

Land Cover Class/Subclass	Characteristics of Land Cover Class/Subclass	Percent of Planning Area Covered
Water	**>80% water**	**21.4**
Ice	≥60% ice	2.2
Clear water	Depth >3.3 feet (1 meter) and no turbidity	10.8
Turbid water	Depth ≤3.3 feet (1 meter) or turbid	8.4
Aquatic	**>50% but <80% water and > 4 inches (10 cm) deep**	**4.2**
Water sedge	>15% water sedge	3.8
Pendent grass	>15% pendent grass	0.4
Flooded Tundra	**>25% but <50% water and < 4 inches (10 cm) deep**	**9.2**
Low centered polygons	≥5% sedge/grass	6.5
Non-patterned	<5% sedge/grass	2.7
Wet Tundra	**>10% but <25% water**	**5.0**
Moist Tundra	**<10% water, <40% shrub (mostly sedges, grasses, rushes, and moss/peat/lichen)**	**40.8**
Sedge/grass meadow	≥50% sedge/grass and <40% tussock cottongrass	10.1
Tussock tundra	≥40% tussock cottongrass	29.1
Moss/lichen	≥50% moss and/or lichen	1.6
Shrub	**<5% water and >40% shrub**	**17.3**
Dwarf	≤12 inches (30 cm) in height	15.5
Low	>12 inches (30 cm) but <4.9 feet (1.5 meters) in height	1.7
Tall	≥4.9 feet (1.5 meters) in height	0.1
Barren Ground	**0-30% vegetation**	**2.2**
Sparsely vegetated	10-30% vegetated	0.5
Dunes/dry sand	<10% vegetation and <10% wet sand, mud, or rock	0.7
Other	<10% vegetation and ≥10% wet sand, mud, or rock	1.0

Key: ≥ - less than or equal to; > - less than; ≤ - greater than or equal to; and < - greater than.

This summary shows that 21.4% of the planning area is open water, while another 18.4% (Aquatic, Flooded and Wet classes) has standing water with varying proportions of plant cover. The single most common cover type is tussock cottongrass. The cottongrass form is more prevalent than it first appears from the table, because the Dwarf shrub class commonly includes tussocks as well. The distinction between the Tussock Tundra and Dwarf Shrub classes is based on the relative proportion of shrubs, a dominant life form. Combining these two classes suggests a total cover by tussocks in the planning area of up to 44.6%.

3.3.2.1 Sensitive Plant Species and Other Rare Plants

In describing plant taxa, Lipkin and Murray (1997) have defined rare plants as those species occurring in 20 or fewer locations throughout Alaska. Rare plants of Alaska's North Slope have more recently been defined and described (Cortés-Burns et al. 2006). This more recent report describes five species of rare vascular plants known to occur in the planning area. Three of these are currently on the BLM Sensitive Species list (Drummond's bluebell, Alaskan bluegrass and False semaphoregrass); however, only Drummond's bluebell still meets BLM's criteria for Sensitive Species as imperiled in Alaska and globally. The other rare plants are False semaphoregrass, Alaskan bluegrass, Eurasian Junegrass and Fewflower draba. All five species are perennials.

Drummond's bluebell (*Mertensia drummondii*), is a small, blue flowering herb that has been found on sand dune habitats (Barren Ground class) along the Kogosukruk River and west of the planning area along the Meade River. Five other sand dune sites within the planning area have been searched for Drummond's bluebell, but no plants have been found (Lipkin 1994). Drummond's Bluebell is listed as imperiled globally and in Alaska by the Alaska Natural Heritage Program. **False semaphoregrass** (*Pleuropogon sabinei*), an aquatic grass, grows in the Aquatic class and has been found between the pendent grass and sedge zones in lakes and ponds. This species is known in Alaska from only a few locations north and northeast of Teshekpuk Lake. False semaphoregrass is considered secure globally, but critically imperiled in Alaska. **Alaskan bluegrass** (*Poa hartzii ssp. alaskana*) grows in the Barren Ground class on sand dunes and has been found at one site near the mouth of Fish Creek as well as a few sites along the Meade River west of the planning area. It is rare or uncommon globally and critically imperiled in Alaska. **Eurasian junegrass** (*Koeleria asiatica*) has been found at several sites in the planning area and further west, where it grows on the Barren Ground class on sandy river banks. Eurasian junegrass is secure globally and imperiled in Alaska. **Fewflower draba** (*Draba pauciflora*), a tiny herb occurring in the Moist and Wet Tundra classes is known from a few coastal sites from Pitt Point to Barrow. It is apparently secure globally and critically imperiled in Alaska.

3.3.3 Wetlands and Floodplains

3.3.3.1 Wetland and Floodplain Definitions

The definition of the term "wetland" may vary. Through its National Wetlands Inventory (NWI) program, the USFWS uses ecological characteristics to define wetlands (Cowardin et al. 1979). According to this protocol, the essential attributes of wetlands are the presence of wetland plants (hydrophytes), the presence of wet soils (hydric soils), or soil saturation or flooding. To date, the NWI program has classified little of the NPR-A. In implementing the Clean Water Act, the USACE also classified wetlands. According to the USACE, wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (22 CFR § 328.3). The definitions of wetlands used by the two agencies are similar; a comparison of these definitions with the land cover classification for NPR-A in Table 3.3-A provides a first order approximation of the amount of the planning area that either agency would classify as wetlands.

The general definition of a floodplain is the lowland and relatively flat area adjoining inland and coastal waters, including at a minimum that area subject to a 1% or greater chance of flooding in any given year (also referred to as the 100-year or base floodplain).

3.3.3.2 Distribution of Wetlands and Floodplains in the Planning Area

With the exception of thaw bulbs under larger lakes and streams, permafrost is continuous under the planning area. Since permafrost forms an impenetrable barrier to water percolation, the soils of the active layer above it remain saturated during summer in all but a few cases.

Even “moist tundra” over these saturated soils would be classified as wetlands. Because of the high shrub component, the Dwarf and Low Shrub subclasses are separated from the Moist Tundra class (see Table 3.3-A). The Dwarf and Low Shrub subclasses also exist on saturated tundra (Kempka et al. 1995; Pacific Meridian Resources 1996) and much of the Dwarf Shrub subclass exists on areas of sedge tussocks. Only the Tall Shrubs subclass, certain areas of lichen-covered rocks or bare rocks or sand may not qualify as wetlands; however, the remainder of the planning area would qualify as wetlands. This suggests that more than 95% of the planning area would be classified as wetlands by at least one of the three sets of criteria.

Many of the floodplains in the planning area are very wide because of the low topographic relief in the Arctic Coastal Plain (ACP). The Lower Colville Floodplain is the largest floodplain in the planning area and includes the portion of the Colville River Floodplain south of the Colville River Delta. The Lower Colville Floodplain delineates the eastern boundary of the planning area. The Ikpikpuk River Floodplain delineates the western boundary of the planning area. Some of the other floodplains in the planning area include those adjacent to Fish Creek, Judy Creek, Kalikpik River, Tingmiaksiqvik (Ublutuoch) River, Kikiakrorak River, Kogosukruk River, Price River, Miguakiak River, and Kealok Creek.

3.3.3.3 Functions and Values of Wetlands and Floodplains

Arctic wetlands provide many useful functions and values. The various ponds, lakes, and drainages of the ACP regulate runoff through storage in the active layer, slowly releasing water to streams over extended periods. Arctic wetlands generally are not sites of discharge or recharge for subpermafrost aquifers, but suprapermafrost groundwater can influence wetland communities beneath Arctic slopes in ways comparable to aquifer discharge in temperate regions.

Arctic wetlands retain or distribute sediments, nutrients, and toxicants. At breakup, streams flood adjacent tundra creating extensive wetland complexes that provide sites for suspended solids to settle, and sediment is trapped by riparian wetlands along large Arctic rivers with mountain headwaters. Microbes and plants contribute to nutrient and contaminant retention or transformation in tundra wetlands since Arctic-tundra species are adapted to low temperatures and are biologically active even under harsh conditions.

Net primary production, nutrient export, and food-chain support are important functions of Arctic wetlands. Tundra production is remarkably high–approximately one-half that of temperate grasslands–and supplies the energy (plant biomass) on which animals exist. Nutrient export is an important function of Arctic wetlands. Arctic-tundra wetland supports food chains, both through the herbivore-based trophic system (from living plant tissues to rodents and ungulates and their predators) and through the detritus-based trophic system (from dead plant tissue to invertebrate to shorebirds and their predators). Alaska’s ACP is largely wetland and supports both herbivore-based and detritus-based trophic systems (Batzli et al. 1980; Hobbie 1984). Waterfowl, lemming, and caribou are major primary consumers on the ACP, with the muskox playing an important role elsewhere on Arctic ranges (White et al. 1981).

Floodplains also provide many useful functions and values. Floodplains provide temporary storage space for flood waters and sediment produced by the watershed. Flood peaks are reduced by this storage. In most cases, once a flood reaches the floodplain, large increases in discharge can be accommodated with very little water surface elevation change. Once stream flows become high enough to clear their banks, sediment-laden water spreads out over the floodplain, loses velocity, and sediments are deposited. These sediments and associated nutrients enhance soils and create growing conditions for healthy riparian areas that can support a multitude of wildlife.

3.3.4 Wildland Fire

Wildland fires include both wildfires and prescribed fires. Wildfires are unplanned fires that occur in wildlands and are caused by natural means (e.g., lightning strikes), whereas prescribed fires are naturally or manually ignited fires that occur in areas where burning is planned. Prescribed fires have not been used as a management tool within the planning area for vegetation management purposes nor will prescribed fires likely be used in the future for the management of vegetation (USDOI BLM and MMS 2003).

Large wildfires are rare in the tundra; most are small and burn less than ½ square mile of land (USDOI BLM 1978a). Because there have been few studies of wildfire on the tundra, it is difficult to document North Slope fire history and fire return intervals. It is not known if the 2007 Anaktuvuk River fire was a rare event or is an indication of a trend due to global warming. Plans are being made to study this fire to answer some of the questions about tundra fires on the North Slope. Lightning is the most likely cause of wildland fires, although humans initiate some fires. Tundra fires can appear as early as May, but most occur in July and August. Fires in the northern portions of Alaska, such as the NPR-A, are more easily stopped by discontinuities in vegetation, wet areas, or physical obstructions (Wein 1976).

Fire behavior is of low to moderate intensity, with low to moderate rates of spread and flame length. The severity of burns in both vegetative communities depends on the amount of moisture in the organic layer. Most fires will be low-severity surface fires. However, a long period of dry conditions can produce fires that remove most of the organic layer, resulting in a moderate- to high-severity fire. Regeneration in burned areas is fast, with the burned area becoming indistinguishable from the surrounding area in 2 to 3 years. However, it may take lichen decades to recover in areas of moderate to high burn severity (USDOI BLM 1978a).

Smoke from wildland fires will be managed using the procedures laid out in "Smoke Effects Mitigation and Public Health Protection Procedures 2007." The smoke management procedures can be found at the following website: http://fire.ak.blm.gov. Several other documents and links about smoke and wildland fire management can also be found at the website.

3.3.5 Fish

This section includes descriptions of fish habitat and fish species in the Northeast NPR-A planning area. For more detailed information see the cited references. More details on subsistence use of fish are described in **section 3.4.2**. A more comprehensive description of the physical and chemical characteristics of rivers and lakes is in **section 3.2.9, *Water Resources and Floodplains***.

3.3.5.1 Fish Habitat

The aquatic habitat of the Northeast NPR-A planning area has not been greatly impacted by humans and should be considered a properly functioning habitat. Some of the more important attributes, such as streambanks and channels, lakeshores, substrates, water quality and quantity, floodplains, and riparian areas are generally unaltered from their natural condition. The location, size, and morphology of rivers and lakes, and the natural balance of physical and chemical attributes, control the diversity and distribution of fish. However, quantification of habitat in the region has been very limited until the last few years. The most comprehensive effort to describe potential fish habitat in the Northeast NPR-A was completed by Moulton (2007).

A potentially limiting factor for fish populations in the Arctic is overwintering habitat. During the 8 to 10 month winter period, freezing temperatures reduce stream habitat by up to 95%, portions of the low salinity near-shore coastal habitat freeze, and unfrozen coastal waters are supercooled (i.e. $<0^{o}$ C) (Craig 1989a). Fish migrate to limited deepwater sites in lakes, rivers, and coastal areas to survive during the winter. Because waterbodies typically freeze to about 6 feet in depth during winter, water depths of 7 feet or more are considered the minimum for supporting overwintering freshwater fish (Phillips Alaska, Inc. 2002; USDOI BLM and MMS 2003). These waters must also be of sufficient size to sustain fish oxygen demands for several months, depending on the number and species of fish utilizing an area. Oxygen depletion, caused by overcrowding or over-demand by biological and chemical processes, can result in fish mortality (Schreier et al. 1980; Schmidt et al. 1989; Reynolds 1997). Deeper-water lakes shown on Map 3-7 have the greatest potential to contain fish during winter.

The 3-month Arctic summer is the critical time for fish to find quality feeding habitat. Food is plentiful only during the summer (Craig 1989a) and many fish will migrate from overwintering areas to habitat that is more productive for feeding, often traveling extensive distances (Morris 2000; Morris 2003). Food sources for different species are highly variable, but may include terrestrial and aquatic insects and their larvae, zooplankton, clams, snails, fish eggs, and smaller fish (Bendock and Burr 1984; Craig 1984a; Craig 1989a). In general, low water temperatures contribute to relatively low productivity. The average annual temperature of the water in large rivers is 2.5° C and in coastal waters is 1°C (Craig 1989a). Many of the main river channels are much less productive than small tributaries and sloughs or connected lakes that are often warmer, and these may be more highly utilized for feeding (Morris 2003; Moulton 2004a). Additionally, river runoff mixing with coastal water creates warm, brackish conditions in nearshore areas, particularly near the mouths of rivers (Craig 1984a). Marine invertebrates migrate into this brackish nearshore band where they thrive in detritus-laden shallows, and freshwater invertebrates are washed downstream into the coastal zone. It has been estimated that of all the marine and freshwater habitat available to fishes during the summer, coastal waters hold 90% of the exploitable prey biomass (Craig 1989b). Many fish will move from freshwater habitats to these estuarine waters to take advantage of the increased food supply. Some species are limited to feeding in low-salinity waters, while others have the osmoregulatory capabilities to regulate salt balance (Gallaway 1990) and can feed up to several miles offshore. It is during this summer feeding period that coastal fish achieve most of their yearly growth (Fechhelm et al. 1992; Griffiths et al. 1992) and accumulate fat and protein reserves needed to survive the winter (Fechhelm et al. 1995, 1996).

Requirements for spawning habitat vary for different Arctic species. A few species spawn successfully in areas of silt or sand substrate, while many others require gravel of a particular size class and relatively clear water (Morrow 1980; Bjornn and Reiser 1991). Therefore, ideal spawning habitat for one species in part of a river or lake may be unsuitable for other species, making it impractical to define spawning habitat in general terms. Identification of spawning areas must occur for individual species, and current knowledge of such locations in the NPR-A is substantially lacking. However, seasonal time periods for most fish spawning in the Arctic are known (USDOI BLM 1979a; Gusey 1982). Except for burbot, which spawn under ice in late winter, Arctic freshwater fish spawn from late spring to early fall.

Lakes are a critical element of the Arctic freshwater ecosystem for many fish in terms of either deep, overwintering habitat (Map 3-7) or shallow, productive, summer feeding habitat. Successful spawning also occurs in lakes for some fish species. The degree to which a lake is connected to a river or stream determines the extent to which the habitat is available for fish use. For example, many of the shallow, unconnected lakes in the Arctic are either fishless or only contain resilient ninespine stickleback (Hablett 1979; Craig and Schmidt 1982; Moulton 1998). Moulton (1998) developed a widely applicable lake-type classification for the Arctic based on the potential for access by fish:

- **Drainage lake:** A drainage lake is part of a well-defined drainage system. It has a year-round, active connection to a river or stream, and does not drain as water levels recede.
- **Tapped lake:** Tapped lakes, like drainage lakes, have an active connection to a river or stream during the summer while water levels remain high enough. However, they drain as water levels recede and the connection may be intermittent.
- **Perched lake:** These lakes often lack well-defined connections to river or stream channels. They are flooded under high water conditions, but do not drain like tapped lakes when floodwaters recede, although the connection is severed at that time. Perched lakes show a gradation of use depending on how frequently a lake is inundated by spring flooding. Frequently flooded lakes can be occupied by almost any species found in the adjacent river system while infrequently flooded lakes typically have less diverse fish communities.
- **Tundra lake:** A tundra lake is a thaw-lake not connected to a river drainage.

3.3.5.2 Fish Species

Thirty-one fish species have been identified in the freshwater and coastal marine habitats of the planning area (Table 3.3-B). Although life history may vary within populations, Arctic fish species can be divided into three general categories: freshwater, migratory (anadromous and amphidromous), and marine. The following section provides brief life history accounts for these species; more detailed species accounts can be found in the 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998; Section III-B-5), Northwest IAP/EIS (USDOI BLM and MMS 2003; III.B.3), and Alpine Satellite Development Plan EIS (USDOI BLM 2004c; 3.3.2).

3.3.5.2.1 Freshwater Fish

Freshwater species, and non-migratory components of amphidromous stocks, largely remain within river, stream, and lake systems year-round, although they may venture into coastal areas where waters are brackish during summer. The distribution of fish within the freshwater environment of the planning area varies with season. During summer, fish may forage within any waterbody having adequate access via interconnecting waterways or seasonal flooding. Winter distribution and survival depends on water depth, net overwintering area, and oxygen content. Sources of information on freshwater fish in the planning area include Kogl (1971); Furniss (1974); Netsch et al. (1977); Bendock (1979b, 1982); Bendock and Burr (1984a, b); Fawcett et al. 1986; Burns (1990); Philo et al. (1993a); Moulton (1996a, b, 1999a, 1999b, 2000, 2001a, b, 2002a, b); MJM Research (2001, 2002, 2003a, b, c, d, e, 2005a, b, c, d, e, 2006b, c, d); Mecklenburg et al. (2002); USDOI BLM (2003, 2005, 2006); Morris (2003); Moulton et al. (2006a, b); Morris et al. (2006); and OASIS and LCMF (2006). See these references for more details on life history and distribution.

While **Arctic grayling** are one of the most widespread and abundant species in the Colville River drainage above the confluence of the East and West Delta channels, they are far less common in the channels, lakes, and streams of the lower Colville River Delta and in freshwater coastal plain lakes and streams of the planning area. Grayling are particularly abundant in the Tingmiaksiqvik River drainage, especially in clear water tributaries connected to lakes. These tributaries support high densities of juvenile grayling, as well as adults. Grayling are also primarily associated with tundra drainages and tundra drainage outfalls along Fish and Judy creeks. Extensive seasonal movements have been observed in the greater Fish Creek region, with many individuals returning to the same small tributaries for feeding each summer. Grayling are also one of the most abundant species in habitats to the west, including tributaries to Teshekpuk Lake and the Miguakiak River.

Table 3.3-B. Fish Species Found in the Northeast NPR-A Including the Colville River Drainage, Coastal Streams and Lakes, and Nearshore Coastal Zone

Common Name	Scientific Name	Iñupiaq Name
Freshwater Species		
Alaska blackfish	*Dallia pectoralis*	Iłuuqiniq
Arctic char	*Salvelinus alpinus*	—
Arctic grayling	*Thymallus arcticus*	Sulukpaugaq
Burbot	*Lota lota*	Tittaaliq
Lake trout	*Salvelinus namaycush*	Iqaluaqpak
Longnose sucker	*Catostomus catostomus*	Milugiaq
Ninespine stickleback	*Pungitius pungitius*	Kakalisaauraq
Northern pike	*Esox lucius*	Siulik
Round whitefish	*Prosopium cylindraceum*	Savigunnaq
Slimy sculpin	*Cottus cognatus*	Kanayuq
Threespine stickleback	*Gasterosteus aculatus*	—
Anadromous Species		
Arctic cisco	*Coregonus autumnalis*	Qaataq
Arctic lamprey	*Lampetra japonica*	Nimigiaq
Bering cisco	*Coregonus laurettae*	Tiipuq
Chinook (king) salmon	*Oncorhynchus tschawytscha*	Iqalugruaq
Chum salmon	*Oncorhynchus keta*	Iqalugruaq
Pink salmon	*Oncorhynchus gorbuscha*	Amaqtuuq
Rainbow smelt	*Osmerus mordax*	Iłhauġniq
Sockeye (red) salmon	*Oncorhynchus nerka*	—
Amphidromous Species[1]		
Broad whitefish	*Coregonus nasus*	Aanaaqłiq
Dolly varden	*Salvelinus malma*	Iqalukpik
Humpback whitefish	*Coregonus pidschian*	Piquktuuq
Least cisco	*Coregonus sardinella*	Iqalusaaq
Marine Species[2]		
Arctic cod	*Boregogadus saida*	Uugaq
Arctic flounder	*Liopsetta glacialis*	Nataaġnaq/Puyyagiaq
Capelin	*Mallotus villosus*	Panmigriq
Fourhorn sculpin	*Myoxocephalus quadricornus*	Kanayuq

Common Name	Scientific Name	Iñupiaq Name
Kelp snailfish	*Liparis tunicatus*	—
Pacific herring	*Clupea harengus*	Uqsruqtuuq
Pacific sandlance	*Ammodytes Hexapterus*	—
Saffron cod	*Eleginus gracilis*	Uugaq

[1] Have some components of their populations that remain in freshwater year-round.
[2] Principal (most commonly caught) coastal fish only.

Burbot are distributed throughout the Colville River watershed and the coastal lakes and streams of the NPR-A, including the Teshekpuk Lake drainage and the Ikpikpuk River. They are unique in that they spawn mid-winter under the ice while all other Arctic freshwater fish spawn between spring and fall. Spawning has been reported in the Colville River near Umiat in late winter, and rearing areas include the mouths of minor tributaries of the lower Colville River Delta. In the Fish Creek drainage, the lower Tingmiaksiqvik River is likely the only suitable spawning location. Radio-tagged burbot in the eastern portion of the planning area have been observed moving long distances, probably in search of sufficient food resources.

Lake trout are extremely rare in the river channels, streams, and lakes of the lower Colville River and delta, and throughout the ACP east and south of Fish Creek. They are widely distributed in ACP lakes north and west of Fish Creek in the planning area. This includes a notable population inhabiting Teshekpuk Lake.

Within the planning area, **round whitefish** occur in Fish Creek, Judy Creek, the Tingmiaksiqvik River, and some smaller streams. They are also found in different types of lakes, although the highest catch rates have occurred in perched lakes.

Arctic char are rarely captured in the planning area, but a few individuals have been identified in the greater Teshekpuk Lake region. Due to taxonomic similarities, they are discussed further in conjunction with Dolly Varden under the Migratory Fish section.

The range of **northern pike** spans the planning area, although catch rates indicate that their density is relatively low. Pike have been captured in the middle and lower reaches of the Colville River, although they are rare throughout the channels, lakes, and streams of the Colville River Delta. To the west they are documented in the middle and upper reaches of the Ikpikpuk River as well as in tributaries to the Miguakiak River.

The planning area and Colville River represent the eastern limit of the **Alaska blackfish** in northern Alaska. In the Colville River Delta, low numbers of blackfish were caught in river channels and tapped lakes, and slightly higher numbers of fish were caught in high and low perched lakes. These fish are found infrequently in other lakes and some have been captured in tributaries to the Tingmiaksiqvik River.

Ninespine stickleback and **slimy sculpin** are fairly ubiquitous in the planning area and both serve as forage fish for other species. However, ninepine stickleback are more widely distributed and present in significantly greater numbers. Slimy sculpin have obligate freshwater populations. Ninespine stickleback have a broad range of salinity tolerance and can utilize brackish and marine waters, with some anadromous forms. Many of the shallow or disconnected lakes that don’t provide viable habitat for any other fish species are inhabited by ninespine stickleback.

Threespine stickleback are extraordinarily rare throughout the Colville River watershed and the NPR-A.

Longnose sucker are rare in ACP lakes and streams to the west of the Colville River in the planning area, although they are more common in the middle reaches of the Colville River.

3.3.5.2.2 Migratory Fish

Migratory fish species include those with anadromous or amphidromous life histories. Anadromous fish breed in freshwater, migrate to the sea as juveniles, and return to freshwater to spawn when they are mature. Spawning adults of some anadromous species will die after spawning one time (e.g. Pacific salmon), while other species have the potential to spawn during more than one year (e.g. rainbow smelt). Amphidromous fish make many migrations between freshwater and brackish or marine water for purposes other than spawning, such as feeding and overwintering. These fish may disperse widely from their streams of origin and make long seasonal migrations each year. Most species with individuals that exhibit amphidromy also have individuals within their population that exhibit resident behavior and never leave freshwater. Sources of information on migratory fish in the planning area include Myers (1949); McPhail and Lindsey (1970); Alt and Kogl (1973); Scott and Crossman (1973); Bain (1974); Craig and Mann (1974); Craig and McCart (1974, 1975); Kogl and Schell (1974); Netsch et al. (1977); Craig (1977a, b, 1984, 1989b); Bendock (1979a, b, 1982); Morrow (1980); Craig and Haldorson (1981, 1986); McElderry and Craig (1981); Griffiths and Gallaway (1982); Smith and Glesne (1982); Gallaway et al. (1983); Griffiths et al. (1983, 1996, 1997); Bendock and Burr (1984a, b); Daum et al. (1984); Fawcett et al. (1986); Moulton et al. (1986a, b, 1989, 1990, 1992, 1993); Cannon et al. (1987); Fechhelm and Fissel (1988); Pedersen and Shishido (1988, in Craig 1989a); Moulton and Field (1988, 1991, 1994); Bickham et al. (1989); Burns (1990); Fechhelm and Griffiths (1990); Glass et al. (1990); Reub et al. (1991); Schmidt et al. (1991); Morales et al. (1993); Philo et al. (1993a, b); Moulton (1994, 1995, 1996a, b, 1997, 1999a, b, 2000, 2001b, 2002a, b); Underwood et al. (1995); Colonell and Gallaway (1997); Everett et al. (1997); Fechhelm and Griffiths (2001); Mecklenburg et al. (2002); MJM Research (2001, 2002, 2003a, b, c, d, e, 2005a, b, c, d, e, f, 2006a, b, c, d); USDOI BLM (2003, 2005, 2006); MBC (2004); Johnson et al. (2004); George (2006); Battelle (2006); Moulton et al. (2006a, b); Morris et al. (2006); and ADFG (2007). See these references for more details on life history and distribution.

Anadromous Species

Arctic cisco are one of the most abundant and widely distributed white fish found in the coastal waters of the Beaufort Sea during summer. The distribution of Arctic cisco within the planning area is limited to coastal waters during summer and the lower Colville River Delta during winter. Most of the Colville River watershed and the lakes, ponds, and stream systems in the planning area are not important habitat for this species. It is the principal species targeted in the fall subsistence and commercial fisheries that operate in the Colville River Delta.

The Colville River is the only drainage west of the Mackenzie River, Canada, large and deep enough to support substantial overwintering populations of subadult and adult fish. No spawning areas for Arctic cisco have ever been identified in Alaska. Strong evidence suggests that most, if not all, Arctic cisco found in Alaska originate from spawning grounds in the Mackenzie River system of Canada. In spring, newly hatched fish are flushed down river into ice-free coastal waters. Some young-of-the-year are transported westward to Alaska by wind-driven coastal currents. In summers with strong, persistent east winds, enhanced westward transport can carry fish to Alaska's Colville River where they take up overwintering residence. Fish remain associated with the Colville River until the onset of sexual maturity beginning at about age 7, at which point they migrate back to the Mackenzie River to spawn.

The **Bering cisco** are found from Bristol Bay, and possibly Siberia, north and east to the Colville River. Very little is known about Bering cisco in the Beaufort Sea, but there is some speculation that fish may be transients from the Yukon River or from rivers in Russia. They are a relatively important subsistence species at Barrow, but are of minor importance to the Colville River subsistence fishery. Their distribution along the North Slope is likely similar to Arctic cisco, being limited to coastal waters during summer and the lower reaches of the Colville River Delta during winter. Bering cisco are not typically found in the freshwater coastal plain lakes and streams of the planning area.

Rainbow smelt are an anadromous pelagic fish that is found throughout the Beaufort Sea. Smelt spawn in the lower reaches of the Colville River and probably do not go upstream farther than they have to in order to reach freshwater. Aside from coming into freshwater in the spring to spawn, they spend their winters and summers in brackish coastal areas and deltas. Rainbow smelt are not normally found in the freshwater coastal plain lakes and streams of the planning area.

Although all five species of Pacific salmon have been reported from the Beaufort Sea, **chinook, sockeye,** and **coho salmon** are extremely rare and no known spawning stocks have been identified. No records indicate the capture of coho salmon in freshwater habitat of the planning area. The occurrence of sockeye and chinook salmon is irregular, with a few individuals being captured in the Tingmiaksiqvik River and Colville River. However, there is some indication that the number of chinook salmon migrating into the Beaufort Sea may be on the rise, with catches off of Point Barrow apparently increasing in recent years.

Pink and **chum salmon** are the most abundant Pacific salmon in the Beaufort Sea, but only small runs occur and their abundance is especially low compared to other fish species in the region. The presence of both species has been documented in the Colville and Ikpikpuk rivers and in streams of Fish Creek drainage. Several pink salmon have been captured in the Miguakiak River, as well. In recent years, pink salmon have been taken near the Itkillik River as part of the fall subsistence fishery (George 2004), although they constitute only a minor portion of total subsistence catch and are not a targeted species. Chum salmon are also taken incidentally in the fall subsistence fishery. The capture of any juvenile salmon is extremely rare, although chum smolts have been captured in the lower Colville River Delta.

Arctic lamprey are not commonly observed in the planning area. Most scientific sampling gears are extremely poor at capturing lamprey and they are not targeted in the subsistence fishery. However, range descriptions for the species include the entire coastal plain in the Alaskan Arctic. While most Arctic lamprey are anadromous and parasitic, some portions of the population may be resident and non-parasitic, as well.

Amphidromous Species

Several forms of **least cisco** inhabit the watersheds of the North Slope. Some are amphidromous, while others are strictly remain in freshwater. They are found in high abundance in many lakes and streams of the planning area, occur in the river channels and lakes of the Colville River Delta, and are one of the most plentiful species found in Beaufort Sea coastal waters. Fall spawning runs, most likely of amphidromous forms, occur in the Colville, Ikpikpuk, and Price rivers.

Like least cisco, **broad whitefish** are common in virtually all habitats of the coastal North Slope in summer and early fall. They are found throughout the freshwater ACP lakes and streams of the planning area, occur in the river channels, outer channels, tapped lakes, and perched lakes of the Colville River, and are one of the most abundant species found in Beaufort Sea coastal waters. Radio-tagged broad whitefish in the Fish Creek region and the Teshekpuk Lake drainage have provided insight into the complicated and variable strategies these fish use. Many individuals travel extensive distances seasonally in order to access suitable feeding, spawning, and overwintering habitat. This includes moving within a single river drainage as well as utilizing multiple river drainages. As discussed in **section 3.4.2, Subsistence**, broad whitefish is an important subsistence fishery for people living on the North Slope.

Humpback whitefish spawn in the Colville River Delta, and middle and upper reaches of the Colville River during September and October. Spawners have also been reported in the upper Ikpikpuk drainage in September. Excluding upriver spawning runs, the summer distribution of humpback whitefish within the planning area is likely limited to main river channels and low-salinity coastal areas. Limited numbers of humpback whitefish are distributed throughout the Ikpikpuk River drainage including the Price River, the lower reaches of Fish and Judy creeks, the Kalikpik River, and the Teshekpuk Lake drainage. They are rarely found in any of the lakes of the planning area.

Dolly Varden and Arctic char have a complicated taxonomic history in Arctic North America. Up through the 1980s the two names were sometimes used interchangeably, and in other cases identification depended on a researcher's opinion on taxonomic differentiation. Since the early 1990s the general consensus of fishery scientists working on Alaska's North Slope has been that Arctic char exist almost exclusively as resident lake species, while Dolly Varden have resident and anadromous forms that utilize multiple habitats. Slight differences in external characteristics, at least discernible by biologists, help to support this. Dolly Varden spawn in many of the mountain streams between and including the Colville and Mackenzie rivers. Although the Colville River drainage supports major stocks of Dolly Varden, most spawning and overwintering areas are outside the planning area. Dolly Varden are rare in freshwater ACP lakes and streams of the planning area and in the channels, lakes, and streams of the Colville River Delta. Dolly Varden migrate downriver to the ocean in spring, then return to their upstream overwintering grounds in late summer. The main channel of the Colville River, which runs along the eastern boundary of the planning area, is the principal migratory corridor for this species.

3.3.5.2.3 Marine Fish

Marine fishes spend the greater part of their lives at sea, although some species may migrate into nearshore, brackish coastal waters during summer, or even move considerable distances upriver. Sources of information on marine fish in the planning area include Walters (1955); Scott and Crossman (1973); Morrow (1980); Craig and Schmidt (1982); Dew and Mancini (1982); Griffiths and Gallaway (1982); Critchlow (1983); Griffiths et al. (1983, 1995, 1996, 1997); Fechhelm et al. (1984); Moulton and Fawcett (1984); Moulton et al. (1986b); Cannon et al. (1987); Moulton and Tarbox (1987); Glass et al. (1990); Reub et al. (1991); Moulton (1996b, 1999b); and Mecklenburg et al. (2002). Only the most prevalent marine fish species are discussed here.

Fourhorn sculpin and **Arctic flounder** are demersal (i.e., living on and near the seabed) species that have circumpolar nearshore distributions in brackish and moderately saline nearshore habitats. Neither species is found far offshore, although both species migrate into brackish coastal habitats during summer to feed, and may travel considerable distances up rivers. Fourhorn sculpin have been reported as far as 85 miles upstream in the Meade River. Small numbers of both species occur sporadically in the Colville River Delta, but there is no evidence of major upstream migrations within the planning area. Both species are very abundant in coastal waters of the NPR-A during summer.

The **saffron cod** is found in brackish and marine waters of the Beaufort Sea east to Bathurst Inlet in Canada. The species frequently enters rivers and may go considerable distances upstream. There is no evidence of major upstream migrations in the planning area.

Arctic cod is one of the most abundant fish species collected in coastal waters during summer. Cod are associated with highly productive transition layers that separate cold marine bottom water and warm brackish surface water. The onshore movement of such layers is an important factor in coastal aggregations of fish. Arctic cod do not actively move into freshwater or low-salinity habitats.

Pacific herring and **capelin** are largely pelagic (i.e. living in open seas). Although most prefer deep water habitat outside of the barrier islands, both species may be found in nearshore zones, such as lagoons or inlets.

3.3.5.3 Commercial Fishing

The Helmericks family operates an under-ice commercial gill net fishery in the Colville River Delta during fall (Gallaway et al. 1983, 1989). The fishery typically operates from early October through the end of November. Fishing effort is concentrated in the Main (Kupigruak) and East Channels of the river near Anachilik Island. The three principal species targeted in the fishery are Arctic cisco, least cisco, and humpback whitefish.

Arctic cisco is the dominant species harvested in the fishery. Arctic cisco declined markedly between 1996 and 2002. Such declines are not unprecedented, occurring between 1973 and 1980 (this period was followed by a peak year in abundance in 1981) and between 1986 and 1991 (a period again followed by increased catch rates in 1992, and a peak in 1993).

Least cisco harvest also fluctuates among years, partially in response to natural oscillations in population strength. However, this species also responds to physical characteristics of the Colville River Delta, preferring water less saline than that of the cogeneric Arctic cisco.

The harvest of humpback whitefish has changed dramatically over the 35-year period of record. Prior to 1981, annual catch rates were nominal at less than five fish per day per 150-foot net. Following a 5-year data gap from 1982 to 1986, harvest increased to annual levels ranging from four to 44 fish per day per 150-foot net. The reasons for this dramatic change in annual harvest are unclear.

3.3.5.4 Subsistence Fishery

The northwest region of the Northeast planning area provides a significant subsistence fishery resource for the people of Barrow. A large portion of the harvest for Barrow occurs in the streams and rivers that drain into Smith Bay, including the Ikpikpuk and Miguakiak rivers and the Teshekpuk Lake system. Broad whitefish (Coregonus nasus) and Arctic grayling (Thymallus arcticus) are the most abundant subsistence fish species. The Miguakiak-Chipp-Ikpikpuk system of connected rivers is recognized for supporting one of the most productive broad whitefish Ikpikpuk system of connected rivers is recognized for supporting one of the most productive broad whitefish fisheries on the North Slope. Harvest occurs during the open-water season primarily with gill nets.

The community of Nuiqsut operates subsistence fisheries year-round, although most fishing effort occurs in summer and fall. The summer fishery generally begins in July and extends until freeze-up, which typically occurs in early September (Moulton et al. 1986a). Fishing occurs in the Nigliq Channel in the western Colville River Delta, in the Colville River just upstream of Nuiqsut in the Tiragruag area, and in the Fish Creek drainage (George and Nageak 1986, Craig 1989b). The summer fishery targets broad whitefish with annual harvests ranging from about 3,000 to 4,000 fish (Moulton et al. 1986a; Nelson et al. 1987). Dolly Varden, humpback whitefish, pink salmon, and chum salmon are also taken incidentally. An important local burbot fishery also occurs in late winter/early spring by setting nets under the ice.

The major fishery of the year for Nuiqsut is the fall under-ice gill net fishery, which begins in late September-early October and typically lasts through late November (Moulton 1997). Fishing effort is concentrated in the upper Nigliq Channel near Nuiqsut, the lower Nigliq Channel near Woods Camp, and the Nigliq Delta (Craig 1989b, Moulton 1999b). Over the past 15 years, effort has shifted downstream and 2000 was the first year in which fishing effort in the Nigliq Delta was the highest of the three areas (Moulton 2001). Arctic cisco is the principal species targeted, accounting for nearly 70% of the total annual harvest. Other targeted species include least cisco, broad whitefish, and humpback whitefish. The estimated mean annual harvest from 1985 to 2000 was 21,241 Arctic cisco, 7,011 least cisco, 1,860 humpback whitefish, and 667 broad whitefish. Species taken incidentally include Bering cisco, Arctic grayling, rainbow smelt, round whitefish, Dolly Varden, burbot, Arctic flounder, and fourhorn sculpin.

Annual harvests of Arctic cisco in the subsistence fishery can fluctuate greatly, similar to the commercial fishery. Harvests from 1996 to 2002 were below normal but picked up considerably in fall 2003 with the entry of the 1997-year class (USDOI MMS 2003a). Harvest rates from 2004 to 2006 were some of the highest observed during the twenty years of monitoring (MJM Research 2005f, 2006a; personal communication with Larry Moulton, 2007).

3.3.5.5 Fish Species of Concern

No fish that inhabit the planning area and associated coastal waters are federally listed as threatened, endangered, or sensitive by the USFWS in Alaska. No fish in the planning area are included on the BLM Sensitive Species list.

3.3.6 Birds

About 80 bird species including seabirds, loons, waterfowl, shorebirds, raptors, passerines, and ptarmigans are expected to occur annually in the planning area or adjacent nearshore Beaufort Sea habitats. Nearly all of these species are migratory and are present only during the summer breeding season from approximately late May through October. During the remainder of the year, most of these species occupy other areas in Alaska, the lower 48 states, Canada, Russia/Asia, Mexico, or Central and South America. This document briefly discusses the distribution and habitat use of some of the species that are common or occur regularly in the planning area. Additional species and more detailed species life-history accounts can be found in 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998; III-B-11), the Northwest IAP/EIS (USDOI BLM and MMS 2003; III.B.4), and Johnson and Herter (1989).

All of the large scale information that exists for waterbirds on the ACP has been collected by the USFWS using a combination of surveys designed to address differences in timing and spatial distribution of different species groups. The 2 surveys that are relied on most heavily in this document for indices of abundance and distributional information are the ACP Breeding Pair Survey (Mallek et al. 2006) and the North Slope Eider Survey (Larned et al. 2006). In 1986 the USFWS initiated an aerial breeding pair survey on the Arctic Coastal Plain; the survey area (61,645.2 km^2) includes all contiguous waterfowl habitat north of the Brooks Range, from the northwest coast of Alaska east to the U.S.-Canada border. The ACP breeding pair survey monitors the majority of the waterfowl populations on the ACP. The ACP breeding pair survey has now been conducted for 20 years and provides indices for breeding waterbird species that are found throughout the ACP. It is recognized by the USFWS that some species of waterfowl are not well represented by this survey due to issues of survey timing (spectacled and Steller's eiders) and breeding waterfowl which have limited spatial distributions (i.e., Pacific brant and common eiders). Specific surveys have been designed and are conducted to collect data on those species not well represented by the ACP breeding pair survey. In 1992 the USFWS initiated a survey on the ACP (North Slope Eider Survey) with the primary goal of obtaining an accurate annual population index and distributional data for the 2 species of eiders listed as Threatened under that Endangered Species Act, spectacled and Steller's eiders (see **section 3.3.8** for information on these species). This survey has provided useful data for spectacled eiders, king eiders, and several other species of waterfowl, but has proven inadequate in sampling intensity for Steller's eiders, which are present on the arctic coastal plain in very low densities. This survey is timed earlier in the year than the USFWS ACP waterfowl breeding population survey due to the difference in phenology of eiders compared with other waterfowl species.

3.3.6.1 Seabirds

Six species of seabirds common across the ACP occur in the planning area: glaucous and Sabine's gulls, pomarine, parasitic, and long-tailed jaegers, and Arctic tern. In addition, black guillemot may occur in offshore areas (Johnson and Herter 1989). Most seabirds arrive on the ACP in early to late May and leave in September to November. Black guillemot is on the BLM Sensitive Species List for Alaska (see Appendix J).

Glaucous gulls are common migrants and breeders on the ACP. Glaucous gulls winter along the Pacific coast from the Aleutian Islands to California and along the Atlantic coast from Labrador and Greenland south to the eastern U.S. Glaucous gulls equipped with satellite transmitters in various location within NE and NW NPR-A have been found to winter in Asia, primarily in the Sea of Okhotsk (D. Troy personal communication). They nest across the ACP, with areas of high-density located both east and west of Dease Inlet in the Northwest National Petroleum Reserve – Alaska and southeast of Teshekpuk Lake in the planning area. The glaucous gull population on the ACP has remained stable since 1992 with a mean population index of 11,870 birds for the years 1992 - 2006 (Larned et al. 2006). Mallek et al. (2006) also reports a stable glaucous gull population from his 14 years of data across the ACP with a 2005 estimate of 18,955. However, many North Slope residents believe that the glaucous gull population on the North Slope has increased in the past 20 years. Noel et al. (2006) determined that it is not clear that glaucous gulls are becoming more abundant on the ACP but there are indications that human populations may influence the patterns of glaucous gull coastal distribution. The National Research Council (2003) reports that glaucous gull populations are increasing across the arctic, however, they state that it is not clear whether the increases in the oil fields are part of a global pattern or associated with local changes caused by oil development. Day (1998) cites numerous accounts of foraging by glaucous gulls in North Slope landfills, including those in oil fields. Nests in mainland areas are often on small islands in lakes, and pairs may nest singly or in small colonies (Gilchrist 2001).

Sabine's gulls are less common than glaucous gulls on the ACP and nest in single pairs or small colonies on the shores or islands of tundra lakes (Johnson and Herter 1989, Noel et al. 2001). Sabine's gulls winter at sea off the west coasts of Africa and South America (Day et al. 2001). In the planning area, Sabine's gulls are most numerous in the area north of Teshekpuk Lake as well as several areas in the Northwest NPR-A. Mallek et al. (2006) reports a non-significant growth rate for Sabine's gulls for the years 1992-2005 and a 2005 population index of 11,657. Larned et al. (2006) reports erratic counts of Sabine's gulls for his early season survey of the ACP and defers to the ACP Breeding Pair Survey (Mallek et al. 2006) population estimate and trend analysis using the reasoning that Sabine's gulls are long-distance migrants and likely arrive on the ACP during the period that best correlates with ACP Breeding Pair Survey dates.

Jaegers spend the winter at sea, but migrate to tundra breeding grounds during the summer. Larned et al. (2005) report that numbers of jaegers counted on surveys fluctuates widely, following microtine prey abundance, and that the overall population trend for jaegers on the ACP is positive. However, the positive growth estimate is driven by the 2006 population index which is approximately 2.3 times greater than the mean annual index. In 2005, the population trend estimate was negative (Larned et al. 2005). Mallek et al. (2006) also reports a long-term growth rate as non-significant and negative and that the 2005 population index for jaegers was 5,804 birds, 17% below the previous 19-year mean. Parasitic and long-tailed jaegers have been recorded breeding in the planning area in small numbers (Burgess et al. 2002, 2003b). Although the planning area is within the breeding range of Pomarine jaegers, these birds are erratic breeders and it is difficult to determine their breeding status in many places (Wiley and Lee 2000). Pomarine jaegers are more common west of the planning area, but may be common in the planning area during migration or during years of high lemming populations (Johnson and Herter 1989).

The Arctic tern is a fairly common breeder and migrant in the Beaufort Sea area that nests most commonly near the coast but may also nest inland (Johnson and Herter 1989). Arctic terns winter in the subantarctic and Antarctic waters of the Pacific, Atlantic, and Antarctic oceans (Hatch 2002). Larned et al. (2006) reported that the trend for the Arctic tern population of the ACP, from 1992 to 2006, appears to have leveled off in the most recent 7 years, after a fairly steady and significant increase through 2000. Mallek et al. (2006) reports a positive and significant growth rate for Arctic Tern populations on the ACP.

3.3.6.2 Loons

Pacific, red-throated, and yellow-billed loons breed across the ACP. Loons arrive on the North Slope in late May and establish breeding territories on tundra lakes and ponds as soon as the margins of these habitats are free of ice and snow (Table 3.3-C). Earnst (2004) indicates that loons may stage in river delta in spring while waiting for on shore habitats to become available. After nesting, loons may move to marine habitats before migration in August and September (Johnson and Herter 1989). Two loon species, the yellow-billed and red-throated, are on the BLM Sensitive Species List for Alaska (Appendix J).

The Pacific loon is the most abundant loon species across the ACP. Aerial surveys during the last 10 years have indicated that the 2006 Pacific loon population estimate for the ACP was slightly below average and while the long-term growth trend is level the last 7 years show a significant negative trend (Larned et al. 2006). The Breeding Pair Survey estimate was 7% below the long-term mean, but also shows a generally level long-term trend (Mallek et al. 2006). The largest concentrations of Pacific loons in the planning area occur to the east and southeast of Teshekpuk Lake and to the southwest of Nuiqsut between Judy Creek and the Tingmiaksiqvik River (Map 3-9). Pacific loons exhibit site fidelity to breeding locations, often returning to the same lake or pond in successive years (Kertell 2000). Pacific loons winter mainly on the Pacific Coast from southeastern Alaska south to Mexico.

Yellow-billed loon is the least abundant loon species on the ACP, and the population index has been somewhat erratic but stable since at least 1986 (Larned et al. 2006; Mallek et al. 2006). However, Mallek et al. (2006) reports that the 2005 population index of 1,871 for yellow-billed loon was 35% lower than the 19-year mean. Breeding yellow-billed loons are distributed unevenly on the ACP and breeding habitat may be more restrictive than for other loon species. The majority of the Alaskan breeding population of yellow-billed loons lies between the Colville and Meade Rivers (Earnst 2004). The largest concentration area for yellow-billed loons in the NPR-A is located in the Northwest NPR-A southeast of Dease Inlet, with other areas of high density located in an east-west band to the south of Teshekpuk Lake in the planning area (Map 3-10). Yellow-billed loons winter along the Pacific Coast from Kodiak Island and Prince William Sound and throughout southeastern Alaska and British Columbia to Vancouver Island, although stragglers may occur further south (North 1994). Recent studies suggest that yellow-billed loons that breed on the North Slope may winter off the coast of North Korea, Japan and China (J. Schmutz pers. comm). Yellow-billed loon was placed on the BLM Sensitive Species List due to its low population level, limited breeding habitat, and low productivity. In 2006 a conservation agreement for yellow-billed loons was finalized and signed by representatives from local, state and Federal resource agencies in northern and western Alaska in order to take measures necessary for the conservation of the species (USFWS et al. 2006). Implementation of this conservation agreement is expected to contribute significantly to reducing or eliminating current, potential, or future threats to the yellow-billed loon and its habitat. These management priorities include a.) the implementation of specific actions to protect yellow-billed loons and their habitats from potential impacts of land use and management activities, including oil and gas exploration, b.) the improvement of inventories and monitoring of yellow-billed loon populations, c.) an assessment of the extent that yellow-billed loons are taken by subsistence hunters, and d.) further scientific study on yellow-billed loon biology, including response to management actions and using control or reference areas. In June 2007, the USFWS determined that listing of the yellow-billed loon as either threatened or endangered under the Endangered Species Act (ESA) may be warranted. The USFWS is moving forward with the evaluation of the species under the guidelines of the ESA.

Yellow-billed loons nest on deep open lakes and deep *Arctophila* lakes that are generally larger than those used by other loon species (Derksen et al. 1981; North 1986; Burgess et al. 2003 a, b; Johnson et al. 2003 a, b), although nests may also occur on smaller wetlands adjacent to large lakes (North 1986; Burgess et al. 2003b; Johnson et al. 2003b). Pairs that nest in small lakes may move broods overland to nearby larger lakes (North 1986). Stehn et al. (2005) conducted a quantitative assessment of habitat variables to determine which landscape scale parameters were preferred by yellow-billed loons in the NPR-A allowing for the relative likelihood of use of individual lakes to be determined remotely. This study indicated preferences for larger lakes, deeper lakes, lakes connected to streams, presence of shoreline emergent vegetation and flooded tundra land cover classes, more complex lake shore line shape, and absence of pacific loons (Stehn et al. 2005).

Red-throated loons are much less common than Pacific loons on the ACP. Although Mallek et al. (2006) reported the 2005 index for red-throated loons as 3,038, 4% below the previous 19-year mean, the long-term growth rate estimate is positive and significant. However, Larned et al. (2005) reported a red-throated loon index for 2006 that was the lowest in the 15 year history of the North Slope Eider Survey. The long-term growth rate is negative and significant as is the trend for the most recent 7 years. Groves et al. (1996) reported declines in the Alaska red-throated loon population since the 1970s within the study area encompassing the ACP, the Y-K delta, coastal Bristol Bay, and various locations in the interior. In the planning area, red-throated loons occur in relatively high densities north, northeast, and south of Teshekpuk Lake (Map 3-11), and larger areas of red-throated loon concentration occur in the Northwest NPR-A. Red-throated loons winter along the Pacific Coast from the Aleutian Islands to northwestern Mexico, and along the Atlantic Coast from the St. Lawrence River south to the Gulf of Mexico (Barr et al. 2000).

Table 3.3-C. Chronology of Activities for Birds Nesting on the Arctic Coastal Plain in the Planning Area

Species or Groups	Arrival in Planning Area	Egg Laying	Hatch	Brood Rearing	Adult Molt	Fall Migration
Loons	Late May - early June	Mid-June - late June	Mid-July - late July	Mid-July - early September	Winter	Late August - September
Tundra swan	Mid-May - late May	Late May - early June	Late June - mid-July	Late June - mid-September	Mid-July - August	Late September - early October
Brant	Late May - early June	Early June - late June	Late June - mid-July	Late June - early September	Mid-July - mid August	Mid-August - early September
Greater white-fronted goose	Mid-May - early June	Late May - mid-June	Late June - early July	Late June - late August	Mid-July - early August	Mid-August - mid-September
Northern pintail males	Late May	Mid-June - late June	Early July - late July	Early July - early September	Mid-July - early August	Early August - mid-September
King eider	Mid-May - late May	Mid-June - early July	Early July - late July	Early July - early August	Early July - early August[1]	Early August - late October[1]
Long-tailed duck	Late May	Late June - early July	Mid-July - late July	Mid-July - early September	Late July - early September	Late September - October

1 Males stage in the Beaufort Sea for 2-3 weeks before molt-migration starts in mid-July, and females stage in the Beaufort Sea from mid-July to late August before they begin to depart in early August.
Sources: Johnson and Herter (1989); Burgess and Stickney (1994); Ely and Dzubin (1994); Limpert and Earnst (1994); North (1994); Austin and Miller (1995); King (1998); Dickson et al. (2000); and USDOI BLM and MMS (2003).

3.3.6.3 Waterfowl

Waterfowl, including ducks, geese, and swans, migrate to breeding grounds within the planning area and other locations on the ACP from wintering grounds located primarily in Canada, the lower 48 states, and Mexico although the eiders winter primarily in waters adjacent to Alaska. Several waterfowl species that occur in the planning area, including brant, long-tailed duck, common and king eiders, and black and surf scoters, are on the BLM Sensitive Species List for Alaska (Appendix J).

Swans and Geese
Tundra swans are common in the area surrounding Dease Inlet and Admiralty Bay in the Northwest NPR-A. In the planning area, tundra swan concentrations occur southwest of Nuiqsut between Judy Creek and the Tingmiaksiqvik River and east and west of Teshekpuk Lake (Map 3-12). Breeding pair surveys have reported a slightly increasing mean annual growth rate (1.0294) since 1986 (Mallek et al. 2006). The 2005 tundra swan index was reported to be 12,002 which was 22% above the 19-year mean, while the tundra swan nest index was 34% above its mean at 1,709 (Mallek et al. 2006). Most tundra swans nesting in the Beaufort Sea area probably winter along the Atlantic Coast principally from New Jersey to South Carolina (Limpert and Earnst 1994). Substantial numbers of tundra swans stage in late summer just west of Teshekpuk Lake (North Slope Borough, unpublished data).

Four goose species commonly nest on the ACP. The greater white-fronted goose is by far the most abundant and widespread species; Canada goose, lesser snow goose, and brant occur in lower densities. Canada and greater white-fronted geese that are counted on the ACP survey in late June and early July each year include both local nesters and molt migrants for other locations, resulting in a wide range in annual estimates. Very high counts in some years likely contain a high proportion of molt migrants and do not indicate large changes in the local nesting population.

Mallek et al. (2006) reported the 2005 white-fronted goose index to be 129,403, which was 4% above the previous 19-year mean. The long-term trend is slightly positive but not significant (Mallek et al. 2006). The largest concentrations of greater white-fronted geese in the planning area occur to the north, northeast, and southwest of Teshekpuk Lake (Map 3-13). Derksen et al. (1981) reported that greater white-fronted geese nested on upland sites or polygonal ground near shallow sedge and pendant grass wetlands, while post-breeding birds used deep open lakes during the molting period (Map 3-14). The goose molting area north and east of Teshekpuk Lake is extremely important for molting white-fronted geese as well as other goose species (Mallek 2006). Mallek (2006) reported a 23-year mean (1982-2005) of 13,244 white-fronted geese during surveys in the Goose Molting Area north and east of Teshekpuk Lake. However, the numbers have increased in recent years, with an annual mean of 24,202 white-fronted geese in this area since 1996, and a high of nearly 35,000 geese in 2002 (Map 3-15; Table 3.3-D). Over 60,191 adult geese and 5,515 goslings of four species were recorded in this area during the 2005 molting season with white-fronted geese accounting for 45.4% (27,296 adults and 4,886 goslings; Mallek 2006) of the total. White-fronted geese from the ACP winter along the coasts of Texas, Louisiana, and in Mexico. White-fronted geese and other waterfowl species are important to both subsistence and sport hunters, not only in Alaska, but also in other states and countries, such as Canada, Russia, and Mexico.

Canada goose is a common species that nests in low densities in the Prudhoe Bay area, the Colville River Delta, and in the planning area. The Canada goose is a much more common breeder in the interior of Alaska than on the ACP. After nesting, small flocks of these interior-nesting Canada geese migrate to the ACP where they aggregate with locally nesting geese to molt. The ACP population of Canada geese has varied from lows near 3,000 in 1989 and 1994 to highs near 47,000 in 1986 and 1999 (Mallek et al. 2003). The 2005 population estimate was 21,200, 17% above the previous 19-year mean for Canada goose (Mallek et al. 2006). Mallek (2006) reported a 23-year mean of 12,170 and a high count of 26,681 in 1984 for Canada geese during surveys in the Goose Molting Area, north and east of Teshekpuk Lake (Map 3-15; Table 3.3-D).

Lesser snow goose is a species that nests primarily in Arctic Canada and Russia, although there are several small and one rapidly growing (Ikpikpuk River Delta) colony nesting on Alaska's ACP. The population of snow geese on the ACP has increased in recent years, with one major colony on the Ikpikpuk River Delta increasing 174% between 2001 and 2002 (Ritchie et al. 2005). The Ikpikpuk colony was found to have 1,107 nests in 2005, a decrease of 23% from the 2004 count. Snow goose nesting is also probable in the Harrison Bay region with broods being detected in that region in 2005 (Ritchie et al. 2005). Based on banding returns snow geese from the Ikpikpuk colony likely winter in California and Mexico and along the Central and Mississippi flyways (Ritchie et al. 2005). The colony on Howe Island in the Sagavanirktok River Delta, adjacent to the active Endicott oil production field, declined in the late 1990s, apparently as a result of predators, including foxes and bears (Johnson 2000a). The Howe Island colony has been increasing in recent years. Snow geese from the Howe Island colony winter primarily in northern California and southern Oregon (Johnson et al. 1996).

Black Brant nest in both small and large colonies that are used year after year. These colonies generally are near the coast but may be 18 miles or more inland (Derksen et al. 1981; Reed et al. 1998; USDOI BLM and MMS 1998). The largest nesting concentration of brant on the ACP is located in the Colville River Delta (Johnson et al. 2002), and another sizeable colony is located in the Sagavanirktok River Delta (Sedinger and Stickney 2000).Forty-five brant colonies have been monitored in the NPR-A yearly since 1994, many of which 7 are located in the planning area (Ritchie et al. 2005). The colonies in the planning area yielded 110 nests in 2005 with the colony located at the outlet of the Miguakiak River (where it leaves Teshekpuk Lake; Map 3-13) containing the greatest number of nests (n=85; Ritchie et al. 2005). Ritchie et al. (2005) has reported a relatively stable population of breeding pairs of brant in their study area in NW and NE NPR-A, although interannual variation in colony size and occupancy at individual colonies is often substantial. The USFWS has been conducting ongoing aerial surveys for ducks and geese on the ACP since 1992, however the sampling schemes used by the USFWS does not adequately sample colonial nesting species (brant and snow geese), therefore trends of nesting populations of brant calculated from these surveys are not considered accurate (Mallek et al. 2006; Larned et al. 2005). The overall Pacific population of black brant has experienced slow downward trends in recent years (USFWS 2006). The Pacific Flyway Council has established a management plan for the brant population that outlines the status of Pacific brant and goals for the population (Pacific Flyway Council 2005). Brant winter along the Pacific Coast from the Aleutian Islands south to Mexico. Some birds also winter along the Asian coast, from Japan and southern China (Bellrose 1976). Brant are valued by subsistence users in northern and western Alaska as well as sport hunters along the West Coast and in Mexico.

Although brant are fairly common breeding birds in the planning area, the area is even more important as a molting area for brant and other goose species. The largest known concentration of molting and brood-rearing brant on the ACP occurs in the northern portion of the Teshekpuk Lake area (maps 3-13 and 3-14; Derksen et al. 1982). As many as 30% of the Pacific flyway population of brant may be present in the Teshekpuk Lake goose molting area during the molting period. Many are failed breeders and non-breeders that have migrated from breeding colonies in western Alaska, Canada, and Siberia, and arrive in the planning area in late June and early July to molt (Bollinger and Derksen 1996). The origin of this molt-migrant population from such distant nesting areas emphasizes the international importance of the Teshekpuk Lake area to molting brant as well as other goose species. Mallek (2006) reported a 24-year (1982-2005) mean of 17,660 brant during surveys in the Goose Molting Area north and east of Teshekpuk Lake (Table 3.3-D). When considering only the last 10 years, the annual mean number is approximately 18,378 birds, although as many as 36,817 brant (Table 3.3-D) and as few as 3,448 have been reported (Mallek 2006, Pacific Flyway Council 2002). The Teshekpuk Lake Goose Molting Area may be the single most important area for molting brant and other geese in the Arctic, based on information in Mallek et al. (2006) and Mallek (2006). A recent study conducted by the USGS has shown that populations of molting geese in the Teshekpuk Lake Special Area (TLSA) have changed in abundance and spatial distribution over the past 30 years, although the causative mechanism for these shifts is not known at this time (Flint et al. 2007). Although the spatial distribution of molting brant in the TLSA has changed in the past 30 years, the actual number of molting brant using the area has remained relatively stable while the greater white-fronted goose population has increased seven-fold and the area which corresponds with the highest rate of population increase for greater white-fronted geese corresponds with the area where brant populations are declining most rapidly (Flint et al. 2007).

Table 3.3-D. Number of Geese Recorded in the Teshekpuk Lake Goose Molting Habitat Area during Aerial Surveys (1982 – 2005)

	All Geese	Brant	Greater White-Fronted Goose	Canada Goose	Snow Goose
1982-2005 mean	42,161	17,660	13,244	12,170	728
1996-2005 mean	52,169	18,378	24,202	11,404	1,433
Total geese (excluding goslings) in 2005	60,191	17,344	27,296	11,637	3,914
Maximum number (1 year)	91,238 (2001)	36,817 (2001)	34,929 (2002)	26,681 (1984)	3,914 (2005)
Source: Mallek (2006).					

Ducks

Fifteen duck species regularly occur on the ACP (Mallek et al. 2006). The two most common species are northern pintail and long-tailed duck, which together comprise about 85% of the total ACP duck population. Other species, including four eider species, occur in much lower densities. Two of the eider species, spectacled eider and Steller's eider, are federally-listed as threatened species and are discussed in **section 3.3.8, *Special Status Species***.

Northern pintail is the most abundant duck in the planning area (Table 3.3-E). Pintail numbers fluctuate from year to year, but no significant population trends have been reported since aerial surveys began in the mid-1980s (Mallek et al. 2006). In 2005 the northern pintail index of 156,754 was 31% below the long-term mean (1986-2004; Mallek et al. 2006). Although no significant population trends are evident on the ACP, northern pintail populations in the lower 48 states and Canada have displayed declines (USFWS 2003). In the planning area, nesting pintails are concentrated in three areas, one north, one northeast, and one southeast of

Teshekpuk Lake (Map 3-15). Additional concentration areas are located east of Wainwright, south of Barrow, and southeast of Dease Inlet in the Northwest NPR-A. Northern pintails winter from southeastern Alaska south throughout much of the central and southern U.S. and into Mexico and the Caribbean.

Long-tailed duck is the second most abundant duck on the ACP (Table 3.3-E). Mallek et al. (2006) reported a significant and declining trend in the ACP long-tailed duck population from 1986 to 2005. The 2005 long-tailed duck index was 84,241, 23% below the previous 19-year mean of 109,169 (Mallek et al. 2006). Larned et al. (2006) reported a 15 year average yearly growth rate of 0.0982 and a growth rate of 0.923 for the most recent 7 years of survey data resulting in a statistically insignificant decline. The largest concentrations of long-tailed ducks in the planning area occur to the north and to the east of Teshekpuk Lake, and in the south central and southwest portions of the planning area (Map 3-16). Other long-tailed duck concentrations occur east of Dease Inlet and in the western portion of the Northwest NPR-A. Over their entire range, long-tailed ducks have shown declining population trends (USFWS 2006). Long-tailed ducks winter along both coasts, with small numbers occurring as far south as California on the west and the Gulf of Mexico on the east.

Table 3.3-E. Occurrence and Representative Abundance and Density of Selected Birds in the Northeast National Petroleum Reserve – Alaska.

Common Name	Presence on the Arctic Coastal Plain (ACP)[1]	Average Northern ACP Population Index[2]	Estimated Proportion Observed in mid- to late June in Planning Area as a Percentage of Total Birds Observed in ACP[2]	Average Planning Area Population Index[2]
Loons/Waterfowl				
Red-throated loon	Early June – late September	3,086	28	826
Pacific loon	Late May – late September	26,522	25	6,709
Yellow-billed loon	Mid-May – mid-September	2,662	33	861
Tundra swan	Mid-May – early October	9,998	26	2,533
White-fronted goose	Mid-May – mid-September	121,895	25	30,314
Black Brant	Late May – early September	8,186	56	4,176
Canada goose	Early June – mid-September	17,436	57	10,612
Northern pintail	Late May – mid-September	70,637	26	18,527
Greater Scaup	Late May – mid-September	18,354	28	5,273
King eider	Late May – October	3,796	31	1,187
Long-tailed duck	Late May – October	55,304	25	14,213
Black Scoter	Late May – early September	3,025	48	1,486
White-winged Scoter	Late May – early September	2,816	58	1,683
Passerines				
Common raven	Resident	59	11	3
Seabirds				
Glaucous gull	Early May – November	16,241	24	3,886
Sabine's gull	Late May – early September	11,589	33	3,687
Arctic tern	Late May – early September	23,658	32	7,610
Jaegers	Late May – mid-September	7,083	25	1,677
Raptors				
Snowy owl[3]	Resident	944	12	196

Common Name	Presence on the Coastal Plain Ecounit	Estimated Population[4]		
Raptors				
Arctic peregrine falcon	Mid-April – mid-September	58	—	—
Gyrfalcon	Resident	10	—	—
Rough-legged hawk	Late April – early October	58	—	—

[1] Resident = Present throughout the year.
[2] Values calculated from ACP Breeding Pair Surveys (Platte and Stehn 2007). The Planning Area = 25% of the total ACP survey area.
[3] Values calculated from North Slope Eider Survey (Platte and Stehn 2007)
[4] Value for Coastal Plain ecoregion which encompasses NE and NW NPR-A; from Ritchie et al. 2003 supplemented with Nigro and Ritchie 2003.
— = Data not available.
Sources: Larned et al. (2006); Mallek et al. (2005); Platte and Stehn (2007); Nigro and Ritchie 2004; Ritchie et al. 2003.

King eider is the most abundant eider species on the ACP (Larned et al. 2006). Evidence from counts of eiders as they pass Point Barrow during migration suggests that the Beaufort Sea king eider population has declined by approximately 56% between 1976 and 1999 (Suydam et al. 2000). Most of these eiders migrate to northwestern Canada to nest. Despite the declining trend at Point Barrow, Larned et al. (2006) reported an increasing population trend for king eiders on the ACP from 1993 to 2006 with an annual average growth rate of 1.02. However, the trend for the most recent 7 years has been negative but not statistically significant. The 2006 king eider population index of 12,896 is slightly below the long-term average (Larned et al. 2006). Increased densities of King eiders have been noted in the core breeding area southeast of Teshekpuk Lake in the last 7 years of the survey (Larned et al. 2006).

The largest concentration of king eiders in the planning area is in a large area south and east of Teshekpuk Lake (Map 3-17). Female king eiders exhibit strong site fidelity to breeding areas on the North Slope according to satellite telemetry studies (Phillips and Powell 2006). Noel et al. (2001) reported two flocks of eider hens and ducklings on a lake in the planning area southeast of Teshekpuk Lake that contained approximately 800 birds in late July. Only one nest was discovered during ground searches around the entire perimeter of this lake during the incubation period, indicating that important brood-rearing areas may not necessarily be important for nesting. Broods may move some distance from nesting to brood-rearing areas. King eiders disperse from nesting areas on the ACP and move through the Beaufort Sea to molting and wintering locations in the Bering Sea (Phillips et al.2007). Phillips et al.(2007) found that king eiders were most concentrated in the areas of Smith and Harrison Bays during post-breeding and that previously undescribed wing molt and wintering locations were located in the Beaufort Sea, Olyutor Bay and the west side of the Kamchatka Peninsula.

Common eider is a seaduck that nests primarily in loose aggregations or colonies on barrier islands, although they also nest on coastal spits or beaches (Goudie et al. 2000). Nearshore coastal distributions during nesting surveys indicate that breeding pairs of common eiders are more numerous along the coast between the Colville River Delta and the Canadian border than they are along the coast of the planning area (Dau and Hodges 2003). Aerial surveys conducted during the early incubation period along the entire ACP between 1999 and 2002 showed that less than 1% of all common eiders detected were found along shoreline segments in the planning area while much larger numbers of common eiders were detected along the shoreline of the NW NPR-A and from the Colville River east to Demarcation Bay (Flint et al. 2003). In 2006 Dau and

Larned (2006) found 0.4% of all mainland shore line observations of common eiders to be in the planning area while 35% of all common eider detections were found in the NW NPR-A. Total numbers of common eiders detected during Dau and Larned's (2006) survey of the ACP were up 12% from the 1999-2006 average, and were 20% higher than the 2005 total count. Lack of barrier islands (a favorite nesting habitat) near the coastline of the planning area is thought to contribute to the low numbers of common eiders found there. Most common eiders from the Beaufort Sea population probably winter from the Bering Sea pack ice, south to the Aleutian Islands and Cook Inlet (Goudie et al. 2000). Suydam et al. (2000) reported indices to the number of common eiders migrating past Barrow have declined dramatically in recent years.

3.3.6.4 Shorebirds

The North Slope provides some of the most productive shorebird habitat in northern Alaska. As a group of species, shorebirds are notoriously difficult to survey from the air–the approach that is needed in order to obtain broad scale distribution and abundance estimates in Northeast NPR-A. Map 3-18 portrays the estimated relative densities for large shorebirds (bar-tailed and Hudsonian godwit and whimbrel) as reported by the USFWS. More than 30 species of shorebirds are known to breed on the North Slope, and as many as 6 million shorebirds are thought to spend the summer in the NPR-A (Cotter and Andres 2000). Shorebirds occur in greater densities than other bird groups across the ACP. Based on observations on the Colville River Delta and near Barrow, about 15 shorebird species could be expected to breed regularly in the planning area and another 20 species could occur as migrants (Troy 2000). Cotter and Andres (2000) recorded 13 species nesting near Inigok in the central portion of the planning area during 1998. Burgess et al. (2003b) reported 12 shorebird species nesting on intensively searched study plots in the eastern portion of the planning area during 2 years of study. Andres (2004) reported that latitude was the best predictor of shorebird density and species richness for all species combined in the NPR-A with higher densities recorded in more northern latitudes. The greatest densities occurred at sites with high percentages of flooded and wet sedge-moss vegetation types; densities were lower at inland sites which were drier and had more shrubs. The most abundant species were semipalmated and pectoral sandpipers, and red phalarope. A study conducted in the Olak region of the Teshekpuk Lake Special Area in 2005 and 2006 found that 12 species of shorebirds were found in the area with pectoral and semipalmated sandpipers and red phalaropes accounting for the greatest numbers of nests found (Liebezeit and Zack 2006).

In general, shorebirds are present on the North Slope from May to September. After hatching, brood-rearing shorebirds move to tundra and aquatic habitats adjacent to their nests. Many shorebirds move to coastal habitats to feed before migrating. Adults often migrate before juvenile birds, and juvenile shorebirds may not leave until late August or September (Johnson and Herter 1989, Andres 1994). Fall flocks may sometimes be composed entirely of juvenile birds. Wintering areas for shorebirds vary among species and include locations in the lower 48 states, Mexico, Central and South America, Asia, and Africa. One shorebird species, the buff-breasted sandpiper, regularly occurring in the planning area, is on the BLM Sensitive Species List for Alaska (Appendix J).

Shorebird nesting densities on the ACP vary depending on location and habitat (Table 3.3-F). Cotter and Andres (2000) reported shorebird nest densities of 77.7 nests per km^2 on study plots in drained-lake basin habitat, but only 12.9 nests per km^2 on tussock/ridge tundra in the central portion of the planning area. Johnson et al. (2003b) considered all habitats and reported a greater overall shorebird nest density of almost 90.6 nests per km^2 in the Colville River Delta near the Alpine field where nests were associated with two habitat types: wet sedge willow and moist sedge shrub. One of the most important areas for shorebirds in the planning area may be the area north of Teshekpuk Lake where Andres (2004) reported shorebird densities as high as 137.3 pairs per km^2 in areas northeast and northwest of the lake. In the Olak region of the Teshekpuk Lake Special Area Liebezeit and Zack (2006) found overall nest density (all nests of all species including non-shorebird species) to be 132.4 nests/km^2 in 2006 and 90.7 nests/km^2 in 2005 and that nest predation was the most important cause on nest failure. Of note Liebezeit and Zack (2006) found nest densities of 20.0 nests/km^2 for pectoral sandpipers, 10.6 nests/km^2 for semipalmated sandpipers and 15.0 nests/km^2 for red phalarope. Based on work conducted in June 1998 – 2000, Bart and Earnst (2005) estimated that the total population of all shorebirds in the northeastern half of the planning area to be 356,000 – 455,000 birds.

Four fixed-wing aerial surveys for postbreeding shorebirds were conducted along the coast of the ACP during late July and through August of 2006. These surveys were designed to count all shorebirds along the coast of the ACP from Kaseguluk Lagoon to the Canadian Border. When survey data were restricted to only those coastal areas within NE NPR-A and a visibility correction factor applied, the resulting estimates of small shorebirds ranged between 50,000 and 100,000 birds (A Taylor pers. comm.). Within the planning area numbers of small shorebirds increased throughout the survey period. Postbreeding shorebirds congregate along coastal areas within the planning area in order to accumulate the fat resources that are necessary for successful migration to wintering areas.

A number of shorebird species that breed or regularly occur in the planning area are considered to be species that are highly imperiled or are species of high concern in the Canadian and U.S. Shorebird Conservation Plans (Brown et al. 2001; Donaldson et al. 2001). In 2004 the U. S. Shorebird Conservation Plan was updated and lists the buff-breasted sandpiper as highly imperiled, and the American golden-plover, western sandpiper, whimbrel, bar-tailed godwit, ruddy turnstone, sanderling and the arcticola subspecies of the dunlin were designated as species of high concern (U.S Shorebird Conservation Plan 2004). All of the above listed species either breed or regularly occur in the planning area.

Plovers

Two plover species are regularly observed in the planning area; the **American golden-plover** is a common species while the **black-bellied plover** is uncommon in some areas while it is found to be abundant in other areas (Liebezeit and Zack 2006). Black-bellied and American golden-plovers tend to nest on upland sites that are drier than those used by other shorebirds (Johnson and Herter 1989). Black-bellied plovers breed most commonly near the coast and tend to nest in dry tundra habitats next to wet areas (Derksen et. al. 1981; Johnson and Herter 1989). American golden-plovers also nest in dry upland sites where their nests consist of scrapes on the tundra that are lined with mosses and lichens. American golden-plover nest densities generally range from approximately 0.3 to 4.1 nests per km^2 (Table 3.3-F; TERA 1992; Cotter and Andres 2000; Johnson et al. 2000, 2003b; Burgess et al. 2003b). Black-bellied plovers winter on the west coasts of North and South America, from southern British Columbia south to Chile and on the east coasts of North and South America from New Jersey to Argentina (Terres 1982). The American golden-plover winters on the plains of central South America (Terres 1982).

Table 3.3-F. Breeding Season Abundance and Nest Density of Some Shorebird Species on the Arctic Coastal Plain

Species	Abundance on ACP[1]	Highest Density (nests per km²)
American golden-plover	C	4.1
Baird's sandpiper	U	0.3
Bar-tailed godwit	U	0.8
Black-bellied plover	U/A	3.6
Buff-breasted sandpiper	U	2.8
Dunlin	U/C/A	9.6
Long-billed dowitcher	FC/C	8.0
Pectoral sandpiper	C/A	55.7
Red phalarope	C/A	15.0
Red-necked phalarope	C/A	13.5
Ruddy turnstone	U	data not available
Semipalmated sandpiper	C/A	37.3
Stilt sandpiper	U	3.1

[1] A = Abundant; C = Common; FC = Fairly Common; and U = Uncommon.
Ranges in nest densities are reported in various studies. Most of the data come from studies conducted in areas outside of the National Petroleum Reserve – Alaska (except see Liebezeit and Zack 2006), including the Colville River Delta and Point McIntyre in the Prudhoe Bay area.
Sources: Johnson and Herter (1989); TERA (1992); Cotter and Andres (2000); Johnson et al. (2000, 2003b); and Burgess et al (2003b); Liebezeit and Zack 2006.

Sandpipers and Phalaropes

Sandpipers and phalaropes considered common to abundant in the planning area include dunlin, semipalmated sandpiper, pectoral sandpiper, stilt sandpiper, long-billed dowitcher, red-necked phalarope, and red phalarope. These shorebird species use a wide variety of habitat types but tend to nest in wet and moist sedge meadows, and aquatic sedge and grass marshes. Dunlin, and semipalmated and pectoral sandpipers may also nest in drier habitats including moist tussock tundra (Johnson and Herter 1989; Phillips Alaska, Inc. 2002).

The shorelines of shallow-sedge ponds are important feeding areas for **semipalmated sandpipers** in the planning area in late June to early July (Derksen et al. 1981). Semipalmated sandpiper nest density averaged 10.9 nests per km² on study plots in the eastern portion of the planning area (Burgess et al. 2003b) and 10.6 nests/km² in the Olak Region (Liebezeit and Zack 2006). Cotter and Andres (2000) reported that semipalmated sandpipers in the NPR-A near Inigok nested exclusively in drained lake basins where their nest density equaled that of **pectoral sandpipers**. Liebezeit and Zack (2006) reported semipalmated sandpiper nest densities of 10.6 nests/km² in their study area. Cotter and Andres (2002) also reported pectoral sandpipers in the NPR-A near Inigok nested exclusively in drained lake basins where nest density was 28.5 nests per km², although nest density in the entire study area was only 4.1 nests per km² when all habitats were considered. Liebezeit and Zack (2006) reported pectoral sandpiper nest densities of 20.0 nests/km² for their study area. Semipalmated sandpipers winter from Florida south along coastal areas through Central America to southern Brazil, and from Guatemala to northern Chile (Terres 1982).

Dunlin use a wide range of habitat types, but are more abundant near the coast than inland (Derksen et al. 1981; Johnson and Herter 1989). Average nest density was 1.6 nests per km² in the eastern portion of the planning area (Burgess et al. 2003b) and 5.6 nests per km^2 in the Olak Region (Liebezeit and Zack 2006). During post-breeding shorebird surveys on the Colville River Delta, dunlins comprised about 50% of all sightings and were the most abundant species on coastal shoreline silt barrens (Andres 1994). Most dunlin that breed in the Planning Area probably winter along the coasts of China and Japan. Recent evidence suggests that dunlin in Europe and North America are declining (Warnock et al. 1997).

Long-billed dowitcher is a shorebird species that uses a variety of nesting habitats across the ACP, but appears to prefer wet habitats associated with strangmoor (Troy 2000). Long-billed dowitcher nest density ranges from 0 to 7.5 nests per km^2, averaging 5.7 nests per km^2 in the eastern portion of the planning area (Burgess et al. 2003b), 2.6 nests per km^2 in the central portion of the planning area (Cotter and Andres 2000) and 8.1 nests per km^2 in the Olak Region (Liebezeit and Zack 2006). Long-billed dowitchers winter from the southern U.S. south through Mexico to Panama (Terres 1982).

Red phalarope nest density (2.1 nests per km^2) in the eastern portion of the planning area was less than that of red-necked phalaropes (6.5 nests per km^2; Burgess et al. 2003b). Cotter and Andres (2000) did not find red phalaropes nesting in the central portion of the planning area, but red-necked phalarope nest density was 2.8 nests per km^2. Liebezeit and Zack (2006) found both red and red-necked phalaropes nesting in their study area south east of Teshekpuk Lake at densities of 15.0 nests/km^2 and 6.3 nests/km^2 respectively. Phalarope nest densities may vary considerably from year to year, but have been as high as 15.0 and 13.5 nests per km^2 for red and red-necked phalaropes, respectively. Phalaropes winter at sea in the Pacific and Indian oceans, and off the coast of west and south Africa (Terres 1982).

Buff-breasted sandpiper is a BLM Alaska Special Status Species (Appendix J) and also is listed as an imperiled species in the U.S. shorebird conservation plan (U.S. Shorebird Conservation Plan 2004) and of high conservation concern by Partners in Flight and in the Canadian shorebird conservation plan (Donaldson et al. 2001). Historically, buff-breasted sandpiper numbers may have been in the millions, but their populations declined due to hunting and loss of habitat along its migratory route in the central United States and on its wintering grounds in South America (Terres 1982). The current population may number around 15,000 (Donaldson et al. 2001). Buff-breasted sandpiper is a high arctic breeder which breeds in Alaska from Point Barrow and Atqasuk eastward (Lanctot and Laredo 1994). Buff-breasted sandpiper is the only North American shorebird species that uses a lek mating system (Gotthardt and Lanctot 2002). Habitat use depends on sex and breeding stage; males display in the first snow-free areas, typically along barren ridges, creek banks, and raised, well-drained areas with reticulate-patterned ground and scant vegetation (Lanctot and Laredo 1994). After snow melt most males display together in moist, graminoid meadows with *Carex aquatilis* and *Eriophorum angustifolium* as dominant vegetation types. Nests are on dry slopes with numerous sedge tussocks (Prevett and Barr 1976), on moss-willow-varied grass tundra and in moist or wet sedge-graminoid meadows on non-patterned or strangmoor ground (Lanctot and Laredo 1994). Buff-breasted sandpipers are highly site faithful to breeding territories and a loss or alteration of these traditional territories may prevent birds from breeding successfully, potentially leading to reduced productivity and lower recruitment rates. Relatively few observations of buff-breasted sandpipers have been reported for the NPR-A (Gotthardt and Lanctot 2002), although intensive shorebird studies in the NPR-A have been conducted much less frequent than in other portions of the ACP. In recent years, Cotter and Andres (2000) reported buff-breasted sandpipers nesting at Inigok in the central portion of the planning area, and Burgess et al. (2003b) reported six nests on study plots in the eastern portion of the planning area. Liebezeit and Zack (2006) report buff-breasted sandpipers as uncommon on their study area south east of Teshekpuk Lake. Buff-breasted sandpipers winter primarily on the pampas of Argentina, Uruguay and Brazil (Gotthardt and Lanctot 2002). Threats to buff-breasted sandpipers include habitat loss along migration routes and in wintering areas, as well as exposure to pesticides (Lanctot and Laredo 1994).

Bar-tailed godwit is an uncommon breeding species on the ACP east to the Sagavanirktok River (Johnson and Herter 1989). In recent years, bar-tailed godwit nests have been recorded in the Colville River Delta and the eastern portion of the NPR-A (Burgess et al. 2003a, b; Johnson et al. 2003a). Liebezeit and Zack (2006) report bar-tailed godwits as a rare species in their study area and did not find any nests of the species. Bar-tailed godwits breeding in the planning area probably winter in southeast Asia and on South Pacific islands.

3.3.6.5 Raptors

Raptors are birds of prey that include falcons, hawks, eagles, and owls. The snowy owl and gyrfalcon are the only raptors known to overwinter on the ACP; all others migrate south to overwinter (Johnson and Herter 1989). The Colville River and adjacent wetlands in the southern portion of the planning area provide the North Slope's single most important raptor nesting habitat area, with significant proportions of several Alaskan species' populations occupying bluffs and cliffs along its shoreline. In the NPR-A, cliff-nesting raptors are more common inland than near the coast. The peregrine falcon, gyrfalcon, and rough-legged hawk are regular breeders on cliffs along the Colville River in the Colville River Special Area. The golden eagle occurs regularly in the planning area. A long-term dataset for peregrine falcons, gyrfalcons and rough-legged hawks nesting along the Colville River was initiated by Cade (1960) in 1952 and following that efforts were sporadic until 1978, after which surveys have been conducted yearly by the USFWS with support from BLM through 2005. Aerial surveys were conducted in 1977 and repeated in 1999 over all appropriate habitat in the NPR-A in order to compare cliff-nesting raptor population between the 2 periods and assess the present distribution, abundance, and degree of recovery of the peregrine falcon population in the region. A document outlining a code of conduct for operations in areas of nesting raptors has been developed and implemented by the BLM to provide protection from disturbance to raptors nesting in NPR-A.

The **Arctic peregrine falcon** was removed from the ESA list in 1994, and monitoring of the population was required until 1999 (59 FR [Federal Register] 50796). The peregrine falcon is on the BLM Sensitive Species List for Alaska (Appendix J). Within the planning area peregrine falcons nest along the bluffs of the Colville River south of Nuiqsut, and along the Ikpikpuk, Kogosukruk and Kikiakrorak Rivers (Ritchie et al. 2003; Map 3-19). Ritchie and Wildman (2000) reported approximately 15 pairs of peregrine falcons in the areas they surveyed within the planning area during aerial surveys in 1999. Numerous nests are also located along the Colville River south of Umiat in the Colville River Special Area. Nigro and Ritchie (2004) reported 16 peregrine falcon nests between the mouth of the Etivluk River and Umiat and another 25 nests between Umiat and Ocean Point on the Colville River in 2003. The densest component of the ACP peregrine falcon population occurs along the lower Colville, Kogosukruk, and Kikiakrorak Rivers (Ritchie et al. 2003).

Gyrfalcon is an uncommon species on the ACP, but is a fairly common nesting species south of the planning area in the foothills of the Brooks Range and on cliffs and bluffs along the Colville River south of Umiat. Ritchie and Wildman (2000) did not report any gyrfalcons on the ACP or in the foothills of the planning area during aerial surveys in 1999, although the surveys did not include the raptor nesting area along the Colville River south of Umiat. Nigro and Ritchie

(2004) reported 7 nests between the mouth of the Etivluk River and Umiat and another five gyrfalcon nests between Umiat and Ocean Point along the Colville River in 2003. A hatch year gyrfalcon outfitted with a satellite transmitter in Denali National Park was tracked to the planning area where it spent most of September and October of 1995 (C. McIntyre pers. comm.). Although gyrfalcons may remain on the breeding grounds throughout the year, some birds may move south through Canada to the northern U.S (Terres 1982) during winter.

Rough-legged hawks were found to be the most abundant and widespread cliff-nesting raptor in the NPR-A (Ritchie et al. 2003). Eighty percent of the rough-legged hawk nests found during aerial surveys in 1999 were found in the southern foothills region (Ritchie et al. 2003). Nigro and Ritchie (2004) reported 39 rough-legged hawk nests in the planning area along the Colville River in 2003. Rough-legged hawks usually nest on cliffs or ledges. Rough-legged hawks winter south, to southern Canada and over much of the lower 48 states (Terres 1982).

Golden eagles are not known to nest in the planning area but they are found nesting in the nearby southern foothills of the Brooks Range (Ritchie et al. 2003). Subadult golden eagles are known to frequent the ACP during spring and summer although they appear to be more common to the east of the planning area (Johnson and Herter 1989). Sub-adult golden eagles outfitted with satellite transmitters in Denali National Park were found to use the planning area during summer (C. McIntyre pers. comm.). Although the main prey of the golden eagle is the Arctic ground squirrel, they are also known to prey on newborn caribou calves during spring (Johnson and Herter 1989). **Bald eagles** are also occasionally observed on the ACP (Johnson and Herter 1989).

Most raptors on the North Slope are cliff-nesting species, but ground-nesting raptors on the ACP include snowy and **short-eared owls** and **northern harrier**. These species breed irregularly across the ACP and are most common during years with high microtine rodent populations. Snowy owls are a fairly common resident in the Beaufort Sea area, breeding irregularly in coastal areas from Barrow to the east through northern Canada (Johnson and Herter 1989). Short-eared owl is an occasional breeder on the ACP, and northern harriers occasionally breed in the northern foothills of the Brooks Range (Johnson and Herter 1989). **Merlins** are likely to occur in the planning area as stragglers (Hohenberger et al. 1994).

3.3.6.6 Ptarmigans

Willow and **rock ptarmigan** are found in the planning area. Ptarmigan are ground-nesting birds in the grouse family that may remain on the ACP as year-round residents. These species are not generally recorded during aerial surveys for birds on the ACP (Larned et al. 2003; Mallek et al. 2003). Johnson et al. (2003a) reported higher nest densities for willow ptarmigan than for rock ptarmigan in the planning area near the Alpine field (Burgess et al. 2003b). reported only willow ptarmigan nesting at study sites in the eastern portion of the planning area, although some unidentified ptarmigan nests were also reported. Liebezeit and Zack (2006) reported nesting densities of willow ptarmigan to be 3.1 nests/km^2 in their study area south east of Teshekpuk Lake, they did not encounter any rock ptarmigan on their study area.

3.3.6.7 Passerines

Most passerines found on the ACP winter in temperate and tropical regions in the Americas or southern Asia (USDOI BLM and MMS 1998). They generally arrive on the North Slope from late May to early June and remain until mid- to late August (Johnson and Herter 1989). With the exception of the common raven, passerines on the ACP are tundra-nesting species.

Lapland longspur are the most common species nesting across the ACP. The average nest density on study plots in the eastern portion of the planning area was 20.7 nests per km^2 (Burgess et al. 2003b). Liebezeit and Zack (2006) found Lapland longspurs to be the highest density nesting species (42.5 nests/km^2) in their study area south east of Teshekpuk Lake. Other species, including **savannah sparrow, redpoll, snow bunting**, and **yellow wagtail** may be fairly common to abundant breeders. Snow buntings are very common on the ACP in areas of development where they find nesting sites in crevices of buildings, pipelines, and other man-made structures. They are probably not common in the planning area, but numbers would likely increase should development occur.

Common raven, though not abundant, is the only permanent resident passerine on the ACP. Ravens may use man-made structures such as buildings and towers for nest sites. In recent years, common ravens have been reported nesting at the Alpine field (Johnson et al. 2003b). Ravens are common in the foothills and mountains of the Brooks Range south of the NPR-A. They nest on cliffs where they construct nests that may be used in subsequent years by rough-legged hawks or gyrfalcons (Johnson and Herter 1989). Before human development on the ACP, common ravens were uncommon because of the lack of suitable nesting habitat. However, over the past several decades common raven nesting habitat (buildings and other man-made structures) on the ACP has become more common although it is unknown to what extent the population may have taken advantage of this increase in nesting habitat (Hohenberger et al. 1994). No long-term surveys adequately assess common raven population status on the ACP however, an increase in population is inferred from increased numbers counted at the North Slope Borough Landfill in Prudhoe Bay and the expansion of its range onto the ACP {Day 1998). Some individuals over-winter on the ACP near human food sources and their over-winter survival rate is believed to be higher than it would be without access to anthropogenic food resources. Recent changes in garbage handling and in the operation of the Prudhoe landfill have likely reduced but not eliminated access to anthropogenic food resources. Changes in landfill practices were associated with a roughly 50% decline in raven counts at the Prudhoe landfill (Hechtel cited in Day 1998). The only birds recorded at Prudhoe Bay during the Christmas Bird Count were common ravens. As their numbers have increased, common ravens are suspected to have become important predators of tundra-nesting birds on the ACP; however, no direct measurement of their impact is available (Day 1998).

3.3.7 Mammals

3.3.7.1 Terrestrial Mammals

Terrestrial mammals occurring in the planning area include caribou, muskox, moose, grizzly bear, Arctic fox, red fox, wolverine, gray wolf, and small mammals such as the Arctic ground squirrel, ermine, least weasel, lemming, voles, and shrews (USDOI BLM and MMS 1998). These species occur across the North Slope and in many other parts of Alaska. Polar bears occur in the planning area in terrestrial and marine habitats, but they are generally considered marine mammals (e.g., they are covered under the Marine Mammal Protection Act [MMPA]) and are proposed for listing as threatened under the Endangered Species Act (USFWS 2007). Polar bears are described **in section 3.3.8, *Special Status Species***. The terrestrial mammals that may be present in the planning area are listed in Table 3.3-G. This Supplemental IAP/EIS briefly discusses the distribution and habitat use of some of the species that are common or occur regularly in the planning area. More detailed species and life-history accounts can be found in 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998; III-B-39) and Northwest IAP/EIS (USDOI BLM and MMS 2003; III.B.5).

Caribou

Caribou herds are defined by the geographic location of their calving areas because cow caribou have high fidelity to calving areas and usually return each year following seasonal migrations (Skoog 1968; Cameron and Whitten 1979; Davis et al. 1986). Genetic data and field observations indicate that fall and winter ranges of different herds sometimes overlap, and that this may result in some interbreeding between herds (Skoog 1968; Whitten and Cameron 1983; Prichard et al. 2001; Cronin et al. 2003).

Table 3.3-G. Mammal Species Known or Suspected to Occur in the Planning Area

Common Name	Scientific Name	Iñupiaq Name	Abundance[1]
Large Mammals			
Arctic fox	*Alopex lagopus*	Qusrhaaq/tibiganniaq/ qujhaaq	Common
Caribou	*Rangifer tarandus*	Tuttu	Abundant
Gray wolf	*Canis lupus*	Amabuq	Rare or accidental
Grizzly (brown) bear	*Ursus arctos*	Akjaq	Uncommon
Lynx	*Lynx canadensis*	Niutuuyiq/niutuiyiq/ nuutuuyiq	Rare or accidental
Moose	*Alces alces*	Tiniikaq/tuttuvak/ titiniika	Uncommon
Muskox	*Ovibos moschatus*	Umifmak/imummak	Uncommon
Red fox	*Vulpes vulpes*	Kavviaq/kayuqtuq	Uncommon
Wolverine	*Gulo gulo*	Qavvik/qapvik	Uncommon
Small Mammals			
Arctic ground squirrel	*Spermophilus parryii*	Siksrik	Abundant
Barrenground shrew	*Sorex ugyunak*	Ugrugnaq	Common
Brown lemming	*Lemmus trimucronatus*	Aviffaq	Uncommon
Collared lemming	*Dicrostonyx groenlandicus*	Qixafmiutauraq	Common
Ermine (short-tailed weasel)	*Mustela erminea*	Itibiaq/tibiaq	Common
Least weasel	*Mustela nivalis*	Naulayuq	Uncommon
Northern red-backed vole	*Clethrionomys rutilus*	Avieeaq	Rare or accidental
Singing vole	*Microtus miurus*	—	Common
Snowshoe hare	*Lepus americanus*	Ukalliuraq/ukalliq	Rare or accidental
Tundra shrew	*Sorex tundrensis*	Ugrufnaq	Uncommon
Tundra vole	*Microtus oeconomus*	Avieeaq	Uncommon
Other Mammals			
Coyote	*Canis latrans*	Amabuuraq	Rare or accidental
Mink	*Mustela vison*	Tibiaqpak	Rare or accidental
Porcupine	*Erethizon dorsatum*	Ixuqutaq/qifabluk	Rare or accidental
River otter	*Lontra canadensis*	Pamiuqtuuq	Rare or accidental

[1]Abundant – species is present in great numbers in an area; Common – species is very likely to be seen in a given area but in fewer numbers than an abundant species; and Uncommon – a species that is regularly present but is seen infrequently. Species designated as rare or accidental are at the limit of their range.
Source: This table was modified from Phillips Alaska, Inc. (2001).

There are four caribou herds in Arctic Alaska: the Teshekpuk Lake Herd (Map 3-20), the Central Arctic Herd (CAH; Map 3-21), the Western Arctic Herd (WAH; Map 3-22), and the Porcupine Caribou Herd. Caribou of the TLH and CAH have a portion of their ranges in the planning area (Maps 3-20 and 3-21). Since the planning area is not used by the Porcupine Caribou Herd and is only occasionally used by the WAH, these two herds are not discussed further (USDOI BLM and MMS 2003).

Teshekpuk Lake Herd (TLH)

Sources of information on the TLH include White et al. (1975); Davis and Valkenburg (1978, 1979); Silva (1985); Dau (1986); Carroll (1992, 1995, 1997, 1999, 2001, 2003a); Philo et al. (1993c); Brower and Opie (1996, 1997); Whitten (1997); Cronin et al. (1998); USDOI BLM and MMS (1998, 2003); Noel (1999, 2000); Ballard et al. (2000); Kellyhouse (2001); Prichard et al. (2001); Jensen and Noel (2002); National Research Council [NRC] (2003); Prichard and Murphy (2004); Noel and George (2003); Person et al. (2007). This is not meant to be an exhaustive list of publications on the TLH, but presents the primary information without being redundant.

Population Status and Range. The TLH was recognized as a separate herd from the WAH and CAH in the mid-1970s (Davis and Valkenburg 1978). The primary range of the TLH is the North Slope west of the Colville and Itkillik rivers, with the peripheral range sometimes extending as far south as the Nulato Hills of the Brooks Range and as far east as the Arctic National Wildlife Refuge.

Most of the herd's range is in the northern portion of the NPR-A (Map 3-20). In one study, the annual range of individual radio-collared caribou varied from 1,388 mi^2 to 80,670 mi^2. Visual estimates of the number of animals in the TLH were recorded in 1978 (3,000 to 4,000 caribou), and 1981-1982 (4,000 caribou; BLM unpublished data). In 1984, the first photocensus of the TLH counted 11,822 caribou. Other photocensus estimates in 1985 (13,406 caribou), 1989 (16,649 caribou), and 1993 (27,686 caribou) documented a steady increase in the TLH. This was followed by a decrease in the herd estimate in 1995 (25,076 caribou). The estimate again increased in 1999 (28,627 caribou) and in 2002 (45,166 caribou). It is most likely that the 1999 photocensus resulted in an underestimate, and the herd has gradually increased from the mid 1990's to 2002 (Carroll 2005). However, due to poor weather and caribou distribution, the TLH has not been photocensused since 2002. An unusual eastward movement of a portion of the herd during the winter of 2003-2004 resulted in a significant mortality event which may have affected the TLH population. Also, emigration among North Slope caribou herds occurs but is poorly documented (Person et al. 2007).

Migration. Most TLH caribou begin migrating from winter ranges across northern Alaska to the Teshekpuk Lake area during May. By early June, most of the cows move into calving areas around the lake. After calving, most TLH caribou move north of Teshekpuk Lake, with most parturient cows traveling through the narrow migration corridors between the lake and the Kogru River to the east and the lake and Smith Bay to the west. Most of the herd uses the area along the coast for insect relief. After the insect-relief period, TLH caribou spread out and can be found across the North Slope coastal plain, primarily within the National Petroleum Reserve – Alaska. Fall movements of the TLH are variable among individual caribou and years. Most TLH caribou winter on the National Petroleum Reserve – Alaska coastal plain in most years, but occasionally some or most of the herd winters in other places such as the eastern coastal plain, the central Brooks Range, or northwestern Alaska as far south as the Nulato Hills.

Calving Grounds. The calving grounds of the TLH are primarily in the northern portion of the planning area near Teshekpuk Lake. Map 3-23 displays the calving season (June 1-15) utilization distribution for satellite-collared females that calved successfully from 1990-2005. If snowmelt occurs in late spring, more caribou will calve south of the lake than if snowmelt occurs in early spring. Kelleyhouse (2001) reported that the size of the TLH annual calving grounds ranged between 938 mi^2 and 1,861 mi^2. Recent calving by the TLH has been concentrated southeast and northeast of Teshekpuk Lake (Prichard and Murphy 2004). Carroll (2001) reported that in 2000 calving occurred all around Teshekpuk Lake and that more calves than usual were seen south and west of the lake. Aerial transect data (1999–2001) agree with telemetry data (1990-2004) that during the calving period, caribou use the entire area around Teshekpuk Lake (Carroll, pers. comm; Carroll et al. 2005).

The importance of this area to calving caribou is emphasized by observed calving success in abnormal years. The return of pregnant cow caribou to the Teshekpuk Lake area can be delayed in years when the caribou migrate further away during winter, or when snow-pack is deeper than normal and/or spring melt-off is later than normal. When their return to the Teshekpuk Lake area is delayed, more cows than usual calve along the way and this in turn results in lower than average calving success (Carroll et al. 2005). During 1996-97 most of the herd migrated much farther south than usual and many cows arrived late to the Teshekpuk Lake area. Only 8 of 21 collared caribou were found in the lake area during calving time and 6 of these calved successfully. The "lake area" is defined here as that area unavailable for leasing, available but without surface activity, or protected by "special caribou stipulations" in the Record of Decision for the Northeast NPR-A (USDOI BLM 1998). Of the other 13 collared cows, only one calved successfully for an overall successful calving percentage of 33%. In 2001, heavy snow and a late snow melt-off slowed the migration and only 16 (44%) of 36 collared cows calved successfully. Calving success for collared cows that did make it back to the Teshekpuk Lake area in 2001 was higher (88%) than ones found outside the lake area (10%).

Summer Distribution and Insect-relief Areas. The Teshekpuk Lake area is important as summer range because of prevailing winds and proximity to the coast, river deltas, and lake edge that provide insect-relief habitat and adjacent forage (Maps 3-24 and 3-25). On the ACP, caribou behavior and movements during summer are greatly influenced by harassment from mosquitoes and oestrid flies (White et al. 1975). During periods with little or no insect activity, caribou move back inland (Lawhead 1988).

The TLH summer range is between Barrow and the Colville River. In June and July, caribou are often located around the edges of Teshekpuk Lake and in the area between Teshekpuk Lake and the Beaufort Sea from the Ikpikpuk River to the Kogru River. Many other caribou use habitats as far east as Fish Creek. These areas are used regularly by the TLH for insect relief and foraging. Additionally, small groups of caribou occur at the Pik Dunes (about 18 miles south of Teshekpuk Lake) to avoid insects. Other insect-relief habitats in the summer range include sand dunes and ridges. The relatively narrow land areas on the east and west sides of the Teshekpuk Lake are important travel corridors for caribou moving between habitats north and south of the lake.

Fall and Winter Range Use and Distribution. During fall migration, some caribou again use the narrow corridors east and northwest of Teshekpuk Lake (above). Some caribou in the TLH are present year-round in the Teshekpuk Lake area. During fall (August-September), many caribou have been observed around the lake and as far east as Fish Creek. Use of this area as winter range may involve from 10-100% of the herd (based on radio and satellite telemetry of collared caribou). During most years, the majority of TLH caribou winter on the coastal plain of the NPR-A, but portions of the herd may also winter in a variety of other places. In some years, portions of the herd have migrated as far as the Nulato Hills to the south, Point Hope to the west, and the Arctic National Wildlife Refuge to the east.

Harvest. Subsistence harvest of the TLH is year-round, with most occurring between July and October by residents of Anaktuvuk Pass, Atqasuk, Barrow, Kaktovik, Nuiqsut, Point Hope, and Wainwright. It is difficult to determine precise numbers for TLH harvest because not all hunters report their harvest and because most villages harvest caribou from more than one herd. However, by examining village subsistence harvest studies and using radiotelemetry data to determine the percentage of caribou that are in village hunt areas during harvest season, a reasonable estimate can be made of TLH harvest. Approximately 2,500 TLH caribou in 1999-2000, 2,760 during 2000-2001, and 4,463 in 2002-2003, were harvested by residents of North Slope villages (Carroll 2005). Harvest of the TLH by sport hunters is generally low and mostly confined to the Colville River drainage.

Central Arctic Herd (CAH)

Sources of information on the CAH include White et al. (1975); Roby (1978); Cameron and Whitten (1979); Whitten and Cameron (1980); Gavin (1983); Carruthers et al. (1984); Lawhead and Curatolo (1984); Dau (1986); Jakimchuk et al. (1987); Fancy et al. (1989); Pollard et al. (1996a, b); Smith (1996); Noel et al. (1998); USDOI BLM and MMS (1998, 2003); Lenart (1999b, 2003); Lawhead and Johnson (2000); Murphy and Lawhead (2000); Noel and Olson (1999a, b); Olson and Noel (2000); Prichard et al. (2001); Burgess et al. (2002); Lawhead and Prichard (2002); Phillips Alaska, Inc. (2002); Douglas et al. (2002); Lawhead et al. (2003); and NRC (2003).

Population Status and Range. The range of the CAH extends east and west from the Colville River, to the Canning River and north and south from the Beaufort Sea coast to the southern slope of the Brooks Range (Map 3-21). During summer, portions of the CAH may range short distances west of the Colville River in the planning area and east of the Canning River in the Arctic National Wildlife Refuge. Large movements of the CAH west of the Colville River into the planning area are unusual (Lawhead et al. 2006). The calving grounds are between the Colville and Canning rivers within 100 miles of the Beaufort Sea.

The CAH was estimated at approximately 5,000 caribou in 1975 and increased to approximately 23,444 in 1992. The CAH declined to 18,093 in 1995 and then increased again to 19,730 in 1997 and 27,128 in 2000. The most recent photocensus conducted in the summer of 2002 documented approximately 32,000 caribou.

Migration. The CAH caribou migrate between winter range in the Brooks Range and summer range on the ACP. In general, parturient cows arrive on the ACP between early May and early June, calving occurs between the last week of May and the second week of June, and bulls arrive by early July. A gradual southward fall migration generally occurs after the insect-relief season ends in mid-August.

Calving Grounds. The CAH calves between the Colville and Canning rivers to the east of the planning area, within 100 miles of the Beaufort Sea, with calving concentrated in areas east and west of the Sagavanirktok River. Calving data in the Colville-Kuparuk region from 1993 to 2002 showed that the greatest calving densities were approximately 12 miles south of the Kuparuk oil field. Lower densities of calving have been reported within and adjacent to the Kuparuk and Milne Point oil fields. Calving has occurred since the oil fields were built in 1980–

1981 in these areas, but the proportion of the herd calving in and near the oil fields has decreased since the mid-1980s (Cameron et al. 2005).

Summer Distribution and Insect-Relief Areas. The summer range of the CAH encompasses the area between the Canning and Colville rivers and between the Brooks Range and Beaufort Sea. When harassed by insects, caribou of the CAH typically use coastal areas, river deltas and bars, and non-vegetated habitats such as gravel roads and pads for relief from insects. During periods of harassment by insects, large groups of caribou have been observed along the Beaufort Sea coastline, near Franklin Bluffs, on oil field roads and gravel pads, and on the deltas of the Canning, Kadleroshilik, Kuparuk, Sagavanirktok, Shaviovik, and Staines rivers. Aerial surveys have documented CAH caribou moving west into the Colville River Delta and the planning area. The largest such movement (more than 10,000 caribou) occurred in July 2001.

Winter Range Use and Distribution. Most CAH caribou move south from the summer range to the mountains and foothills of the Brooks Range. Surveys during March 2001 and February 2002 located caribou north and south of the Brooks Range and east and west of the Dalton Highway/Trans-Alaska Pipeline System (TAPS) corridor. As many as several hundred CAH caribou may overwinter on the ACP, some within the Kuparuk oil field. Fall and winter ranges of the CAH, TLH, and WAH may overlap.

Harvest. Local subsistence hunters from Nuiqsut and Kaktovik and non-local hunters harvest between 200 and 900 CAH caribou each year. Non-local subsistence and sport hunters hunt mostly along the Dalton Highway.

Muskoxen

Muskoxen occurred throughout northern Alaska, but they were extirpated from the ACP in the mid-1800s (Hone 1934). Muskoxen were reestablished by translocation to Nunivak Island near the western Alaska coast in 1935 (Spencer and Lensink 1970), to Barter Island and the Kavik River near the Arctic National Wildlife Refuge in 1969 (Jingfors and Klein 1982, USDOI BLM and MMS 2003), and to the west of the planning area near Cape Thompson in 1970 and 1977 (Smith 1989). Thereafter, muskox numbers in northeastern Alaska increased and their range expanded to the Colville River on the west and beyond the Babbage River on the east (Reynolds 1998, USDOI BLM and MMS 2003).

Map 3-26 depicts best potential habitat for muskoxen as determined by studies in the late 1970’s, before any muskoxen had returned to the NPR-A or most of the rest of Alaska’s North Slope. A more recent effort to describe potential muskox habitat in the NPR-A was done by Danks (2000), based on habitats used by muskoxen east of the NPR-A at that time, and land-cover classifications derived from satellite imagery. This analysis described summer and winter habitats separately, and concluded that suitable summer habitat existed primarily in lower-lying drainages and wetter areas, and suitable winter habitat in drier, more rugged, exposed areas. The results for winter had some similarities to Map 3-26, with the most suitable habitat occurring in an east-west belt across central NPR-A, but the most suitable summer habitats were further north in the coastal plain.

ADFG began doing regular surveys of muskoxen in the central North Slope in 1997 after mixed-sex groups had become established there (Carroll pers. comm.). Up to this time, only transitory lone bulls but no mixed-sex groups had been observed in the NPR-A. An estimated 279 muskoxen were counted between the Colville River and the ANWR, with 81 of those being in the Itkillik Hills as a breeding population about 20 miles east of the Colville River, but none were found along the Colville River itself (Carroll pers. comm.; Johnson et al. 1996). In 1998, five muskoxen were observed along the Ikpikpuk River within the NPR-A; ADFG opened an emergency hunt at the request of local residents and muskoxen were not seen in this area again until two were observed in 2000. In that same year, two groups of 16 each were observed along the Colville River. In 2001, three groups were found along the Colville River and a group of five on Fish Creek within the NPR-A. Whether or not the last group survived is not certain, but in 2004 a group of 11 muskoxen was observed not too far away near Inigok. This group moved to the Kogru River and then to lower Fish Creek in 2005, and included nine adults and six calves, so by this time breeding muskoxen were known to occur in the NPR-A. By May, 2007, this group had increased to 21 adults and six calves, but later that month they were found about 25 miles offshore on sea ice for reasons unknown. By mid-June, 13 cows from this group had made it back to land north of Teshekpuk Lake, but no calves or bulls from this group have since been seen. This group of cows was most recently seen in October, 2007, between Teshekpuk Lake and the Lonely DEW-Line site.

Moose

Moose occur at low densities on the ACP, which is the northern limit of the moose's range in Alaska. Moose are widely distributed during the summer, ranging from the northern foothills of the Brooks Range to the Arctic Coast (Map 3-26). As snow accumulates during fall, moose move to riparian corridors of large river systems, where they concentrate in winter. The largest winter concentrations of moose occur in the inland portions of the Colville River drainage, with tall shrubs the predominant and preferred browse species (Mould 1979, Carroll 2000b). As snow cover in the foothills decreases in April, moose begin to move away from winter concentration areas, but generally remain in riparian areas. Census and trend counts throughout the NPR-A and surrounding areas indicated that the moose population declined by 75% between 1992 and 1996, began to increase in 1997, and had recovered to about 65% of their 1991 peak by 2003 (Carroll 2004b).

Grizzly Bear

The ACP is the northern limit of the grizzly bear's range, and is considered marginal habitat because of the severe climate, short growing season, and limited food resources (Shideler and Hechtel 2000). Relatively low densities of grizzly bears (0.2 to 0.8 bears per 1,000 mi^2) use the ACP, with the highest density in the Prudhoe Bay and Kuparuk oil field region (Reynolds 1979, Young and McCabe 1997, Carroll 1998, Shideler and Hechtel 2000, USDOI BLM and MMS 2003). The number of grizzly bears using the Prudhoe Bay and Kuparuk oil fields east of the NPR-A has increased in recent years; 27 bears were captured and marked by ADFG in studies of bear use of the oil fields (Shideler and Hechtel 1995). Foraging bears use the grass meadows on the bluffs along the Colville River during the spring (Swem 1997).

Wolf

Wolf numbers on the ACP and Brooks Range have fluctuated since the 1900s in response to changes in prey populations (caribou and moose), a Federal wolf control program in the 1950s, and aerial and snowmachine hunting by the public since the 1960s (Carroll 2000a, Shideler 2000). After bans on aerial wolf hunting in 1970 and land-and-shoot hunts in 1982, the wolf population increased, especially in the mountains and foothills of the Brooks Range. In general, wolves are more abundant in the Brooks Range than on the ACP.

The highest wolf densities in the National Petroleum Reserve – Alaska are along the Colville River. Surveys near Umiat showed that the density of wolves increased from 0.7-0.8 wolves per 100 mi^2 in 1987 to 1.1 wolves per 100 mi^2 in 1992 (Bente 1998; Carroll 2003b). A survey in 1998 estimated 0.3-0.6 wolves per 100 mi^2, showing that wolf numbers had declined since 1994 (Bente 1998; Carroll 2003b). This decline may have been related to the decrease in the moose population between 1992 and 1996 (see above).

The subsistence harvest of wolves is greatest in the southeastern portion of Game Management Unit (GMU) 26A, where residents of Anaktuvuk Pass and Nuiqsut hunt and trap wolves throughout the winter (Carroll 2000a). The annual subsistence harvest throughout GMU 26A has ranged from approximately 50 to 120 wolves.

Wolverine

Wolverines occur throughout the ACP, but are considered more common in the mountains and foothills of the Brooks Range (Map 3-26; Bee and Hall 1956; USDOI BLM and MMS 1998, 2003). Magoun (1984) estimated a fall population of 821 wolverines for the western North Slope (GMU 26A), based on a density of 0.5 wolverine per 100 mi^2. From 1991 to 1994, 2 to 14 wolverines were harvested in GMU 26A; however, it is likely that more animals are harvested and not reported (Carroll 2000b). Most harvest of wolverines is by residents of the North Slope. From 2000-2001, 23 harvested wolverines were sealed, 26 were sealed in the 2001-2002 reporting year, and 11 were sealed in the 2002-2003 reporting year (Carroll 2004a). This, compared to the early 1990's, may indicate increasing wolverine numbers but could also reflect increased hunter effort and perhaps a higher percentage of harvest reported.

Fox

The Arctic fox is the most common furbearer on the ACP in and near the planning area and its numbers have probably increased with the decline of pelt harvesting since 1929 (Chesemore 1967). Arctic foxes in the Prudhoe Bay oil field area readily use development sites for feeding, resting, and denning, and their densities are greater in the oil fields than in surrounding undeveloped areas (Eberhardt et al. 1982; Burgess et al. 1993; Burgess 2000), suggesting that anthropogenic food sources may support a population increase. Lemmings and voles are important prey year-round for Arctic foxes. Foxes also forage on carcasses of caribou and marine mammals. Harvest data for the Arctic fox are not available, but low fur prices in the mid-1990s resulted in relatively few foxes being trapped (Carroll 1998).

Red fox also occur in northern Alaska on the coastal plain, but are much less common than arctic fox. A study of wildlife on the northern Colville Delta found 12 fox dens between 1992 and 2002, 10 of which were of arctic fox and only two were red fox dens (Johnson et al. 2003). Local residents have noticed an increase of red fox in recent years coincident with warmer winters.

Other Small Mammals

Other small mammals found in the planning area include Arctic ground squirrels, ermine (short-tailed weasel), least weasel, snowshoe hare, two lemming species, three vole species, and two species of shrew (Phillips Alaska, Inc. 2002; USDOI BLM and MMS 2003). Small mammals are important prey for grizzly bears, foxes, wolves, wolverines, and birds of prey. Many small mammals undergo cyclic population fluctuations.

3.3.7.2 Marine Mammals

Marine mammal species that occur regularly in the Beaufort Sea offshore from the planning area include the ringed, bearded, and spotted seal (largha), and beluga (belukha) whale. Other species occurring in smaller numbers include the gray whale, harbor porpoise, killer whale, narwhal, hooded and ribbon seals, and walrus. Bowhead whales are listed as endangered under the ESA, and polar bears are proposed to be listed as threatened. Humpback whales (listed as endangered) were sighted in the Beaufort Sea east of Barrow during the summer of 2007. These species normally occur no further north than the Bering Straits/Southern Chukchi Sea (Angliss and Outlaw 2005) so this is an extralimital occurrence. It is not known if these sightings represent a northward shift in range or a rare movement outside their normal range. The bowhead and humpback whale and polar bear are considered in **section 3.3.8, *Special Status Species.*** All marine mammals in U.S. waters are protected under the MMPA of 1972. In the Act, it was the declared intent of Congress that marine mammals "be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management, and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem."

Table 3.3-H lists the marine mammal species of the Beaufort Sea, including their status under the MMPA and the ESA. Ringed seals and bearded seals are present year-round and move extensively throughout the Beaufort Sea region. Beluga whales are normally present from April to October, and spotted seals are present from July through mid-October. Bearded seals and ringed seals are important subsistence species for hunters from Barrow, Nuiqsut, and Kaktovik. Iñupiat hunters take beluga whales sporadically when they are available.

Table 3.3-H. Marine Mammal Species of the Beaufort Sea Including Common, Scientific, and Iñupiaq Name, Abundance and Residency Classification, and Status Under the Marine Mammal Protection Act and Endangered Species Act

Common Name	Scientific Name	Iñupiaq Name	Abundance[1]	Seasonal Residency	Status Under MMPA[2]	Status Under ESA[2]
Bearded seal	*Erignathus barbatus*	Ugruk	Reliable estimate unavailable	Year-round	Protected	Not listed[3]
Beluga whale	*Delphinapterus leucas*	Sisuaq/ kilalugak	39,258 BS (1992) 3,710 CHS (1991)	Seasonal	Protected	Not listed
Bowhead whale	*Balaena mysticetus*	Abviq	10,545 (2001)	Seasonal	Depleted	Endangered
Humpback whale	*Megaptera novaeangliae*		Reliable estimate unavailable	Rare Visitor	Depleted	Endangered
Polar bear	*Ursus maritimus*	Nanuq	1,526 (2006)	Year-round	Protected	Proposed: Threatened
Ribboned seal	*Histriphoca fasciata*	Qaigullik	Not Available	Reliable estimate unavailable	Protected	Not listed[3]
Ringed seal	*Phoca hispida*	Qaibulik/ qaubutlik	Reliable estimate unavailable (partial surveys indicate >200,000 in 2000)	Year-round	Protected	Not listed[3]
Spotted seal	*Phoca largha*	Qasigiaq	Reliable estimate unavailable	Seasonal	Protected	Not listed[3]

[1] Angliss and Outlaw (2005). Polar Bear estimate from Regehr et al (2006). Numbers in parentheses are date given for last population estimate

[2] Endangered species are classified automatically as depleted; all depleted stocks are strategic stocks. Listed species are addressed in section 3.3.8.

[3] Under status review. (Federal Register March 2008).

Ringed Seal

Ringed seals are the smallest and most abundant of the Arctic ice seals (Smith and Hammill 1981, Kingsley 1986). Ringed seals have a circumpolar distribution, occurring in all areas of the Arctic Ocean, and range from approximately 35°North latitude to the North Pole (Kingsley 1986). The Alaska stock of ringed seals occurs in the Bering, Chukchi, and Beaufort seas (Map 3-27). The size of the Alaska population is not currently known (Angliss and Outlaw, 2005), but estimates range from 1 million to 3.5 million individuals (Frost et al. 1988). The Beaufort Sea population may range from 40,000 in the winter to 80,000 in the summer (Frost and Lowry 1981). Frost et al (2002) detected a possible decline of 31% between the period from 1980-87 and 1996-99 but caution that this may be an artifact of survey timing. Although ringed seals do not occur in large herds, loose aggregations of tens or hundreds of animals do occur, probably in association with abundant prey.

Densities of ringed seals near Prudhoe Bay between 1997 and 2002 ranged from 0.15 to 0.28 seals per mi^2 (Moulton et al. 2003). These are lower than densities calculated in the same area during the 1980s. The differences may be due, in part, to differences in the timing of surveys, the timing of lair abandonment, or a decrease in the abundance of seals since the 1980s (Kelly et al. 2002a, b). During winter and spring ringed seals are found at highest densities on stable shore fast ice and during summer months are found along the receding edge of pack ice.

Bearded Seal

Bearded seals are present throughout the year in the Beaufort Sea (Map 3-28). They are considered common, but not abundant, during late spring through early autumn, and less common during the months of heavy ice cover. They may be found in near shore areas during summer in the central and western Beaufort Sea. No reliable estimate of the abundance of bearded seals in the Beaufort Sea is currently available (Angliss and Outlaw 2005). Their densities in the western Beaufort Sea are highest during the summer and lowest during the winter. The population in Alaska waters is largely migratory, with its center of abundance in the Bering Sea. Their most important habitat during winter and spring is active ice or offshore leads.

Spotted (Largha) Seal

Spotted seals are medium-sized phocids that range along the continental shelf from the central Beaufort Sea through the Chukchi, Bering, and Okhotsk seas to the Sea of Japan. The Alaska stock of spotted seals occurs from the Bering Sea to the Beaufort Sea in the Arctic Ocean. There is currently no reliable estimate of the numbers of spotted seals in Alaska (Rugh et al. 1995; Angliss and Outlaw 2005).

Spotted seals are not common in the Beaufort Sea and are present only during the ice-free summer season (Rugh et al 1997). Recently, spotted seals also have used Smith Bay at the mouth of the Piasuk River, just west of the planning area. Spotted seals have also been reported using haulouts in the Colville River and Dease Inlet (R. Suydam pers. comm. 2006)

Beluga (Belukha) Whale

The beluga, or belukha whale, a subarctic and Arctic species, is a summer visitor throughout offshore habitats of the Alaskan Beaufort Sea (Map 3-30). Two stocks may occur in or near the planning area: the Beaufort Sea and the eastern Chukchi Sea (Richard et al. 2001, Angliss and Outlaw 2005, Suydam et al. 2005). Belugas from the Beaufort Sea stock begin migrating north and east from the Bering Sea following spring leads during April and May (Richard et al. 2001) usually seen at Point Barrow by mid-April through May (Richardson et al 2001). In spring, Belugas often travel near bowhead whales. Once in the Beaufort Sea, most belugas travel through offshore leads to the eastern Beaufort Sea and Amundsen Gulf, where they spend part or all of the summer (Richard et al. 2001). During this time, within the Alaskan Beaufort, belugas are associated water 600 – 6,500 feet in depth and typically heavy ice cover (71 – 100%. Shallow water (<165 feet) and moderate ice cover appear to be avoided (Moore et al. 2000). The majority of summer sightings in U.S waters during surveys conducted from 1982 through 1991 were between Prudhoe Bay and the Canadian border (Moore and DeMaster 1997).

Beaufort Sea belugas begin fall migration in late August and continues through mid-September, following the continental shelf break (Richard et al. 2001) and typically associated with moderate to heavy ice cover (Moore et al. 2000).

The latest population estimate for the Beaufort Sea stock was 39,000 animals in 1992; however, the current population size and trend are unknown (Angliss and Outlaw 2005).

Eastern Chukchi Sea belugas begin their north and eastward spring migration in June into July moving into the northern Beaufort. Like the Beaufort animals they tend to avoid waters less than 660 feet in depth and do not avoid heavy ice cover. Fall migration occurs in October and November (Suydam et al. 2005). In August and later Beaufort Sea and Eastern Chukchi Sea belugas may occur in the same area at the same time

Although the available evidence suggests a preference for deep water (Moore et al. 2000, Suydam et al. 2005), belugas do occur in shallower waters, either pursuing prey, thermal benefits, or for molting. There are limited records of coastal sightings of beluga whales near the Colville River Delta. Helmericks (in Hazard 1988) reported that belugas were common near shorefast ice in the Colville River Delta region until ice moved offshore in July. Seaman et al. (1981) reported sightings of a few groups (ranging up to 100 belugas) during fall migration north and east of the Colville River Delta near Jones, Pingok, and Thetis islands. Recently, Nuiqsut hunters have reported that belugas have been seen in the Nigliq Channel in the Colville River and were seen stranded in shallow water in the Fish Creek Delta (Lampe 2003).

3.3.7.3 Other Marine Mammal Species occurring regularly in or near the Planning Area but in low numbers

Gray Whale

Gray whales have been regularly observed near Barrow (Moore and DeMaster 1997). It is unknown how many of the Eastern North Pacific Stock's approximately 18,800 (Angliss and Outlaw 2005) occur in the Beaufort. Most gray whales observed in summer from 1982-1991 were in the northern Bering Sea (Moore et al. 2000). In the Chukchi and Beaufort Seas gray whales have been heard off Point Barrow from October through May (Moore et al. 2000) and detected in aerial surveys primarily in nearshore waters from Point Barrow to Icy Cape, and occasionally to the northeast of Point Barrow. In September and October they have also been observed northwest of Wainwright near the Hannah Shoal as well as off Point Hope to the south (Moore et al. 2000). Subsistence hunters have reported seeing more gray whales near Barrow in late-summer and autumn, possibly indicating a northward shift in use areas (Moore et al. 2000).

Gray whales use different habitats than bowheads, using areas of shallow water (average depth 125 - 130 feet) and low ice cover (average 1% to 7%) depending on season (Moore and DeMaster 1997). Gray whales may have been subject to episodes of starvation (Moore et al. 2003) and there are recent reports of gray whales appearing "thin."

Pacific Walrus

The Chukchi Sea west of Barrow is the northeastern extent of the main summer range of the Pacific walrus (Angliss and Outlaw 2005); Few been reported in the literature farther east in the Beaufort Sea (Angliss and Outlaw 2005; Harwood et al, 2005). Walrus observed in the Beaufort Sea are typically single animals. No reported use of terrestrial haul-outs in or near the planning area were found in the literature. For additional information on walrus life history in the Chukchi Sea see MMS 2006.

Narwhal

Known primarily from the Nunavut, Greenland, and the European Arctic, narwhal are considered rare in the Beaufort and Chukchi Seas (Dietz et al. 2001, COSEWIC 2004). In areas where they are more common narwhal are associated with deep waters (1,640 – 4,900 feet; (Dietz et al. 2001), during summer they may be selecting for deep water and shelter from wind (COSEWIC 2004).

Ribbon seals

Ribbon seals inhabit the North Pacific Ocean and the adjacent fringes of the Arctic Ocean. In Alaska, they range northward from Bristol Bay in the Bering Sea and into the Chukchi and western Beaufort seas. They are found in the open sea, on pack ice, and rarely on shorefast ice (Kelly, 1988). As the ice recedes in May to mid-July, they move farther north in the Bering Sea, hauling out on the receding ice edge and remnant ice (Burns et al, 1981). Seal distribution throughout the rest of the year is largely unknown; however, available information suggests that many ribbon seals migrate into the Chukchi Sea for the summer months (Kelly, 1988).

Harbour Porpoise

Harbour porpoise are rare but regular visitors to the Beaufort Sea during ice free months. Typically associated with subarctic waters, including the Bering Sea, their occurrence in the Beaufort has been poorly studied and is known primarily from incidental sighting reports and accidental capture in subsistence nets (Suydam and George 1992). Suydam and George (1998) compiled reports and records of harbour porpoise near Point Barrow. Most records are from the area near Barrow, with most in Elson Lagoon. There are additional records near Peard Bay. The near shore sightings may be indicative of the species foraging on fish in lagoons. The Point Barrow area may be the current northward limit of their range (Suydam and George 1992). However, changes in ice formation timing and extent may result in the range shifting further to the north and east, possibly into the planning area.

Killer Whale

Killer whales also are apparently rare but regular visitors to the Beaufort Sea. Sighting reports compiled by George and Suydam (1998) are comprised primarily of observations of killer whales attacking other marine mammals (primarily gray whales) near Point Barrow and along the coast south from that point south along the coast to Peard Bay. George and Suydam (1998) do not report any sightings to the east of Point Barrow. There are no formal surveys conducted for killer whales in the Chukchi or Beaufort Sea; therefore all the reports are incidental and probably underestimate the actual occurrence. However, the time space between reported observations and the relatively few killer whales sighted suggest that they are not common.

3.3.8 Special Status Species - Threatened and Endangered Species and BLM-Designated Sensitive Species

Special Status Species include plants and animals listed under the ESA and sensitive species as identified by the BLM-Alaska State Director following guidance in BLM Manual 6840. There is one marine mammal, two ducks and no plants federally–listed under the ESA in the planning area. There is one mammal, ten birds, and one plant on the BLM sensitive species list known or suspected in the planning area. The BLM's list of sensitive species is provided in Appendix J and discussion of the sensitive species in the planning area are included in the related mammal, bird, and vegetation sections.

The bowhead whale (endangered), humpback whale (endangered), and spectacled and Steller's eiders (threatened) are federally–listed under the ESA. Polar bears are proposed threatened species (USFWS 2007). No other birds, or marine or terrestrial mammals in the planning area are listed under the Federal or State of Alaska endangered species acts (USDOI BLM and MMS 1998, 2003; TAPS Owners 2001; Phillips Alaska, Inc. 2002).

3.3.8.1 Bowhead Whale

The bowhead whale is classified as endangered under the ESA and as depleted under the MMPA. The bowhead whale was listed as endangered in 1970 (USFWS 1970), but no critical habitat has been designated for this species.

The Bering-Chukchi-Beaufort Seas (BCBS) stock of bowhead whales is the largest of the five stocks that occur in the Arctic and subarctic (Map 3-31; Angliss and Outlaw 2005). The size of the stock was estimated at 10,400 to 23,000 animals in 1848, before commercial whaling decreased the stock to between 1,000 and 3,000 animals by 1914 (Woodby and Botkin 1993). This stock has slowly increased since 1921 when commercial whaling ended, and in 2001 estimates indicated a population of 10,500 whales (George et al. 2004, Zeh and Punt 2004). Separate analyses suggest the mean annual rate of increase from 1978 to 2001to be between 3.4% and 3.5% (George et al 2004, Brandon and Wade 2004).

Bowhead whales occur in seasonally ice-covered seas, generally remaining close to the pack-ice edge. Throughout the winter, bowhead whales frequent the marginal ice zone and polynyas in the western and central Bering Sea (Braham et al. 1984). Moore et al (2000) determined that bowhead whales select deeper continental shelf areas (660- 6560 feet) with moderate to light ice conditions during summer (July and August). In autumn (September- October, bowhead whales were associated with shallower outer and inner shelf areas (<660 feet) and light ice conditions (Moore et al. 2000). The BCBS stock of bowhead whales are distributed in summer in a broad area from Amundsen Gulf and the Eastern Beaufort Sea to the eastern part of the East Siberian Sea and into the northern Bering Sea.

Migration

Bowhead whales migrate through the Beaufort Sea offshore of the planning area while traveling between wintering areas in the Bering Sea and summer feeding grounds in the Canadian Beaufort Sea although some animals may remain in areas offshore of the planning area throughout the summer. The spring migration typically begins in the Bering Sea in late March to early April, depending on ice conditions. During the spring migration, bowhead whales follow predictable leads that form along the coast of western Alaska to Point Barrow. From Point Barrow eastward to Amundsen Gulf, the leads and the migration occur presumably farther from shore, although there are few data. From April to June, most bowhead whales are distributed along a migration corridor that extends from their Bering Sea wintering grounds to their feeding grounds in the eastern Beaufort Sea (Moore and Reeves 1993). Some bowhead whales may migrate westward to feeding grounds in the western Chukchi Sea (Bogoslovskaya et al. 1982, Mel'nikov et al. 1997). Bowhead whales arrive on their primary summer feeding grounds in the eastern Beaufort Sea from mid-May through June and remain in the Canadian

Beaufort Sea and Amundsen Gulf until late August or early September. Some whales may occur regularly in the western Beaufort Sea and in the Chukchi Sea along the northwestern Alaskan coast in late summer. These animals are likely summer resident, but may be "early autumn" migrants.

During the spring migration, BCBS bowhead whales migrate in pulses composed of aggregations of individuals (Ljungblad et al. 1986). Iñupiat traditional knowledge (summarized in Braham et al. 1980) holds that the pulses are segregated by age and sex; the first two pulses are generally subadults and adults without calves, while cows with calves do not arrive until the third and final pulse. The first migrants are usually seen near Point Barrow in mid-April, but may arrive later in heavy ice years (Krogman et al. 1989). After passing Point Barrow, most of the bowheads travel east through offshore leads in the continuous pack ice to feeding grounds in the eastern Beaufort Sea (Richardson and Thomson 2002).

Bowhead whales that have summered in the eastern Beaufort Sea begin the fall migration in late August to September and are usually out of the Beaufort Sea by late October (Treacy 1988-1997, 2000, 2002a, b; Moore and Reeves 1993). The fall migration route extends from the eastern Beaufort Sea, along the continental shelf across the Chukchi Sea, and down the coast of the Chukchi Peninsula (Moore and Reeves 1993).

The extent of ice cover may influence the route, timing, or duration of the fall migration. Miller et al. (1996) observed that whales moving from 147° to 150° West longitude in the central Beaufort Sea, migrated closer to shore in light and moderate ice years (median distance offshore 18 to 25 miles), and farther offshore in heavy ice years (median distance offshore 35 to 45 miles).

Foraging

Bowhead whales apparently feed throughout the water column, including bottom or near-bottom, mid-column, and surface feeding (Würsig et al. 1985). Carbon-isotope analysis of bowhead whale baleen indicates that bowhead whales obtain a significant proportion of their food in both summering and wintering areas (Schell et al. 1987; Schell and Saupe 1993). Bowhead whales feed opportunistically where food is available as they migrate through the Alaskan Beaufort Sea sometimes close to shore. (Richardson and Thomson 2002, Treacy 2002b). Examination of stomach contents from whales taken in the Iñupiat subsistence harvest indicates that bowhead whales feed on a variety of invertebrates and small fishes and that the Beaufort Sea is an important feeding area (Lowry 1993, Lowry et al. 2004). Stomach analysis from whales harvested at Barrow found that 73% of the whales taken in autumn were feeding while only 31% of the whales taken in spring were feeding. Whales taken at Cross Island and at Kaktovik during autumn also showed high rates of feeding (Lowry et al. 2004).

Although regular feeding areas and areas of high prey density have not been identified, distribution of apex consumers like bowheads typically is associated with areas of high prey productivity and density (Ainley and DeMaster, 1993). High density areas shown in Map 3-31 may therefore indicate areas important to bowhead for foraging.

Survival and Mortality

Bowhead whales are long-lived species, with examples of individuals greater than 100 years old (George et al. 1999). Commercial and subsistence whaling have been the greatest causes of bowhead whale mortality for the last several centuries. Currently, Alaskan Iñupiat are allowed

67 strikes per year, which, if all were fatal, would result in 0.6% mortality of the stock from subsistence activity. The Iñupiat in some communities preferentially hunt immature whales (Philo et al. 1993b, Suydam and George 2004). Natural annual mortality in bowhead whales has been estimated at 3-7% (Breiwick et al. 1984; Chapman 1984), although it is difficult to estimate natural mortality since few bowhead whales that die of natural causes are seen. Bowhead whales have no known predators except subsistence whalers, and killer whales. Attacks by killer whales have occurred, but the frequency is probably low. Likewise, the scarcity of observations of vessel-inflicted injuries suggests that the incidence of ship collisions with bowhead whales is also quite low (George et al. 1994). Some whales likely die as a result of entrapment in ice, but the number is thought to be relatively small (Philo et al. 1993b). Little is known about mortality rates from microbial or viral disease agents (see Rosa 2006 for additional information on general health of bowhead whale).

Bowhead whales typically calve April through early June (Nerini et al. 1984, Koski et al. 1993); giving birth in leads during spring migration through the Bering and Chukchi Seas. Pregnant bowheads harvested at Barrow during spring also indicate that some portion of the population is calving in the Beaufort Sea (Suydam and George 2004), although the location of calving areas is unknown.

Planning Area

Bowhead whales traverse the NPR-A coast during the spring and fall migrations, although they generally travel several miles offshore. During annual aerial surveys conducted in the autumn in the Beaufort Sea from 1987 to 2001, a few bowhead whale sightings were made in the western Beaufort Sea within about 7 miles of shore, and several whales were seen between Dease Inlet and Smith Bay near the shoreline (Treacy 1988, 1997, 2000, 2002a, b). Occasional groups are seen feeding or milling near the mouth of Dease Inlet (Treacy 2002b), and in 1992, large groups were seen in this area (Treacy 1993). During the spring migration, the nearshore waters are completely ice covered and the migration occurs far from shore.

Humpback Whale

MMS included humpback whales in their EIS for the Chukchi Lease Sale; that information is incorporated by reference here and summarized below (MMS 2006 p III-59 to III-61).

The humpback whale is classified as endangered under the ESA and as depleted under the MMPA. The bowhead whale was listed as endangered in 1970 (USFWS 1970), but no critical habitat has been designated for this species. The Bering Straits are considered to be the northern limit of humpback's range (Angliss and Outlaw 2005) although there is some evidence that they at least historically used the southern Chukchi Sea. It is not known if the 2007 summer observations in the Beaufort Sea east of Barrow are the result of rare extralimital movements or a northward shift in range. They have not been observed during the Minerals Management Service's Bowhead Whale Aerial Survey Project or reported in the Beaufort Sea previously. Regardless there is no information on foraging, movement, or habitat use in the Beaufort or Chukchi Seas.

The humpback whales that were obsereved in the Beaufort are either from the central or western Pacific Stock, no reliable information is available to estimate population size of either stock in Alaska but the north Pacific population (including the western and central Pacific stocks) is likely greater than 6,000. As there is insufficient information to develop reliable population estimates, there is no reliable information on population trend.

North Pacific humpbacks undergo a winter migratation to tropical and temperate areas to calve and mate before returning to northern waters in the summer where the western and central Pacific stocks appear to overlap while foraging in the Gulf of Alaska and possibly the Bering Sea.

Humpbacks are generalist filter feeders taking small crustaceans and fish from the water column. Generally they are believed to feed only during the summer.

3.3.8.2 Spectacled Eider

Population Status

The spectacled eider is a medium-sized sea duck that breeds along coastal areas of western and northern Alaska and eastern Russia, and winters in the Bering Sea (Petersen et al. 2000). Three breeding populations have been described: one in the Y-K Delta in western Alaska, a second on the North Slope of Alaska, and the third in Arctic Russia. The most current population estimate is from a winter survey conducted in 1998, resulting in a population index of approximately 374,700 birds (Larned and Tiplady 1999). The majority of the population is likely from Russia, where the most recent surveys indicated a population of 146,245 (Hodges and Eldridge 2001).

During the 1970s, approximately 50,000 female spectacled eiders nested in western Alaska (Dau and Kistchinski 1977). Data collected by the USFWS in the Y-K Delta suggested that the number of female spectacled eiders nesting in the Y-K Delta declined by approximately 8-14% per year from the 1970s to 1992 (Stehn et al. 1993; Ely et al. 1994). By 1992, the Y-K Delta spectacled eider population was reduced to approximately 4% of the population that existed there in the 1970s, and it was federally-listed as a threatened species in 1993 (USFWS 1993).

Little information is available describing the status of the North Slope spectacled eider population prior to 1992. Historically, the North Slope population has likely been much smaller than Y-K Delta population. The USFWS began conducting aerial surveys for breeding eiders in 1992, which have continued annually through the 2006 breeding season (Larned et al. 2006). The surveys conducted by the USFWS provide the best available information on eider distribution, density and population status. The USFWS divided the survey area into 16 stratum based on coarse ecological and physical attributes and political boundaries including NE NPR-A (Larned et al. 2006). Survey data are compiled by stratum thus an estimate of breeding eider density and numbers for the NE- NPR-A can be developed. It should be noted that the Breeding Eider Survey only covers approximately 41% of the planning area (1.9 million acres); however, very few birds occur south of the southern limit of the survey area.

The 1992 survey was flown too late in the season to be included in trend analyses with subsequent years, but since 1993 the North Slope spectacled eider population index has remained relatively stable, with a slight, non-significant increase over the last 7 years. The 2006 population index (6,713) is below both the 2005 index (7, 820) and the long-term average of 6,916. From 1993 to 2006, the population index ranged from approximately 5,000 to 9,000 birds (Larned et al. 2006). The long-term average for the planning area is 1041 indicated birds, with 56% of that attributed to the area north of Teshekpuk Lake (USFWS, Unpublished Data 2007). No visibility correction factor (a multiplier to account for birds occurring on the transect but not detected) for spectacled eiders has been developed, thus the actual number of birds may be higher than the population index would suggest. However, if the each survey has a similar opportunity to detect (or miss) birds, then the index remains a useful indicator of the relative status of the population.

Spring Migration

Spectacled Eiders leave wintering areas in the Bering Sea and presumably migrate through spring leads in the sea ice to the North Slope. Spring migration routes of spectacled eiders adjacent to the planning area are not well documented. Most of the data are from counts of eiders as they pass Point Barrow in late May and early June. During spring migration, thousands of king and common eiders follow offshore leads and small numbers of spectacled eiders have been recorded during spring counts (Woodby and Divoky 1982; Suydam et al. 1997, 2000). Johnson and Richardson (1981) also reported small numbers of spectacled eiders offshore during spring migration waterbird counts east of the Colville River at Simpson Lagoon, although some of these birds may have been local breeders rather than migrants. Few researchers have conducted inland counts of migrating birds on the ACP, but Myers (1958) reported that spectacled eider was the most abundant eider species migrating along river systems south of Barrow in spring. Since only small numbers of spectacled eiders have been recorded migrating along the coast during spring, it may be that most birds migrate overland across the ACP following river drainages (TERA 1999).

Nesting

Spectacled eiders arrive on the North Slope in late May or early June. They occur in low densities of approximately 0.6 birds per mi^2 across the North Slope from Wainwright to the Prudhoe Bay area (Larned et al. 2006). The highest concentrations occur within approximately 40 miles of the coast in the Northwest NPR-A between Barrow and Wainwright, and in the planning area northeast of Teshekpuk Lake (Map 3-32; Larned et al. 2006). Coarse eider distribution does not appear to have changed substantially over the life of the survey, however, when the mean density distribution from the through 1999 is compared to mean density from 2000 to 2006 period there appears to be an increase in use of the area along the northeastern end of Teshekpuk Lake and in the Cape Halkett area (Larned et al. 2006). However, this may be an artifact of the low sampling intensity and the influenced of clumped distribution, detection rate, environmental variation, and relatively coarse scale at which the data are assembled into the density polygons, thus the distribution in Map 3-32 likely is most representative. Areas of highest density remain west of the Topagoruk River in the Northwest NPR-A planning area (Map 3-32) (Larned et al 2006). Nesting is believed to occur in the general area of birds observed during aerial surveys, but eider density determined through aerial surveys is not necessarily indicative of actual nest density (Johnson et al. 2006).

Spectacled eiders mean breeding season densities within the survey area vary widely ranging from 0.0-0.13 indicated birds/mi^2 to 1.3 – 3.2/mi^2 (Larned et al 2006, USFWS unpublished data). Within the portion of the planning area covered by the survey the average density is 0.065 birds/mi^2; the highest average density area is northeast of Teshekpuk Lake at 0.82/mi^2 (USFWS, unpublished data 2007).

In general, on the ACP spectacled eiders breed near large shallow productive thaw lakes, often with convoluted shorelines and/or small islands (Larned and Balogh 1997; Anderson et al. 1999), and nest sites are often located within 3 feet of a lake shore (Johnson et al. 1996). Based on a small sample size of band returns, there is some evidence that spectacled eider males as well as females may exhibit both breeding site and mate fidelity (TERA 1997). In most cases, brood-rearing apparently does not occur in ponds adjacent to nest sites even if suitable habitat is present (TERA 1995), indicating that not only is the nest site location important, but spectacled eider may also require a much larger area in the general vicinity of the nest site for brood-rearing. Spectacled eiders broods sometimes develop crèches where multiple hens and broods may coalesce (Derksen et al. 1981; Ehrlich et al. 1988). Juvenile birds in the Y-K Delta depart the breeding grounds approximately 59 days after hatch (Flint et al. 2000a). Similar data are not available for ACP birds.

Post-nesting Period

Most males depart the breeding grounds in mid-June after the onset of incubation, moving to coastal bays and lagoons to molt and stage for fall migration. Breeding females typically leave the last week of August. Failed breeders from western Alaska leave the middle of July but stage for approximately 2 weeks along the western coast before departing for molting areas (Petersen et al. 2000). Important molting and staging areas include Harrison Bay and Simpson Lagoon, Smith Bay, Peard Bay, Kasegaluk Lagoon, Ledyard Bay, and eastern Norton Sound (LGL 1992; Larned et al. 1995; Springer and Pirtle 1997; Petersen et al. 1999; TERA 1999; Troy 2003).

Winter

The spectacled eider winters in the Bering Sea south of St. Lawrence Island (Map 3-33; Petersen et al. 1999). Based on counts and aerial photography, spectacled eiders numbered around 360,000 to 375,000 in 1998 (Larned and Tiplady 1999). No more recent estimates are available. The birds congregate here to forage for invertebrates at depths of 150 to 230 feet in areas of open leads. Petersen et al. (1998) reported that spectacled eiders fed on snails, clams, barnacles, amphipods, and crabs.

Critical Habitat

There is no designated critical habitat for spectacled eiders on lands administered by BLM in the NPR-A. USFWS considered designating Critical Habitat on the North Slope and determined that it provided no additional benefit to the recovery and survival of the species (USFWS 2001). Critical habitat has been designated for the spectacled eider, in molting areas in Norton Sound and Ledyard Bay, breeding areas in central and southern Y-K Delta, and wintering area in waters south of St. Lawrence Island. A total of 38,991 mi^2 is designated as critical habitat for spectacled eiders (USFWS 2001).

3.3.8.3 Steller's Eider

Three breeding populations of Steller’s eiders are recognized, two in Arctic Russia and one in Alaska. The Alaska breeding population of Steller’s eider was federally-listed as a threatened species in 1997 due to apparent reduction in the number of birds inferred from the perceived reduction in the breeding range in Alaska (USFWS 1997). Based on comparisons of historical and recent data, Quakenbush et al. (2002) suggested that a reduction in both occurrence and breeding frequency of Steller’s eiders had occurred on the ACP, with the exception of the Barrow area. Larned (2003) also reported a declining trend during annual spring surveys for Steller’s eiders in the Bristol Bay area, although some of the variation may have been due to inter-annual variability in the timing of the eider migration that may have precluded portions of the population from being counted during some years.

The Alaska breeding populations nest primarily on the ACP, although a very small sub-population remains on the Y-K Delta (Map 3-33; Quakenbush et al. 2002; Flint and Herzog 1999). Flint and Herzog (1999) reported single Steller's eiders nests in the Y-K Delta in 1994, 1996, and 1997, and three nests in 1998. Steller's eiders spend most of the year in shallow marine habitats along the Alaska Peninsula and the eastern Aleutian Islands to lower Cook Inlet, with stragglers south to British Columbia. The largest numbers of molting and wintering Steller's eiders concentrate in four areas on the north side of the Alaska Peninsula: Izembek Lagoon, Nelson Lagoon, Port Heiden, and Seal Islands. Some birds from the Barrow breeding population molt in the Kuskokwim Shoals area, and it has been suggested that the Alaskan-breeding population molts in the more northerly portions of the Steller's eider molting distribution (USFWS unpubl data). However, band returns indicate that birds banded and at Izembek Lagoon and Nelson Lagoon returned to the ACP, and a bird that was banded near Barrow was recaptured at Izembek Lagoon (Dau et al. 2000). Steller's eider breeding location and molting locations were not correlated (Dau et al. 2000), but band return numbers and the small size of the Alaska population make it difficult to determine whether ACP breeders use the Kuskokwim or any other area for molting selectively over others.

The range of Steller's eider on the ACP apparently once extended from Wainwright east into the Canada's Northwest Territories (Johnson and Herter 1989; Quakenbush et al. 2002). The species is currently reported east at least to Prudhoe Bay (TERA 1997), but no recent records have been reported east of the Sagavanirktok River (Quakenbush et al. 2002). Steller's eider has not been recorded nesting east of Cape Halkett, other than one recent record inland near the Colville River (Quakenbush et al. 2002). Aerial surveys conducted by USFWS indicate that Steller's eiders are more widely distributed across the ACP than spectacled eiders, but pre-breeding densities are much lower (average density 0.01 birds per mi^2 in 2006; Larned et al. 2006). This pattern holds true for the planning area, where pre-breeding eider observations are patchy and rare, but more broadly distributed than those of spectacled eider, ranging from Umiat to north of Teshekpuk Lake USFWS unpublished data; Map 3.33). Most breeding appears to be restricted to the area south of Barrow (Quakenbush et al. 2002) and estimated densities for this area are higher (0.08 birds/ mi^2; Ritchie et al. 2006) than for the broad region covered by the Breeding Eider Survey (Larned et al 2006). Steller's eiders do not breed every year and may be related to predator/prey cycles (Quakenbush et al. 1995, 2002; Quakenbush and Suydam 1999; Ritchie et al. 2006).

Eider breeding population surveys conducted from 1993 to 2006 suggest a population averaging around 166 birds from 1993 to 2006. The 2006 index was 300 birds. Steller's eider population indices range from 20 to 781 with no birds being seen 5 out of 15 years the survey has been conducted. Reported population indices for Steller's eiders from the annual Eider Breeding Population survey have high variance as a result of a very small sample sizes, making an accurate estimate of trends impossible (Larned et al 2006). Another population survey conducted near Barrow was initiated in 1999 with a higher transect density (50% aerial coverage; Ritchey et al 2006). As noted this area contains the highest density of Steller's eiders on the ACP, with an indicated population of 96 birds, or roughly one-third the total population index for the Breeding Eider Survey area in 9% of the area covered by the breeding survey (Larned et al. 2006, Ritchie et al. 2006). What both surveys distinctly show is that the number of Steller's eiders present on the North Slope is highly variable and that the breeding population is concentrated in the area south of Barrow.

Steller's eiders nests are located on tundra habitats often associated with polygonal ground both near the coast and at inland locations. Emergent sedge and pendent grass provide important areas for feeding and cover. Nest predators include jaegers, common ravens, glaucous gulls, and

Arctic foxes. Avian predators, including snowy owls, and peregrine and gyrfalcons, have been the predominant natural cause of adult Steller's eider mortality. Steller's eider broods apparently are less mobile than those of spectacled eiders and remain in ponds with emergent sedge and pendent grass within about 500 feet of the nest site.

Causes for the decline of the Steller's eider population in Alaska may include increased predation pressure on the North Slope and Y-K Delta breeding grounds, subsistence harvest, ingestion of lead shot, and contaminants (Henry et al. 1995). Bustnes and Systad (2001) also suggested that Steller's eiders may have specialized feeding behavior that may limit the availability of winter foraging habitat. Steller's eiders could be affected by global climate regime shifts that cause changes in prey communities.

Critical Habitat

USFWS (2001) chose not to designate critical habitat for Steller's eiders on lands administered by BLM in the National Petroleum Reserve – Alaska (USFWS 2001) . Critical habitat was designated in breeding areas on the Y-K Delta, a staging and molting area in the Kuskokwim Shoals, and molting areas in waters associated with the Seal Islands, Nelson Lagoon, and Izembek Lagoon in Southwestern Alaska. A total of 2,830 mi^2 is designated as critical habitat for Steller's eiders (USFWS 2001).

3.3.8.4 Polar Bear

The polar bear was proposed to be listed as threatened on 9 January 2007 (USFWS 2007). The proposed listing was determined to be warranted based on a finding that there is a present or threatened destruction, modification, or curtailment of the bears' habitat or range due to reduced sea ice (USFWS 2007).

During the open-water season, polar bears are usually associated with the pack ice, although they may be seen on land or swimming in open water at considerable distances from the ice. During the fall open water period, polar bears commonly swim ashore and scavenge beached carcasses or the remains of bowhead whales taken by subsistence hunters (Klaxdorff and Proffitt 2003, Miller et al. 2006, Schliebe et al. 2006)).

The Beaufort Sea coastline, as well as river drainages and bluffs along lakes throughout NPR-A, provide important areas used by polar bears for resting, feeding, denning, and seasonal movements. In the last decade, the numbers of polar bears occurring along coastal areas of the Beaufort Sea have been increasing (Stirling and Andriashek 1992, Amstrup and Gardner 1994, Amstrup 2000). The reason for the increase in numbers of polar bears is unknown, but is likely related to the reduction in sea ice extent and timing of formation. Polar bear numbers on land during the open water period are likely to continue to increase as sea ice extent continues to decrease. Alternately, the increase may be related to selective hunting of land denning bears beginning with by those associated with the early commercial whaling (Amstrup and Gardner 1994), some combination of the two, or other influence.

Both SBS and Chukchi bears den on pack ice and on land. Fifty-three percent of the dens detected by radio-telemetry were on pack ice, while 38% were on land (Amstrup and Gardner 1994). Terrestrial maternal dens were significantly less common within the planning area than along the coastal plain of the ANWR (Amstrup and Gardner 1994). Of 35 terrestrial dens on the ACP of northern Alaska in 2001, the majority (29) were found along coastal bluffs with remainder found on river/creek banks, lake shores, and one at an abandoned drilling pad. All dens were within 15 miles of the coast (Durner et al. 2003). There has been an apparent shift in recent years to more terrestrial denning and less pack ice dens, possibly do to changes in pack ice features that reduce its suitability as denning habitat (Fischbach et al. 2007)

In the planning area, polar bears are known to have denned at or near Cape Simpson, Smith Bay, Lonely, Pogik Bay, Cape Halkett, Eskimo Islands, Atigaru Point, and the Colville River Delta (Map 3-29). SBS bears do appear to have fidelity to regional denning areas and substrate type, but not to particular denning sites. In other words, females may return to general geographic areas but not necessarily to specific site of a previous maternal den (Amstrup and Gardner 1994). Average distance between subsequent dens was 181 miles. Therefore historic dens may not be a good indicator of future den sites but do suggest that future denning should be expected in the general geographic area.

Polar bears prey primarily on ringed seals and bearded seals; they also take walruses and beluga opportunistically (Amstrup and DeMaster 1988). Polar bears also come to shore to scavenge on marine mammal carcasses during the fall open-water period. In fall during recent years, large numbers of polar bears have been concentrated near the villages of Barrow and Kaktovik, and near the Nuiqsut whaling camps on Cross Island.

Population Status and Trend

The International Union For Conservation of Nature and Natural Resources (IUCN) Polar Bear Specialist Group has identified 19 populations of polar bears; although some overlap occurs there is sufficient spatial segregation to support delineation of the individual populations (Schliebe et al. 2006). The Southern Beaufort Sea population is the dominant stock occurring in the planning area although some Chukchi Sea bears occur in the area (Amstrup et al. 2004). The SBS population is estimated to be 1,500 (Regehr et al. 2006). There is no reliable estimate for the Chukchi Sea population (Schliebe et al. 2006).

Although a statistically significant decline in SBS population cannot be demonstrated from the data available, there are indications that some factor, believed to be reductions the amount of sea ice, and changes in formation and break-up timing, is adversely affecting demographic parameters and may ultimately result in a decline in numbers(Regehr et al. 2006, Schliebe et al. 2006). Regehr et al (2006) observed declines in survival of cubs past 6 months and decreases in skull size and body weight. Additional analysis indicates that survival and breeding success decline in poor ice years (Regehr et al. 2007). A decline in body mass of subadults and reduced growth rates have also been observed (Rode et al. 2007). These changes are likely due to nutritional stress and are correlated with reduced sea ice (Regehr et al. 2007, Rode et al. 2007). These changes are similar to what was observed in the Western Hudson Bay population several years before a measurable decline in population was detectable (Stirling et al. 1999, Derocher et al. 2004, Regehr et al. 2006).

3.3.8.5 BLM Sensitive Species

BLM Sensitive Species are a subset of the BLM Special Status Species (SSS) category. Threatened and endangered species occurring on BLM managed lands are automatically included on the SSS List and have been addressed in the preceding section. Sensitive species are designated by the BLM State Director.

The sensitive status is assigned to species that occur on BLM managed lands for which BLM has the capability to significantly affect the conservation status of the species through management. Species may be designated as "sensitive" for the following reasons:

1. could become endangered in or extirpated from a state, or within a significant portion of its distribution in the foreseeable future,
2. are under status review by FWS and/or NMFS,
3. are undergoing significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution,
4. are undergoing significant current or predicted downward trends in population or density such that federally–listed, proposed, candidate, or State listed status may become necessary,
5. have typically small and widely dispersed populations,
6. are inhabiting ecological refugia, specialized or unique habitats, or
7. are State listed but which may be better conserved through application of BLM sensitive species status.

(BLM Manual 6840, 2001)

The only terrestrial mammal species on the BLM Sensitive Species list that may occur in the planning area is the Canada lynx (see Appendix J). Lynx occur at very low densities in the mountains and foothills of the Brooks Range and are generally not found on the ACP, including in the planning area (Carroll 1998); therefore, they are not discussed further. There are 10 Sensitive bird species (black brant, black guillemot, long-tailed duck, black scoter, surf scoter, yellow-billed loon, red-throated loon, king eider, buff-breasted sandpiper, and peregrine falcon), and and three plant Sensitive species (Drummond's bluebell, Alaskan bluegrass, and False semaphoregrass) known to occur in or near the planning area (Appendix J). The Sensitive species are addressed within their general taxonomic categories (sensitive bird species are covered in **section 3.3.6, *Birds,*** and plants in **section 3.3.2.1 *Sensitive Plant Species and Other Rare Plants***).

3.4 SOCIAL SYSTEMS

3.4.1 Cultural Resources

This section discusses the cultural resources and history of habitation of the planning area. Cultural resources include sites and materials of prehistoric Native American, historic European and Euro-American, and historic Iñupiat origin (e.g., traditional cabin sites, campsites, and burial grounds).

The culture history of northern Alaska is unique and significantly different at the most basic level from the culture history of not only the rest of North America but the remainder of the Western Hemisphere. At the end of the Pleistocene Epoch (the last Ice-Age) northern Alaska and adjacent Siberia were part of a contiguous land mass called Beringia. At that time immigrant populations of humans migrated across the dry land connection from Asia into northern Alaska and subsequently expanded southward to inhabit this half of the planet prior to the arrival of Europeans in the late 15th Century. Archaeological research has revealed the physical remains of roughly 14,000 years (all dates are calendar years) of human occupation within northern Alaska; the only locale on our half of the globe where human occupation can be traced, unbroken, from its beginning to the present day (Kunz et al. 2003).

Beringia existed during the glacial episodes of the Pleistocene when world-wide sea level was as much as 300 feet lower than today. Beringia was comprised of Alaska, northwestern Yukon Territory and most of Siberia as well as the connecting land bridge. This was a mostly unglaciated land mass of nearly two million square miles with an extreme continental climate which can be ecologically described as a steppe prairie (Hopkins et al. 1982). Bison, horse, mammoth, caribou, and muskoxen were among the large mammals that inhabited this vast open region. The people who lived there depended upon these animals as a source of food, clothing and shelter to such a degree that their life style evolved around and was tailored to the behavior and availability of these animals.

The central portion of ancient Beringia now lies beneath the waters of the Beaufort and Chukchi Seas. As a result, archaeological data from this now submerged area is generally unattainable and the interpretation of the initial chapter of the culture history of northern Alaska is based in part upon speculation. While most archaeologists would agree that northern Alaska was initially occupied by immigrants from Northeast Asia who crossed the land bridge from Siberia to Alaska around 18,000 years ago, and that some time before 13,500 years ago their descendants moved south and populated the rest of the Western Hemisphere, that is probably where consensus would end.

While the oral history and traditions of the indigenous Native populations of Northern Alaska provides a cultural perspective in regard to their occupation of the region, with the exception of the very recent past, scientific data regarding the human occupation of northern Alaska results from archaeological and related research. In the archaeological record cultural groups are identified by the materials they have left behind. Because of their surviveability most frequently these materials are stone tools. Most prehistoric cultural groups made some readily identifiable type of stone tool(s), the shape, style, and/or manufacturing technique of which is unique to their group, a sort of cultural fingerprint. Using this method and other procedures such as radiocarbon dating, the culture history of northern Alaska can be traced through time. While archaeologists may interpret data differently, as more archaeological research is conducted in northern Alaska the history of human occupation becomes clearer and more generally agreed upon.

Recent archaeological work suggests that during the initial period of occupation two cultural entities were present in northern Alaska. Although these cultures were roughly contemporaneous, their flaked stone industries were quite different from each other. One of these cultures is identified by an assemblage of stone tools similar to types found in Siberian sites of the same time period. The primary identifying characteristics of this culture is the presence of a microblade and burin technology, the lack of broad scale use of bifacial reduction in the tool manufacturing process, and the production of projectile points that display little consistency in style or shape. The other early group's stone tool assemblage is totally devoid of microblade technology, relies primarily on bifacial technology, and produces bifacial projectile points of consistent style and shape. This cultural entity is North American in its essence and is technologically and stylistically identical to the stone tool industry of the earliest inhabitants of the North American High Plains, the Paleoindians.

Because there is no evidence in Western Beringia (Siberia) for a cultural group whose stone tool industry is primarily bifacial, the assumption is made that the "bifacial" cultural entity came into being in Eastern Beringia (Alaska). Although to a large degree speculative, the following scenario appears to be a reasonable interpretation of circumstances during this earliest period of human occupation. Following the Last Glacial Maximum, approximately 22,000 years ago, microblade cultures began moving northeastward across Western Beringia and entered Eastern Beringia as early as 18,000 years ago. Although most of northern Alaska was unglaciated, southern Alaska, adjacent Yukon Territory and British Columbia were glaciated, blocking any movement out of northern and interior Alaska (Mann and Hamilton 1995). As a result northern Alaska was like an enormous corral, confining the Siberian immigrants and thwarting any southward movement. Over the next several millennia some of the cultural groups that occupied Eastern Beringia probably intermixed and blended forming a new cultural identity and technology partially in response to the unstable and changing environmental/ecological conditions that marked the end of the Pleistocene. At the same time, some groups may have remained basically unchanged in terms of the cultural and technological orientation they had brought with them from Western Beringia. By the time the glaciers to the south had receded enough to allow passage out of Alaska, two technologically distinct cultural groups appear to be present in northern Alaska. While there is little doubt that the original Siberian microblade culture immigrants are more ancient than the Alaskan bifacial technology culture, as of this writing the bifacial-based culture's radiocarbon dates indicate their occupation of northern Alaska began at least as long ago as 13,700 years, while the oldest date for the microblade culture is about 11,800 years ago. If the preceding scenario of cultural evolution is reasonably accurate future research should reveal the presence of Siberian microblade technology sites that predate those displaying bifacial technology. Regardless, the following is a description and chronological ordering of the cultures of northern Alaska as they appear at present.

Table 3.4-A. Cultures of Northern Alaska

Culture/Tradition	Approximate Age	Representative Material	Representative Sites
Paleoindian	13,700 – 11,800 years ago	Bifacial lanceolate projectile points, bifacial knives, single & multispured gravers	Mesa, Bedwell, Hilltop, Tuluaq Hill, Kuna Bluff
American Paleoarctic	11,800 – 8,000 years ago	Microblade technology, burins, bifacial projectile points and knives	Gallagher Flint Station, Lisburne, Kurupa Lake, Kealok Creek
Northern Archaic	8,000 – 3,000 years ago	Microblade technology, notched and stemmed bifacial projectile points and knives, large scrapers	Tuktu, Kurupa Lake, Lisburne, Gallagher Flint Station, Kuparuk Pingo
Denbigh Flint Complex (Arctic Small Tool Tradition)	5,000 – 2,400 years ago	Microblade technology, stylized burins, diminutive side and end blades, flake knives, composite tools	Croxton, Punyik Point, Mosquito Lake, Kurupa Lake, Gallagher Flint Station, Walakpa
Choris	3,800 – 2,200 years ago	Burins, large bifacial projectile points, pottery, ground stone, bone, antler & ivory implements, semi-subterranean houses	Choris Peninsula, Cape Krusenstern, Ribdon, Ipnaq, Gallagher Flint Station, Walakpa
Norton	2,600 – 1,800 years ago	Pentagonal projectile points, end and side blades, flake knives, discoids, ground stone, pottery, composite tools, antler, bone & Ivory implements, semi-subterranean houses	Iyatayet, Walakpa, Mosquito Lake, Pik Dunes, South Meade, Punyik Point
Ipiutak	1,800 – 1,200 years ago	End & side blades, flake knives, discoids, (no pottery or ground stone), composite tools, intricate ornamental ivory carvings, burials, semi-subterranean houses	Point Hope, Croxton, Punyik Point
Birnirk	1,600 – 1,000 years ago	End & side blades, ground slate tools, ivory and antler harpoon heads, composite tools, pottery, semi-subterranean houses	Birnirk, Niglik, Walakpa, Point Hope, Cape Krusenstern, Nunagiak, Utqiaġvik, Nuwuk
Thule	1,000 – 400 years ago	End & side blades, ground slate tools, ivory and antler harpoon heads, composite tools,	Cape Krusenstern, Nunagiak, Niglik, Walakpa, Utqiaġvik, Nuwuk

Culture/Tradition	Approximate Age	Representative Material	Representative Sites
		pottery, semi-subterranean houses	
Late Prehistoric Eskimo	700 – 400 years ago	End & side blades, long, stemmed projectile points, pottery, bone, antler, ivory implements, ground stone, semi-subterranean houses	Tukuto Lake, Etivlik Lake, Kinyuksugvik, Swayback Lakes
Nunamiut	400 years ago - Historic	Bifacial stone projectile points, bone & antler projectile points, ground stone, sod houses	Colville River, Etivlik River, Anaktuvuk River,

3.4.1.1 Major Cultural Periods

Paleoindian Tradition: 13,700 – 11,800 years ago

Although northern Alaska may well be the region where the Paleoindian culture and stone tool industry first evolved, it was not where Paleoindians were first recognized. Paleoindians were first identified 80 years ago in an archaeological site more than 3000 miles to the south at Folsom, New Mexico. It was not until the 1970s that Paleoindian sites were recognized in northern Alaska, a circumstance which caused archaeologists to reexamine theories regarding the peopling of the New World (Kunz 1982; Kunz and Reanier 1994, 1995; Reanier 1995). Since the middle of the last century, Paleoindians have been considered by most researchers to represent the first indigenous, geographically widespread, North American cultural tradition (Kunz and Reanier 1994, 1995). The Paleoindian sites of northern Alaska are found primarily in the Brooks Range, although isolated projectile points have been found in the vicinity of Teshekpuk Lake. The Paleoindians are known for their excellent stone workmanship, producing distinctive edge-ground, bifacial, lanceolate projectile points, spurred end scrapers, and multi-spurred gravers. Radiocarbon dated Paleoindian sites in northern Alaska include Bedwell on the Sagavanirktok River, Hilltop in the Atigun River Gorge, Mesa in the Iteriak Creek Valley and Tuluaq Hill in the Noatak drainage (Kunz 1982; Kunz and Reanier 1994, 1995; Reanier 1995; Rasic 2000; Kunz et al. 2003). As the climate and vegetational regime began to change at the end of the Pleistocene and the large Ice Age mammals disappeared and the ecosystems reorganized themselves, the Paleoindians vanished from northern Alaska's archaeological record (Kunz et al. 2000).

Sites of the Paleoindian tradition are found almost exclusively in the Brooks Range and their northern foothills. Because of their extreme age sites of the Paleoindian tradition are not numerous although more will certainly be found as research continues. As of this date, probably more locales of Paleoindian activity have been found in the NPR-A than in any other area in northern Alaska and the potential for finding additional sites that will shed more light on the first indigenous people to inhabit the New World is extremely high.

American Paleoarctic Tradition: 11,800 – 8,000 years ago

As previously mentioned, the microblade technology of this cultural entity suggests its origins lie in Siberia and that in northern Alaska it is at least as old as the Paleoindian tradition.

Although its cultural flavor is Siberian, beyond that, the American Paleoarctic tradition is loosely defined, technologically, but could generally be referred to as being "kind of clunky" (Anderson 1968, 1970, West 1981, Dumond 1987). The wedge-shaped microblade core is one of the hallmarks of this tradition but that core type along with burin technology is also an element in the stone tool industries of more recent cultural groups as well, thus making cultural assessment of undated sites difficult. While there are some sites in northern Alaska that technologically appeared to belong to this tradition, such as the Lisburne site (Bowers 1982) on Iteriak Creek and a large site on Kurupa Lake (Schoenberg 1995), only recently has one, located on Kealok Creek south of Teshekpuk Lake, been reliably dated older than about 8000 years ago (Reanier 2003). Other dated sites in northern Alaska such as the Gallagher Flint Station near the University of Alaska's Toolik Field Station date near the more recent end of the time period (Ferguson 1997).

Based on radiocarbon dates, the people of this cultural tradition appear in northern Alaska slightly before the end of the Paleoindian period. By that time mammoth, horse, and probably bison were no longer present. Caribou numbers appear to have been low at that time and although muskoxen and moose were also present they were not numerous enough to be a reliable resource. These circumstances suggest that making a living during this period in northern Alaska may have been more difficult than it had been earlier.

Two of the most intriguing questions concerning the culture history of northern Alaska (and for that matter the culture history of the Western Hemisphere) is the relationship between the American Paleoarctic tradition and contemporary groups in Siberia as well as the relationship between the Paleoindian tradition and the American Paleoarctic tradition. These questions bear on the most basic aspects of the arrival and dispersal of modern humans throughout the western hemisphere. While archaeological sites in the southern NPR-A have already provided valuable information concerning these questions, there is little doubt that as yet undiscovered sites contain additional information that will be significant in further addressing these questions.

Northern Archaic Tradition: 8000 – 3000 years ago

The late Pleistocene cultures were followed by a cultural continuum known as the Northern Archaic tradition (Anderson, 1968). Probably less is known about the cultures of this tradition than any other in northern Alaska. The primary hallmark of the stone tool assemblages of this tradition is microblade technology and while wedge-shaped microblade cores predominate, other core types such as tabular and conical also occur. Other diagnostic tools include large, bifacial side/corner notched and stemmed projectile points. Bifacial knives, and large scrapers are also common elements of the stone tool assemblage. By the time Northern Archaic tradition peoples appear in northern Alaska, significant ecosystem changes have occurred. Global warming and its accompanying increase in atmospheric moisture resulted in increased annual precipitation and cloud cover (Mann et al. 2002). As a result the firm, dry Pleistocene steppe prairie was replaced by moist, tussock tundra which significantly reduced human mobility on the landscape. Caribou were the only numerous large mammal in northern Alaska during this time period and Northern Archaic peoples were probably significantly effected by the dramatic cyclical rise and fall of their numbers. Unlike the earlier north Alaskan cultures, Northern Archaic tradition sites are commonly found well into interior Alaska, suggesting both a tundra and woodland orientation. The microblade and burin technology of the Northern Archaic tradition suggest that it may have evolved out of the American Paleoarctic tradition.

In northern Alaska Northern Archaic sites appear to occur most often in the Brooks Range and its northern foothills although evidence of this cultural tradition can also be found on the Arctic Coastal Plain. Excavation has occurred at two large sites, Tuktu, near Anaktuvuk Pass (Campbell 1961) and at Kurupa Lake (Schoenberg 1995). Both of these sites appear to date around 7500 years ago and may be good age indicators for other large undated Northern Archaic Sites in the region such as Lisburne on Iteriak Creek (Bowers 1982; 1999) and KNA-15 on the Kuna (Kunz 2001). A number of smaller Northern Archaic sites have been noted in the Colville River drainage and may provide additional information regarding this poorly understood cultural tradition (Davis et al. 1982). It is reasonable to assume that there are yet undiscovered Northern Archaic sites that could contribute significantly to the understanding of this tradition.

Arctic Small Tool Tradition: 5000 – 2400 years ago

The Arctic Small Tool tradition (ASTt) is in the opinion of many circumpolar archaeologists, the most intriguing cultural tradition in the Arctic. It is the beginning of what can be referred to as the Eskimo cultural continuum, a cultural manifestation that was organized differently and exploited the regional resources differently than the preceding cultural entities had. While its roots may lie in Siberia, its birth place as an identifiable cultural entity in the archaeological record lies in Alaska. It is interesting that the ASTt's seemingly sudden appearance is associated with a climatic shift, the end of the Holocene Warm Period. The ASTt was defined by archaeologist William Irving (1962, 1964) after several seasons of excavation at a Denbigh Flint Complex site at Punyik Point on Etivluk Lake which lies in the southeast corner of the NPR-A. Irving saw a strong technological relationship between the Denbigh Flint Complex Culture, the Pre-Dorset (Sarqaq) Culture and the Independence I Culture of the central and eastern Arctic (Canada and Greenland). Together these cultures comprise the ASTt, a tradition which expanded across the Arctic from Alaska to Greenland, a surface distance of nearly 5000 miles, in less than 500 years.

As its name implies, the Arctic Small Tool tradition is typified by a variety of small, flaked stone tools. Among these are end and side blades (usually combined to make composite projectile points), microblades, and mitten-shaped (stack-step) burins. Of the three cultures that make up the Arctic Small Tool tradition only the Denbigh Flint Complex is found in northern Alaska.

Denbigh Flint Complex: 5000 – 2400 years ago

The Denbigh Flint Complex (DFC) can be viewed as the oldest of the Eskimo continuum cultures and the founding and geographically farthest west culture of the Arctic Small Tool tradition (Irving 1961, 1964). The DFC stone tool industry is defined by small, well made, delicate, bifacial, end and side blades, as well as flake knives, burins, and microblade technology. The end and side blades, burins and often flake knives exhibit parallel oblique flaking a distinctive DFC trait. However the most distinctive element of the DFC stone tool industry is the burin. This tool is manufactured and used in such a way that as the implement is resharpened by the removal of spalls, a pattern of sequential notches is created along one edge rendering its appearance unmistakable from any other stone tool. The presence of microblade technology is also a defining attribute as that technology does not occur in any of the other Eskimo continuum cultures. In short, of all the cultures present in northern Alaska, the DFC is the most easily and readily recognized from the components of its stone tool assemblage.

The DFC time period overlaps with the last half of the Northern Archaic period and it is quite probable that these two groups may have interacted with each other. However the number of

DFC sites on the northern Alaska landscape is much greater than the number of Northern Archaic sites, suggesting that the DFC population was much larger. In fact, as a cultural entity the DFC occupied a much more extensive area than did the earlier Paleoindians or any of the subsequent Eskimo cultures of northern Alaska. Probably the primary reason the DFC was so prolific was that it could exploit coastal, tundra, and woodland environments. However, even in coastal sites where the DFC people hunted sea mammals, primarily seals, their tool kit appears to have been more oriented toward hunting caribou (Giddings and Anderson 1986). Denbigh Flint Complex sites are common throughout the Brooks Range hundreds of miles from the coast and the range of the DFC people extended at least as far south as that of the historic Nunamuit Eskimo.

Prior to the appearance of the DFC in northern Alaska, flaked stone tools were almost exclusively made from chert, a rock type that is an excellent tool stone and is abundant throughout the southern NPR-A. Obsidian (volcanic glass) which is also a tool stone shows up only infrequently in the region's archaeological sites that are not DFC and/or are more than 5000 years old. While the DFC people made the majority of their stone tools from chert they also used obsidian and to a greater degree than cultures that preceded or followed them. Analysis of obsidian from northern Alaska sites indicates that the vast majority of the glass comes from Batza Téna, the only obsidian source in interior Alaska, is located on the Indian River 200 miles south of the southernmost point in the NPR-A (Clark and Clark 1993; Cook 1995, Kunz et al. 2001, 2003). The increased use of the Batza Téna obsidian source by the DFC people is further evidence of their mobility, larger and more geographically widespread population, and established trading networks.

While the majority of known DFC sites appear to result from caribou skin tent camps, usually occupied during the more clement months, semi-subterranean house remains have also been found (Irving 1962, 1964). It is believed that semi-subterranean houses usually indicate a winter occupation, as a semi-subterranean house provides better protection from the harsh winter conditions than does a skin tent. Although only a few have been excavated, DFC houses appear to be rectangular and about ten by eight feet in size, and were probably excavated no deeper than three feet below the surface. A willow framework arched over the excavation and supported a roof of sod blocks sheathed by caribou skins (Kunz 2006).

The large DFC sites that have been excavated in northern Alaska are Croxton and Punyik Point (both in the southern NPR-A), Kurupa Lake, Mosquito Lake, and the Gallagher Flint Station and all lie along the northern edge of the Brooks Range. The average age of the DFC occupation at these sites is 4000 – 3400 years ago. However, at Mosquito Lake there are dates that indicate that DFC people were occupying the site as late as 2400 years ago (Kunz 1977), and a date from the Gallagher Flint Station suggests a similar late occupation by DFC people (Slaughter 2006). A date of around 2400 years ago that appears to be associated with DFC materials was obtained at the Walakpa site near Barrow (Stanford 1971, 1976).

Choris: 3800 – 2200 years ago

Choris is a bit difficult to figure out. Most of the dated sites relating to that culture are found on the Choris Peninsula near Kotzebue (Giddings 1957; Giddings and Anderson 1986). A few sites along the north face of the Brooks Range that appear to be Choris, or contain a Choris component such as Ribdon, Ipnaq, and the Gallagher Flint Station, have yielded dates around 2400 years ago (Bacon, 1975; Slaughter 1974; Bowers 1983). The Choris type site dates range between 2800 and 2400 years ago. Some archaeologists view Choris as being transitional between Denbigh and the Norton Culture. Denbigh and Choris dates appear to overlap to a degree, as do Choris and Norton dates. There are some similarities in the Choris and DFC stone tool assemblages such as burins and parallel oblique flaking. However, Choris burins are not of the DFC type. Parallel oblique flaking, common on DFC tools, does occur on some Choris projectile points. Additionally, Choris assemblages contain pottery, ground stone tools and implements of bone, antler and ivory, which are generally lacking in the DFC. The lack of some of these implements may in large part be attributed to the fact that being organic they have succumbed to the rigors of time.

Although most of the known Choris sites occur in the Choris Peninsula area, the culture seems to be more oriented toward terrestrial rather than marine resources. At the same time none of these sites have displayed a Norton – Choris – Denbigh sequential stratigraphy, although some sites have yielded a mix of artifacts attributable to these cultures (Stanford 1971, 1976). Differences in the artifact assemblages between Choris sites often appear to be on a scale that exceeds the acceptable limits of inter-site variability thus rendering the description/definition of Choris to be rather loose. In addition, artifacts such as small end and side blades that are common in the stone tool assemblages of other Eskimo continuum cultures appear to be absent in Choris. The absence of these artifacts is extremely telling, as they are essential in the manufacture of composite tools which is probably the most significant trait common to all cultures of the Eskimo continuum. Further, the dates attributed to Choris that range between 3800 – 3000 years ago seem too old if Choris lies between the DFC and Norton in the Eskimo continuum sequence.

As with DFC, it is believed that Choris people probably used caribou skin tents during the warmer months of the year. There is also evidence that semi-subterranean houses were used as well. However, unlike the DFC houses and the houses of the other Eskimo continuum cultures which are most often rectangular, the Choris houses are round (Giddings 1957).

In the final analysis, it appears there are (as will be seen) enough differences between Choris and the cultures of the Eskimo continuum to exclude it from that relationship. If Choris was spawned by the DFC, it appears to have been an evolutionary dead end. In short, it seems to be less difficult to exclude Choris from the Eskimo continuum cultural sequence than it is to include it. Additional research may help to clarify this issue. At present however, there is little indication of the presence of such sites in the planning area.

Norton: 2600 – 1800 years ago

As was the case with the DFC, the people of the Norton culture exploited the resources of both the Arctic coast and the interior. While they appear to be equally comfortable in either environment, there is a suggestion that overall they are more oriented toward terrestrial rather than marine resources. In fact their geographic range closely mirrors that of the DFC and although they do not seem to be quite as prolific. While Norton shares some assemblage traits with Choris such as pottery and ground stone implements, it seems to share more with the DFC. Although the DFC microblade and burin technology is absent in Norton, side and end blades, flake knives, and discoids are common and except for the absence of parallel oblique flaking are identical to those of the DFC. While some of the Norton end blades are stemmed, the artifact that is most distinctly Norton is a small pentagonal edge-ground projectile point which does not occur in any of the other Eskimo continuum assemblages. The presence of stone lamps, which burned animal fat and were used to provide heat and light, as well as labrets, objects used as mouth adornments, in the Norton assemblage marks their debut in the Eskimo continuum cultures. Additionally, tools of bone, antler, and ivory, many of which represent component parts of composite tools, occur with greater frequency than in the preceding cultures, although in part this may be due to a higher survivability rate because of less time spent in the ground.

Overall, other than the presence of pottery, none of the Norton tool types suggest that these people were living any differently than the earlier DFC people. This strong similarity is probably based on the fact that caribou continued to be the primary subsistence resource providing food, as well as materials for clothing, shelter and tools. The Norton people also used the same types of dwellings that were used by the DFC people.

Ipiutak: 1800 - 1200 years ago

Ipiutak follows Norton in the Eskimo cultural continuum and while the primary aspects of the culture are the same, there are some dramatic differences, although the differences may be more of a social than cultural nature. The Ipiutak flaked stone tool inventory is much the same as DFC and Norton particularly in terms of end and side blades, discoids, and flake knives (Larson and Rainey 1948). There is also a strong similarity with the Norton bone/antler/ivory industry. On the other hand, Ipiutak has no pottery, and no ground stone tools or lamps. Since these three items could be construed as technological advancements introduced by the Norton culture it seems odd that they were not carried over to Ipiutak along with the flaked stone and bone/antler/ivory tool industries.

However, what really sets Ipiutak apart is a variety of somewhat strange artistic objects recovered in large part from burials at the type site at Point Hope including, intricate ornamental ivory carvings, such as chains, carved ivory eyes with jet pupils and ivory mouth covers (Larson and Rainey 1948). The Point Hope site is huge, more than 600 semi-subterranean houses, and as such is quite atypical of all other Ipiutak sites which are much smaller. Although less numerous than DFC or Norton sites, Ipiutak sites are found in both coastal and interior settings and, as were their predecessors, they appear more oriented toward exploiting terrestrial rather than marine environments. There are Ipiutak sites scattered across the planning area although the largest occupations occur at Tukuto and Etivluk lakes and at along the Kuna River.

Maritime Eskimos. About 1600 years ago another group of Eskimos appears in the archaeological record of northern Alaska. The similarity in the style of both stone and organic tools suggests a direct linkage with the preceding, and in the case of Ipiutak, contemporary Eskimo continuum cultures. The primary difference is that the subsistence orientation of these people is more maritime than it is terrestrial. For much of the year these people lived in semi-subterranean houses on the Arctic coast.

Birnirk: 1600 – 1000 years ago

Probably the most distinctive feature in the Birnirk tool assemblage are wonderfully carved and decorated ivory harpoon heads. Not only their presence but their numbers indicate the movement towards a greater exploitation of marine resources (Ford 1959; Spencer 1959). While it does not appear that the Birnirk people were more than occasional whalers, they did hunt seals and walrus extensively. They also harvested fish and waterfowl, and caribou continued to be an important element among their subsistence resources. Flaked stone side and end blades, as well as ground slate tools such as ulus, were common elements of their lithic industry as well as numerous implements of bone, antler, and ivory including harpoon heads, tool handles, and composite tool parts.

Although it is believed that skin boats have been part of every Arctic culture's tool kit since the end of the Pleistocene, the Birnirk people's increased emphasis on maritime resources suggests an increased use of skin boats, and possibly the construction of larger boats than was the case previously. While increased use of watercraft undoubtedly enhanced the mobility of these people along the coast, unlike the earlier Eskimo continuum cultures, they do not appear to have ventured very far inland. They are known from sites along the coast from Kotzebue to Barrow (Giddings and Anderson 1986).

Thule: 1000 – 400 years ago

About 1000 years ago the Thule culture appears in northern Alaska's archaeological record. The development of this culture appears to have been strongly influenced by two events, the warming of the climate, which affected the distribution and character of the sea ice and the invention of the dragfloat which is integral to successful open water whaling. Associated with this was the continued development and use of large, open, skin boats. The Birnirk emphasis on marine resources was continued and intensified by their Thule descendents who raised open water whaling to a level never before attained in the Arctic. The tool kit of the Thule people was almost identical to that of the Birnirk culture and included flaked stone end and side blade insets, ground stone implements, pottery, along with the addition of specialized implements of bone, antler and ivory directly associated with the pursuit and capture of whales (Ford 1959; Larson and Rainey 1948; Giddings and Anderson 1986).

As a result of the moderation in the climate and the technological advances associated with whaling, the Thule people spread across the Arctic as rapidly and nearly as completely as had the Arctic Small Tool tradition people nearly 3000 years earlier. However, the rapid expansion of the Thule people was predicated on a maritime orientation which kept them geographically focused on the coastal plain, whereas the earlier ASTt people were more terrestrially oriented occupying the coast and areas hundreds of miles inland as well. At some point, probably about 400 years ago, the Thule people became what is recognized as the modern Iñupiat who were first encountered by Europeans in the late 1700s.

Late Prehistoric Eskimo: 700 – 400 years ago

From roughly the end of the Ipiutak period, about 1200 years ago, until about 700 years ago, there appears to be a time of very limited occupation and exploitation of interior northern Alaska. This apparent hiatus is based upon a lack of known archaeological sites that date within this period which could simply reflect the need for further research. However, the amount of archaeological survey conducted in the region should have turned up at least a few sites if they were present in even limited numbers. This makes some sense when coupled with the fact that north Alaskan Eskimos are less oriented toward terrestrial resources that are not in close proximity to the coast during this period than they had been previously.

About 700 years ago the interior of northern Alaska begins to be utilized by people who construct semi-subterranean houses, usually with associated cache pits. As was the case in earlier times, these houses are almost always clustered along the shores of large lakes and the remains of caribou drive lines are often found nearby. The people of this time period are referred to as Late Prehistoric Eskimos (LPE) and although they overlap in time with the coastal Thule people, they do not seem to be Thule people living in the interior. This determination is based on differences in the artifacts found in LPE and Thule tool assemblages. Prior to Birnirk times, Eskimo continuum cultures such as DFC, Norton and Ipiutak displayed little difference in their tool kit whether they resided on the coast or in the interior, although as previously mentioned, those cultures were more terrestrial than maritime in their orientation. Some aspects of the LPE and Thule cultures are generally similar, such as using semi-subterranean houses and making arrow heads and other tools out of antler. However, the differences, few ivory implements and check stamped rather the curvilinear pottery in the LPE tool assemblage, outweigh the similarities to the extent that the LPE seem to be to some degree culturally distinguishable from Thule. Late Prehistoric Eskimo are known from a number of sites in the NPR-A, such as Tukuto, Etivluk, and Swayback lakes, and in the Nigu and Kuna river drainages (Hall 1976; Irving 1964; Kunz 2002, 2003).

Nunamiut: 400 years ago to present

The Nunamiut Eskimo first appear in northern Alaska's archaeological record about 400 years ago (Kunz and Phippen 1988). The appearance of the Nunamiut may well be the result of a direct and rapid evolution out of the Late Prehistoric Eskimo that occurred as the result of the introduction of new technology: dog traction. While dogs are known to have been domesticated and used by Arctic residents for thousands of years, until roughly 400 years ago their role in northern Alaska appears to have been primarily as a beast of burden, companion, and perhaps as an aid in the hunt. Archaeological evidence suggests that about 400 years ago dogs were hitched to a sled for the first time in northern Alaska. This event had a dramatic effect on the residents of the region because it exponentially increased their ability to move about the country. Greater mobility meant people could make use of the subsistence resources of a much larger area, and thus had more options available to them. This single circumstance is probably responsible for the abrupt change that is seen in the lifestyle of the inhabitants of interior northern Alaska about 400 years ago.

For the previous 4000 years the inhabitants of northern Alaska's interior appear to have spent the winter months living in semi-subterranean houses located on the shores of large lakes. The lakes that were chosen for this purpose were located near reliable fall caribou concentrations so that a large supply of meat could be obtained and set aside for the winter. The lakes chosen also had good fish resources so that if the fall caribou numbers were meager or when the cached meat reserves were exhausted, fish could be utilized as the primary food source (Gerlach and Hall, 1988). This system had been developed in large part because of the limited mobility of the people. On foot, it was not easy or practical for hunters to venture very far afield or households to change locations if resources ran out during the winter. Dog traction changed all that. Almost overnight people began to abandon lakeside semi-subterranean houses and begin living in sod or moss houses constructed in willow patches along stream drainages. This made the resources of the riparian zone, wood for fuel and construction and stone for tool making, easily accessible to them, while the sled and dogs allowed them to travel extensively to exploit a variety of food resources previously not readily available to them. Because moss/sod houses degrade rapidly, the most commonly found type of Nunamiut archaeological sites are the ones comprised of stone tent rings. These sites are often found situated on elevated, well drained ground adjacent to a stream and a substantial willow patch. Such sites are found throughout the NPR-A.

The introduction of dog traction among the coastal Eskimos had a similar but less dramatic effect due to their lifestyle. They were more oriented toward marine resources which, along with the use of watercraft, reduced their need for overland mobility to some degree. Although they did occasionally construct sod houses along stream courses, they continued to live in semi-subterranean houses along the coast where driftwood was plentiful.

While the Eskimo were not among the first residents of northern Alaska, since they first appear in the archaeological record, their use of the area is unbroken (Reanier, 1997; Sheehan, 1997). Their technological sophistication enabled them to exploit both coastal and interior ecosystems and they soon became dominant and more numerous than any of the groups that had previously inhabited the region.

While the mid-18th century marked the beginning of the historic period in Alaska, because of its geographical proximity to the Old World, some north Alaskan archaeological sites that predate Columbus' discovery of the New World contain materials manufactured in Europe or Asia. This circumstance is unique to Alaska, and the most prominent of these sites is located in the southern NPR-A. Some of the later history also played out in this region as the result of contact with the Euro-American arctic whaling fleet beginning about 1860. This resulted in more than 50 years of continuous contact that altered the traditional culture, and set in motion a massive alteration of Native Alaskan lifestyle (Brower, 1942; Foote,1964; Bockstoce, 1978). In just a few generations, the indigenous people of the northern Alaska moved from the Stone Age to the Atomic Age.

3.4.1.2 Prehistoric Resources in the Planning Area

Twenty-eight documented prehistoric sites are located within the planning area (Appendix I; ADNR OHA 2003). These resources include both dated sites and undated sites that have been assigned to the prehistoric period. These undated sites include, but are not limited to, Uyagagviit (HAR-155), Niglik (Nigliq) (HAR-169), and Paptaun (TES-002), as well as various lithic sites. Uyagagviit means "place where one can get many rocks" and is a site that has been used since prehistoric times as a quarry for net weight stones. Uyagagviit represents the only source for net weight stones on the Nechelik Channel (Hoffman et al. 1988; IAI 1990a, b). The site of Niglik (Nigliq; HAR-169; TLUI-58/TLUIHAR-084) contains prehistoric artifacts as well as historic artifacts. Nigliq was a vital link in the aboriginal trade and commerce network from prehistoric times through the early 20th century (Hoffman et al. 1988; IAI 1990a, b). Davis et al. (1981) reported a large multicomponent site (TES-014) containing cultural resources scattered over the surface of an extensive sand flat near the base of an eroding dune and the remains of two rectangular sod houses (TES-020), and a large sod meat cellar or storage facility located on top of a well-drained, raised point of land near the northeast end of a small captured lake on the southwest shore of Teshekpuk Lake. It should be noted that the planning area has not been completely surveyed for cultural resources and the lack of documented prehistoric sites in specific portions of the planning area does not preclude the existence of undocumented prehistoric sites.

3.4.1.3 Overview of Regional History (Approximately A.D. 1827 to Present)

Some of the earliest recorded observations of northern Alaska and its inhabitants occurred in the Arctic region in the early to mid-19th century, when contact between Euro-American explorers, as well as the Arctic whaling fleet, and Alaskan Natives first occurred. The following years of continuous contact between commercial whalers and North Slope Iñupiat drastically altered the traditional culture (e.g., populations, subsistence practices, and settlement patterns; Bockstoce 1978, 1995). The following descriptions outline the history in the region.

European/Euro-American Expansion, Exploration, and Ethnographic Research

The exploratory period on the North Slope began in 1826 with the first Franklin expedition. Sir John Franklin and his crewmembers sailed westward from the Mackenzie River to the Return

Islands just west of Prudhoe Bay and spent 1825-1826 at the Herschel and Barter islands. That same year, Beechey's expedition sailed north from the Bering Strait to Point Barrow. Franklin, as well as other early explorers, noted that the presence of European trade goods (such as tobacco, iron, and copper) preceded their arrival among the Iñupiat on the North Slope. In 1837, Thomas Simpson of the Hudson's Bay Company traveled from the east to Point Barrow. Kashevarov sailed past Nuvuk twice in 1838, but had hostile relations with the Iñupiat (Vanstone 1977). In 1849, Lieutenant Pullen, of the HMS Plover, surveyed the Arctic coast from Wainwright Inlet to the McKenzie River. Between 1847 and 1854, contact between Europeans and the Iñupiat increased because of the influx of whalers to the region, and exploration of the region increased as ships searched for the lost Franklin expedition. From 1852 to 1853, R. Maguire, of the HMS Plover, wintered at Point Barrow. Richard Collinson, a captain on one of the search ships looking for Franklin's lost expedition, collected Iñupiat place names for areas along the coast from Barrow to the Mackenzie River while wintered off the ice of Camden Bay in 1853-1854 (Schneider and Libbey 1979).

During the commercial whaling period, items such as metal tools and firearms became increasingly important to the Iñupiat material culture. By the 1850s, guns were in use by local Iñupiat people; and by the 1880s, Iñupiat whalers were using commercial whale darting guns and bombs. Beginning in 1881, J. Murdoch and Lieutenant P.H. Ray, members of the International Polar Expedition, collected ethnographic information over the course of 2 years at Point Barrow. During the last quarter of the 19th century, epidemic diseases caused a severe population decline among the North Slope Iñupiat. Declines in caribou populations resulted in famine that caused inland Iñupiat to leave their homes and relocate to coastal communities such as Barrow, where coastal Iñupiat populations had declined from diseases such as smallpox and influenza (Reanier 2002).

Interest in the geology and history of the early culture of the area began in earnest at the beginning of the 20th century, but access was generally limited to coastal or easily accessible areas (e.g., Stefansson 1906–1907, 1908-1912, and 1913-1918; E. de K. Leffingwell [1919] 1906-1914; Rasmussen 1924; Spencer 1952). The initiation of petroleum development has led to intensive investigations of cultural resources on the North Slope. The NSB Commission on History and Culture initiated the TLUI for the North Slope in the 1970s in anticipation of and in response to increased resource development on the North Slope (Schneider and Libbey 1979).

Missionary Efforts, Trading Posts, and Reindeer Herding

Christian missionaries first arrived in Barrow in 1890. Because of the efforts of Christian missionaries and evangelization by the Iñupiat, Christianity was nearly universal on the North Slope by 1910 (Reanier 2002). Mission schools were established between 1890 and 1910 at Wales, Point Hope, and Barrow, as well as other places that were not previously occupied year-round. Eventually, the original mission schools split into separate entities: government schools and church-operated missions. Trading posts were set up near the missions and schools. These areas became focal points for the Native population, and settlements grew up around each one (Schneider and Libbey 1979).

At the end of the 19th century, Sheldon Jackson, a Presbyterian missionary, introduced reindeer herding to Alaska Natives. Following the collapse of the commercial whaling industry, reindeer herds were maintained by Iñupiat near Wainwright, Barrow, and Nuiqsut, as well as other settlements on the North Slope (Schneider and Libbey 1979). In 1937, the "Reindeer Act" placed the management of the Alaskan reindeer herds under the jurisdiction of the Bureau of Indian Affairs and legally transferred ownership of all reindeer in Alaska to Native Alaskans.

In 1939, the Federal government bought the reindeer owned by non-Natives (Stern et al. 1980). Reindeer herding ended in 1938 across much of the North Slope partially due to the collapse of the market for meat and hides (Reanier 2002).

At the beginning of the 20th century, whale oil and baleen decreased in importance. The fur trade filled some of the economic gap left by the collapse of the whalebone (baleen) market and the subsequent demise of commercial whaling. For the Iñupiat, trading traditionally has had social and economic importance. Trading posts in the area began to cease operation in the 1930s due to the Great Depression and reduced fur demand. Most of the trading posts had ceased operations by the 1940s (Schneider and Libbey 1979).

Military Presence/DEW-Line Sites

In the early 1950s, the U.S. and Canada, under threat of atomic warfare, planned a DEW-Line that was to expand across the northern regions of Alaska and Canada in order to provide advance warning for interception and counterattack (Denfeld 1994). The DEW-Line was renamed the North Warning System in 1985. Two DEW-Line sites are located in the planning area. The Kogru River DEW-Line site (POW-B) was an intermediate DEW station that was activated in 1957. The POW-B site was deactivated in 1963, and all buildings at the site were demolished in 1999 (Denfeld 1994).

Point Lonely (POW-1) is an auxiliary DEW-Line site located within the planning area. The POW-1 is a 2,830-acre facility located between Smith Bay and Harrison Bay, on the Beaufort Sea. The USDOD activated the Point Lonely facility in 1953 as an auxiliary radar station in the DEW-Line. The DEW radar at Point Lonely was removed in 1987 and the DEW-Line site was closed in 1989. The Point Lonely Short Range Radar Site was built in 1992 and activated in 1993. The Point Lonely facility is currently used as an Unattended Radar site. The site includes a radar structure, support building, fuel tanks, and a helicopter landing area. The inactive facilities include a 5,000-foot gravel airstrip, one 25-module train, a hangar, a warehouse, a garage, a fuel storage tank, and four communications antennas (Denfeld 1994).

The DEW-Line Alaska Segment has been found to be eligible for inclusion on the NRHP and POW-1 (TES-048), as well as its road system (TES-043), airfield (TES-044) and pad system (TES-045), has been physically surveyed, inventoried, and assessed, and is also considered eligible for the NRHP designation (ADNR OHA 2003).

3.4.1.4 Community History

Anaktuvuk Pass

Anaktuvuk Pass is just south of the continental divide in a low pass connecting the drainages of the Anaktuvuk and John rivers, 60 miles west of the Dalton Highway. The area has been used by the interior Iñupiat people, called the Nunamiut, for at least 500 years and by Iñupiat predecessor groups for at least 4,000 years. The modern village began in 1949 with the establishment of a trading post, followed by a post office in 1951 and a church in 1958. Residents incorporated as a fourth class city in 1959. A permanent school was established in 1961, and the community was reclassified as a second-class city in 1971 (Hall et al. 1985).

Atqasuk

The village of Atqasuk is on the banks of the Meade River, 60 air miles south of Barrow. The name means "the place to dig the rock that burns" (Alaska Department of Community and Economic Development [ADCED] 2003). The Atqasuk area is rich in caribou, fish, and waterfowl, and hunters access areas of the coast for seals and other marine resources through connections with Wainwright and Barrow residents. The Atqasuk area is the location of several former settlements used in prehistoric and historic times. The current village site is near a bituminous coal mine that provided fuel for government and private facilities in Barrow during and after World War II. From 1951 to 1957, the village had a post office under the name of Meade River. The Bureau of Indian Affairs mandate regarding school attendance for children in the 1940s forced most residents in the area to move to Barrow. However, former residents continued to use the Meade River area for subsistence purposes. In 1971, the passage of the ANCSA encouraged Iñupiat people to reestablish the community. Beginning in 1975, the community of Atqasuk was resettled by residents of Barrow and former residents of Tigalook (old Atqasuk; Schneider et al. 1980). The Meade River area has traditionally been hunted and fished by Iñupiat. Many residents are from other areas of the North Slope and continue to return to those areas for subsistence hunting and fishing.

Barrow

Barrow has been occupied for approximately 4,000 years, with continuous occupation for the last 1,300 years (Dumond 1987). The earliest occupants of the Barrow area were bearers of the Birnirk culture. The Iñupiat name for the Barrow area is Utqiagviq, meaning "the place where we hunt snowy owls." Because Barrow is situated on a point of land where the sea ice is prone to cracking, the main subsistence focus has been marine mammal hunting, particularly whaling. The reliance on subsistence activities remains a key component of the Barrow economy and the local Iñupiat culture. Barrow has been (e.g., trade, commercial whaling, and schools), and continues to be (e.g., NSB administration and wage employment) the population, social, and economic center for the North Slope Iñupiat. As Barrow is a regional center, many residents are from other areas of the North Slope. Because of this, current residents of Barrow, as well as historical residents, commonly travel to traditional subsistence use areas that are in other areas of the North Slope (e.g., Meade River, Teshekpuk Lake, Colville River) for subsistence hunting and fishing.

Nuiqsut

Nuiqsut is on the Nigliq Channel on the west side of the Colville River Delta. The Nuiqsut area provides a diverse seasonal abundance of terrestrial mammals, fish, birds, and other resources, and is a prime area for fish and caribou harvests. The name Nuiqsut recalls prehistoric and historic camps and settlements occupied by many families on the main channel of the Colville River that had been used traditionally as an area for hunting, fishing, trapping, and trading (Hoffman et al. 1988). The people of Nuiqsut call themselves Kuukpikmuit, or the "People of the lower Colville River" (Brown 1979). Most residents in the area moved to Barrow when the Bureau of Indian Affairs mandated school attendance for children in the 1940s. However, former residents continued to use the Colville River area for subsistence purposes. The passage of the ANCSA led to the reestablishment of the community. In April 1973, the community of Nuiqsut was resettled by 27 families who embarked on a 150-mile trek from Barrow to the Colville River. Many of these people had lived in the Colville River area 25 to 30 years earlier and were "seeking an alternative to the accelerating urbanization of Barrow" (Libbey et al. 1979).

3.4.1.5 Historic Resources/TLUI Sites in the Planning Area

In general, coastal Iñupiat from the prehistoric period through current times have settled in small villages on peninsulas or points of land where conditions are ideal for sea mammal hunting, and have traveled inland for caribou, fish, and furbearers on the river systems. The relationship of the Iñupiat to their natural environment remains a cornerstone of their personal and group identity (NSB Contract Staff 1979). Signs of past occupation (such as remains of camps or houses) generally mark historical places of significance. Old occupation sites are not regarded by the Iñupiat as being truly abandoned, but are valued by the Iñupiat as the living and dying places of ancestors "no longer recalled but still a part of the surrounding world," and may have supernatural associations that affect the way they are used by modern populations. Cultural associations with the land may be contained in recollections of the recent past, stories of remote history or "folklore," and in supernatural beliefs. Oral traditions and supernatural beliefs are connected to specific features of the landscape or "connected to locations where remote historical events involving the people, the animals and the landforms took place." The Iñupiat believe that "each place is entirely unique and imbued with its own importance

Historic sites located in the planning area are listed in Appendix I. There are 76 documented historic sites in the planning area. It should be noted that undocumented historic sites may be located in the planning area, as not all of the planning area has been surveyed for cultural resources.

Traditional Land Use Inventory

The NSB's TLUI is a compilation of subsistence resource/use locations, landmarks, place names, travel routes, and special significance locales that exist in the living memory of the Iñupiat people. Place names and traditional land use sites encompass locations where important events or activities, frequently subsistence use, took place, and place names reflect an "ethnohistoric present" or a living memory of the past. Without written records, this rich component of oral tradition may extend back three to four generations or even beyond" (Lobdell and Lobdell 2000). The number of TLUI locales exceeds the number of recorded archaeological sites in the planning area. This demonstrates that the communal cultural memory of the Iñupiat people is an extensive and extremely valuable resource.

A description of TLUI sites for the planning area is provided in Appendix I. There are 239 documented TLUI sites in the planning area. The existing literature that describes TLUI sites is not consistent in how TLUI sites and their associated numbers are expressed, and many TLUI sites have numbers that were assigned in the 1970s (TLUI [old]) as well as new numbers assigned later (NSB 2003a). Appendix I also provides a description of the TLUI sites using the TLUI (old) and TLUI numbers, the site name/place name (Iñupiaq and English), and the site description when available.

3.4.1.6 Summary

The modern Iñupiat population that utilizes the planning area is as successful today, subsisting in one of the harshest environments on the planet, as that of their prehistoric ancestors. The evidence that supports this statement, the material culture of the North Slope, resides in thousands of archaeological and historical sites distributed throughout the region. These sites contain the physical manifestation of the culture history of the NPR-A, a nonrenewable resource. This resource has both scientific and cultural value.

To date, in the 2-3% of the NPR-A that has been examined for the presence of cultural sites, more than 1,200 prehistoric and historic sites have been located; however, not all have been formally recorded. These sites range in age from nearly 12,000 years ago through the 20th century (Reanier 1997, Sheehan 1997). Much of this inventory work was conducted as part of the 105c studies during the late 1970s and early 1980s by the USGS, the National Park Service and the BLM (Davis et al. 1981; Carter 1982, 1983a, b; Hall and Gal 1988). Additional work by the NSB's Commission on Iñupiat History, Language, and Culture produced the Nuiqsut and Teshekpuk Lake area TLUI, a compilation of locales of various types of traditional land use through time by the Iñupiat people (NSB 1978, 2003).

To date, 343 (28 prehistoric and 76 historic AHRS and 239 TLUI) cultural resource sites have been recorded in the planning area (Appendix I). These known cultural resource sites are clustered in a few locales within the planning area. This distribution does not reflect locational preference of prehistoric and historic people, but rather indicates that only portions of the planning area (e.g., well sites, portions of the coast, the Colville River, the Ikpikpuk River, and the Teshekpuk Lake area) have been examined through some type of organized reconnaissance for the presence of cultural sites. The TLUI sites generally cluster in these same areas with greater density on the lower Ikpikpuk River and associated drainages (NSB 1978, 2003). The absence of recorded cultural sites across most of the planning area is simply the result of the limited research that has been conducted there (NSB 1978, 2003; Davis et al. 1981; Hall and Gal 1988). In the most general terms, where inventories and surveys have been conducted, cultural sites usually have been found.

3.4.2 Subsistence

Subsistence hunting is the foundation of the region's culture, and provides a mainstay of the diet for many families. In addition to its cultural and dietary significance, subsistence food production can be viewed as import substitution. Because of high transportation costs and a relatively small market size, food costs in North Slope communities are much higher than in Alaska's major urban population areas. According to a NRC (1999) study, young men in Iñupiat communities choosing to balance wage employment with seasonal subsistence activities and higher levels of household cash income are directly correlated with peoples' commitment to natural resource harvesting. Kruse (1986) found that young men participated in major subsistence activities as much as the older generation, and those who had been exposed to Western influences through outside schooling tended to be more interested in subsistence.

The planning area is comprised of Federal land managed by BLM. Therefore, management of subsistence hunting in the planning area is ruled by Title VIII of the ANILCA, which defines subsistence uses as:

> The customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of inedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter or sharing for personal or family consumption; and for customary trade (16 USC § 3113).

On Federal lands in Alaska, Federal law grants subsistence users priority over other users when it is necessary to restrict the taking of wildlife for conservation or other reasons. As a result, Federal agencies are responsible for managing subsistence hunts and will continue to do so until legislation bringing state law into compliance with Federal regulations can be enacted

(USDOI USFWS 1992). The USDOI also manages subsistence fisheries on Federal lands (Hulen 1996a, b; Kizzia 1996; Whitney 1996).

The NSB Municipal Code defines subsistence as:

> An activity performed in support of the basic beliefs and nutritional needs of the residents of the borough and includes hunting, whaling, fishing, trapping, camping, food gathering, and other traditional and cultural activities (NSB Municipal Code 19.20.020 [67]).

For Alaska Natives, subsistence is more than the harvesting, processing, sharing, and trading of marine and land mammals, fish, and plants. Subsistence embodies cultural, social, and spiritual values that are the essence of Alaska Native cultures (Bryner 1995, ADNR 1997). The Alaska Federation of Natives (2003) describes subsistence as:

> The hunting, fishing, and gathering activities which traditionally constituted the economic base of life for Alaska's Native peoples and which continue to flourish in many areas of the state today... Subsistence is a way of life in rural Alaska that is vital to the preservation of communities, tribal cultures, and economies. Subsistence resources have great nutritional, economical, cultural, and spiritual importance in the lives of rural Alaskans… Subsistence, being integral to our worldview and among the strongest remaining ties to our ancient cultures, is as much spiritual and cultural, as it is physical.

Subsistence resources are highly valued and central to the customs and traditions of many cultural groups in Alaska, including the North Slope Iñupiat. These customs and traditions encompass sharing and distribution networks, cooperative hunting, fishing, and ceremonial activities. Subsistence fishing and hunting are important sources of nutrition and non-traditional employment in almost all rural communities. The ADFG estimates that the annual wild food harvest in the Arctic area of Alaska is approximately 10,507,255 pounds, or 516 pounds per person per year. Subsistence harvest levels vary widely from one community to the next. Sharing of subsistence foods is common in rural Alaska (ADFG 2000).

Subsistence is part of a rural economic system, called a "mixed, subsistence-market" economy, wherein families invest money into small-scale, efficient technologies to harvest wild foods (ADFG 2000). Fishing and hunting for subsistence provide a reliable economic base for many rural regions. Domestic family groups who have invested in gill nets, motorized skiffs, and snowmachines conduct these important activities. Subsistence is not oriented toward sales, profits, or capital accumulation (commercial market production), but is focused toward meeting the self-limiting needs of families and small communities. Participants in this mixed economy in rural Alaska augment their subsistence production by cash employment. Cash (from commercial fishing and trapping) and/or wages (from public sector employment, construction, fire fighting, oil and gas industry, or other services) provide the means to purchase the equipment, supplies, and gas used in subsistence activities. The combination of subsistence and commercial-wage activities provides the economic basis for the way of life so highly valued in rural communities (Wolfe and Walker 1987). As one North Slope hunter observed: "The best mix is half and half. If it was all subsistence, then we would have no money for snowmachines and ammunition. If it was all work, we would have no Native foods. Both work well together" (Alaska Consultants, Inc. [ACI] et al. 1984).

Full-time, year-round wage employment has positively and negatively affected the pursuit of subsistence resources. It has positively affected the subsistence hunt by providing cash for snowmachines, boats, motors, fuel, equipment, and ammunition required for the hunt. Full-time year-round employment limits the time a subsistence hunter can spend hunting to after work hours. Employment in the oil fields or away from the communities further limits the pursuit of subsistence resources, as the primary hunters may be away working at the best times for harvesting certain resources. During midwinter, this time window is further limited by waning daylight. In summer, extensive hunting and fishing activities can be pursued after work without any light limitation, but travel is limited to raised ground and waterways by difficult travel on wet tundra. Speaking at the 2001 meeting in Nuiqsut for the Liberty Development and Production Plan Draft EIS, Rosemary Ahtuangaruak, then-acting mayor of the community, put the conflict in these terms: "They require the guns and the snowmachines to allow them to harvest in the narrow windows of time that exist due to commitment to work. They are torn by the traditional needs of providing from the land and the stresses of needing cash to purchase items that save on time" (USDOI MMS 2001).

The following sections briefly describe subsistence harvest activities in and near the planning area.

3.4.2.1 Subsistence Use of the Planning Area

The primary subsistence-harvest areas for Barrow, Atqasuk, Nuiqsut, communities whose residents harvest or rely on subsistence resources that may spend time in the planning area, are shown in Map 3-35. The subsistence harvest area for Anaktuvuk Pass is shown in Map 3-42, and for Wainwright in Map 3-41. Seasonal movement to hunting sites and camps for subsistence activities involves travel over and use of extensive areas from as much as 70 miles offshore to the mountains of the Brooks Range.

3.4.2.2 Community Subsistence-Harvest Patterns

Subsistence resources are often harvested from specific camps where multiple resource harvest opportunities are available in each season. Generally, communities harvest resources nearest to them, but harvest activities may occur anywhere in the planning area. Harvests tend to be concentrated near communities, along rivers and the coastline at particularly productive sites. The distribution, migration, and the seasonal and more extended cyclical variation of animal populations makes determining what, where, and when a subsistence resource will be harvested a complex activity. Areas might be used infrequently, but they can be quite important harvest areas when they are used (USDOI BLM 1978e).

Species use and harvest success can vary greatly over short periods of time, and short-term harvest data analyses can be misinterpreted as a result. For example, if a particular community did not harvest any bowhead whales in one year, community use of caribou and other species would increase to compensate for the loss of that resource harvest. If caribou are not available in one winter, other marine and terrestrial species would be hunted with greater intensity. Scenarios such as this have taken place in Kaktovik and Nuiqsut in the last 25 years (Brower and Hepa 1998). For example, in 1992 the percentage of the three primary resource categories harvested by Nuiqsut was relatively equal, with terrestrial mammals comprising 27.6%, marine mammals 35.1%, and fish 34.6% (Fuller and George 1997). However, during the harvest recording period of July 1994 to June 1995, marine mammals in Nuiqsut comprised only 2% of the total harvest, with terrestrial mammals increasing to 69% of the total harvest (Brower and Opie 1997). This increase in harvest of terrestrial mammals, primarily caribou and moose, was the result of the community failing to land a whale during the 1994 fall season. In cases such as these, the cultural value of sharing and reciprocity ensures that other communities will contribute subsistence foods to the communities affected. In some cases, communities have sponsored hunts in their vicinity for communities suffering a harvest failure. Anaktuvuk Pass and Nuiqsut have recently participated in such an exchange (Stephen R. Braund and Associates [SRBA] 2003b). However, even when sharing and reciprocity are able to meet the dietary need for subsistence foods, the cultural significance of a failed hunt can be quite significant. For example, Rosemary Ahtuangaruak of Nuiqsut said:

> We had seismic activity in Camden Bay that caused us to lose two whaling boats. We did not harvest whale two seasons in a row. We went without whale those winters. Those were the deepest, darkest winters I faced as a community health aide. We saw an increase to the social ills, we saw domestic violence, we saw drug and alcohol abuse, we saw all the bad things that come when we are not able to maintain our traditional life activities (USDOI BLM 2004d).

While subsistence resource harvests differ between communities, the resource combination of bowhead whales, caribou, and fish are the main subsistence resources for Barrow, Nuiqsut, Wainwright, and Atqasuk. Bowhead whale hunting, which includes a great deal of cooperation and preparation year-round, is the impetus and focus of the North Slope Iñupiat sociocultural system. The bowhead whale is the preferred meat and the subsistence resource of primary importance because it provides a unique and powerful cultural basis for sharing and community cooperation (Stoker 1983). Caribou is the most important overall subsistence resource in terms of number of animals harvested and consumed, and the greatest frequency of hunting trips taken. Depending on the community, fish is the second or third most important resource after caribou and bowhead whales. Bearded seals and waterfowl are also considered primary subsistence species. Seal meat, oil, and hides are important staples and necessary complements to other subsistence foods. Seal oil, in particular, is desired for use as a condiment. Waterfowl are important during the spring, when they provide the first fresh meat of spring and add variety to the subsistence diet. Migratory birds from the project area are important to Native peoples in western, southwestern, and interior Alaska, and along the Pacific Flyway.

The subsistence pursuit of bowhead whales is of major importance to the communities of Barrow, Wainwright and Nuiqsut, and some Atqasuk men whale with Barrow or Wainwright crews. The sharing of whale maktak and meat is important to inland communities. Whaling continues to be the most valued activity in the subsistence economy of these communities, even in light of harvest constraints imposed by International Whaling Commission quotas. Seasonally plentiful supplies of other subsistence resources such as caribou and fish, as well as supplies of retail grocery foods, supplement and support whale harvests. Whaling traditions include kin-based crews, use of skin boats during the spring whaling season, onshore preparations for distribution of the meat, and regional and extra-regional participation and sharing. These traditions remain central values and activities for Iñupiat in these North Slope communities. Bowhead whaling strengthens family and community ties and the sense of a common Iñupiat heritage, culture, and way of life. In this way, whaling activities provide strength, purpose and unity in the face of rapid change. Barrow is the only community within the area that harvests whales in both the spring and the fall. The community of Wainwright only harvests whales during the spring from the shore-fast sea ice, as bowhead whales do not travel near enough to be successfully harvested during their fall migration south (Kassam and Wainwright Traditional Council 2001). Subsistence whaling for the community of Nuiqsut occurs only during the fall season, although some Nuiqsut hunters travel to Barrow to participate with Barrow whaling crews during the spring whaling season (NSB 1998).

3.4.2.3 Traditional Iñupiat Settlement Patterns

The North Slope Iñupiat have undergone numerous changes as they adapted to changing cultural, social and physical environments. Before sustained contact with Euro-Americans, the Iñupiat moved seasonally between coastal and riverine environments on the ACP, gathering at communally recognized locations for seasonal bowhead whale hunts or cooperative hunts using caribou drive lines and subsequent celebrations of successful harvests. If the whale harvest was successful, the meat and maktak were distributed and a celebration, Nalukataq, was held. The Iñupiat would again disperse to coastal and riverine winter residences after whaling (SRBA and Institute of Social and Economic Research [ISER] 1993). Numerous regional groups of Iñupiat and Athabaskans gathered at trading fairs, including one in the Nuiqsut area (Elavgak in Brown 1979).

The Iñupiat developed adaptive responses to the variable distribution and availability of subsistence resources, including sociocultural and technological strategies. Sociocultural strategies included an emphasis on sharing and hospitality, non-restrictive land use rules, wide-ranging mobility to extract sparsely distributed resources, and an adaptive set of hunting rules and techniques. Examples of hunting rules included letting caribou herd leaders pass so the main herd follows and taking only as many caribou as necessary. Examples of hunting techniques included the use of caribou drivelines and allu, or breathing hole hunting for seals. Technological adaptations included specialized tools for harvesting subsistence species, innovation as new materials were introduced (e.g., steel, plastic, woven fabrics), and a willingness to adopt new technologies from other cultures if there were clear advantages in their use (e.g., rifles, outboard motors, snowmachines; Brown 1979; IAI 1990a, b).

Euro-American contact began intermittently in the early 19th century and intensified with the shift of commercial whaling north of the Bering Strait in the 1850s. The establishment of a shore-based whaling station at Barrow in 1884 brought Iñupiat from other areas to Barrow in pursuit of wage employment, access to technologically advanced and trade goods, and increased trade opportunities. Eskimo people from as far as Siberia and Saint Lawrence Island moved to Barrow to participate in the commercial whale harvest. After the Pacific Steam Whaling Company ceased shore-based whaling from Barrow in 1896, Iñupiat whalers took over the shore-based whale harvest, with more affluent captains maintaining as many as six crews year-round (SRBA and ISER 1993).

Changes in resource distribution, fluctuations in whale and caribou populations, epidemic disease, and prolonged contact with Euro-Americans caused major changes in the geographic distribution and lifeways of the Iñupiat (SRBA and ISER 1993). The eventual depletion of whales and other marine mammals, as well as the increased hunting pressure caused by the need to provision commercial whaling crews, may have caused critical resource shortages. The promise of jobs and access to trade goods in conjunction with famine and disease caused a decline in the overall population of the region and the relocation of inland peoples to the coastal villages. In response to the famine and a need to feed stranded commercial whalers, the Federal government instituted reindeer herding programs in Point Hope, Wainwright, and Barrow, which lasted until the 1930s. The Barrow reindeer herd dispersed by 1952 because of inattention, predation by wolves, and assimilation into wild caribou herds.

Commercial whaling ended by 1910, and fur trapping became an alternative method for the Iñupiat to participate in the cash economy. While commercial whaling had brought Iñupiat from the interior to the coast, specifically to Barrow and Wainwright, trapping encouraged the Iñupiat to disperse along the coast and return to the interior to winter trapping camps. The

Depression forced fur prices down and made trapping unprofitable for Iñupiat hunters. Following the Depression, the Iñupiat population again aggregated into centralized communities following the establishment of schools, missions, and churches, and the enforcement of truancy laws. Economic growth presented opportunities that drew Iñupiat to the growing cities of Fairbanks and Anchorage (Hoffman et al. 1988).

During World War II, the U.S. Navy and other Federal agencies began exploring the then PET-4, mapping the Beaufort Sea coast, and establishing research stations near Barrow (Ebbley and Joesting 1943). After the war, DEW-Line sites provided employment to Iñupiat people and allowed them to continue to use subsistence resources while providing access to Euro-American goods and services (Hoffman et al. 1988). Wage employment (e.g., NPR-A, Naval Arctic Research Laboratory, DEW-Line sites, Federal Aviation Administration, and Weather Bureau) attracted inland and coastal Iñupiat to Barrow (Human Relations Area Files, Inc. 1992).

Not all Iñupiat moved to centralized communities. Many continued to move around on the land much as their ancestors had. Iñupiat who had settled in Barrow or Wainwright for access to education and health care returned seasonally to the areas from where they or their families had come. Following the passage of ANCSA, groups that had centralized in Barrow and other coastal villages to gain access to education, health care, employment, and other advantages of a more urban life began to return to formerly used subsistence harvest areas and established the communities of Nuiqsut, Anaktuvuk Pass, and Atqasuk (Brown 1979).

3.4.2.4 Contemporary Subsistence Uses

Contemporary subsistence uses reflect centuries-old seasonal resource harvest patterns based on resource availability and abundance. The Iñupiat have adopted aspects of Euro-American culture and technology while maintaining core elements of Iñupiat culture, values, and identity (IAI 1990 a, b), and have creatively adopted new technologies to further traditional subsistence pursuits and maintain connections to the land (Spencer 1976).

Anaktuvuk Pass

The Nunamiut people of Anaktuvuk Pass are among the few in the NSB without direct access to marine mammals. As a consequence, the Iñupiat of this village rely heavily on terrestrial mammals and fish for subsistence. Caribou is the main terrestrial mammal resource, with moose and Dall sheep also important resources for hunters. Freshwater fish from area lakes and streams are an important supplement to terrestrial mammals. Terrestrial resources are often bartered for marine resources from other communities, particularly Nuiqsut and Barrow (Brower and Opie 1996, Fuller and George 1999).

Seasonal Round

Caribou hunting is the mainstay of the Nunamiut (inland Iñupiat) subsistence hunt. Caribou are hunted year-round as needed, and heavily from July through November (Figure 3-3). The caribou migrate through the Anaktuvuk Pass area twice a year, in the spring and fall, but the number and timing of the caribou migrating through the area vary from year to year. Dall sheep, grizzly bear, and moose are hunted in August, September, and October some distance from the village, with Dall sheep the main target. Between November and April, furbearer harvesters travel substantial distances from the community, with peak harvest activity in February or March depending on snow conditions. Birds and fish are supplementary to terrestrial mammals but are harvested when available and increase in importance if caribou numbers are low. Berries are seasonally important, with salmonberries and blueberries providing the majority of vegetable foods.

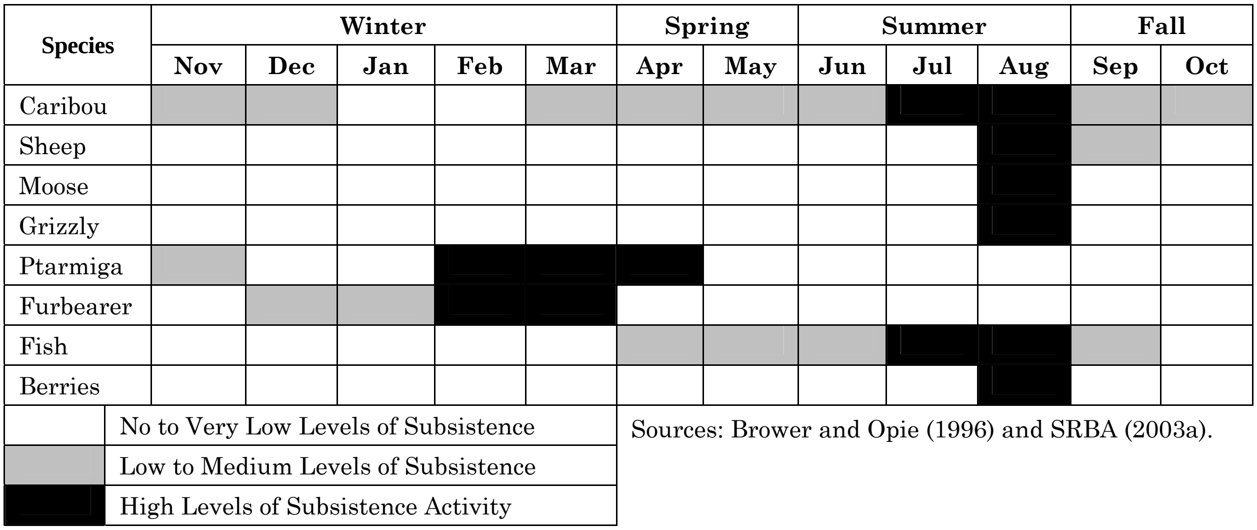


Figure 3-3. Annual Cycle of Subsistence Activities – Anaktuvuk Pass.

Subsistence Harvests

Since resource users in Anaktuvuk Pass have no direct access to marine mammal resources, terrestrial mammals comprise up to 95% of the harvest, with nearly three-fourths of the community participating in the harvest. Caribou are the main terrestrial mammal species harvested, with moose and sheep also harvested in small numbers. Fish are a smaller component of the subsistence diet by weight, but are still an important food source. Fish species harvested include grayling, Arctic char, lake trout, burbot, and pike. Birds harvested during the brief migration period include a variety of geese and ducks. Preferred species are white-fronted and Canada geese and several species of small ducks, such as northern pintails. Vegetation harvested includes berries and masu, or "Eskimo potatoes" (SRBA 2003b).

Subsistence Use Areas

An important factor contributing to the resettlement of the Anaktuvuk Pass area was the seasonal migration of caribou through Anaktuvuk Pass. Map 3-42 is a partial subsistence use area map for the last 10 years based on interviews conducted in 2003 for the Alpine Satellite Development Project Final EIS (SRBA 2003a, b; USDOI BLM 2004c). More detailed and exhaustive mapping of lifetime subsistence use areas for the community were presented in the 1985 report produced by Hall et al. (1985) for the NSB and in the 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998).

A harvest strategy formerly used by residents was herding small groups of migrating caribou into lakes, streams, or valleys to limit their mobility and then harvesting and processing the caribou in a cooperative group undertaking (Spearman 1979). While waiting for the caribou to be herded through these areas, members of the group would fish in the streams and lakes. Many residents recall this way of life from their youth in the smaller communities (e.g. Chandler Lake, Killik River, and Tulugaq Lake), which in the 1950s came together in Anaktuvuk Pass (Rausch 1951, 1988). Nunamiut hunters bartered furs and dried caribou for other resources, such as marine mammal fats and hides, with coastal people at trade fairs in the Colville River Delta, Barrow, and Barter Island. Anaktuvuk Pass people currently trade resources and hunting access with Nuiqsut people in much the same manner as they did during traditional times; however, hunters now use modern means of transportation and hunt on a compressed time schedule (Spearman 1979; Hall et al. 1985; Ahtuangaruak 2001; USDOI MMS 2001; SRBA 2003b).

Highest use areas are within 20 miles of Anaktuvuk Pass, with most hunting trips taken in the immediate vicinity of the community (Brower and Opie 1996). Lifetime subsistence use areas, as depicted in Hall et al. (1985), encompass the entire NSB from Aklavik, Canada, to Kivalina and Kotzebue Sound, and north to Point Barrow and Wainwright. Anaktuvuk Pass residents also traveled to Fort Yukon, Bettles, Wiseman, and Old Crow while trapping or working at seasonal jobs (Paneak 1990, Brower and Opie 1996). Travel corridors and trapping areas included the Sagavanirktok, Killik, Kobuk, Itkillik, John, and Colville rivers and the coast between the Colville River Delta and Demarcation Point (Hall et al. 1985).

Resource users have used the valleys and slopes of the Brooks Range between the Killik River valley and Itkillik Lake, with some resource users having gone farther east and west on occasion. Most resource users did not go farther south than the Alatna, Hunt Fork, and North Fork rivers, although some had made trips to Bettles in the past. North of the Brooks Range, resource users traveled by snowmachine and all-terrain vehicle along the front slope of the mountains east to Itkillik Lake, west to Chandler River, north to Rooftop Ridge, and parallel the Colville River past Umiat to the Chandler and Killik rivers, then heading back south into the mountains. Periodic trips to Nuiqsut were made along the east or west side of the Anaktuvuk River, almost to its confluence with the Colville River, then headed east towards the Kuparuk hills, and north to Nuiqsut along a trail that roughly parallels the Itkillik River.

Periodic shortages of caribou and other game have made living inland difficult for Iñupiat people for centuries and have required them to follow the migrating caribou herds year-round. In the late 1940s, the Nunamiut settled into Anaktuvuk Pass from Chandler Lake, Killik River, and Tuluġaq Lake, partially in response to the requirement for children to attend school. A result of sedentary life was the increased difficulty resource users experienced in harvesting adequate amounts of subsistence foods, even with modern transportation and other equipment. An added and more recent complication was the establishment of the Gates of the Arctic National Park and Preserve, which has restricted the use of certain all-terrain vehicles (such as Argos and four-wheelers) at snow-free times of the year, thereby restricting Nunamiut from accessing subsistence areas that they formerly occupied and used during the snow-free months (Hall et al. 1985; SRBA 2003b).

Several times in the 1970s and 1980s and as recently as 1994 and 1998, Anaktuvuk Pass residents found it necessary to travel great distances to procure enough caribou to feed their community. The NSB has paid for some trips, using charters and float planes to fly hunters from Anaktuvuk Pass to places like Umiat and Schrader Lake (located approximately 60 miles southwest of Kaktovik; SRBA 2003b). More recently, hunters have traveled to Nuiqsut to harvest caribou for Anaktuvuk Pass, and on other occasions Nuiqsut hunters have provided caribou, fish, and other coastal foods during lean times. Anaktuvuk Pass resource users reciprocate with gifts of dry meat and other Nunamiut specialties.

A lifetime Anaktuvuk Pass hunter, describing his winter trail to Nuiqsut, indicated he traveled in February or March, hunting as he traveled. This hunter stated that he generally hunted along the trail, and used his binoculars to look out to the sides of the trail for game. He went to Nuiqsut once or twice a year, but did not do any fishing on the way to Nuiqsut, just wolf and wolverine hunting. He stated that his trips had a dual purpose, to hunt and to visit relatives that include cousins, aunts, and uncles in Nuiqsut, and that he generally stayed in Nuiqsut less than a week. He put 6,000 miles on his snowmachine in 6 months (SRBA 2003b).

There is friendly competition between hunters and communities in the pursuit of wolves, wolverines, and foxes. Several Anaktuvuk Pass hunters have traveled north to Nuiqsut, and hunted wolf, wolverine, and caribou en route. One hunter said, “I hunted everything on my trip to Nuiqsut,” and described the trip to Nuiqsut as “one camp” away. In other words, he left Anaktuvuk Pass, made camp for one night, and then went to Nuiqsut the next day. Other hunters remarked similarly on the route, noting important landmarks and features along the way. One hunter had harvested wolf and wolverine near Ocean Point in 1998. While residents of several communities encounter each other while hunting furbearers, it was often noted that “it is better for them to see your tracks than for you to see theirs,” as often the tracks of other hunters was a sign that the animal being sought had already been taken or run off by the other hunter.

Atqasuk

The area surrounding Atqasuk is rich in caribou, fish, and waterfowl, and a few hunters access areas of the coast for seals and other marine resources. Some Atqasuk hunters are members of Barrow whaling crews and take part in bowhead whaling and festivities there, returning with shares after a successful harvest.

Atqasuk residents use the same variety of marine resources as Barrow residents, but only a small portion of the marine resources used by Atqasuk residents are acquired on coastal hunting trips initiated in Atqasuk; most are acquired on coastal hunting trips initiated in Barrow or Wainwright with relatives or friends (ACI et al. 1984; SRBA 2003b). These connections with coastal and marine resources are important to the community. As one resident observed: “We use the ocean all the time, even up here; the fish come from the ocean; the whitefish as well as the salmon migrate up here” (ACI et al. 1984).

Seasonal Round

Atqasuk subsistence harvests rely on a diversity of seasonally abundant resources that hunters must harvest when available (Figure 3-4). Some species, like ptarmigan and caribou, may be present year-round, but are only harvested when permitted or when encountered. December and January are generally not productive months for subsistence resource pursuits because of the winter weather and seasonal darkness. Between November and April, furbearer harvesters travel substantial distances from the community to harvest wolves, foxes, and wolverines, with peak harvest activity in February or March depending on snow conditions. In late February and through March, some residents may begin fishing under the ice on the Meade River, its tributaries, and any lakes that do not freeze completely, as an adjunct to fur and caribou hunting (SRBA 2003b).

Hunters may harvest caribou if they are encountered at this time, and the need to harvest more caribou may increase through March as late fall food supplies are depleted. The harvest of caribou increases as daylight increases and the weather becomes increasingly moderate. Some residents may travel to Barrow to participate in spring whaling. Beginning in May, hunters pursue migrating birds and caribou. The breakup of river ice and lack of snow in June make travel difficult. After the ice goes out, gill-netters harvest fish near the community as the fish move upriver to spawn. The high water on the rivers and lakes of the area in late spring and early summer allows the most extensive boat travel. Later in the summer, the water levels may be too low to allow long-range travel, so community residents plan their travels for late June through July. Subsistence resources are particularly abundant from July through September. Berries are seasonally important. Hunters harvest grizzly bears, moose, squirrels, and migratory birds throughout the summer. By October, migratory birds have left the area, and hunters shift their focus to caribou and fish. In November, hunters attempt to harvest enough caribou for the upcoming winter.

Atqasuk residents harvested caribou primarily within 10 miles of Atqasuk, with the majority harvested between July and December (Hepa et al. 1997). Although the late summer-early fall harvest is the most important, caribou are harvested every month of the year (Figure 3-4). Caribou migration patterns and limited access prohibit hunting in the late spring and early summer.

Residents harvested fish between June and November, with the greatest number of fish harvested between August and October. Fall and early winter is the preferred time for fishing, when water levels drop in the Meade River and the water becomes clearer. The most productive season for gillnetting begins in June and runs through to fall and early winter. During the fall, fishing continues under the ice in the Meade River and in nearby lakes (Schneider et al. 1980; ACI et al. 1984; NSB 1998).

Atqasuk residents harvest migratory birds, especially white-fronted geese, from late April through June when they begin to appear along rivers, lakes and the tundra, following the snowline north (NSB 1998). Hunters also harvest ptarmigan at this time. From late August through September, waterfowl are hunted continually through June and July along the major rivers (e.g., Meade River and its tributaries), and on numerous lakes and ponds. Ptarmigan are also heavily hunted during the fall (NSB 1998). Waterfowl eggs are gathered in the immediate vicinity of the community for a short period in June (ACI et al. 1984).

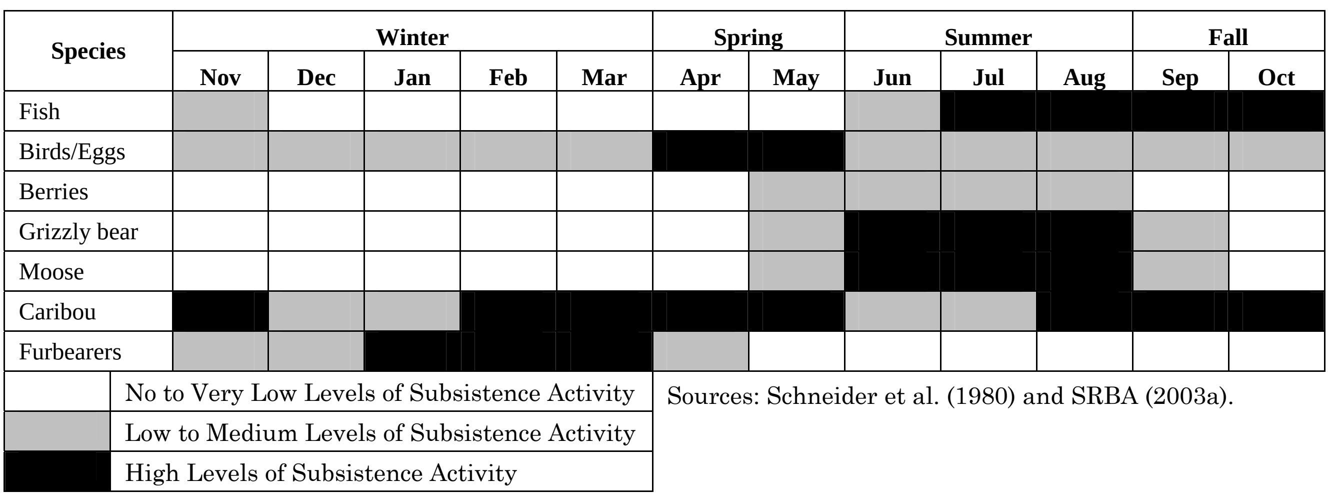


Figure 3-4. Annual Cycle of Subsistence Activities – Atqasuk.

Subsistence Harvests

Atqasuk is similar to Nuiqsut and Barrow in that residents harvest caribou, fish, and birds locally; however, Atqasuk is more connected to Barrow for marine mammal harvests and membership in whaling crews (Hepa et al. 1997). Neither the ADFG nor MMS have collected subsistence harvest data for Atqasuk, and the NSB Department of Wildlife Management has only harvest data for 1994–1995 (Hepa et al. 1997) and only participation data for 1992 (Fuller and George 1999). During the 1994–1995 harvest year, 57% of the harvest by edible pounds consisted of caribou, with 37% fish, 3% birds, 2% marine mammals, and 1% plants.

Most Atqasuk residents participated in subsistence activities and shared subsistence resource harvests. Of interviewed households in 1994-1995, 77% of residents attempted to and/or were successful in harvesting subsistence resources (Hepa et al. 1997). Fuller and George (1999) reported a participation rate of 90% for the 1992 harvest year; of households that successfully harvested subsistence resources in 1994-1995, 91% shared their resources with others and 4% did not.

Caribou is the most important resource, by weight, harvested by Atqasuk residents. A subsistence harvest survey conducted by the NSB Department of Wildlife Management, covering the period from July 1994 to June 1995, noted 187 reported caribou harvested by Atqasuk hunters, approximately 57% of the total subsistence harvest in edible pounds (Hepa et al. 1997). Caribou are hunted by boat and snowmachine and on foot from hunting camps along the Meade, Inaru, Topaguruk and Chipp river drainages (which also are used for fishing). Caribou hunting by snowmachine involves considerable travel over a widespread area and is generally incidental to furbearer hunting (Schneider et al. 1980; ACI et al. 1984). Caribou harvest surveys of Atqasuk residents conducted by ICAS and the ADFG provide the following community total estimates for four consecutive reporting years: 194 caribou during the 2002-2003 reporting year; 329 in 2003-2004; 217 in 2004-2005; and 171 in 2005-2006 (Pedersen 2006).

Fish is a preferred food in Atqasuk; respondents indicated that fish is the second most important resource in quantity harvested (ACI et al. 1984). Summer gillnetting, hook and line, late fall and winter jigging through ice, and winter gillnetting under the ice are the four most common fishing techniques. The most prevalent subsistence fishing activity is catching humpback whitefish and least cisco in gillnets. Also caught are broad whitefish, burbot, grayling, and chum salmon (only in some years), all of which are fished with gillnets, baited hooks, and jigging (Craig 1987). Nets are most commonly set close to the community. Narvaqpak (southeast of Atqasuk) is a popular fishing area (NSB 1998). Most fishing occurs along the Meade River, only a few miles from the village; however, fish are also pursued in most rivers, streams, and deeper lakes of the region. Fish camps are also located on two nearby rivers, the Usuktuk and the Nigisaktuvik, and downstream on the Meade River, near the Okpiksak River (Craig 1987).

Humpback whitefish and least cisco accounted for 96% of the summer catch in 1983. The summer gillnet fishery in the Meade and Usuktuk rivers produced a harvest of approximately 8,450 pounds of fish. Adding catches with other gear (angling) and winter catches (1,100 pounds and 2,700 pounds, respectively); the total harvest was approximately 12,250 pounds. The annual per capita catch in 1983 was about 43 pounds, with a total of 231 residents in the village (Craig 1987). A subsistence-harvest survey conducted by the NSB Department of Wildlife Management, covering the period from July 1994 to June 1995, reported that fish harvested by Atqasuk hunters represented 37% of the total subsistence harvest in edible pounds (Hepa et al. 1997).

The subsistence harvest survey, conducted by the NSB Department of Wildlife Management, reported that bird harvests by Atqasuk hunters represented 3% of the total subsistence harvest in edible pounds (Hepa et al. 1997). Subsistence hunters at Atqasuk harvested 279 birds in May, 8 seals in July, and 84 gallons of berries between July and September. Other subsistence foods may be received as shares and traded or bartered within the community and with other villages. Between October and May, fur hunters harvested 2 wolves, 6 ground squirrels and 10 wolverines.

Subsistence Use Areas

Subsistence hunters at Atqasuk use harvest locations relatively close to the community, with some use of the coast west of Barrow and of Dease Inlet (Schneider et al. 1980; Hepa et al. 1997). The main advantages of Atqasuk's location are access to river and lake resources and position in the migration path of the Teshekpuk caribou herd (Schneider et al. 1980). Atqasuk's lifetime subsistence use area, as described in the 1970s and depicted in Map 3-40, extends from northeast of Wainwright to Barrow, along the coast to the vicinity of Smith Bay, south along the Ikpikpuk River to the Titaluk River, and west and north to Peard Bay (Pedersen 1979).

Based on SRBA interviews of subsistence users in Atqasuk, the recent (last 10 years) use area has expanded, as compared to the use area depicted by Pedersen (1979; Map 3-40). The recent use area extends from the eastern edge of Teshekpuk Lake in the east, to the Kaolak River in the west, to the Inaru River in the north, and beyond the Colville River in the south (Map 3-40). Several Atqasuk residents have ties to the Smith Bay-Cape Halkett–Kogru River areas, and some of these residents intensively used the area north and southeast of Teshekpuk Lake in their youth. One hunter stated that there were "numerous small camps and villages along the coast between Drew Point, Smith Bay, and Dease Inlet. It was a [caribou] grazing area" (SRBA 2003b). He explained that there were many ice cellars in an area between the mouth of the Ikpikpuk River and Teshekpuk Lake, named Shubjat, because it was high, dry ground away from the coast. Polar bears, with their keen sense of smell, would find and dig up the coastal ice cellars.

Atqasuk hunters travel east as far as Fish and Judy creeks. Resources sought in the eastern portion of the current Atqasuk use area include fish, wolf, wolverine, and caribou. The harvest of caribou in this eastern area, which is incidental to the pursuit of wolves and wolverines, takes Atqasuk hunters far from the community on several extended trips each winter. Atqasuk hunters encounter furbearer and caribou hunters from other communities on these extensive travels. The Kalikpik and Kogru river area and the Fish and Judy creeks area are occasionally used by in the winter by Atqasuk hunters traveling by snowmachine, primarily in search of wolf and wolverine. The Kalikpik and Kogru river area is a "homeland" for several Atqasuk families, who in the past traveled by boat and harvested caribou, birds, and fish in this area.

During the summer and fall, subsistence use areas for caribou, fish, waterfowl, and berries are primarily centered around Atqasuk, generally within 50 miles of the community. The harvest of resources near Atqasuk, both in the summer and winter, consists of day trips involving snowmachines, all-terrain vehicles, and boats, dependent on season. However, one subsistence user said he would go to one harvest area for a week, and then he would go home for a week or two, gas up, and go to another harvest area (SRBA 2003b).

It is not uncommon for winter hunters on snowmachines to encounter hunters from other communities. One Atqasuk hunter, who took several long winter hunting trips, said that he does not go to the area above Umiat, instead leaving "that country to those guys in Nuiqsut. They come up and hunt all over that area in moose season." Hunters make use of camps and cabins belonging to hunters, often relatives, from other communities to support their hunting trips. Atqasuk hunters do not hunt regularly in the Nuiqsut or Colville River areas, traveling to Nuiqsut only for special occasions, such as funerals.

Barrow

Barrow is situated on a point of land, the demarcation point between the Chukchi and Beaufort seas, where the sea ice is prone to cracking. The main subsistence focus in this area has been marine mammal hunting, and whaling in particular. Barrow is one of 10 Alaska Eskimo bowhead-whaling communities. Bowhead whale hunting is the key activity in the organization of social relations in the community and represents one of the greatest concentrations of effort, time, money, group symbolism, and significance (SRBA and ISER 1993). Other harvested resources, such as caribou, waterfowl, and several varieties of fish, are vital for subsistence and available to residents, but have less influence on the organization of social relations (Maps 3-38 and 3-39).

Seasonal Round

Barrow's seasonal round is related to the timing of subsistence resources (Figure 3-5). Preparation for bowhead whaling occurs year-round. Spring bowhead hunting is undertaken by Barrow whalers during April and May, with May generally being the most successful month (SRBA and ISER 1993). Traditionally, whaling crew members opportunistically hunted other marine mammals, such as seals and polar bears, following spring whaling. Beginning with the whaling season of 1978, bowhead whale quotas instituted by the International Whaling Commission altered traditional spring whaling activities by reducing the opportunity for harvesting bowheads and limiting the pursuit of other marine mammals so as not to jeopardize the bowhead whale hunt. Waterfowl are hunted during the spring whaling season when their flights follow the open leads, providing a source of fresh meat for whaling camps. Later in the spring, Barrow residents harvest many geese and ducks; the harvest peaks in May and early June and continues through the end of June.

Beluga whales are available from the beginning of the spring whaling season through June, and occasionally into July and August, in ice-free waters. Barrow hunters do not like to hunt beluga whales during the bowhead whale hunt for fear of scaring away the larger animals. Thus, the hunters harvest beluga whales after the spring bowhead whale season ends, which is dependent on when the bowhead whale quota is reached. Bearded seals are harvested more often than the smaller hair seals, because of their large body size and thick hides. They are hunted in both the Chukchi and Beaufort seas during the summer months and from open water while hunters are pursuing other marine mammals (NSB 1998).

Once the spring whaling season is over, usually in late May or early June, subsistence activities diversify. Some hunters turn their attention to hunting seals, walrus, and polar bears, while others go inland to fish or hunt for waterfowl and caribou. The harvest of eiders and geese begins in early to mid-May, weather and ice conditions permitting. In June, Iñupiat hunters hunt geese and opportunistically harvest caribou, ptarmigan, and eiders. Residents of Barrow harvest eiders during the "fall migration" in September at Pigniq or "Duck Camp" which is road-accessible and located north of town.

Barrow hunters harvest caribou in April but usually refrain from taking caribou during May because of calving and the spring thaw. Barrow residents harvest the largest number of caribou in July and August, when they are available to people hunting from boats. In addition, caribou are in peak condition in August, and Barrow hunters prefer to harvest them at that time (Fuller and George 1999). Barrow hunters also harvest marine mammals, eiders, and fish in August, depending on the weather and ice conditions. Bearded seals are harvested principally for their blubber, which is rendered into oil, and their skins, which are used for boat coverings. Barrow hunters harvest ringed seals primarily for their meat. Walrus are harvested in July and August when they drift north with the floe ice, provided the pack ice moves close enough to Barrow.

Freshwater fishing occurs from breakup (June) through November. Residents fish for Arctic cod year-round, but broad whitefish, the most heavily harvested species, are harvested from June to October. Fish harvested in August include whitefish, grayling, salmon, and capelin. Inland fishing intensifies when whitefish and grayling begin to migrate out of the lakes into the major rivers in August. This is also the peak harvest period for berries and greens (Schneider et al. 1980; ACI et al. 1984). Families may go up the Colville River to harvest moose and berries during moose hunting season in August and early September.

If ice conditions are favorable, fall bowhead whaling may occur as early as mid-August and continue into October. Residents of Barrow who remain inland hunt caribou if the animals are accessible; otherwise, they concentrate on fishing for grayling and burbot. The subsistence fish harvest generally peaks in October (under-ice fishery), when whitefish and grayling are concentrated in overwintering areas (Fuller and George 1999). Barrow residents also harvest ground (or parka) squirrels and ptarmigan, and, if weather and ice conditions permit and the animals appear close to town, seal and caribou are harvested during November and December (SRBA and ISER 1993). During the winter months, residents of Barrow harvest furbearers, and hunt a small number of polar bears in the winter and spring.

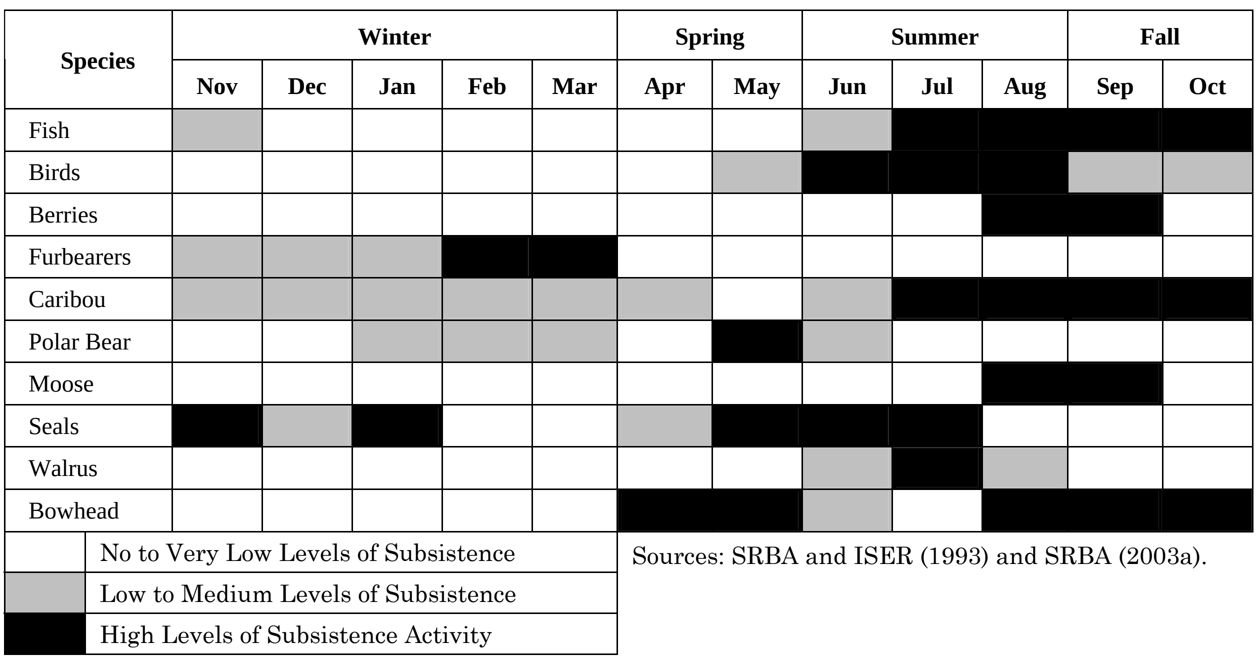


Figure 3-5. Annual Cycle of Subsistence Activities – Barrow.

Subsistence Harvests

Barrow's total annual subsistence harvests ranged from 621,067 pounds in 1987 to 1,363,736 pounds in 1992 (SRBA and ISER 1993). The 1992 harvest of 349 pounds per capita of wild resources represents nearly 1 pound per day per person in the community. Barrow residents rely heavily on large land and marine mammals and fish. During a 3-year study by SRBA and ISER (1993), marine mammals comprised approximately 55% of the total harvest, and land mammals contributed 30% of the total. Fish constituted approximately 7% of the total harvest in Barrow, with broad whitefish being the most important fish resource (4% of the total harvest). Birds (eiders and geese) contributed less than 2% of the total harvest by weight; however, participation in bird hunting was high (Fuller and George 1999).

No other marine mammal is harvested with an effort as concentrated and intense as that of the bowhead whale harvest. Bowhead whales are very important in the subsistence economy, and accounted for over 21% (an average of 10 whales per year) of the annual Barrow subsistence harvest from 1962 to 1982 (Stoker 1983). During the final year of a study in 1989, data indicated that approximately 58% of the total harvest was marine mammals and close to 43% of the total harvest was bowhead whales (SRBA and ISER 1993, ADFG 2001). As with all species, the number of bowhead whales harvested varies from year to year. Over the past 30 years, the number of whales taken each year varied from 0 to 23. Barrow's current community residents stated that 1982 was the only year in which no bowhead whales were harvested (ACI et al. 1984; SRBA and ISER 1993).

Barrow whalers hunt bowhead whales from camps located along the coast from Point Barrow to the Skull Cliff area. There are approximately 30 spring whaling camps along the edge of the landfast ice. While the locations of these camps depend on ice conditions and currents, most whaling camps are located south of Barrow. The distance of the leads from shore varies from year to year. The leads are generally parallel to and quite close to the shore, but occasionally break directly from Point Barrow to Point Franklin, forcing Barrow whalers to travel over the ice as far as 10 miles offshore. Typically, the lead is open from Point Barrow to the coast, and hunters whale only 1 to 3 miles from shore. A stricken whale can be chased in either direction in the lead. Spring whaling in Barrow is conducted almost entirely with skin boats, which are easier to maneuver than aluminum skiffs, and do not transmit sounds that could alert nearby whales (ACI et al. 1984; SRBA and ISER 1993). In the fall, whaling occurs east of Point Barrow, from the Barrow vicinity to Cape Simpson. During the fall migration, Iñupiat whalers use aluminum skiffs with outboard motors to pursue the whales in open water, up to 30 miles offshore.

The annual average number of beluga whale harvested in Barrow, between 1962 and 1982, was estimated to be five whales, or less than 1% of the total annual subsistence harvest (Stoker 1983). In SRBA and ISER's study, there were no harvests of beluga whales in the 3-year period of data collection; however, non-sampled households might have harvested some beluga whales (SRBA and ISER 1993, ADFG 2001). The annual subsistence harvest for the eastern Chukchi Sea was reported to be approximately 60 beluga whales per year by the NOAA Fisheries Service (Angliss and Lodge 2002). Since 1987, the Alaska Beluga Whale Committee recorded 23 beluga whales taken by Barrow hunters, ranging from 0 in 1987, 1988, 1990, and 1995, to 2 in 1992, to a high of 8 in 1997 (Fuller and George 1999, Alaska Beluga Whale Committee 2002).

Ringed seals are the most common hair seal species harvested by Barrow residents. From 1962 to 1982, hair seal harvests were estimated at between 31 and 2,100 seals a year. The average annual harvest from 1962 to 1982 was estimated at 955 seals, or 4% of the total annual subsistence harvest (Stoker 1983). During 1987 through 1989, ringed seals provided approximately 2% of the total edible pounds harvested (SRBA and ISER 1993, ADFG 2001). The hunting of bearded seals is an important subsistence activity in Barrow. Bearded seal meat is a preferred food, and the skins are used to cover skin boats used for whaling. Six to nine bearded seals' skins are needed to cover a boat. Bearded seals are harvested more often than the smaller hair seals, because of their large body size and thick hides. The average annual subsistence harvest of bearded seals from 1962 to 1982 was 150 seals, or approximately 3% of the total annual subsistence harvest (Stoker 1983). The reported average annual harvest of 174 bearded seals during the 1987 to 1989 period provided slightly more than 4% of the total edible pounds harvested for those study years (SRBA and ISER 1993).

The annual average harvest of walrus from 1962 to 1982 was estimated at 55 individuals, or approximately 5% of the total annual subsistence harvest (Stoker 1983). The 1987 to 1989 study indicated a greater walrus harvest than reported earlier; an annual harvest of 81 walrus provided 9% of the total edible pounds of meat harvested during this period. From 1989 to 1995, 109 walrus were harvested, ranging from a low of 1 walrus harvested in 1989 to a high of 30 in 1993 (Stephensen et al. 1994; Cramer 1996). Between 1990 and 2002, the harvest ranged from 7 to 206 animals (SRBA and ISER 1993, Fuller and George 1999, Schliebe 2002).

Caribou, the primary terrestrial source of meat for Barrow residents, are available throughout the year, with peak harvest periods from February through early April and from late June through late October. Over the 20-year period from 1962 to 1982, residents harvested an annual average of 3,500 caribou, which accounted for 58% of the total annual subsistence harvest (Stoker 1983). From 1987 through 1989, caribou provided 22 to 30% of the total edible pounds harvested by Barrow residents (SRBA and ISER 1993, ADFG 2001). Caribou harvest surveys of Barrow residents conducted by ICAS and the ADF&G provide the following community total estimates for three consecutive reporting years: 4,935 during the 2002-2003 reporting year; 4,796 in 2003-2004; and 4,364 in 2004-2005 (Pedersen 2006).

Barrow residents harvest marine and riverine fish, such as capelin, char, cod, grayling, salmon, sculpin, trout, and whitefish (ACI et al. 1984); however, their dependency on fish varies with the availability of other resources. From 1969 to 1973, the average annual harvest of fish was about 80,000 pounds (Craig 1987); from 1962 to 1982, the estimated annual average was 60,000 pounds (Stoker 1983). In a 1986 partial estimate of fish harvests for the Barrow fall fishery in the Inaru River, the catch included least cisco (45%), broad whitefish (36%), humpback whitefish (16%), Arctic cisco (1%), fourhorn sculpin (1%), and burbot (less than 1%; Craig 1987). Fish harvests from 1987 to 1989 were approximately 80,000 pounds annually and provided approximately 11% of the total annual edible subsistence harvest (SRBA and ISER 1993).

Migratory birds, particularly eider ducks and geese, provide an important food source for Barrow residents because of their dietary importance during spring and summer. In May, hunters travel great distances, along major inland rivers and lakes, to harvest geese, while most eider and other ducks are harvested along the coast (Schneider et al. 1980). Snowy owls have been documented as an occasional food resource harvested by the residents of Barrow (Pederson et al. 1979, Spencer 1959, SBRA 1988). However, recent harvest documentation shows little use of snowy owls as a subsistence resource (ADF&G 2001, Fuller and George 1997). Birds' eggs are still gathered occasionally, especially on the offshore islands where foxes and other predators are less common. Barrow residents harvested an estimated annual average of 8,000 pounds of birds from 1962 to 1982, which accounted for approximately 1% of the total annual subsistence harvest (Stoker 1983). From 1987 to 1989, 74,145 pounds of birds were harvested, accounting for approximately 4% of the total edible pounds harvested (SRBA and ISER 1993, ADFG 2001).

Subsistence Use Areas

The community of Barrow incorporates residents from throughout the NSB. Many residents may hunt in the areas where they were raised, which may include the subsistence harvest areas of other communities. Pedersen (1979) documented Barrow lifetime subsistence use areas in the 1970s, and SRBA and ISER (1993) conducted a 3 year subsistence harvest study in Barrow for the 1987 to 1989 harvest years. With few exceptions, generally associated with offshore and furbearer use, the harvest locations for the 1987 to 1989 study period are located within

Pedersen's (1979) Barrow lifetime community land use area as depicted in maps 3-38 and 3-39. The documented Barrow subsistence use area represents a large geographic area, extending from beyond Wainwright in the west to the Kuparuk River in the east and south to the Avuna River. Inland use areas go beyond the Colville River to the foothills of the Brooks Range. The Barrow subsistence harvest data from both the 1970s and 1980s and through the 1990s to 2003 (SRBA 2003a, b), show Barrow residents using the Colville River Delta area for subsistence activities.

Hunters interviewed by SRBA (2003b) used the area east of Cape Halkett to pursue wolf, wolverine, and caribou. The winter wolf, wolverine, and caribou hunting areas overlapped, as hunters looking for wolf and wolverine tended to travel over great distances and they also harvested caribou on their travels. In summer, the caribou use area extended down the coast from Smith Bay to Cape Halkett, across the coastal areas of Harrison Bay, to the Colville River Delta and up the Colville River as far as Ocean Point. Several Barrow families have relatives living in Nuiqsut, and people commonly move back and forth between the two communities. Many Barrow residents have ancestral ties to areas between Barrow and Nuiqsut, and people continue to return to those areas for subsistence activities at traditionally used places. Barrow hunters use the planning area primarily for caribou, moose, and furbearers (wolf and wolverine). One Barrow interviewee indicated he had hunted moose in the Colville River from south of Umiat to approximately Ocean Point. The hunters indicated that they fished as far east as the lakes in the vicinity of Cape Halkett.

Several families now living in Barrow have elders who were born and raised along the coast between Smith Bay and the Colville River Delta. These families had moved to Barrow primarily because of the requirement that children attend school, with some moving to take jobs or access medical care. Most moved to Barrow in the late 1940s. Once they resided in Barrow, each family made special efforts to return to the coast from Smith Bay to the Cape Halkett area to continue traditional subsistence activities at traditional family harvest areas. Currently, the third generation of these families continues to use the area, often harvesting resources that are less available in the Barrow area, such as furbearers (wolf, wolverine, fox, and Arctic ground squirrels), caribou, and moose. Seal and fish are harvested closer to Barrow.

The approximate boundary for Barrow's primary subsistence harvest area for caribou, as reflected in research conducted in the late 1980s and early 1990s, extends southwest from Barrow along the Chukchi coast for roughly 35 miles, then runs south and eastward toward the drainage of the upper Meade River. It heads easterly, crossing the Usuktok River, and then trends north and east, crossing the Topaguruk and Oumalik rivers, until it reaches Teshekpuk Lake; from here the boundary generally follows the coastline back to Barrow (SRBA and ISER 1993). A Barrow hunter described a recent summer caribou hunt as follows:

> When the Western Arctic Herd are further west from Barrow in Point Lay or Point Hope, that's too far to travel. We had to go east through the ocean to the Cape Halkett area and go into creeks looking for caribou. On nice warm days, you find caribou on the coast and in the water, in the end of July or the first part of August. We go for one week. My uncle has a cabin near Cape Halkett (SRBA 2003b).

Furbearer hunts are unlike subsistence food resource hunts in that they involve friendly competition. Furs are not shared in the same way as food resources, and the hunts are conducted over much larger areas. One hunter stated in good humor, "We fish closest to our own area, we do not try to step on each others toes with fish, but we have no respect (for territory) when it comes to wolf and wolverines" (SRBA 2003b). Barrow residents from the same families, noted for their connections with the Cape Halkett area, use a vast area to the south and east of Teshekpuk Lake for furbearer hunting, and go into the Fish and Judy creeks, Tingmiaksiqvik River, Itkillik River, and Umiat areas while looking for wolves and wolverines. One hunter interviewed said, "I like to go to the south side of Teshekpuk Lake, Inigok, and Umiat before the snow is too soft to get wolves and wolverines for clothing" (SRBA 2003b). Another hunter, explaining his winter hunting by snowmachine, said:

> From February through March, I travel to the east for furbearers. I go down to Price River, then to Fish and Judy creeks, then through Inigok to the Ikpikpuk, back over to the Colville to Umiat, down through the Itkillik, back and forth in a circle, then up to Teshekpuk Lake. I go on both sides of the river. By April the fur isn't so great, so I go home (SRBA 2003b).

Hunters occasionally use the Kalikpik-Kogru rivers area for caribou during the summer, especially if caribou are not available closer to Barrow (SRBA 2003b). The hunters travel by boat as far as Kogru River. It is likely that other Barrow hunters travel further east. This area is both an historic and current use area for several Barrow families. The Colville River Delta is on the eastern edge of Barrow's use area. Barrow residents use snowmachines to hunt for caribou, wolf, wolverine, and fox in winter near Fish and Judy creeks. Hunters use cabins and camps near Teshekpuk Lake (e.g., Puviaq and Inigok) and along the Ikpikpuk and Chipp rivers as bases for snowmachine travel.

In addition to the harvest of resources, use of these areas is important to Barrow residents for maintaining connection to family history, graves, structures, caches, ice cellars, campsites, and traditional harvest areas. Although there are high costs in fuel, time, equipment, and effort for these trips, the cultural connection to these traditional areas is strong.

Nuiqsut

A diverse seasonal abundance of terrestrial mammals, fish, birds, and other resources is available in the area immediately surrounding Nuiqsut. Traditional subsistence activities in the Nuiqsut area revolved around caribou, marine mammals, and fish, with moose, waterfowl, and furbearers as important supplementary resources. Nuiqsut's location on the Colville River, some 35 miles upstream from the Beaufort Sea, is a prime area for fish and caribou harvests, but is less advantageous for marine mammal harvests (ADCED 2003). The Colville River is the largest river system on the North Slope and supports the largest overwintering areas for whitefish (Craig 1989a).

Twenty-seven families from Barrow permanently resettled in Nuiqsut in 1973. The Nuiqsut area was formerly a place where Iñupiat and Athabaskan people gathered to trade and fish, maintaining connections between the Nunamiut of the inland areas and the Taremiut of the coast (Brown 1979). ANCSA allowed Iñupiat from Barrow who wished to live in a more traditional manner to select the site for resettlement, and many of those who moved there had some family connection to the area (IAI 1990a, b). Easy access to the main channel of the Colville River for fishing, hunting, and ease of movement between upriver hunting sites and downriver whaling and sealing sites was the primary reason for selection of the site (Brown 1979).

For Nuiqsut, important subsistence resources include bowhead whales, caribou, fish, waterfowl, ptarmigan, and, to a lesser extent, seals, muskox, and Dall sheep. Polar bears, beluga whales, and walruses may be taken opportunistically while in pursuit of other subsistence species.

Seasonal Round

The seasonal availability of many important subsistence resources directs the timing of subsistence harvest activities (Figure 3-6). Beginning in March, Nuiqsut residents hunt ptarmigan. Waterfowl hunting begins in the spring, and hunters typically harvest ducks and geese while participating in other subsistence activities such as fishing for burbot or lingcod (IAI 1990a, b). Fishing may occur year-round, but is most common from breakup (late June) through November (Fuller and George 1999).

Caribou are harvested primarily during the late summer and fall months but are hunted year-round. Moose hunting takes place in August and September in boat-accessible hunting areas south of Nuiqsut (Fuller and George 1999). August is the primary harvest month for caribou and moose because water levels are right for traveling upriver or on the coast by boat, the animals are usually in their best condition and moose are legal to hunt in Game Management Unit 26 for subsistence harvesters. Berries are seasonally important.

Many Nuiqsut residents participate in subsistence fishing. If weather and ice conditions permit, summer net fishing at fish camps or near the community begins in June or July. Gill netting at campsites is most productive between October and mid-November. Fishing for grayling also occurs in the fall. Furbearer hunters pursue wolves and wolverines through the winter months, primarily in mid-March and April. Furbearer hunting can be undertaken anytime during the winter; however, most hunters avoid going out in the middle of winter because of poor weather conditions and lack of daylight (IAI 1990a, b).

Nuiqsut's location on the Nigliq Channel of the Colville River, with large resident fish populations, reflects the importance of fish to subsistence users. The river supports 20 species of fish, approximately half of which are taken by Nuiqsut residents (George and Nageak 1986). Local residents generally harvest fish during the summer and fall. The summer, open-water harvest lasts from breakup to freezeup (early June to mid-September). The summer harvest covers a wide area, is longer than the fall/winter harvest in duration, and a greater number of species are caught. Broad whitefish, the primary species harvested during the summer, is the only anadromous species harvested in July. Thomas Napageak related that "in the summer when it is time to fish for large, round-nosed whitefish, the place called Tirragruag gets filled with them, as well as the entrance to Itkillik. Nigliq River gets filled with nets all the way to the point where it begins. We do not go to Kuukpiluk in the summer months. Then we enter Fish Creek... another place where they fish for whitefish is Nuiqsagruaq" (USDOI BLM and MMS 1998).

In July, lake trout, northern pike, broad whitefish, and humpback whitefish are harvested by residents of Nuiqsut. Traditionally, coastal areas were fished in June and July when rotting ice created enough open water for seining. Nuiqsut elder Sarah Kunaknana, interviewed in 1979, said: "...in the little bays along the coast we start seining for fish (iqalukpik). After just seining one or two times, there would be so many fish we would have a hard time putting them all away" (Shapiro et al. 1979). Salmon species reportedly have been caught in August, but not in large numbers. Pink and chum salmon are the species most commonly caught (George and Nageak 1986). Arctic char is found in the main channel of the Colville River, but is not abundantly caught (George and Kovalsky 1986, George and Nageak 1986, ADFG 2001).

The fall/winter under-ice fish harvest begins after freezeup, when the ice is safe for snowmachine travel. Local families fish for approximately one month after freezeup, until the river ice is too thick to allow the setting of nets through holes in the ice. The Kuukpigruaq

Channel is the most important fall fishing area in the Colville River region, and the primary species harvested are Arctic and least cisco.

Even though Nuiqsut is not located on the coast (it is approximately 25 miles inland with river access to the Beaufort Sea), bowhead whales are a major subsistence resource. Bowhead whaling is usually undertaken between late August and early October from Cross Island, with the exact timing depending on ice and weather conditions. Ice conditions can dramatically extend the season up to 2 months or contract it to less than 2 weeks. Unlike Barrow spring whaling, where the hunt is staged from the edge of ice leads using skin boats, Nuiqsut whalers use aluminum skiffs with outboard motors to hunt bowhead whales in open water in the fall. Generally, bowhead whales are harvested by Nuiqsut residents within 10 miles of Cross Island, but hunters may travel much further from the island. Nuiqsut hunters harvest few polar bears, but when they are harvested it is often after the fall whaling season.

Seals are hunted nearly year-round, but the bulk of the seal harvest occurs during the open-water season. In the spring, seals may be hunted once the landfast ice goes out. Present day sealing is most commonly done at the mouth of the Colville River when it begins flooding after breakup in June. According to Thomas Napageak:

> ...when the river floods, it starts flowing out into the ocean in front of our village affecting the seals that include the bearded seals in the spring month of June. …When the river floods, near the mouth of Nigliq River it becomes filled with a hole or thin spot in [the] sea ice that has melted as the river breaks up. When it reaches the sea, that is the time that they begin to hunt for seals, through the thin spot in the sea ice that has melted. They hunt for bearded seals and other types of seals (USDOI BLM and MMS 1998).

Nuiqsut hunters described three species of terrestrial furbearers as being especially important: wolf, wolverine, and fox (SRBA 2003b). Once there is adequate snow in the winter for snowmachine travel, usually by November, hunters seriously begin the pursuit of wolf and wolverine.

Species	Winter					Spring		Summer			Fall	
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Fish	High		Low–Medium	Low–Medium	Low–Medium	Low–Medium	Low–Medium	High	High	High	Low–Medium	High
Birds/Egg	Low–Medium	Low–Medium	Low–Medium	Low–Medium	Low–Medium	High	High	High	High	Low–Medium	Low–Medium	High
Berries								Low–Medium	Low–Medium	High		
Moose									Low–Medium	High	Low–Medium	
Caribou	Low–Medium	High	Low–Medium	Low–Medium	High	High	High	Low–Medium	High	High	Low–Medium	High
Furbearer	Low–Medium	Low–Medium	Low–Medium	Low–Medium	Low–Medium	High	Low–Medium					Low–Medium
Polar	High	Low–Medium	Low–Medium	Low–Medium	Low–Medium	Low–Medium	Low–Medium				Low–Medium	Low–Medium
Seals	Low–Medium	Low–Medium			Low–Medium	High	Low–Medium	High	High	High	High	Low–Medium
Bowheads										Low–Medium	High	

Key	
(white)	No to Very Low Levels of Subsistence Activity
(grey)	Low to Medium Levels of Subsistence Activity
(black)	High Levels of Subsistence Activity

Sources: Research Foundation of the State University of New York (1984), IAI (1990), and SRBA (2003a).

Figure 3-6. Annual Cycle of Subsistence Activities – Nuiqsut.

Subsistence Harvests
Subsistence activities are important components of the Nuiqsut economy and of local Iñupiat culture and identity (IAI 1990a, b). A 1993 ADFG subsistence study showed that nearly two-thirds of all Nuiqsut households received more than half of their meat, fish, and birds from local subsistence activity (Pedersen 1995). This activity is supported by the cash component of the mixed economy. Nuiqsut is situated closer to current and foreseeable areas of petroleum development than any other community on the North Slope. This development has deterred subsistence resource users from hunting, fishing, and gathering at their former harvest areas east of the Colville River and at coastal areas such as Oliktok Point (IAI 1990a, b; Fuller and George 1999). Subsistence food use and harvest is important for residents of Nuiqsut who have lived in the community for more than 10 years. As employment has increased in Nuiqsut, jobs are being filled by people who move into the community from elsewhere and who may not have the time, knowledge, or inclination to attempt to harvest subsistence foods in the Nuiqsut area. As long-term local residents continue to be underemployed, the value of subsistence foods continues as a lower cost alternative to imported foods (CRA 2002). However, a determinative link between household wage income and household subsistence productivity has not been demonstrated; the former is apparently dependent on education levels, and the latter on the number of capable producers in the household (Pedersen et al. 2000).

Nuiqsut's total annual subsistence harvests ranged from 160,035 pounds in 1985 to 267,818 pounds in 1993. The 1993 harvest of 742 pounds per capita of wild resources represents approximately 2 pounds per day per person in the community. In 1985, fish and land mammals accounted for 86% of Nuiqsut's total subsistence harvest, and marine mammals contributed 8%. In 1993, fish, land mammals, and marine mammals accounted for approximately one-third each. The importance of subsistence to Nuiqsut residents is further reflected in the high participation rates in 1993 in households that harvest (90%), try to harvest (94%), share (98%), and use (100%) subsistence resources.

Nuiqsut whalers have not successfully harvested bowhead whales consistently in the past (20 whales from 1972-1995), but their success has improved in recent years. Unsuccessful harvests were common in the 1980s, with no whales taken in 1983-1985 or 1988; however, in the 1990s, the only unsuccessful years were 1990 and 1994 (USDOI MMS 1996a, USACE 1998). Recently, Nuiqsut landed 4 whales in 2000, 3 in 2001, 4 in 2002 and 4 in 2003 (Galginaitis and Funk 2005).

Nuiqsut residents have indicated that beluga whales are not significant to the subsistence cycle of the community, although some beluga whales are incidentally harvested during the bowhead whale harvest. In recent testimony, Thomas Napageak stated: "I don't recall a time when I went hunting for beluga whales. I've never seen a beluga whale here" (USDOI BLM 1998).

Seals are a culturally important subsistence species for food, skins, and barter. In historic times, seal oil lamps provided heat and light for Iñupiat dwellings and a condiment for dried foods. Seal meat and oil are still locally consumed and traded to Anaktuvuk Pass for dried caribou and other products. Seal skins are used for handicrafts and other articles, bartered, or sold (SRBA 2003b). A 1993 ADFG subsistence survey in Nuiqsut indicated that 32% of the total subsistence harvest was marine mammals, and 3% of the total harvest was seals (ADFG 2001). Fuller and George (1999) estimated that 24 ringed seals, 16 bearded seals, and 6 spotted seals were harvested in 1992, and that overall, marine mammals (including bowhead whales) contributed 35% to the total subsistence harvest. A subsistence harvest survey conducted by the NSB Department of Wildlife Management, covering July 1994 to June 1995, reported a harvest of 23 ringed seals and a 2% contribution of marine mammals to the total subsistence harvest because no bowhead whales were harvested that season (Brower and Opie 1997, Brower and Hepa 1998).

ADFG subsistence survey data indicate that two walruses were harvested in the 1985-1986 harvest season, but no new walrus data for the community have been gathered since 1986 (ADFG 2001). Walruses are probably incidentally taken during seal hunting (NSB 1998). Nuiqsut residents have indicated that polar bears are not a significant subsistence resource for the community and, if taken, would be an incidental harvest. One polar bear was reported harvested between 1962 and 1982, and 20 were harvested between 1983 and 1995 (Stocker 1983, Schliebe 1995, Brower and Opie 1997, Brower and Hepa 1998, NSB 1998, ADFG 2001).

Nuiqsut hunters harvest several large land mammals, including caribou and moose. Caribou may be the most preferred mammal in Nuiqsut's diet, and during periods of high availability, it provides a source of fresh meat throughout the year. In 1985, Nuiqsut hunters harvested an estimated 513 caribou, providing 60,000 edible pounds of meat, or 38% of the total subsistence harvest (ADFG 2001). Fuller and George (1999) estimated that 278 caribou were harvested in 1992. A 1993 ADFG subsistence study estimated a harvest of 672 caribou, providing 82,000 edible pounds of meat, or 31% of the total subsistence harvest (ADFG 2001). In 1993, 74% of Nuiqsut's households harvested caribou, 98% used caribou, 79% shared caribou with other households, and 79% received caribou shares (ADFG 2001). A subsistence harvest survey, covering July 1994 to June 1995, reported that Nuiqsut hunters harvested 258 caribou, which made up 58% of the total subsistence harvest in edible pounds (Brower and Hepa 1998). Caribou harvest surveys of Nuiqsut residents conducted by ICAS and the ADF&G provide the following community total estimates for four consecutive reporting years: 344 during the 2002-2003 reporting year; 554 in 2003-2004; 547 in 2004-2005; and 369 in 2005-2006 (Pedersen 2006).

Although small numbers of moose are harvested, they are a valued component of the subsistence harvest in Nuiqsut, and hunters spend considerable effort in their pursuit. Moose offer a significant amount of meat per animal harvested because of their relatively large size compared to other terrestrial mammal subsistence resources (SRBA 2003b).

Fish provide the most edible pounds, per capita, of any subsistence resource harvested by Nuiqsut. While variable by season and from year to year, fish provide a relatively stable, predictable, and substantive contribution to subsistence resource harvests. The subsistence harvesting of fish is not subject to seasonal limitations under Federal fisheries management, and no permit is required for rural residents, a situation that adds to their importance in the community's subsistence round. Nuiqsut has the largest documented subsistence fish harvest on the Beaufort Sea coast (Moulton et al. 1986a, Moulton 1997). On occasion, fish may provide the only source of fresh, easily accessed subsistence foods.

The summer fish catch in 1985 totaled about 19,000 pounds, mostly of broad whitefish. In the fall, approximately 50,000 pounds of fish were caught for an annual per capita catch of 244 pounds, and some of this catch was shipped to Barrow (Craig 1987). A 1985 ADFG subsistence survey estimated the edible pounds of all fish harvested at 176 pounds per capita, or approximately 44% of the total subsistence harvest. In 1992, 35% of the edible pounds of Nuiqsut's total subsistence harvest was fish, and by 1993, the estimate of edible pounds of all fish harvested had risen to approximately 251 pounds per capita, or approximately 34% of the total subsistence harvest. A subsistence harvest survey conducted by the NSB Department of Wildlife Management, covering July 1994 to June 1995, reported that the subsistence fish harvest provided 30% of the total subsistence harvest (Brower and Opie 1997, Brower and Hepa 1998).

The most important species of waterfowl for Nuiqsut hunters are Canada and white-fronted geese and brant; eiders are also harvested. Ruth Nukapigak relates that "...when the white-fronted goose come, they do hunt them. When the thin ice near the mouth of the river breaks up, that is when they start duck hunting. We, the residents of Nuiqsut, go there to hunt for ducks when they arrive" (USDOI BLM and MMS 1998). The only upland bird hunted extensively is the ptarmigan (Brower and Hepa 1998, ADFG 2001). Recent data indicated that the bird harvest provides 5% of the total subsistence harvest (Brower and Hepa 1998).

Subsistence Use Areas

The Iñupiat community of Nuiqsut has subsistence harvest areas in and adjacent to the planning area. Nuiqsut's marine subsistence harvest area is in the Beaufort Sea from Cape Halkett in the west to Flaxman Island in the east, and up to 30 miles offshore. Before oil development at Prudhoe Bay, the onshore area from the Colville River Delta in the west to Flaxman Island in the east, inland to the foothills of the Brooks Range, and especially up the drainages of the Sagavanirktok, Colville, Itkillik and Kuparuk rivers, were historically important to the Iñupiat for subsistence harvests of caribou, waterfowl, furbearers, fish, and polar bears.

Pedersen (1979) documented Nuiqsut "lifetime" and 1973 to 1986 land use areas. Brown (1979) and Hoffman et al. (1988) also documented Nuiqsut subsistence use areas in the 1970s, which are incorporated within the lifetime use areas depicted in Pedersen (1979; Map 3-37).

Nuiqsut is one of 10 Alaska Eskimo whaling communities. Many of those who resettled Nuiqsut were experienced whalers and crew who remembered past whale harvests before the temporary abandonment of the settlement (IAI 1990a, b). Nuiqsut whale hunting is based out of Cross Island, approximately 70 miles northeast of Nuiqsut and approximately 15 miles from West Dock on the west side of Prudhoe Bay. Nuiqsut whalers travel approximately 100 miles from Nuiqsut to the Cross Island whaling camp. Nuiqsut whaling occurs in the fall when the whales migrate closer to shore, because the spring migration path is too distant from shore for effective hunting with small boats. Nuiqsut residents also participate in Barrow's spring whale hunt through close family ties in that community (Fuller and George 1999).

The general Nuiqsut harvest area for bowhead whales is located off the coast between the Kuparuk and Canning rivers. Nuiqsut has been a bowhead whaling community since its reestablishment in 1973. Whalers currently travel to Cross Island to conduct fall bowhead whaling. In the past, they used Narwhal Island as a base, and still have structures there. Cross Island has cabins and equipment for hauling up and butchering the whales. Nuiqsut hunters typically travel out either the Nigliq or the main Colville channel of the Colville River Delta, depending on water levels, and travel along the coast, inside or just outside the barrier islands.

Ringed, spotted, and bearded seals are important subsistence resources for Nuiqsut hunters. Seals are harvested along the coast and offshore from Cape Halkett in the west to Foggy Island Bay in the east. In the summer, Nuiqsut hunters harvest ringed and spotted seals in the Colville River as far south as Ocean Point. In the spring, hunters usually shoot seals in the water and on the ice edge (SRBA 2003b). In April and May, hunters ride out to Harrison Bay on snowmobiles and look for breathing holes—cracks in the ice and open water where seals might surface to breath. By the second week in June, open waters on the Colville River and much of Harrison Bay allow hunters to take boats out on a route called "around the world." This route follows the Nigliq Channel to Harrison Bay, west to Atigaru Point, along the ice edge out as far as 28 miles, then to Thetis Island (called Amauliqtuq), east to Oliktok Point, and back south through the main channel of the Colville River. Thetis Island is used as a shelter when the weather turns bad. This route is also used to harvest eiders, and occasionally walruses (SRBA 2003b).

Harvest location data for caribou collected by the NSB (Brower and Hepa 1998, NSB 2003b) and ADFG (2001, 2003), and hunting area interviews (SRBA 2003b) conducted in Nuiqsut for the Alpine Satellite Development Project EIS, indicated that there are several primary harvest areas for caribou. North of Nuiqsut, these harvest locations include the Nuiqsut area, the Colville River Delta, the Nigliq Channel, and the Fish and Judy creeks area. To the south of Nuiqsut, the Colville River provides access to areas and sites such as Itkillikpaat, Ocean Point, the Itkillik River, Umiat, and the confluences of the Anaktuvuk and Chandler rivers. West of Nuiqsut are some of the most important remaining subsistence use areas for terrestrial mammals, including caribou, wolf, and wolverine. Nuiqsut hunters travel as far west as Barrow, and some reported traveling to within sight of Atqasuk, in pursuit of subsistence resources, particularly when they are less abundant near Nuiqsut. Travel to the east is undertaken by heading south of the Kuparuk and Meltwater projects by snowmachine, then looping back north to the vicinity of Franklin Bluffs and sometimes beyond. In open water months, travel east is by boat along the coast for caribou, seal, eider and sea ducks, and in fall to Cross Island for whaling. These areas are usually associated with TLUI sites, cabins, camps, and Native allotments with harvest locations for other species nearby. These harvest locations may be used in winter (October through May), summer (defined as the open water period, including June through September), or both, and they may be accessed by foot, boat, all-terrain vehicle, and snowmachine. Nuiqsut hunters use the general vicinity of Teshekpuk Lake to harvest caribou, wolves, and wolverines, and several Nuiqsut families, along with relatives in Barrow and Atqasuk, share use rights to cabins, camps, and allotments in the area and consider it their homeland.

Nuiqsut resource users have a long history of subsistence fishing in the Colville River and its tributaries from the Colville River Delta to the confluence with the Ninuluk Creek, in the Nigliq Channel and nearby Fish and Judy creeks, and in the innumerable lakes in the region. Nuiqsut fishermen also use coastal areas east to the Kuparuk River and fish around several barrier islands, including Thetis and Cross islands. Many families set nets near Nuiqsut in the Nigliq Channel when time, transportation needs, or funds do not permit longer trips from town, particularly during the school and work year. Cooperative arrangements are made between resource users wherein resources (such as time, equipment, gas, and labor) are pooled in exchange for shares of the harvest. Resource users often fish in conjunction with other subsistence activities, such as caribou and moose hunting and berry picking, especially in harvest areas with camps and cabins. Certain species of fish are only seasonally available and must be harvested when present in the area. Nuiqsut fishers freeze or dry these fish for later use and barter. Other fish species are available year-round and provide fresh food as well as a welcome change in the diet during the winter and spring (SRBA 2003b).

Waterfowl harvested by the Iñupiat of Nuiqsut occupy two habitats in the greater Nuiqsut area. Ducks, geese, and brant molt and nest in the wet tundra to the north of Nuiqsut. Eiders nest on the sandy areas of the Colville River Delta and the barrier islands, molting after their arrival. Both groups of waterfowl raise their young in the area until fall, when they migrate south. Nuiqsut hunters harvest waterfowl during the migration in May and June using snowmachines and boats. The hunters harvest the migrating birds from snow blinds built to the south, near Sentinel Hill and Ocean Point or at Fish Creek. Once the river breaks up, hunters look for birds by boat, and start to look for eiders in the Colville River Delta and in Harrison Bay at the ice edge as summer approaches. Hunters end the waterfowl harvest when the birds are on their nests (SRBA 2003b).

In earlier times, Iñupiat resource users harvested flightless molting birds by cooperatively “herding” them into creeks, then dividing the harvest between the work group members. One resident remembered doing this as recently as the late 1940s at Oliktok Point. Nuiqsut people in the past gathered and stored eggs from waterfowl nests on the tundra. According to the 2003 interviews, eggs are no longer gathered, and certain species of waterfowl are not harvested for various reasons. Some residents indicated that they do not eat certain varieties of ducks (e.g. oldsquaws, northern pintails), while many chose to avoid harvesting black brant and spectacled eiders because they are species of concern. Nearly all interviewed resource users harvest geese in May, and most harvest some eiders when breakup allows boat travel on the river and in Harrison Bay (SRBA 2003b).

The harvest area for furbearers extends from the eastern edge of the Colville River Delta along the coast, almost to Admiralty Bay, and then south along the Ikpikpuk River to the Colville River, eastward to the Toolik River, north and crossing the Dalton Highway to Franklin Bluffs, and west and north back to the Colville River Delta (SRBA 2003b).

Wainwright

The community of Wainwright enjoys a diverse resource base that includes both terrestrial and marine resources. Marine subsistence activities focus on the coastal waters from Icy Cape in the south to Point Franklin and Peard Bay in the north. The Kuk River lagoon system—a major marine estuary—is an important marine and wildlife habitat used by local hunters. Wainwright's terrestrial subsistence-harvest area is primarily within the boundaries of the Northwest NPR-A planning area, but their utilization of and reliance on the Teshekpuk caribou herd validates their inclusion as a community potentially affected by decisions made within the Northeast NPR-A.

Seasonal Round

Bowhead whales are Wainwright's most important marine resource; they are available in the Wainwright area beginning in late April. However, Wainwright is not as ideally situated for bowhead whaling as Point Hope or Barrow. Beluga whales are available to Wainwright hunters during the spring bowhead-whaling season (late April to early June); however, pursuing belugas during this time jeopardizes the bowhead whale hunt, so the beluga hunt occurs only if no bowheads are in the area. Belugas are also available later in the summer (July through late August) in the lagoon systems along the coast. The reluctance of Wainwright residents to harvest belugas during the bowhead-whaling season means the community must rely on an unpredictable summer harvest; consequently, the relative importance of the beluga whale varies from year to year (Nelson 1969; ACI 1984).

Walruses are present seasonally in Wainwright, with the exception of a few that overwinter in the area. The peak walrus hunting period occurs from July to August as the southern edge of the pack ice retreats. In late August and early September, Wainwright hunters occasionally harvest walrus that are hauled out on beaches. The focal area for hunting walruses is from Milliktagvik north to Point Franklin. However, hunters prefer to harvest walruses south of their communities so northward-moving pack ice can carry the hunters toward home while they butcher their catch on the ice. This northward-moving current also helps the hunters return home in their heavily loaded boats (Nelson 1969).

Wainwright residents hunt four seal species–ringed, spotted, ribbon (all hair seals), and bearded seals. Ringed seals (the most common species) are generally available throughout the ice-locked months. Bearded seals are available during the same period, but they are not as plentiful. Although they are harvested less frequently, spotted seals are common in the coastal lagoons during the summer; most are taken in Kuk Lagoon. Ribbon seals occasionally are available during the spring and summer months. Ringed and bearded seals are harvested most intensely from May through July (ACI 1984). Most ringed seals are harvested along the coast from Milliktagvik to Point Franklin, with concentration areas along the shore from Kuk Inlet southward to Milliktagvik and from Nunagiaq to Point Franklin. Migrating seals are most concentrated at Qipuqlaich, just south of Kuk Inlet (Nelson 1969).

Wainwright residents harvest a variety of fish in most marine and freshwater habitats along the coast and in lagoons, estuaries, and rivers. The most important local fish harvest occurs from September through November in the freshwater areas of the Kuk, Kugrua, Utukok, and other river drainages (Craig 1987). Ice fishing for smelt and tomcod (saffron cod) occurs near the community, primarily during January, February, and March. In the summer months, Wainwright residents harvest Arctic char, chum, and pink salmon, Bering cisco (whitefish), and sculpin along the coast and the lower portions of Kuk Lagoon (Nelson 1969; ACI 1984). The most common species harvested in the Kuk River system are Bering cisco and least cisco, grayling, lingcod, burbot, and rainbow smelt. Other species that are harvested less frequently along the coast, and in some cases in estuaries or freshwater, include rainbow smelt, flounder, cisco, saffron cod, arctic cod, trout, capelin, and grayling (Nelson 1969; Craig 1987). Marine fishing is conducted from Peard Bay to Icy Cape and in Kuk Lagoon.

Caribou is the primary source of meat for Wainwright residents. Before freezeup, caribou hunting is conducted along the inland waterways, particularly along the Kuk River system. It is during this fall-time hunt that the majority of caribou are harvested by the community. Residents frequently harvest caribou opportunistically during the winter while out furbearer trapping and hunting.

The migration of ducks, swans, murres, geese, and cranes begins in May and continues through June. The waterfowl harvest is initiated in May at whaling camps and continues through June. Hunting decreases as the bird populations disperse to their summer ranges and nesting locations. During the fall migration south, the range is scattered over a wide area and, with the exception of Icy Cape, hunting success is limited (ACI 1984). Because the bowhead harvest and spring bird hunting periods overlap, hunters sometimes have to choose between the two activities. At whaling festivals following a successful bowhead harvest, geese are traditionally served as well. It is often the friends and relatives of a whaling captain who take care of providing geese for the feast. With brant, hunters prefer the taste of spring birds because they have not yet begun to eat vegetation from the inland freshwater habitat. Brant that come through Wainwright in the spring are coming from saltwater lagoons near Cold Bay on the Alaska Peninsula. Many hunters do not the like new Federal regulations requiring the use of steel shot, claiming that it does not bring down geese as well as lead shot (Kassam and Wainwright Traditional Council 2001).

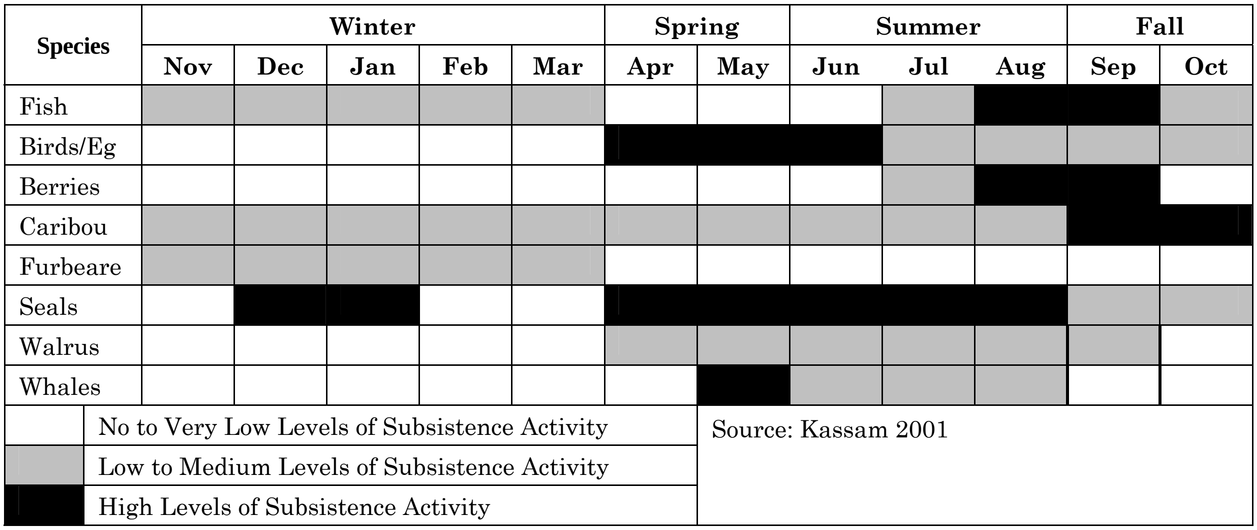


Figure 3-7. Annual Cycle of Subsistence Activities – Wainwright

Subsistence Harvest

From 1962 to 1982, the bowhead harvest accounted for 8.2% of the total annual subsistence harvest (an average of 1.5 whales taken each year) (Stoker 1983). The annual bowhead harvest has not varied as much as the harvest of other subsistence resources. However, since 1982, the number of whales taken has varied from 0 to 6, and the relative bowhead contribution to the total annual subsistence harvest has increased. In a subsistence study conducted in Wainwright from 1988 to 1989 (SRBA 1989), bowhead whale accounted for 42.3% of total edible pounds harvested while marine mammals made up 70% of the total edible pounds harvested. Two whales were harvested during the 1989 to 1990 season, and composed 29% of the total edible pounds harvested (ADFG 2001). No bowheads were taken in 1992 and the marine mammal harvest was made up primarily of walrus, beluga whale, and bearded seal (Fuller and George 1997).

Between 1962 and 1982, the annual average harvest of belugas is estimated at 11, or 2.7% of the total annual subsistence harvest (Stoker 1983). In Braund's studies (SRBA and ISER 1989, 1993), two beluga whales were harvested, making up 1.1% of Wainwright's harvest in 1989. In 1990, no whales were harvested. During the eight year period (1990 – 1998) the beluga harvest ranged between 0-38 animals. In 2001 23 whales were taken (Fuller and George 1997). Between 1962-1982, the annual average harvest of walrus is estimated at 86, or 18.5% of the total annual subsistence harvest (Stoker 1983). In Braund's 1989 study, walrus composed 17.6% of the total harvest and in 1989 they accounted for 33.7% of the total harvest (SRBA 1991). Since 1989, the annual walrus harvest has ranged from 0 to 153 animals. In 1992, 82 walrus were harvested, composing 25% of the total subsistence harvest (Fuller and George 1997).

The bearded-seal harvest is an important subsistence activity in Wainwright, because it is a preferred food and the skins are used as covers for the whaling boats (ACI 1984). The best harvest areas for bearded seals are on the flat ice south of Wainwright, off Qilamittagvik and Milliktagvik and beyond, towards Icy Cape (Nelson 1981). Although no annual harvest data was available for bearded seals in the 1962-1982 twenty-year-average computation, the annual average subsistence harvest (between 1962 and 1982) was estimated at 250 seals, or about

12.3% of the total annual subsistence harvest (Stoker 1983). In 1988, Braund (SRBA and ISER 1989) documented that 97 bearded seals were harvested, accounting for 6.6% of the marine-mammal harvest that year. One hair seal harvest during the past 20 years is estimated at between 250 and 1,600 seals. In recent years, approximately 250 hair seals have been harvested each year. In 1989, Braund recorded 98 hair seals (ringed and spotted), composing 1.1% of the total marine-mammal harvest (SRBA 1991).

Traditionally, ringed and bearded seals were widely harvested. Today, bearded seal is the most sought after species and ringed seal is not considered as important (Kassam and Wainwright Traditional Council 2001). The bearded seal is considered a mainstay subsistence resource and is prized for its fat and meat. It is harvested from spring through fall. Smaller bearded seal are preferred for their meat and the larger ones are considered best for rendering oil. Some elders have commented that there is a change in the taste and texture of bearded seal meat and oil. The meat has a stronger taste when boiled and the oil rendered from the blubber is not white (Kassam and Wainwright Traditional Council 2001).

Between 1969 and 1973, the annual fish harvest was about 3,800 lbs. The annual per capita fish catch was 9 lbs (Craig 1987). Stoker (1983, as cited by ACI 1984) uses this data and lists fish as a minor resource in the total harvest of Wainwright subsistence resources (approximately 0.8% of the annual harvest averaged over 20 years). Fish were the third-largest source of subsistence foods and the third-most-important species harvested in Wainwright in 1981. In Braund's study, fish made up 3.9% of the total harvest in 1989, with whitefish and least cisco the most important. In 1990, fish accounted for 4.9% of the total harvest, with least cisco and rainbow smelt again the most important species (SRBA and ISER 1993). This increase in the importance of fish resources can be attributed to: 1) the increase in the importance of fish as a subsistence resource because snow machines and motorized skiffs have made distant fish camps more accessible; and 2) a value change that has stimulated the residents' interest in fishing and camping away from the community (Nelson 1969).

The fish harvest plays an important role in strengthening kinship ties in the community (Nelson 1969; ACI 1984). In addition, fish are a crucial resource when other resources are less abundant or unavailable and, over time, fish are a more reliable and stable resource (Nelson 1969). Fuller and George (1992) estimated that fish resources made up 8.8% of the total subsistence harvest in 1992. The community noted that recently there seems to be more salmon in local rivers. Historically, chum salmon was the only variety caught, but recently people have reported catching king, chum, Coho, and sockeye (Kassam and Wainwright Traditional Council 2001).

Wainwright's caribou harvest area centers around the community, and the Kuk River and its tributaries (Map 3-41). Between 1962 and 1982 the annual caribou harvest averaged 1,200 animals (Stoker 1983), accounting for 51.6% of the total annual subsistence harvest. Caribou are available throughout the year, with a peak harvest period from August to October. In Braund's 1989 study in Wainwright, caribou made up 23.1% of the total harvest, and in 1990 they composed 23.7% of the total harvest. In 1992, 748 caribou were harvested, representing 34.3% of the annual subsistence harvest (SRBA 1991; SRBA and ISER 1989, 1993; Fuller and George 1997). Over the last 50 years, hunters contend that caribou have become tamer and many do not migrate but instead spend the entire year in the Wainwright area (Kassam and Wainwright Traditional Council 2001).

Wainwright residents annually harvest an estimated 1,200 lbs of birds, between1962-1982, which comprises about 0.3% of the total annual subsistence harvest (Stoker 1983). In 1989, Braund reported that birds were 2.4% of the total harvest and geese were 2.0% of the total bird harvest; in 1990, birds were 2.1% of the harvest (SRBA 1991; SRBA and ISER1993). Although the volume of waterfowl meat is a relatively small portion of the total subsistence harvest, waterfowl hunting is a key element in Wainwright's subsistence routine. Like fishing, bird hunting is highly valued in social and cultural terms. Waterfowl dishes are an essential part of community feasts prepared for holidays such as Thanksgiving and Christmas (Nelson 1969). Fuller and George (1992) estimated that birds made up 4.5% of the total subsistence harvest in 1992.

Subsistence Use Areas
Subsistence users from Wainwright primarily concentrate their efforts along the Utukok, Kokolik, and Upper Kuk tributaries, including the Iviasruk, Koalik, Ketik and Avalik rivers, and along Carbon Creek, all located in the Northwest NPR-A. The ability to hunt and fish along the upper reaches of these waterways during the summer depends primarily on the condition of the river channel and the amount of flow. White-fronted geese are hunted in May by snow machine when rivers are still frozen, and non-breeding and failed breeding brant are harvested in the latter part of June along the coast. Fall-time caribou hunting is also primarily river based, and takes place during August-October. Hunting caribou from along the rivers allows for the easy transport of the meat back to the village by boat. Fishing activity along the waterways can take place all summer from July to September, but it is thought that fish taste better in the fall. Upriver fishing occurs in late August by way of nets during the evening, with the focus on harvesting grayling, whitefish, burbot, lingcod and dolly varden (Kassam 2001).

During the winter and spring months, harvesting is facilitated by the ability to use snowmachines for overland travel. Residents from Wainwright frequently travel into the DeLong Mountains for furbearer and caribou hunting. Caribou are sporadically located across the North Slope all winter long, and many hunters plan a combined furbearer and caribou hunting trip to acquire fresh meat during the winter months. Caribou hunting also takes place in late April, before the snow cover and ability to travel by snowmachine is over, in order to have a store of caribou meat during the summer months (Schneider and Bennett 1979). The primary furbearers targeted during the winter are wolverine and wolf, with arctic fox and red fox harvested closer to the community in the springtime.

3.4.2.5 Subsistence User Avoidance of Developed Areas

Following the reestablishment of Nuiqsut in the Colville River Delta in 1973, community residents re-familiarized themselves with the subsistence resources of the area based on the knowledge of elders who had remained in the area or continued to use the area while living in other communities. Their subsistence harvest and use areas are documented in Nuiqsut Paisaŋich in a series of maps (Brown 1979) created by the NSB as part of its program of traditional land use documents (Hoffman et al. 1988), and by Pedersen (1979 and In Prep). In 1973, oil development was some distance from the community, but its impacts were felt by residents who had ties to the developed area and by residents who wished to use subsistence areas on the east side of the developed area (Brown 1979). These issues and concerns were documented in the early 1980s by researchers working under contract to MMS for the Social and Economic Studies Program (Institute for Social and Economic Research [ISER] 1983). The ISER (1983) report documented the high potential Iñupiat subsistence users have noted for conflicts between industrial and Iñupiat land uses and subsistence access. The report also outlined the conflicts and concerns between Iñupiat subsistence uses and industry (ISER 1983). No other community in Alaska is as close as Nuiqsut to intensive oil exploration, development, and production. This proximity is reflected in residents' increased concerns about reduced subsistence access through increased regulations, competition with outsiders, and the imposition of physically obstructive facilities in traditional use areas (ISER 1983).

Through the 1980s, the industrial developed area expanded overland west from Prudhoe Bay, and the possibility of nearshore and offshore development near Nuiqsut was impending (IAI 1990a). By 1985, development encompassed subsistence and traditional use areas from Oliktok Point south along the Kuparuk River (Pedersen et al. 2000). The harvest of marine resources at specific locations was complicated or prevented by onshore development at traditional camps (e.g., Oliktok Point, Niakuk) and by offshore activity (e.g., drilling, seismic testing, and sealift; Pedersen et al. 2000).

By 1990, Galginaitis wrote in MMS Social and Economic Studies Special Report 8 that "Perhaps the most obvious effect of oil development in the Nuiqsut area has been that it has effectively removed certain areas from the Nuiqsut subsistence land use area" (IAI 1990a). Subsistence users' reasons for avoiding or not avoiding areas in response to oil development in the late 1980s were similar to those noted in the 1983 ISER study and included regulatory constraints, cultural prohibitions from using developed areas, lack of cultural privacy, notice or belief that a resource is contaminated, and physical obstacles and barriers such as low pipelines and steep gravel road side-slopes (ISER 1983, IAI 1990a).

Nuiqsut subsistence use areas retreated from the east as development moved westward from Prudhoe Bay to Oliktok Point, particularly in the area of the Kuparuk River Unit field. Onshore development displaced subsistence uses east of the Colville River for the majority of Nuiqsut users, and the few who continued to use the area did so primarily for political purposes and did not take many caribou there (IAI 1990b). By 1990, the concern in the community of Nuiqsut was that development would continue to encroach on their shrinking subsistence and traditional use areas on the Itkillik and Colville rivers and the Colville Delta (IAI 1990b). At that time, some hunters noted that further development in these subsistence use areas would impose a severe hardship on the community of Nuiqsut (IAI 1990b).

In 1993, onshore subsistence harvests and uses east of the Colville River and north of Nuiqsut declined to near zero, and development activity was encroaching on valued traditional use areas (Pedersen et al. 2000). Whaling at Cross Island, the use of onshore camps, and storage of the bowhead harvest at Oliktok Point became deeply entwined with oil company personnel and oversight, as companies sought to minimize the time spent by Iñupiat hunters in the developed areas and to avoid attracting polar bears to Oliktok Point by shipping whale meat and maktaq by air to Nuiqsut. This assistance provided some advantages to subsistence users because it was convenient and saved them time; however, it also reduced the autonomy of the hunters and subjected them to scrutiny and regulation throughout the whaling process, which resulted in a lack of cultural privacy (Pedersen et al. 2000).

Nuiqsut caribou harvests within the developed area in 1993 were at or near zero. Four percent were within 5 miles of developed areas, 17% were harvested from 6 to 15 miles, and 79% were harvested more than 16 miles from development. The 1994 caribou harvest data were similar in terms of the percent of caribou harvested in relation to harvest proximity to development. Key informants noted in a 1998 Nuiqsut group session that they no longer used the developed area northeast of Nuiqsut as intensively as they had in the past because of difficulties in accessing the area, lack of privacy, loss of cultural landmarks, uncertainty regarding regulations, and oil field security enforcement (Pedersen et al. 2000).

For the study years reported in Pedersen et al. 2000 (i.e., 1993 and 1994), harvest locations and amounts for caribou are consistent with the published and unpublished harvest location data from the NSB Division of Wildlife Management for 1994-95, 2000, and 2001 (Brower and Hepa 1998; NSB Department of Wildlife Management 2003b). Both sets of data support the finding that Iñupiat subsistence users harvest most of their caribou in locations that are distant from developed areas east of the Colville River. This shift applies to most other subsistence resources, as well.

Pedersen and Taalak (2001) conducted a survey of Nuiqsut households during June 1999 through May 2000. Caribou were the most widely used terrestrial big game resource in Nuiqsut, with an average of four caribou per household when averaged for all community households. According to their report, 75% of the 371 caribou harvested by Nuiqsut hunters from June 1999 through May 2002 with known harvest locations were harvested west of Nuiqsut, 11% were harvested in the immediate vicinity of the community, and only 14% were harvested to the east. Seventy-eight percent of all known caribou harvests occurred away (6 to >16 miles) from oil production facilities in 1999-2000. Twenty-two percent were reported harvested in peripheral areas (0 to 5 miles) to development, and there were no reports of harvests during this time period inside the industrial developed area. In general, these findings are consistent with the earlier conclusions for the 1993 and 1994 caribou harvests (Pedersen et al. 2000). However, the 1999-2000 caribou harvests classified as distant (> 16 miles) from oil development dropped to 51%, compared to 79% in 1993 and 77% in 1994. This reduction is the result of oil development (Alpine field) moving west into the Colville Delta, an area of focused Nuiqsut caribou harvests, especially during June through September.

Development in this area is too recent and there are insufficient data available to conclude whether harvesters will increase their distance from development in response to this relatively new facility. Furthermore, in 1999-2000, the Alpine field footprint was relatively small compared to larger development east of the Colville River, and ConocoPhillips Alaska, Inc., has made efforts to work with Nuiqsut to accommodate hunters. Systematic, time series monitoring of subsistence harvests and locations to document any changes to subsistence harvest patterns is being undertaken in Nuiqsut, Barrow, and Atqasuk by the Alaska Department of Fish and Game, the Bureau of Land Management, and the Iñupiat Community of the Arctic Slope (Pedersen 2004).

Based on data from Pedersen et al. (2000) and Pedersen and Taalak (2001), as a consequence of oil development, Nuiqsut caribou harvesters tend to avoid development, with approximately 78% of the 1993 and 1994 caribou harvests occurring greater than 16 miles from the development east of the Colville River. In addition, 51% of the 1999-2000 harvests occurred greater than 16 miles from the Alpine field development, while 27% occurred 6 to 15 miles from the Alpine field development.

Further development anticipated in Pedersen et al. (2000) has come to pass with the development of Alpine, Meltwater, Tarn, Fiord, and other oil fields in the vicinity of Nuiqsut. This ongoing development has contributed to a feeling of being “boxed in” for Nuiqsut subsistence users (Pedersen et al. 2000). A National Research Council report on the Cumulative Environmental Effects of Oil and Gas Activities on Alaska’s North Slope recently concluded that:

> On-land subsistence activities have been affected by the reduction in the harvest area in and around the oil fields. The reductions are greatest in the Prudhoe Bay field, which has been closed to hunting, and in the Kuparuk field, where the high density of roads,

drill pads, and pipelines inhibits travel by snowmachine. The reduction in area used for subsistence is most significant for Nuiqsut, the village closest to the oil-field complex. Even where access is possible, hunters are often reluctant to enter oil fields for personal, aesthetic, or safety reasons. There is thus a net reduction in the available area, and this reduction continues as the oil fields spread (NRC 2003).

3.4.3 Sociocultural Systems

The topic of sociocultural systems encompasses the cultural values and social organization of the society. This section provides a profile of the sociocultural systems that characterize Barrow, Atqasuk, and Nuiqsut. All of these communities are within the NSB. The ethnic, sociocultural, and socioeconomic makeup of the communities on the North Slope is primarily Iñupiaq (Iñupiat).

Sociocultural systems of the North Alaskan Iñupiat are described and discussed in detail in the Liberty Development and Production Plan Final EIS (USDOI MMS 2002), the Beaufort Sea Sale 170 Final EIS (USDOI MMS 1998), the Beaufort Sea Oil and Gas Development Project/Northstar Final EIS (USACE 1998), and the Beaufort Sea Sale 144 Final EIS (USDOI MMS 1996a). Sociocultural systems of the North Alaskan Iñupiat are also described and discussed in detail in the Northeast National Petroleum Reserve-Alaska Final IAP/EIS (USDOI BLM 1998), Northwest National Petroleum Reserve-Alaska Final IAP/EIS (USDOI BLM and MMS 2003), Alpine Satellite Development Plan FEIS (USDOI BLM 2004c), and Northeast National Petroleum Reserve-Alaska Final Amended IAP/EIS (USDOI BLM 2005).

The following description is augmented by information from current studies including: USDOI BLM National Petroleum Reserve – Alaska 105(c) studies and other pertinent documents (USDOI BLM 1978a, b, c; 1979b, c, d; 1981; 1982a, b, c; 1983a, b, c; 1990; 1991; Schneider et al. 1980; Hoffman et al. 1988; SRBA et al. 1993; Alaska Natives Commission 1994; Human Resources Area Files 1994; Fall and Utermohle 1995; ADFG 1996, 2002; and USDOI MMS 1996b, c).

3.4.3.1 Cultural Values

For centuries, survival in the Arctic has centered on the pursuit of subsistence foods and materials and the knowledge needed to find, harvest, process, store, and distribute the harvest. The development of Iñupiat culture depended on passing on traditional knowledge and beliefs about subsistence resources. This knowledge included observations of game behavior, how to use those observations to successfully locate and harvest game, and how hunters and their families should behave to ensure successful harvests in the future. Other skills and knowledge handed down through the generations included a suite of tools, techniques, and strategies necessary to survive and even thrive in the harsh Arctic environment (Spencer 1976). For the Iñupiat, subsistence and culture continue to be inextricably intertwined. The process of obtaining, refining, and passing on subsistence skill is inextricably linked to the Iñupiat culture, which is based on interdependent family groups, and a tradition of sharing harvested resources.

Traditionally, Iñupiat cultural values focused on their close relationship with natural resources, specifically game animals and the supernatural, which was believed to control natural phenomena, with specific beliefs in animal souls and beings controlling the movements of animals. Other cultural values include conflict avoidance, an emphasis on the community, its needs, and its support of other individuals. The Iñupiat respect people who are generous, cooperative, hospitable, humorous, patient, modest, and industrious (Lantis 1959; Milan 1964; Chance 1966, 1990). Although there have been substantial social, economic, and technological changes in Iñupiat lifestyle, subsistence continues to be the central organizing value of Iñupiat sociocultural systems. The Iñupiat remain socially, economically, and ideologically loyal to their subsistence heritage. Indeed, "most Iñupiat still consider themselves primarily hunters and fishermen" (Nelson 1969). North Slope residents voice this refrain repeatedly (Kruse et al. 1983; ACI et al. 1984; IAI 1990a, b; USDOI MMS 1994). Bernice Pasula stated at the Beaufort Sea Sale 124 EIS scoping hearings in Nuiqsut that "I am a whaler, and I am proud to be a whaler, and my kids will be whalers too for as long as it'll go on, and maybe someday I'll have my own crew, and that's my dream" (USDOI MMS 1990a).

Task groups are still organized to hunt, gather, and process subsistence foods. Cooperation in hunting and fishing activities also remains an integral part of Iñupiat life, and a major component of significant kin ties is the identity of those with whom one cooperates (Heinrich 1963). Large amounts of subsistence foods are shared within and between the communities and the people one gives to and receives from are major components of what comprises significant kin ties (Heinrich 1963; ACI et al. 1984). As discussed in the 2004 Alpine Satellite Development Plan Final EIS (USDOI BLM 2004c), the sharing of subsistence foods is essential to the maintenance of family ties, kinship networks, and community well-being. Disruption of subsistence harvest patterns could alter these cultural values and affect community social structure. For the system of sharing to operate properly, some households must consistently produce a surplus of subsistence goods. For this reason, the supply of subsistence foods in the sharing network is more sensitive to harvest disruptions than the actual harvest and consumption of these foods by the primary producer.

The cultural value placed on kinship and family relationships is apparent in the sharing, cooperation, and cooperative subsistence activities occurring in Iñupiat society. Cultural values are also apparent in the patterns of residence, reciprocal activities, social interaction, adoption, political affiliations, employment, sports activities, and membership in voluntary organizations (e.g., Mother's Club, Search and Rescue; ACI et al. 1984). Barrow resident Beverly Hugo, testifying at public hearings for the MMS' Beaufort Sea Sale 124 EIS, summed up Iñupiat cultural values this way:

> ...these are values that are real important to us, to me; this is what makes me who I am... the knowledge of the language, our Iñupiat language, is a real high one; sharing with others, respect for others... and cooperation; and respect for elders; love for children; hard work; knowledge of our family tree; avoiding conflict; respect for nature; spirituality; humor; our family roles. Hunter success is a big one, and domestic skills, responsibility to our tribe, humility... these are some of the values... that we have... that make us who we are, and these values have coexisted for thousands of years, and they are good values... (USDOI MMS 1990b).

Bowhead whale hunting remains the center of Iñupiat spiritual and emotional life; it embodies the values of sharing, association, leadership, kinship, Arctic survival, and hunting prowess (Bockstoce et al. 1979; ACI et al. 1984). The importance of the whale hunt is more than emotional and spiritual. The organization of the crews does much to delineate important social and kin ties within communities and define community leadership patterns. The structured sharing of the whale harvest helps determine social relations within and between communities (Worl 1979, ACI and SRBA 1984, IAI 1990a, b). Structured sharing also holds true for caribou, fish, and other subsistence pursuits. Only fur hunting is governed by a good-natured competitiveness among hunters (SRBA 2003). In Iñupiat communities, the giving of subsistence foods does more than feed people; it bonds giver and receiver, joining them to a living tradition and reinforces a feeling of community.

Today, this close relationship between the spirit of a people, their social organization and the cultural value of subsistence hunting may be unparalleled when compared with other areas in America where energy development is taking place. The Iñupiat's continuing strong dependence on subsistence foods, particularly marine mammals and caribou, creates a unique set of potential effects from onshore and offshore oil exploration and development on the social and cultural system. Barrow resident Daniel Leavitt articulated these concerns during a 1990 public hearing for Beaufort Sea Sale 124 EIS:

> ...as I have lived in my Iñupiat way of livelihood, that's the only... thing that drives me on is to get something for my family to fill up their stomachs from what I catch (USDOI MMS 1990c).

Integrity of Place

In traditional times, Iñupiat extended family groups named themselves for the areas they used, which the Iñupiat in turn subdivided into people of the land (Nunamiut) and people of the coast (Taremiut; Spencer 1976). Some of the people who resettled Nuiqsut, for example, considered themselves Kuukpikmuit, people of the Colville River Delta. One strategy Iñupiat used to maintain their connection to their homelands before the resettlement period was to use summer and winter school vacations to go from Barrow out to their camps. These regional groups reestablished NSB communities, many depopulated by the 1960s, in order to ease access to places that were important subsistence and meeting places. The availability and use of modern transportation technology allowed continuous use when it was necessary to reside in Barrow for education, health care, and/or employment (Brown 1979).

Many people continue to use or desire to return to camps and harvest locations used in traditional times. Iñupiat consider traveling "out on the land" to be the natural and preferred state of affairs, and many feel even a brief trip can be therapeutic and stress relieving (IAI 1990a, b). Some residents preserved their camps by applying for allotments before the passage of ANCSA, while others continue to use the land much as they had before Congress enacted ANCSA and ANILCA to address land ownership issues in Alaska. Maintaining these ties to traditionally used sites, many listed in the NSB TLUI, is a priority for residents of Iñupiat communities (Brown 1979).

3.4.3.2 Social Organization

The social organization of Iñupiat communities is strongly based on kinship. Kinship forms "the axis on which the whole social world turn(s)" (Burch 1975a). Historically, households were composed of large extended families, and communities were kinship units. Today, there is a trend away from the extended-family household because of increased mobility, availability of housing, and changes in traditional kinship patterns. However, kinship ties in Iñupiat society continue to be important and remain a central focus of social organization.

The social organization of North Slope Iñupiat encompasses not only households and families but also wider networks of kinsfolk and friends. These types of networks are related through overlapping memberships, and are embedded in those groups responsible for hunting, distributing, and consuming subsistence resources (Burch 1970). An Iñupiat household on the North Slope may contain a single individual or group of individuals who are related by marriage or ancestry. The interdependencies among Iñupiat households differ markedly from those found in the United States as a whole.

In the larger non-Iñupiat society, the demands of wage work emphasize a mobile and prompt workforce. While modern transportation and communication technologies allow for contact between parents, children, brothers, sisters, and other extended-family members, more often than not, independent nuclear households (father, mother, and children) or conjugal pairs (childless couples) form independent "production" units that do not depend on extended-family members for the day-to-day support of food, labor, or income. In contrast to the non-Native culture, in the Iñupiat culture individual family groups depend on the extended family for support and provision of day-to-day needs.

Associated with these differences, the Iñupiat hold unique norms and expectations about sharing. Households are not necessarily viewed as independent economic units, and giving, especially by successful hunters, is regarded as an end in itself, although community status and esteem accrue to the generous. The sharing and exchanging of subsistence resources strengthen kinship ties (Nelson 1969; Burch 1971; Worl 1979; ACI et al. 1984; Luton 1985; Chance 1990).

3.4.3.3 Characteristics of the Population

The North Slope includes two relatively distinct populations: local residents who are predominately indigenous Iñupiat natives, and the oil and gas industry workforces, who rotate on a regular schedule and are temporary worker/residents in the region. As temporary residents, the oil and gas industry workers have minimal participation in the local economy, and their needs for all services are provided by industry. On the other hand, full-time residents of the region form the primary social structure and the local economy.

The North Slope has a fairly homogeneous population of Iñupiat–about 72% in 1990. This is an approximation, as the 1990 Census did not distinguish between Iñupiat and other Alaskan Natives and American Indians, although there were only 110 individuals (1.8% of the total NSB population) in the NSB that fell into these latter two classifications. The Census did distinguish between Eskimo, Aleut, and Indian, although Iñupiat, Yup'ik, Cup'ik, and Siberian Yup'ik were grouped together as "Eskimos;" "Indians" included the Haida, Eyak, and Tsimsian Athabascan tribes. The percentage in 1990 ranged from 92.7% Iñupiat in Nuiqsut to 61.8% Iñupiat in Barrow (USDOC Bureau of the Census 1991). In 1990, the populations of the communities near the planning area were 139 in Point Lay, 492 in Wainwright, 3,469 in Barrow, 216 in Atqasuk, and 354 in Nuiqsut. In 2000, population counts were 247 for Point Lay, 546 for Wainwright, 228 for Atqasuk, 4,581 for Barrow, and 433 for Nuiqsut (USDOC Bureau of the Census 2000). The percentages in 2000 ranged from 89.1% Iñupiat in Nuiqsut to 64.0% Iñupiat in Barrow. In 2000, 5,450 (73.8%) NSB residents reported they were all or part Alaska Native or American Indian. Although the Census did not differentiate between Eskimo, Aleut, and Indian, it did ask for the individual's "Alaska Native or American Indian tribe(s)." Based on tribal data, at least 4,594 of the 7,385 NSB residents were Eskimo.

North Slope society responded to early contacts with outsiders by successfully changing and adjusting to new demands and opportunities (Burch 1975a; Worl 1978; NSB Contract Staff 1979). Since the 1960s, the North Slope has witnessed a period of intense change, with the pace of change quickened by the area's oil developments (Lowenstein 1981). In the Prudhoe Bay/Kuparuk River industrial complex, oil-related work camps have altered the seascape and landscape, making some areas off limits to traditional pursuits such as hunting. Large NSB

Capital Improvement Projects have dramatically changed the physical appearance of NSB communities.

In 1970 and 1977, residents of North Slope villages were asked about their state of well being in a survey conducted by the University of Alaska-Anchorage (UAA) Institute of Social and Economic Research (Kruse et al. 1983). The survey noted significant increases in complaints about alcohol and drug use in all villages between 1970 and 1977. Since then, numerous studies have documented marked increases in social pathology in North Slope villages, in parallel with similar changes noted throughout rural Alaska. These changes are described in detail in **section 3.4.10, *Public Health***. Social services have increased dramatically from 1970 to the present, with increased NSB budgets and grants acquired by or through the Arctic Slope Native Association and other nonprofit organizations, and village and regional tribal governments. Health and social-services programs have attempted to meet the needs of alcohol and drug-related problems with treatment programs and shelters for wives and families of abusive spouses and with greater emphasis on recreational programs and services, yet a lack of adequate funding for individual NSB city governments has hampered the development of these programs. In addition, declining revenues from the State of Alaska have seriously impaired the overall function of NSB city governments. Partnering together, tribal governments, city governments, and the NSB government may be able to provide programs, services, and benefits to residents. For several years, all communities in the NSB have banned the sale of alcohol, although alcohol possession is not banned in Barrow, and many communities are continually under pressure to bring the issue up for a local referendum vote (NSB 1998).

The introduction of modern technology has tied the Iñupiat subsistence economy to a cash economy (Kruse et al. 1982 in IAI 1990b). Nevertheless, oil-supported revenues help support a lifestyle that still is distinctly Iñupiat; indeed, outside pressures and opportunities have sparked what may be viewed as a cultural revival (Lantis 1973). What exists in the communities of the North Slope is a dual economic system "in which a modern cash economy and traditional subsistence are interwoven and interdependent," and through which the culture adapts and perpetuates itself (USDOI BLM 1979a, NSB 1998). People continue to hunt and fish, but aluminum boats, outboards, and all-terrain vehicles now help blend these pursuits with wage work. Iñupiat whaling remains a proud tradition that involves ceremonies, dancing, singing, visiting, cooperation between communities, and the sharing of foods. The possible effects of the proposed action on subsistence have been and will continue to be a major issue for residents in the North Slope communities.

The baseline of the present sociocultural system includes change and strain. The very livelihood and culture of North Slope residents have come under increasing scrutiny, regulation, and incremental alteration. Increased stresses on social well being and on cultural integrity and cohesion have come at a time of relative economic well being. The anticipated challenges on the culture by the decline in Capital Improvement Projects funding from the state have not been as significant as once expected. The buffer effect has come mostly through the dramatic growth of the NSB's own permanent fund, the NSB taking on more of the burden of its own capital improvements, and its emergence as the largest employer of local residents. However, NSB revenues from oil development at Prudhoe Bay are on the decline, and funding challenges (and subsequent challenges to the culture) continue as the state legislature alters accepted formulas for NSB bonding and funding for rural school districts.

North Slope residents exhibit an increasing commitment to area-wide political representation, local government (the revitalization of the Indian Reorganization Act [IRA] tribal governments), and the cultural preservation of such institutions as whaling crews and dancing organizations, as well as the revival of traditional seasonal celebrations. The NSB's Commission on Iñupiat History, Language, and Culture is an important body for preserving Iñupiat heritage, from conducting elders conferences and other cultural activities to preserving oral histories and actively pursuing the repatriation of cultural artifacts and remains under the Native American Graves Protection and Repatriation Act (Kruse et al. 1983; ACI et al. 1984; USDOI MMS 1994, 1995a, 1996a, 1997; USDOI BLM 1997; NSB 1998).

3.4.4 Environmental Justice

Environmental justice is an initiative that culminated with President Clinton's February 11, 1994, EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," and an accompanying Presidential memorandum. The EO requires that each Federal agency consider environmental justice to be part of its mission. Its intent is to promote fair treatment of people of all races, so no person or group of people bears a disproportionate share of the negative effects from the country's domestic and foreign programs. Specific to the EIS process, the EO requires that proposed projects be evaluated for "disproportionately high adverse human health and environmental effects on minority populations and low income populations."

U.S. Environmental Protection Agency guidelines for evaluating the potential environmental effects of projects require specific identification of minority populations when either: 1) a minority population exceeds 50% of the population of the affected area; or 2) a minority population represents a meaningfully greater increment of the affected population than of the population of some other appropriate geographic unit, as a whole.

The North Slope includes two relatively distinct populations: local residents who are predominately indigenous Iñupiat natives, and the oil and gas industry workforces, who rotate on a regular schedule and are temporary worker/residents in the region. As temporary residents, the oil and gas industry workers have minimal participation in the local economy, and their needs for all services are provided by industry. On the other hand, full-time residents of the region form the primary social structure and the local economy.

The North Slope has a fairly homogeneous population of Iñupiat; the percentages in the 2000 Census ranged from 89.1% Iñupiat in Nuiqsut to 64.0% Iñupiat in Barrow. In 2000, 5,450 (73.8%) NSB residents reported they were all or part Alaska Native or American Indian. Although the Census did not differentiate between Eskimo, Aleut, and Indian, it did ask for the individual's "Alaska native or American Indian tribe(s)." Based on tribal data, at least 4,594 (62.2%) of the 7,385 NSB residents were Eskimo (see **section 3.4.3, *Sociocultural Systems***). Based on the census data, the minority population in the NSB is well above the 50% threshold specified in the USEPA guidelines, so it is appropriate to consider potential environmental justice issues in evaluating the effects of the planning area alternatives.

Personal income is the income received by people from all sources: private sector and government wages, salary disbursements, other labor income, farm and nonfarm self-employment income, rental income, personal dividend income, personal interest income, and transfer payments. Per capita personal income is the annual total personal income of the residents of an area divided by their resident population. Per capita personal income can be a measure of economic well being because the amount of goods and services that people can afford is often directly related to their personal income. Personal income estimates do not attempt to quantify the non-cash contribution of subsistence activities to the economic well-being of NSB residents.

Figure 3-12 shows annual per capita personal income (in 2000 dollars) for residents of the North Slope, compared to that of Alaska residents as a whole, for 1969 through 2000. From 1975 through 1991 and from 1993 through 1996, per capita personal income of North Slope residents exceeded the statewide average, sometimes by as much as 50%. Starting in 1984, the real per capita income in the region began to decline and the gap narrowed. Currently, the North Slope average is virtually the same as the average for the state as a whole.

While North Slope residents have often enjoyed higher real personal per capita incomes than the statewide average, the statewide average has been notably less volatile than that of the North Slope. This is to be expected, as regional economies that are not highly diversified tend to be more sensitive to internal and external economic changes.

Based on the per capita income data, the North Slope population would not qualify as a low-income community for environmental justice consideration. However, personal income data alone do not address the question of overall economic well-being. The average cost of living is much higher on the North Slope than in Anchorage, for example, and, as noted above, many North Slope residents benefit from subsistence activities, which also do not figure in the income data. Regardless, it is not necessary to dissect the income/economic well-being issue in greater detail because environmental justice considerations are triggered by the race/ethnicity threshold.

Scoping meetings were held in the NSB communities of Anaktuvuk Pass, Atqasuk, Barrow, and Nuiqsut during development of the Amended IAP/EIS. Iñupiat translators were provided at these meetings to facilitate participation of non-English speakers. Environmental justice considerations for the Amended IAP/EIS were also gathered through 1) a meeting in early December 2003 with residents of Nuiqsut and with the residents of Barrow and Nuiqsut in mid-January 2004, 2) local radio broadcasts and notices in the North Slope newspaper, 3) follow-up meetings that included discussions specific to environmental justice concerns, 4) public hearings in Anaktuvuk Pass, Atqasuk, Barrow, Bethel, and Nuiqsut on the Draft Amended IAP/EIS, and 5) ANILCA 810 hearings in the same communities as the meetings on the Draft Amended IAP/EIS. The concerns expressed in the Amended IAP/EIS process are relevant to the Supplemental IAP/EIS process and are considered in this Draft Supplemental IAP/EIS.

Input on the concerns of environmental justice populations was again solicited at the inception of the Supplemental IAP/EIS process. BLM issued a Federal Register notice on December 4, 2006 requesting comments. On December 19, 2006, BLM requested input from the Iñupiat Community of the Arctic Slope, the regional tribal government, as well as from the tribal governments of the villages of Anaktuvuk Pass, Ataqasuk, Barrow, Nuiqsut, and Wainwright. To better address the concerns of environmental justice populations, BLM on January 12, 2007 entered into a Memorandum of Understanding with the North Slope Borough making the NSB a cooperating agency for the Supplemental IAP/EIS. In addition to providing the NSB a more integral role in the drafting of this IAP/EIS, consideration of environmental justice issues has been enhanced through the cooperative agency relationship with the Borough through the Borough's substantial contribution to a better understanding of public health issues. At the outset of the Supplemental IAP/EIS process, the NSB, through the assistance of the Alaska Inter-Tribal Council, and BLM initiated a series of consultations regarding human health. The outcome of these meetings was the agreement to collaboratively incorporate an appraisal of human health concerns as a part of the IAP/EIS. The results of this process are included in the relevant sections on health in this document.

Major concerns expressed at these meetings and through response to BLM publications included:

- Protecting Native Allotments, hunting and fishing camps, and cultural sites
- Identifying and protecting important subsistence areas
- Protecting caribou migration routes
- Restricting access to subsistence areas and resources
- Providing river setbacks or buffers to protect historic fishing sites
- Studying and maintaining the health of fish and wildlife
- Mitigating seismic disturbance of caribou, fish, and whales
- Making better use of Traditional Knowledge
- Providing natural gas to local communities
- Providing more local hire
- Involving local people in scientific studies of resources
- Including local people in the planning process
- Improving oversight and enforcement of mitigation measures
- Cleaning up contaminated sites
- Minimizing disturbance from staging areas, roads, docking facilities, and pipeline access
- Clarifying the BLM's government-to-government policy (ENSR 2004)
- The need to assess impacts to human health and means to mitigate impacts to health

In addition, Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," requires the BLM to consult with Iñupiat tribal governments of the North Slope on Federal matters that significantly or uniquely affect their communities. The USEPA's Environmental Justice guidance of July 1999 stresses the importance of government-to-government consultation. As one way to foster tribal participation and mitigate exploration and development impacts in the planning area, BLM created the Subsistence Advisory Panel in 1998. Representatives from the communities of Anaktuvuk Pass, Atqasuk, Barrow, Nuiqsut, and Wainwright, a representative from the NSB, and BLM decision-makers, compose the Subsistence Advisory Panel. Since its inception, the Subsistence Advisory Panel has met numerous times in NSB communities, resulting in an ongoing dialogue that will guide BLM in making decisions on future exploration and development activities in the NPR-A.

3.4.5 Land Uses and Coastal Management

3.4.5.1 Land Ownership and Uses

Land Ownership

The planning area boundary extends to the northern boundary of the NPR-A, generally following the shoreline but extending offshore to encompass certain bays and lagoons. The boundary follows the eastern boundary of the NPR-A from the coast up the Colville River to a point about 25 miles southwest of Umiat. From there it jogs north 27 miles and then west 54 miles to the Ikpikpuk River, which forms the western boundary of the planning area.

The majority of land within the planning area is under Federal jurisdiction, with the remaining lands limited primarily to Native entities. The majority of these are located around the village of Nuiqsut (Map 1-2). The State of Alaska also owns a small portion of the planning area.

Federal Jurisdiction

Executive Order 3797, signed by President Warren G. Harding on February 27, 1923, reserved 23.7 million acres and established the Naval Petroleum Reserve Number 4 (PET-4). This area was reserved for oil and gas development for Naval defense purposes. The NPRPA of 1976 (PL 94-258) transferred jurisdiction of PET-4 from the Navy to the Secretary of the Interior and renamed it the National Petroleum Reserve – Alaska. The planning area encompasses approximately 4.6 million acres, of which 4,511,753 acres are under Federal jurisdiction.

Ownership of the land in the bays and lagoons that are within the NPR-A boundary, but tidally influenced, were disputed between the state and Federal governments. The U.S. Supreme Court in the United States v. State of Alaska (Orig. 84), commonly known as the “Dinkum Sands” case, ruled in June of 1997 that these lands are federally–owned because the land was retained by the U.S. Congress at statehood (1959). These offshore lands within the planning area could be made available to oil and gas leasing, along with onshore Federal lands. Lands beyond this northern boundary, extending from mean low tide out for 3 miles, are owned by the State of Alaska under the Federal Submerged Lands Act.

Native Allotments

The Native Allotment Act of 1906, as amended, allowed an Alaskan Indian and/or Eskimo to receive up to 160 acres of vacant and unappropriated land. Applicants had to show use and occupancy of lands selected.

The majority of the Native allotments within the NPR-A were closed to selection prior to the passage of the ANILCA. This was a result of applicants being informed that if they relinquished their claims, the village corporations would receive ANCSA conveyances sooner, and then the corporations would reimburse the applicants for the lands relinquished. Another factor was the belief that the NPR-A lands were not available for selection under the Native Allotment Act of 1906.

With the passage of the ANILCA (Section 905), allotments within the NPR-A were reinstated with the exception of the allotments on lands conveyed to the village corporations of Atqasuk, Barrow, or Wainwright. Section 12 of the Technical Correction Act of 1992 amended Section 905 of the ANILCA to allow the allotments on lands conveyed to the corporations within the NPR-A to be reconveyed if certain conditions were met. All three villages will reconvey the Native allotments to the U.S. for certification of the Native allotment to the applicant.

Certificates of Allotments issued on lands valuable for oil and gas contain a reservation of those minerals to the U.S. It is presumed that all certificates for allotments in the planning area will contain this reservation. There are approximately 34 allotments comprising approximately 4,380 acres within the planning area. All 34 have been surveyed and have been, or are being, certificated.

Village Corporation Lands

The ANCSA allowed the four village corporations of Atqasuk, Barrow, Nuiqsut, and Wainwright to select surface lands under Sections 12(a) and 12(b). The NPRPA reiterated the availability of lands for selection and conveyance by village corporations under the ANCSA. Section 12 of the Technical Corrections Act of 1992 allowed the villages to reconvey lands under a valid Native allotment application in exchange for an equal number of acres of additional selections. For the village of Nuiqsut, the total 12(a) and (b) entitlement is 77,014 acres within the planning area. Currently, 28,970 acres have been patented and 29,360 acres have been conveyed on an interim status. The village corporation completed its land selection in late 2007 (Map 3-43).

Regional Corporation Lands

The ASRC owns 5,400 acres of surface land in the planning area at Cape Halkett, which was exchanged for ASRC's Kurupa Lake lands (5,332 acres) on December 9, 1981. The ASRC also owns limited subsurface rights within the planning area.

The ANCSA did not allow the ASRC to select the subsurface estate within the NPR-A. However, Section 12(a)(l) did allow the ASRC to select the subsurface estate from lands outside the NPR-A withdrawal in acreage equal to its entitlement. Public Land Order 5183, dated March 9, 1972, clarified this process while it withdrew NPR-A lands from subsurface selection by the regional corporation. The NPRPA (1976) reiterated the arrangement in 1976, recognizing the village corporations' selections of surface estate as provided by ANCSA without providing for other land claims.

It was not until five years later that selections by regional corporations were allowed in the NPR-A. The Appropriations Act of 1981 (PL 96-514) authorized the Secretary of the Interior to lease lands within the NPR-A for oil and gas exploration and development. The passage of this Act allowed the implementation of Section 1431(o) of the ANILCA by providing specific legislative authority to exchange NPR-A lands contingent upon legislative direction to open the NPR-A to commercial development. This specific provision allowed the ASRC to select the subsurface of village-selected lands if lands within 75 miles of the village lands were made available for commercial development. The ASRC selected the subsurface estate under all lands selected by Nuiqsut and under a portion of the lands conveyed to Wainwright. At Nuiqsut, the ASRC will receive the subsurface rights once the entitlement is completed.

State of Alaska

The state owns 1,450 acres at the Umiat Airport, which were obtained by a Quit Claim Deed on June 1, 1966 (U.S. Survey 9571). Lands beyond the northern boundary of the planning area, extending from mean low tide out for 3 miles, are owned by the State of Alaska under the Federal Submerged Lands Act. The ADNR makes decisions on the use of these state lands, including decisions on oil and gas leasing.

3.4.5.2 Land Uses

Authorized Use

Poor soil conditions in the planning area limit the ability of BLM to entertain most land use proposals for summer operations. Permafrost underlays the entire NPR-A, and floodplains and wetlands cover the majority of the area, reducing even further BLM's ability to allow surface activity. Some winter activities are allowed with specific restrictions on a case-by-case basis.

Current management policy for the planning area allows only those activities that, with stipulations, would have a negligible impact on the environment. Because of the fragile nature of thawed tundra during the summer, permit sites are restricted to durable areas such as gravel bars, beaches, or existing gravel pads. During the winter, when the freeze has stabilized the mineral soils and the snow protects the vegetation, it is possible to traverse the tundra with Rolligon-type vehicles (low-impact vehicles operating on the tundra with minimal disturbance).

The activities listed below represent a sampling of long-term and short-term land use currently authorized or pending authorization within the planning area:

- Annual overland resupply moves between the various North Slope villages using track- or Rolligon-equipped vehicles.
- Inactive (Lonely) and inactive (Kogru) DEW-Line installation locations.
- Minimum Impact Permits (3-year duration) authorized under FLPMA and/or NPRPA include, but are not limited to, a Wildlife Observation Station at Teshekpuk Lake issued to the NSB, a paleontological dig (dinosaur bones) in the Colville River drainage at Ocean Point, and a staging/storage area for Veritage at Inigok airstrip.
- A 15.5-acre lease to Cook Inlet Region, Inc., a Native regional corporation, for the USGS/Husky logistics camp and staging area near the Lonely DEW-Line installation. Cook Inlet Region, Inc., took possession of the buildings through a General Services Administration agreement.
- Numerous Special Recreation Permits within the planning area that authorize commercial sport hunting operations for up to a 5-year duration.
- Annual winter geophysical activities (seismic) by geophysical research companies throughout the planning area.
- Authorization for continued research on revegetation at well sites, climatic studies, etc.
- Various communication/navigation-related authorizations to Federal agencies for Vortec sites, radar beacon sites, communication towers, etc.

There currently are approximately 20 authorizations for these types of activities within the planning area. Most of these are the type that allows use for 3 to 5 years, with none exceeding 20 years.

Access

There are no existing roads that link the planning area with any other villages within the NPR-A. BLM, however, has linked the villages of Barrow, Atqasuk, Wainwright, and the Kogru River, northwest of Nuiqsut, with marked trails (marking is ongoing) that are usable only during the winter. These winter trails follow, but are not part of, existing ANCSA Section 17(b) easements, which connect existing road networks within the various villages with state, public, or private roads outside the NPR-A. The trails do not cross Native Allotments. There are no ANCSA 17(b) easements within the Nuiqsut village lands.

Structures

There are a number of structures, primarily cabins, on Federal public lands without BLM authorization. The BLM has entered into an agreement with the NSB for the borough to assist in completing an inventory to establish the location and users of these structures.

3.4.5.3 Coastal Zone Management

The Coastal Zone Management Act (CZMA) (16 USC 1451-1464, Chapter 33), enacted in 1972 and last amended in 1996, and the Alaska Coastal Management Act (ACMA; AS [Alaska Statutes] 46.39 and 46.40), enacted in 1977 and last amended in 2003, guide development and land use in coastal areas to provide a balance between the use of coastal areas and the protection of valuable coastal resources.

Alaska Coastal Management Program

In 1979, the Alaska Coastal Management Program (ACMP) was approved pursuant to the CZMA. The ACMP includes statewide standards and coastal district enforceable policies addressing development and use of natural resources within the coastal zone. Pursuant to the 2003 ACMA revisions, amendments to the ACMP were submitted to the Office of Ocean and Coastal Resource Management (OCRM) in the National Oceanic and Atmospheric Administration (NOAA). OCRM approved the amended ACMP effective December 29, 2005. The coastal zone and coastal district boundaries are mapped in Coastal Zone Boundaries of Alaska, an atlas first produced by the former Alaska Division of Governmental Coordination (ADGC; 1988), and now maintained by the Alaska Department of Natural Resources. Maps of the coastal zone boundaries can also be seen on the internet at: www.alaskacoast.state.ak.us/GIS/boundary.htm. Portions of the planning area are included on Harrison Bay, Ikpikpuk River, Teshekpuk, and Umiat maps. Activities either occurring within the coastal zone or that may reasonably be expected to affect coastal resources and uses must be conducted in a manner consistent with the ACMP.

The CZMA excludes Federal lands from coastal zone jurisdiction, however, the exclusion of Federal lands does not remove Federal agencies from the obligation of complying with the consistency provisions of Section 307 of the CZMA when Federal actions or federally–permitted activities on these excluded lands have spillover impacts that affect any land or water use or natural resource of the coastal zone within the jurisdiction of a state's management program (15 CFR § 923.33; 16 USC 1456; 11AAC 110.400). Federal activities, such as an oil and gas lease sale, having reasonably foreseeable effects on any coastal use or resource must be consistent to the maximum extent practicable with the standards of the ACMP and the approved enforceable policies of relevant coastal districts' management plans. A consistency determination prepared by BLM initiates the state's review for oil and gas lease sales.

Federally permitted activities in the coastal area of NPR-A must undergo an ACMP review if they require a listed Federal authorization (15 CFR § 930.53[a][(1]; 11 AAC § 110.400). Federally–permitted activities outside the coastal zone that have reasonably foreseeable effects to coastal resources or uses must also undergo a state consistency review. Applicants for these federally permitted activities must certify that their activities are consistent with the ACMP. The state consistency review for federally–permitted activities begins when the state receives a consistency certification and necessary data and information from the party submitting the application to the Federal agency. Federally permitted activities subject to ACMP review will not be authorized if they are not consistent with the statewide standards of the ACMP and approved coastal district enforceable policies.

The standard of review for Federal activities, such as oil and gas lease sales, is that a project must be consistent with the ACMP "to the maximum extent practicable." The consistent "to the maximum extent practicable" standard does not apply to federally–permitted activities. The standard of review for applicable federally–permitted activities requires that these activities must be consistent with the ACMP standards and enforceable policies.

Thirty-three coastal districts have developed coastal management programs with enforceable policies that became part of the ACMP. District plans developed and approved under the previous ACMP expired in September 2007 and must be updated to comply with the revised ACMP. Amendments to the district programs must be approved by the ADNR commissioner and by the Secretary of Commerce through the NOAA OCRM. The statewide standards that may be relevant to potential activities in the planning area addressed in this Supplemental IAP/EIS are summarized below.

Resources and Habitats

Several coastal habitat areas were identified as being subject to the ACMP habitats standards, including offshore areas; estuaries; wetland; tideflats; rocky islands and sea cliffs; barrier islands and lagoons; exposed high-energy coasts; rivers, streams, and lakes (including associated floodplains and riparian management areas); and important habitat. Each habitat has a policy specific to maintaining or enhancing the attributes that contribute to its capacity to support living resources (11 ACC 112.300).

Air, land, and water quality are included as the second of three policy areas under Resources and Habitats. The ACMP defers to the mandates and expertise of the ADEC for these resources. The standards incorporate by reference all the statutes, regulations, and procedures of the ADEC that pertain to protecting air, land, and water quality (11 AAC 112.310). Concerns for air and water quality are cited frequently during state reviews for consistency.

The third policy area encompasses historic, prehistoric, and archeological resources. For these resources, the ACMP indicates the ADNR will designate "areas of the coastal zone that are important to the study, understanding, or illustration of national, state, or local history or prehistory, including natural processes" (11 ACC 112.320).

Uses and Activities

Nine topics are addressed under this heading: 1) coastal development, 2) natural hazard areas, 3) coastal access, 4) energy facilities, 5) utility routes and facilities, 6) timber harvest and processing, 7) sand and gravel extraction, 8) subsistence, and 9) transportation routes and facilities. All of these uses and activities, except timber harvest and processing, may be relevant to potential activities within the NPR-A.

Implementation of the revised ACMP requires that adverse impacts to coastal zone resources be avoided where practicable and minimized where avoidance is not practicable. Where neither avoidance nor minimization is practicable, compensatory mitigation of adverse impacts should be implemented "to the extent appropriate and practicable" (11 AAC 112.900).

Both the Federal CZMA and the ACMP require that uses of state and Federal concern be addressed (CZMA,16 U.S.C 1451, et seq., AS 46.40.060, and AS 46.40.070). The ACMA further stipulates that local districts may not arbitrarily or unreasonably restrict or exclude such uses in their coastal management programs. Among the uses of state concern are the siting of major energy facilities and of transportation and utility routes and facilities.

North Slope Borough Coastal Management Program

Currently there is not an approved NSB District coastal management program in effect. The NSB Coastal Management Program (CMP) developed and adopted in 1984 under the previous ACMP expired in September 2007. The NSB District Plan Amendment, pursuant to the revised ACMP is currently under development but the approval process has not been completed.

The NSB has adopted administrative procedures for implementing the policies contained in its expired CMP based on the permit process established under the NSB's Land Management Regulations (LMRs) found at Title 19 of NSB Municipal Code and the consistency-review process of Title 46 of the Alaska Statutes. The following is a brief discussion of the NSB's local land use plans that exist in the region.

North Slope Borough Land Management

The NSB Comprehensive Plan and LMRs were adopted in December 1982. The LMRs were revised in April 1990. The revisions simplified the regulatory process but did not alter the basic premise of the comprehensive plan–to preserve and protect the land and water habitat essential to subsistence living and the Iñupiat character of life.

A revised NSB Comprehensive Plan developed after a lengthy planning process was approved by the NSB Assembly in October 2005. The NSB is nearing completion of a significant amendment of its LMRs after a similarly lengthy planning process.

The current LMRs have five zoning districts: Village, Barrow, Conservation, Resource Development, and Transportation Corridor. All areas within the NSB are in the Conservation District unless specifically designated as within the limited boundaries of the villages or Barrow, as a unitized oil field within the Resource Development District, or along the TAPS corridor (the Transportation Corridor).

Uses are categorized in the LMRs as: 1) uses that can be administratively approved without public review, 2) uses that require a development permit and must have public review before they can be administratively approved, or 3) uses that are considered conditional development that must be approved by the Planning Commission.

The 1990 revisions in the LMRs incorporated the policies of the NSB CMP and supplemented these with additional policy categories: Village Policies, Economic Development Policies, Offshore Development Policies, Coastal Management and area-wide policies, and Transportation Corridor Policies. Offshore policies are specifically limited to development and uses in the portion of the Beaufort Sea that is within the NSB boundary. All the policies address oil and gas leasing activities, onshore and offshore. The enforceable policies of the expired NSB CMP have been incorporated within the zoning ordinance in Section 19.70.050.

It is BLM's policy to consider local zoning to the extent practical in any decision regarding the use of Federal lands. Local land use plans in the NPR-A are acknowledged, but they do not necessarily control activities on Federal lands.

3.4.6 Recreational and Wilderness Resources

3.4.6.1 Recreation Resources

BLM describes recreation resources in terms of the Recreation Opportunity Spectrum (ROS). The ROS classes are: Primitive; Semi-Primitive Nonmotorized; Semi-Primitive Motorized; Roaded Natural; Roaded Modified; Rural; and Modern Urban.

All lands are placed in a particular ROS class based on the setting, activities available, and the type of experience afforded. Once classified, lands are managed for recreation according to their ROS class. Most of the lands in the planning area fall within the Semi-Primitive Motorized management class. The remainder, corresponding to private lands within the planning area, falls within the Roaded Modified class.

Setting

The planning area is a vast Arctic region with outstanding recreation opportunities. Portions of the area are well suited for outdoor recreational activities such as backpacking, float boating, camping, fishing, hunting, and winter sports. Hunting and fishing activities of area residents are not extensively addressed here because those activities are too deeply ingrained in the subsistence lifestyle to be considered recreational.

With its small resident population, costly access, lack of facilities, and few visitors, the area currently is underused and could support additional recreation in the future. Despite its immense size (4.6 million acres), recreational use of the planning area probably represents about 1% of total statewide recreation.

Because of the lack of roads to (and within) the planning area, summer access is almost exclusively by charter aircraft. Aircraft are available for charter at various locations; however, all charter operators are located outside of the planning area. Guide services are an additional cost and vary with the type of guided activity.

Among the more attractive opportunities afforded by the planning area are those associated with the pristine quality of the region, such as backpacking, hunting, float boating, and wildlife viewing. The untouched environment, combined with the remoteness of the area, offer a wilderness experience comparable to any other available in the U.S. Even in Alaska, there are few areas such as the NPR-A, where a person can be 100 miles or more from the closest village or site of human activity. The area's principal outdoor recreational activities are described in the following sections.

Activities

Backpacking and Hiking

Very little backpacking (overnight trip) or hiking (day trip) unrelated to subsistence activities presently takes place within the planning area. It is likely that fewer than five recreational backpacking parties (four persons per party) enter the area each year, and most of this use probably is limited to areas near Umiat. Backpacking and hiking also occur in the major river valleys in conjunction with float-boating activities. The backpacking/hiking season is rather short, generally from late June to early September. There are no developed hiking trails. Access for backpacking is provided by aircraft using the larger lakes and gravel bars as landing sites.

Boating

Very little recreational use (i.e., not related to subsistence) is made of the rivers and lakes in the planning area. Between 15 and 25 multi-day recreational float trips (four persons per trip) are estimated to occur within the planning area each year. Boating of rivers (i.e. the Colville) is done both inside and outside of the planning area, but the 15 multi-day float trips are considered within the planning area. Most of the boating is done with rubber rafts or folding kayaks to facilitate access by aircraft, which land on gravel bars or beaches, large pools on the rivers, or on lakes. Generally, the opportunities for float boating on rivers in the planning area are not outstanding in comparison to similar opportunities offered elsewhere in Alaska. For example, none of the rivers in the area offer whitewater boating because most of the rivers have an insufficient flow of water during much of the summer. Some of the better boating rivers in the area are the Colville and the Ikpikpuk rivers. The Colville River wildlife viewing includes peregrine falcons, as well as other raptors, including gyrfalcons, rough-legged hawks and golden eagles, and the river has one of the highest densities of nesting birds of prey and songbirds in the Arctic. Along its banks, boaters have the opportunity to view towering cliffs, bluffs, and huge gravel bars with a rich riparian community of willows and alders, mosses and lichens, and may see caribou from the Western Arctic Herd, which traverses the area throughout the spring, summer and fall. The waters of the Colville support over 20 species of freshwater and anadromous fish, including arctic char and grayling. The river also provides an outstanding experience for people interested in paleontology, as evidence of mastodons, woolly mammoths and dinosaurs can be found in the river banks and mud cliffs.

Recreational boating and sailing are not practical on the many lakes and ponds in the planning area due to the shallowness of most lakes.

Sightseeing

According to Alaska's Outdoor Recreation Plan, sightseeing is one of the most popular recreational activities of Alaska's residents and the most popular recreational activity of visitors to Alaska (ADNR 1976). Although very little sightseeing occurs in the planning area, the opportunity to view wildlife in its natural habitat is perhaps the most exciting recreational opportunity in the region. Millions of waterfowl and other birds seasonally migrate to and through the area. Grizzly bear, Arctic fox, wolf, wolverine, caribou, moose, various raptors, and other animals inhabit the area. Some species tend to gather in the river valleys at certain times of the year, while other animals are found in large numbers near the coast (USDOI BLM 1978d). Following are descriptions of several notable wildlife viewing areas in the planning area.

- The area along the Arctic Coastal Plains (ACP) of the NPR-A, including Teshekpuk Lake, contains the highest concentration of geese, swans, ducks, gulls, terns, jaegers, and loons in the National Petroleum Reserve – Alaska. Snowy owls may also be observed along the coast during the summer months.
- The area located approximately north of 70° North latitude, south of Teshekpuk Lake and between the Colville and Ikpikpuk rivers, has moderate to high concentrations of waterfowl, jaegers, terns, and loons during the summer.

- The area along the Colville River from just south of Nuiqsut to the planning area boundary is a moderate concentration area for moose during the winter and caribou during the summer.
- The area along the middle and lower segments of the Colville River provides habitat for a subspecies of peregrine falcon and other raptors during the summer. North of Umiat, the chance for viewing ptarmigan along the river increases. The area also provides an opportunity for observing grizzly bears from June through September.
- The area located on the upper Ikpikpuk River affords opportunities to observe moose during the summer. Grizzly bears and ptarmigan also may be seen here from June through September.

The prime viewing conditions are related to the open, treeless nature of the Arctic tundra, the tendency of some animals to concentrate in the riverine areas, the long hours of daylight during the summer, and lack of extensive contact between wildlife and humans.

Guided or packaged sightseeing tours offered by various companies may account for a significant increase in the total number of visitors to the region in the future. However, most of this use would be limited to villages and village corporation lands and would not affect the public lands. At present, this activity is almost exclusively focused on Barrow (outside the planning area).

Sport Hunting

Big-game animals are the primary quarry of most sport hunting in the planning area. Few trophy animals are found, however, and game populations are abundant only in scattered locations within the planning area. Caribou of the Teshekpuk Lake Herd (TLH) are the most numerous big-game animal in the planning area. Subsistence hunting by North Slope residents accounts for most of the caribou harvest within this herd. Most moose are taken within the Colville River drainage, particularly near Umiat. Moose populations on the North Slope, are not large in numbers, however, they are rebounding from a mysterious die-off in the early to mid 90's. One of the largest concentration areas for moose found on the North Slope are found along the Colville River. Grizzly bears are the only bears hunted in the planning area; black bears do not inhabit the area. Grizzlies are hunted during the fall and spring, primarily in the foothills and protected river valleys of the southern portion of the planning area.

Sport Fishing

Sport fishing on the Arctic Slope is largely an incidental activity conducted opportunistically by persons in the area primarily for other purposes, such as big-game hunting, float boating, construction, or government projects.

Winter Activities

Very little winter recreation is known to occur in the planning area beyond the immediate area of Nuiqsut. Although extensive travel is usually linked to subsistence hunting and fishing and to visiting other villages, some travel is recreational. The gentle terrain and wind-packed snow throughout much of the planning area create favorable conditions for snowmachining, dogsledding, and cross-country skiing. The best skiing is found in the river and creek drainages, where snow is deeper and the hard-pack surface more level than elsewhere.

Tourism

Tourism could account for the greatest increase in the number of visits to the planning area in the future. Currently, few visitors leave the immediate vicinity of the villages or Native corporation lands.

Off-Highway Vehicles

In Presidential EOs and BLM regulations, the term "off-road vehicle" or "ORV" has a legally established definition. For this discussion however, the term "off-highway vehicle" or "OHV" will be used. This is a designation treated by the public, industry, and land management agencies as interchangeable with the term "ORV" to describe the broad use of motorized vehicles in the planning area.

Recreational (nonsubsistence) use of OHVs is considered very low in the planning area. The area has vast stretches of wet, boggy terrain covered with tussocks, making OHV use difficult during the summer months. While some summer OHV use does occur adjacent to village lands and subsistence camps, access to the planning area is primarily via aircraft or motorboat along waterways.

Winter use of snowmachines is more common, although mostly associated with subsistence activities. Inter-village winter travel occurs along several travel routes that can migrate with changing snow and ice conditions, making a trail route difficult to establish and winter travel dangerous for the average recreational user. There is a potential for development of guided tour operations between villages, although this activity would need to be authorized through a Special Recreation Permit under 43 CFR Part 2930 regulations and would include use stipulations.

Recreational Experience

For the most part, the recreational experience provided by the planning area is primitive. Virtually the entire area is characterized by an unmodified natural environment with a very low concentration of users and very little evidence of human use. The opportunity for isolation from the sights and sounds of other humans and to feel a part of the natural environment is high. Activities are not dependent on BLM facility development. The primitive experience may be tempered, however, because use of snowmachines and motorized boats is permitted.

Existing Recreation Developments

No BLM-maintained or authorized recreational developments or structures exist on public lands within the planning area. There is no developed road system into or through the area. Recreational access is almost entirely by aircraft. Typically, natural features such as lakes, rivers, gravel bars, and ridges serve as airstrips. Umiat, located on state land on the southeastern boundary of the planning area, has a state owned, lease holder-maintained airstrip and fuel is available from the lease holder. The village of Nuiqsut has a maintained landing strip that can be used by the public, although use by nonresident recreationists are not encouraged. Emergency landings are possible at various DEW-Line sites located along the coast.

3.4.6.2 Wilderness Characteristics

There are no Congressionally-designated wilderness areas in the planning area; however, almost all BLM-managed lands within the planning area, especially those lands removed a short distance from villages (i.e. Nuiqsut), offer wilderness characteristics of solitude, opportunities for primitive and unconfined recreation, and for the most part are natural. As noted in Chapter II, wilderness as a program will not be a part of this plan. However, BLM will, as a part of the affected environment, describe the wilderness characteristics of the planning area.

The planning area was evaluated for wilderness characteristics during the Section 105(c) studies in 1978. Practically all of NPR-A remains in a state of de facto wilderness as it was during that study. Residents of the area do occupy seasonal dwellings or fish camps, which if not entirely compatible with naturalness and solitude are, nonetheless, minor impacts to an otherwise primitive area. While the local population travels extensively by motorized vehicle (primarily snowmachines) over parts of the planning area, particularly near communities, there are no roads outside the communities. In spite of the NPR-A having been subjected intermittently to oil and gas exploration since the 1920s, the overall character of the planning area (excluding private lands) is that of a natural, undisturbed area, with very few obvious signs of modern human influence or presence. A visitor to the area or an inhabitant of one of the few settlements in or near the NPR-A can easily find opportunities for solitude (USDOI BLM 1978d).

In 2001, BLM conducted an additional inventory of wilderness characteristics within the planning area, which identified the entire planning area as possessing wilderness characteristics. Although most of the planning area possesses wilderness characteristics, there are distinct differences in the characteristics, attributes, and uses within the planning area.

Naturalness

Because of the sheer size of the planning area, most of the lands appear to have had very limited human intrusion. A portion of the eastern section of the planning area, however, especially those lands near Nuiqsut, is used and has been used for many years by the people who live in the community. Use consists of subsistence hunting with OHVs, motorboats, etc. Trails have been established from village to village and from villages to camps along river corridors. Many trails have no specific direction and were made in pursuit of subsistence resources.

Village to village utility proposals, such as power lines, natural gas lines, and other facilities oriented to village and/or city living, are being looked at for future accommodations. Cabins, generally used as seasonal dwellings for subsistence fishing camps, are scattered along the rivers and some lakes. Native Allotments either are, or will become, private lands. These allotments tend to be located primarily near Nuiqsut and along rivers.

Other facilities in place throughout the planning area (camps, airstrips, wellheads, etc.) remain from past oil and gas exploration. Most of these facilities are in various stages of reclamation. Some of the old methods of seismic surveys and transportation of personnel and equipment did leave lasting impacts on the soils and vegetation of the area. Scars of this past activity are still noticeable in some parts of the planning area today.

Roadless

Most of the planning area is roadless as defined by the BLM Wilderness Inventory and Study Procedures Handbook (USDOI BLM 2001): "The word 'roadless' refers to the absence of roads which have been improved and maintained by mechanical means to insure relatively regular and continuous use. A way maintained solely by the passage of vehicles does not constitute a road."

Outstanding Opportunities for Primitive and Unconfined Recreation

Outstanding opportunities for a primitive and unconfined recreation experience do exist in the planning area. These opportunities are largely attributed to the extreme remoteness of the area. Even in Alaska, there are a limited number of locations where an individual can be more than 100 miles in any direction from the nearest population center. This isolation provides exceptional opportunities for wilderness experiences.

Wildlife

Wildlife is an important characteristic that affects the quality of the wilderness experience in three ways. First, it enhances the experience by its very presence, particularly those species that commonly cause people to visualize wild country. In the Arctic, these species may include grizzly bear, polar bear, wolf, wolverine, caribou, moose, loons, gyrfalcon, peregrine falcon, golden eagle, and ptarmigan. Wildlife-viewing opportunities in the planning area are very good because some forms of wildlife are locally abundant and easily viewed at comfortable distances across relatively flat, treeless terrain. Wilderness-associated species are those often associated in the public's mind with (although not always biologically dependent on) a wilderness-like environment. Second, because of their intolerance of humans or their need for large areas of untrammeled land, some species can survive best in wilderness settings. Third, primitive, natural areas may provide habitat for rare and endangered species, which visitors would otherwise never have an opportunity to view. These species may not inherently need natural areas for their habitat, but because they are close to extinction, natural, wild areas become a sanctuary.

Environment and Challenge

To many people, wilderness evokes images of an area where one can experience solitude or serenity and that requires self-reliance. Recreational users of wilderness also expect outstanding opportunities for unusual adventure, excitement, and challenge. Nearly all of the NPR-A offers a wilderness environment in which visitors can experience feelings of solitude, adventure, and serenity.

Opportunities for Scientific Study

The presence of features for scientific, educational, scenic, or historical value are important wilderness characteristics. The opportunity for nature study or informal outdoor education as well as formal scientific study is an important attribute of wilderness, if study can be done in a manner compatible with the essence of wilderness and ongoing subsistence activities. Research opportunities in the planning area have been and are still excellent.

3.4.6.3 Wild and Scenic Rivers

A review of the previous planning efforts and Wild and Scenic Rivers (WSR) inventories and studies revealed that the planning area has been reviewed for WSR values at least four times previously.

The first study was completed in July 1972 by the Bureau of Outdoor Recreation. In a report entitled Alaska Task Force Report on Potential Wild and Scenic Rivers as Part of the Native Claims Settlement Act, two rivers within the study area, the Colville and Ikpikpuk rivers, were identified for further review.

The second WSR inventory was conducted as a result of a provision contained within Section 105(c) of the NPRPA (1979). In compliance with this Act, the Colville and Ikpikpuk rivers again were inventoried and studied for WSR designation. No rivers in the planning area currently are included in the National WSR System.

A third review of Wild and Scenic Rivers eligibility was conducted as part of the NPR-A Northeast IAP/EIS in 1998.

A fourth review was conducted in conjunction with the NPR-A Northeast Amended IAP/EIS in 2005.

Eligibility Review

Colville River

The Section 105(c) report (December 1978) states:

The Colville River from its headwaters to Umiat meets the criteria established by the Wild and Scenic Rivers Act (WSRA) for inclusion into the National WSR system as a “wild river area.” Outstanding values associated with the Rivers Area are wildlife, geologic, recreational, and archeological.

Under provisions of the WSRA (1968), as amended in 1984, Congress had 3 years after submission of the study to address designation of the Colville River as a WSR. Congress did not take any action, and the river corridors returned to their former management. The ANILCA (1980) directed the Secretary of the Interior to study several rivers in Alaska, but in the case of the Colville River, it said that the 105(c) study is sufficient for Congressional purposes. The effect of this directive was that the Colville River was placed in a protective management status. Protective management limits projects that would adversely affect the free-flowing nature of the rivers and provides for the enhancement of the “outstandingly remarkable values” that made the river eligible for WSR status.

Factors considered in the Colville River suitability determination and all subsequent reviews included but were not limited to the following:

- Characteristics that make the area a worthy addition to the National WSR System;
- Status of land ownership, use in the area, amount of private lands, and associated incompatible uses;
- Reasonably foreseeable potential uses that would be enhanced, foreclosed, or curtailed;

- Federal, public, state, tribal, local, or other interests in designation or non-designation, including the cost thereof that may be shared;
- Estimated costs of acquiring lands or interest in lands; and
- The ability of BLM to manage and/or protect the river as a WSR.

Field studies were conducted in 1997 to update the eligibility findings from the Section 105(c) report. These studies were discussed on pages III-C-49 to III-C-54, and in appendices G and H in the 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998). These studies showed that there had been little change in the Colville River between its headwaters and Umiat and that the 1978 report accurately characterized the Colville River as a "wilderness river." The river reach between Umiat and Nuiqsut was also found to be eligible for designation as a WSR because of the outstanding wildlife and paleontological values of this portion of the river.

Unquestionably, the Colville River has many characteristics that would make it a worthy addition to the WSR system. However, critical factors in evaluating the Colville River's suitability as a component of the WSR system are land ownership and the BLM's ability to manage and/or protect the river as a WSR. The relevant segments of the Colville River corridor being studied at this time are not solely under BLM jurisdiction. The riverbed, the corresponding body of water, and the right (east) bank of the river are owned and managed by the State of Alaska and the ASRC. Only the left bank is managed by the BLM. To protect and manage the river as a WSR would require the State of Alaska and ASRC to support the suitability determination and to make a commitment to assist in protecting the identified river values. While both the State of Alaska and ASRC recognize the significance of the Colville River and the importance of protecting identified resources, both clearly reject the notion that inclusion of the Colville River in the WSR system is the way to accomplish this goal (USDOI BLM and MMS 1998). Further, the ASRC is "strongly opposed" to any designation that, in their experience, limits the traditional use of the area by the Iñupiat people. The NSB has also stated that it does not support the designation of the Colville River as a WSR. Without the support and assistance of local interests and other land owners/managers, the Colville River is unmanageable and, therefore, unsuitable as a component of the WSR system.

Ikpikpuk River

The conclusion in the 1978 Section 105(c) report indicated:

Because of the limited boating season, low water level, very limited and expensive access, repetitive scenery and low overall recreation potential, the Ikpikpuk River is not considered to be an outstanding candidate for the WSR System.

Field investigations completed in 1997 indicated that there has been little change in the Ikpikpuk River. For most of its length, the river still is characterized as a "wilderness river" with little evidence of human presence, but no resource values (i.e., wildlife, fisheries, geologic, scenic, historic, cultural, or other similar values) were found to be outstandingly remarkable. The most significant resource values noted were paleontological. Studies indicate that where the Ikpikpuk River erodes the Cenozoic formation, significant Pleistocene mammoth and other mammalian remains are exposed. While these resources are important as they relate to the archaeological investigations at the Mesa site and the North Slope, they are not as significant as the paleontological values found on the Colville River and thus not considered outstandingly remarkable in a regional context as required by the WSRA.

No new information has been gathered that would change the original 1978 determination that the Ikpikpuk River does not contain outstanding WSR values and, therefore, it was found not eligible.

Other Rivers

During the NPR-A Northeast IAP/EIS review process, sixteen additional rivers and creeks not addressed in the 105(c) report were screened, using the eligibility criteria of free flowing and containing at least one "outstandingly remarkable value." While all of the rivers met the free flowing criteria, none of the rivers were found to have "outstandingly remarkable values and are thus not eligible for further consideration.

No new information has been gathered that would change the conclusions of the 1998 Northeast IAP/EIS ROD, or the 2005 Amendment to the Northeast IAP/EIS in which no rivers were determined suitable for inclusion in the National Wild and Scenic Rivers System.

3.4.7 Visual Resources

Visual resources are described in the context of the Visual Resource Management (VRM) system. The VRM is the system used by BLM to inventory and manage visual resources. It provides an analytical method to analyze potential visual impacts and to apply visual design techniques to ensure that surface-disturbing activities are harmonious with their surroundings. The planning area boundary encompasses non-federal lands, including State of Alaska lands and Kuukpik Corporation lands. Neither of the applicable non-federal entities has a system or methodology to assess the impacts of projects to the visual resources of the landscape. While BLM cannot apply stipulations to non-federal lands, the VRM system is applied to the entire planning area. Implementing VRM involves two steps: conducting an inventory and providing an impact assessment. During the inventory stage, data are collected to identify the visual resources of an area in order to designate visual resource inventory classes.

An in-depth inventory of visual resources within the planning area was conducted as part of the NPR-A 105(c) studies completed in 1979. The 1998 Northeast IAP/EIS VRM study was based entirely on the NPR-A 105(c) report. The 2003 Alpine Satellite Development Plan study established updated VRM information for the Alpine field portion of the planning area.

3.4.7.1 Scenic Quality

The scenic-quality evaluation describes the characteristic landscape and determines scenic-quality ratings for the visual resources of the planning area. Visual resources are defined as the land, water, vegetation, animals, and structures that are visible on the land. The evaluation is intended to represent the overall impression a viewer has of the visual resources from several important viewpoints or locations, rather than the view from any one location, including an aerial view, or during any one season of the year.

The scenic quality data component of VRM classes were collected as part of the 1979 105(c) report and the 2004 Alpine Satellite Development Plan Final EIS. The planning area was used as the frame of reference for rating scenic quality (USDOI BLM 2004c; **section 3.4.8**).

The planning area was divided into 16 scenic-quality rating units (SQRUs) using the basic elements of landform, vegetation, water, color, distinctiveness, and cultural modification.

Landform is characterized by vertical relief and spatial composition. Vegetation is represented by species, variety, and extent. Water is characterized by its shape, pattern, and color. Color is defined by its relative scales of hue (classifications of red, yellow, green, blue, or combinations) and value (lightness and darkness), and intensity (degree or strength). Distinctiveness is a measure of uniqueness within a region. Cultural modifications are defined as any human-caused change in the landform, waterform, or vegetation, or the addition of a structure that creates a visual contrast in the basic elements (form, line, color, texture) of the natural landscape.

Each SQRU was evaluated to determine its scenic quality. The planning area has seven SQRU units: the Beaufort Sea Coast, Dry Plains, Eastern Ridges, Large Water Bodies, Lower Colville River, Middle Colville River, and the remaining Wet Plains. Each SQRU was rated-on a scale of A through C as to the quality of its visual aesthetics:

- Class A SQRU has a great deal of visual variety, contrast, and harmony.
- Class B SQRU has a moderate amount of visual variety, contrast, and harmony.
- Class C SQRU has little visual variety, contrast, and harmony.
  (See Map 3-45).

The following summarizes the landscape character and scenic quality of each SQRU.

The Beaufort Sea Coast SQRU, Class Rating C: The Beaufort Sea Coast SQRU consists of a 1-mile wide band along the Beaufort Sea coastline. It is characterized by broad horizons, large skies, limited topographic relief, and pack ice. The scenic variety of vegetative types is limited, with little contrast in the vegetation. Notable contrast occurs between vegetated and nonvegetated areas. Strong forms and lines establish the edge between land and water. The water is the dominant element in the landscape. Changes in color depend on the day. On bright sunny days, there is a stark contrast between the light blue of the sky, the darker grey blue of the ocean, and the bright green of the land. On cloudy days the contrast is more subtle with some contrast between the green of the vegetation and brown soil and numerous shades of blue and gray on the water, ice, the horizon, and in the sky. Polygonal ground forms create contrast in color tones of the vegetation.

Dry Plains, SQRU, Class Rating C: The Dry Plains SQRU is a flat, continuous plain with little visible topographic relief except for widely scattered drainage demarcations, pingos, and polygons. Its vegetation consists of low growing tussock tundra species. Water bodies are few and subtle. Color contrast is subtle within the more homogeneous vegetation. Because the Dry Plains are almost flat, there is little contrast between the blues of the water and the greens of the vegetation, unless you are in the immediate vicinity of the water.

Eastern Ridges, SQRU, Class Rating C: The Eastern Ridges SQRU is predominantly in the southern region of the planning area extending west from the Colville River but exclusive of the Colville River Valley. The unit is distinguished by low east-west ridges which appear to be similar when present. The ridges are dissected by meandering streams, leaving a series of buttes, mesas, and steep-walled faces. This SQRU has some variation in topographic relief and has a wide variety of plant species but few vegetative types. Vegetation consists of tundra species and taller willow and alder along streams and rivers creating interesting patterns in color and texture with barren soils and stream beds. Small streams and rivers are a dominant element in the landscape.

Large Water Bodies, SQRU, Class Rating A: This SQRU encompasses Teshekpuk Lake. It is characterized by distant views, broad horizons, large skies, and limited topographic relief. Plant species are generally of the tussock tundra community and slightly taller than similar species in surrounding units. Taller vegetative types occur along the shore lines. The unit is similar to Remaining Wet Plains (see below). An outstanding feature is the large water bodies where large expanses of water are visually dominate. The lake has complex shoreline features with bays, spits, lagoons, islands, beaches, and extensive shoal areas creating a unique scene of land dominated by water. The lake reflects the sky and light. The shape and patterns of water in this unit are unprecedented. Teshekpuk Lake is one of the largest lakes in the state. This is an adjusted Scenic Quality Rating from the 105C study based on comments received during review.

Middle Colville River, SQRU, Class Rating A: The Middle Colville River SQRU, from the southeastern corner of the planning area to Umiat, is characterized by deep pools, fast riffles, long gravel bars, riparian vegetation, varied and abundant wildlife species, and prominent geologic features. This section of the river is contained by high, steep, rugged bluffs, and creates some of the finest scenery in the NPR-A. Other geologic features include coal seams, faults, and continuous folds (large anticlines and synclines). This unit exhibits greater visual difference in vegetation and has more variety in form, texture, and color than any of the other units. Stands of tall shrubs contrast sharply with the short vegetation communities above the riverbanks in both color and texture. Water must be considered a dominant influence in the scenery.

Lower Colville River SQRU, Class Rating B: The Lower Colville River SQRU consists of the riparian area of the Colville River from Umiat downstream to the mouth at the Beaufort Sea. This section of the river is characterized by 400-foot bluffs on the west bank near Umiat that gradually decrease to 10 to 20 feet at Nuiqsut, as well as twisted river channels and irregular oxbow lakes that add pattern and line to the landscape. The east bank of the river is characterized by willows and smaller brush species, while vegetation is lower near the mouth of the river creating diversity in form, texture, and color. Flat water comprises the lower Colville River. Sandbars provide the opportunity to view the mountains to the south.

Remaining Wet Plains, Class Rating C: This SQRU occupies approximately 75% of the planning area. The presence of thousands of lakes distinguishes the Wet Plains from other rating units. Water is the dominant visual element and presents in ice-wedge polygon patterns and numerous elliptical and elongated lakes. The most distinguishing features of the Wet Plains are its vastness and flatness and lakes. The landform is described as a flat continuous plain, displaying little relief other than those small differences along stream corridors and pingos. Variation in elevation is approximately 7 feet. There is a high diversity of plant life within these wet plains creating a contrast primarily in polygons. Notable contrast occurs between vegetated and non-vegetated areas along rivers and streams in the gravel bars and bluffs. The composition of vegetation produces little variation in form, texture, and pattern. Colors provide contrast between the greens and browns of vegetation and barren soils and the blues and grays of the water bodies.

3.4.7.2 Visual Sensitivity

Visual sensitivity is a key component in identifying VRM classes. In the 1979 105(c) report, visual sensitivity used two factors: the amount of use an area receives and viewers' expressed attitudes toward what they see. The report mapped areas of visual concern, delineating them as high, moderate, or low concerns for changes in scenic quality and for prevention of visible change in the landscape. Additional data used to determine sensitivity were obtained from meeting notes from Subsistence Advisory Panel meetings, written comments on the 1998 Northeast IAP/EIS, and from conversations with agency staff knowledgeable about uses within the planning area. Areas identified as sensitive include known travel routes, areas of human habitation, areas of traditional use, and Native allotments. Numerous areas are noted to have potentially high visual sensitivity. Residents of the North Slope Borough view the landscape as very important and they have a high level of interest and sensitivity to any changes to the natural landscape (see Sensitivity Level Rating Sheet and Map 3-46).

3.4.7.3 Distance Zones

Distance zones are the third major component, along with scenic quality and visual sensitivity, in determining visual resource inventory classes. They are also important in assessing visual impacts. Distance from an object affects how clearly elements of a landscape are perceived, with visible details of a particular object decreasing with increasing distance. Distance zones are one basis for determining the visual sensitivity of planning areas. The VRM system recognizes three distance zones: Foreground-Middleground, Background, and Seldom-Seen.

Each distance zone is defined as follows:

- **Foreground-Middleground Zone.** This is the area that can be seen from each travel route for a distance of up to 5 miles where management activities might be viewed in detail.
- **Background Zone.** This is the remaining area that can be seen from each travel route to approximately 15 miles. It does not include areas in the background that are so far distant that the only thing discernible is the form or outline.
- **Seldom-Seen Zone.** These are areas that are not visible within the Foreground-Middleground and Background zones and areas beyond the Background Zone. (See Map 3-47).

3.4.7.4 Cultural Modifications

While Cultural Modifications are taken into account in the Scenic Quality Rating Process, larger scale development has occurred in the planning area and is discussed in this section. The planning area is still primarily a natural landscape where man has not substantially changed the scenic quality. However some areas have been modified by the activities of man. Buildings are the most likely to be seen and have the most modification from the natural landscape. The main areas where buildings exist are Nuiqsut, Umiat, Camp Lonely, and Lonely DEW-Line site.

Nuiqsut is located along the eastern boundary of the planning area. The community has a population of about 433 living in mostly single family houses covering about 9 square miles. Other landscape modifications include the landfill and associated road, and a road to the Colville River. The community introduces straight vertical and horizontal lines in a predominately horizontal landscape. Color differences between the natural greens and the many shades of the community's buildings, and the browns of the roads and landfill are evident. The structures introduce distinct rectangular form into a natural landscape with indistinct, irregular, and complex landforms.

Umiat, Camp Lonely, and Lonely DEW-Line site are smaller in size but have many of the same resulting modifications to the natural landscape as Nuiqsut.

Other buildings found throughout the planning area are cabins and camp structures associated with subsistence activities. These structures are usually isolated single story small plywood cabins that produce some contrast with the surrounding landforms but on a very local scale along rivers, creeks and lakes. The exception is along the Miguakiak River and Teshekpuk Lake where structures are more clustered or present as "strip development."

Airstrips are located at five places within the planning area. While the profile of an airstrip is low, landform changes are introduced by brown colors in predominantly green vegetation and more regular lines than the surrounding irregular vegetation.

Capped wells (called Christmas trees) dot the landscape. However, given the small footprint and most being less than 6 feet tall, these modifications are very hard to see unless you are within a couple hundred feet of them.

There are no permanent roads outside the communities, and very few trails exist very far from any community. Summer travel is primarily by watercraft along rivers and the coastal areas. Some areas around Nuiqsut receive travel by ATV, however, these trails are hard to see from more than about 25 feet away. Ice roads are used during the winter months and leave changes in vegetation colors during the summer, but again, this contrast is very hard to see from more than a few feet away.

While these areas introduce modifications to the landform, they also provide places of use and special interest or key observation area from which to evaluate the sensitivity levels.

3.4.7.5 Visual Resource Inventory Classes

Based on the combination of the scenic quality, sensitivity levels, and distance zones, interim VRM classes have been identified for the planning area. The VRM recognizes the following classes and corresponding objectives:

- **Class I Objective:** To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention.
- **Class II Objective:** To retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer.
- **Class III Objective:** To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract the attention but should not dominate the view of the casual observer.
- **Class IV Objective:** To provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high and may dominate the view and be the major focus of viewer attention.

The planning area can be divided into three general physiographic areas. These three areas are the Beaufort Sea Coast, the Wet Plains and the Colville River Valley. The transitions between these physiographic areas are generally subtle. The Middle Colville River Valley is characterized by high steep bluffs while the rest of the area has a gentle slope towards the Beaufort Sea. Elevational change is from 1100 feet along the Colville River to sea level, with most of the area being less than 600 feet. Vegetation also offers the most diversity between the

Colville River Valley and the rest of the area, with higher growth of willows and shrubs along the Colville River and the lower elevations with predominately tundra plant matrix of dwarf shrub and grasses. There is very little color changes between vegetation types but major color changes between vegetated areas and water bodies. Land form transitions from a steep, rough, irregular landscape along the Colville River Valley to a rolling to flat indistinct landscape along the Beaufort Sea.

VRM Inventory Classes for the planning area are summarized in the Table below and depicted on Map 3-48.

Table 3.4-B. VRM Inventory Classes for the Planning Area

VRM Inventory Class	Acreage
VRM Inventory Class I	24,000 acres
VRM Inventory Class II	274,000 acres
VRM Inventory Class III	1,478,000 acres
VRM Inventory Class IV	2,882,000 acres

Note: Acres rounded to nearest 1,000.

3.4.7.6 Visual Resource Management Within the Planning Area and on Adjacent Lands

Alpine Satellite Development Plan EIS

The only Visual Resource Management classes established in the 1998 Northeast IAP/EIS ROD were along the Colville River in the Colville River Land Use Emphasis Area. It is BLM policy that interim Visual Resource Management classes are established when a project is proposed for which no VRM objectives have been approved. Using scenic quality, sensitivity, and distance zones as well as other management factors, the Alpine satellites were assigned three VRM classes. The Colville River, from the southern project boundary to Harrison Bay, including the Delta area, is VRM Class II. Fish Creek, Judy Creek, and the Tingmiaksiqvik River is VRM Class III. The rest of the project area is VRM Class IV.

Northeast National Petroleum Reserve – Alaska EIS Record of Decision (October 1998)

The 1998 Northeast IAP/EIS ROD assigned VRM classes to some areas of Colville River. The Colville River Land Use Emphasis Area will be managed for VRM Class I upstream of Umiat and VRM Class II below Umiat, with exceptions allowed for subsistence structures and essential pipeline crossings.

Northwest National Petroleum Reserve – Alaska IAP/EIS Record of Decision (January 2004)

The Northwest IAP/EIS ROD assigned VRM classes as follows: The lands along the Colville River area are designated VRM Class I. Identified estuarine areas and lands along the 21 rivers eligible for designation as WSRs are designated VRM Class II. All lands within 3 miles of the banks of all identified water bodies are designated VRM Class III. The remainder of the Northwest NPR-A is designated VRM Class IV.

3.4.8 Transportation

Transportation systems developed for the Prudhoe Bay/KRU complex would be the expected source of transportation support for development activities in the planning area. The planning area lies near the western extremity of the Prudhoe Bay/KRU complex. The Prudhoe Bay/Kuparuk wells are mature producers supported by an extensive network of access roads and crude-oil-gathering lines. This network is constantly expanding as new and satellite crude oil production sites are identified. The Alpine field has brought the expanding North Slope infrastructure to the edge of the NPR-A. Pertinent land routes (Dalton Highway, North Slope oil roads, associated trails, and ROWs), airports and airstrips, and cargo-docking facilities are discussed in this section.

Within the NPR-A, there are few roads, identified ROWs, or airstrips, and no developed marine facilities exist along the planning area coastline. Any future oil and gas industry expansion into the NPR-A would extend from existing North Slope infrastructure. The Dalton Highway and the Deadhorse Airport would be the primary access routes most of the year for development of the planning area. Consequently, this section concentrates on the existing Prudhoe Bay/Kuparuk facilities east of the planning area, and those limited facilities within the planning area.

3.4.8.1 Road Systems

The Dalton Highway (also known as the Haul Road) is a 415-mile-long north-south, all-weather gravel road connecting Livengood with Deadhorse at Prudhoe Bay. The Dalton Highway is the sole overland route connecting Prudhoe Bay to central and southern Alaska's other major highway systems. The Dalton Highway is 28 feet wide with an average of 3 to 6 feet of gravel surfacing. In the early years of the road only the portion of the highway from Livengood to the Yukon River Bridge, and later Disaster Creek, was open to the public. In 1995, the Dalton Highway was opened to public access up to the security gates in Deadhorse. Beyond the security gate, the oil field roads are privately owned and maintained. NSB residents are allowed access to oil field roads to access their communities; other members of the public must obtain special approval from North Slope operators.

The majority of the vehicles traveling the Dalton Highway are commercial freight vehicles associated with oil field activities, although a few privately owned vehicles and commercial tour operators also use the Dalton Highway. Summer (June-August) traffic levels for the Dalton Highway are substantially higher than traffic levels for the rest of the year. During the summer of 2000, each month's average daily traffic count at milepost 56 of the Dalton Highway (Yukon River Bridge or approximately 135 miles north of Fairbanks) was approximately 450 vehicles, however, the annual average daily traffic (AADT) count at the same checkpoint was 245. Farther north, at the Atigun River count station, AADT levels dropped to 230 vehicle trips (Alaska Department of Transportation and Public Facilities [ADOTPF] 2003).

Traffic levels on the Dalton Highway have increased over recent years. At the Yukon River Bridge, the AADT was approximately 200 in 1996, 245 in 2000, and 254 in 2002 (ADOTPF 1996, 2001; Fantazzi 2004). Annual Dalton Highway truck traffic (loaded and unloaded combined) in 1996 was 45,236 trucks, accounting for an average of about 125 per day, or over 60% of total traffic. While truck traffic increased by over 35% between 1990 and 1996, it had fallen back to approximately 82 truck trips per day by 2000 (ADOTPF 2001). Average daily truck traffic accounted for only 34% of total traffic in 2000, even as total traffic was increasing, indicating that non-commercial traffic has been growing in recent years.

The main road within the Prudhoe Bay/KRU complex, connecting the Dalton Highway to the oil field infrastructure is the Spine Road. This road crosses through both the Western and Eastern Operating areas of the Prudhoe Bay Oil Field, and provides access from Deadhorse west to the Kuparuk Oil Field Base Camp and east to the Endicott Oil Field. Milne Point and other satellite fields and facilities within the Operating areas are connected to the Spine Road. Within Prudhoe Bay's Eastern and Western Operating areas, there are approximately 200 miles of interconnected gravel roads. There are approximately 94 miles of other interconnected roads within the Kuparuk River Unit. There are also 8 miles of causeways providing access to facilities and drilling sites, including the 5-mile long causeway to the Satellite Production and Main Production Islands at the Endicott field. Traffic data are not available for the roads within the Prudhoe Bay/KRU operating area.

Since 1998, approximately 35 miles of new gravel roads have been constructed in oil and gas fields on the North Slope. This includes 4 miles of new roads east of Prudhoe Bay and 31 miles farther west. Of the latter, 25 miles were associated with the Kuparuk fields, 2 miles were for the CD-2 Access Road for the Alpine field, and 4 to connect the Alpine CPF to CD-4. In 2001, there were approximately 400 miles of gravel roads associated with oil and gas fields on the North Slope. Where gravel roads have been constructed on the North Slope to access oil and gas infrastructure, they are typically 35 feet wide and 5 feet thick.

Alpine in the Colville River Delta is connected seasonally by an ice road to the Spine Road. Exploratory drilling of the Alpine Satellite Development Project prospect also was assisted by ice-road connections to the Prudhoe/KRU complex. In addition to the existing gravel roads connecting CD-2 and CD-4 to the Alpine CPF, ConocoPhillips has proposed more than 20 more miles of gravel roads and a bridge across the Nigliq Channel of the Colville River to link three proposed satellite production pads to Alpine. These additional roads await federal and NSB approval.

In the winter, the village of Nuiqsut (to the Southwest of Alpine) is connected to road system by ice road. Otherwise Nuiqsut's gravel road system is limited to connecting the airstrip, housing, and community facilities. Data are not available for traffic volumes on Nuiqsut's road system. Overland and over water travel by Nuiqsut residents is achieved year round by all-terrain vehicles, boats, and snowmachines. Aircraft are also widely used for transportation.

Other North Slope villages are limited to local gravel roads providing access to the airstrip, housing, and community facilities. Overland and over water travel by residents is achieved year round by all-terrain vehicles, boats, and snowmachines. Aircraft are also widely used for transportation.

West of the Colville River, outside the villages, surface transportation routes for petroleum exploration take the form of ice roads or Rolligon trails. The winter transport routes vary, using nearby lakes as water sources for ice-road construction. Construction of ice roads may start as early as December and typically traffic must cease in late April or early May to avoid tundra damage. Residents of Nuiqsut also utilize these ice roads which often connect to the Spine Road and the road system south from Deadhorse.

3.4.8.2 Aviation Systems

There are two major airstrips in the Prudhoe Bay/KRU area, the state-owned and operated Deadhorse Airport and the privately owned and operated KRU airstrip. The Deadhorse Airport is served by a variety of aircraft and can accommodate Boeing 737 jet aircraft. The airport consists of an 6,500 feet long by 150 feet wide asphalt airstrip, a small passenger terminal and hangars, storage warehouses, and equipment for freight handling. Alaska Airlines provides commercial air transportation into Deadhorse; annual passenger counts for scheduled flights on Alaska Airlines are estimated at 140,000 people. The KRU airstrip is owned and operated by Shared Services Aviation. The airstrip is 6,500 feet long and 150 feet wide; it is primarily used by BP's and CPAI's Shared Services Aviation, providing scheduled flights several times per week (Morrison 1997). Aviation Shared Services transports only employees, contractors, and cargo. From 1992 and 1996, Shared Services Aviation carried between 205,000 and 220,000 oil and support company personnel passengers (Ahern 1997). Commercial cargo service is also provided into Deadhorse and to satellite oil field strips. Annual tonnage shipped by air into the Prudhoe/KRU complex is probably between 250 to 500 tons. Most cargo is transported on the ground via the Dalton Highway.

Barrow is the transportation hub for villages on the North Slope. Barrow has a state-owned airport with an asphalt runway approximately 6,500 feet long and 150 feet wide. Alaska Airlines provides regularly scheduled jet passenger flights into Barrow from Anchorage and Fairbanks. Other air carriers offer shuttle service from Barrow to North Slope communities. The Barrow Airport is accessible year-round. Available airport services include minor airframe and power plant repairs (USDOC NOAA 1997). Airport facilities include two large hangars, storage warehouses, and equipment for freight handling.

Nuiqsut is serviced by a 4,500-feet long gravel airstrip located adjacent to the village. The airport is equipped with a rotating beacon, approach lights, high-intensity runway lights, and visual-approach slope-indicator systems. The runway is not attended or monitored (USDOC NOAA 1997). The community is served by twice-daily flights from Barrow and Deadhorse carrying passengers, cargo, and mail. Chartered aircraft also use the airport on a regular basis.

A 5,000-feet long gravel airstrip owned by CPAI is located at the Alpine field near pad CD-1. It is used to support oil field activities.

3.4.8.3 Marine Transportation Systems

Marine transportation on the North Slope generally is freight oriented with the exception of relatively small, inboard and outboard engine watercraft used by villagers and less frequently for scientific research. Marine transportation on the North Slope is used to bring in fuel, freight and prefabricated facilities.

Marine shipments to the North Slope are limited to a seasonal window between late July and early September, when the Arctic coast is ice-free. Port facilities on the North Slope range from shallow-draft docks with causeway-road connections, to facilities located at Prudhoe Bay, to beach-landing areas in North Slope communities. Because there is no deepwater port, cargo ships and oceangoing barges are typically offloaded to shallow-draft or medium-draft ships for lightering to shore. Occasionally, smaller craft also are used to transport cargo upriver.

There are three dockheads for unloading barges at Prudhoe Bay. A 1,100-foot-long causeway connects East Dock to a 100-foot-wide by 270-foot-long wharf constructed from grounded barges;

this dock is no longer used. (USDOD et al. 1984). West Dock, a 13,100-foot-long by 40-foot-wide, solid-fill, gravel causeway, is located along the northwestern shore of Prudhoe Bay east of Point McIntyre. There are two unloading facilities off of the gravel causeway at West Dock. One facility is located 4,500 feet from shore and has a draft of 4 to 6 feet. The second facility is located about 8,000 feet from shore and has a draft of 8 to 10 feet. Water depths around the causeway average 8 to 10 feet.

There is another dock at Oliktok Point extending 750 feet from the original shoreline. At the dockface, the water depths reach 10 feet while at the bottom of the dock's boat ramp water depths draw at least 5 feet. The Oliktok facility also doubles as a seawater-treatment plant (Rookus 1997).

Marine sealifts bring oil field supplies and equipment to the Prudhoe Bay/Deadhorse area. Arrival and offloading occurs generally from late July through early September due to the presence of sea ice at other times.

There are no port facilities in Barrow. Supplies and cargo are brought into the area by barges and larger cargo ships and taken to shore by smaller vessels. Supplies are either offloaded directly onto the beach or are lifted off the vessel by crane. The primary area used for offloading supplies is located north of the community.

Nuiqsut is located roughly 18 miles upriver from the sea on a channel of the Colville River. Supplies and cargo are brought to the shoreline of the Beaufort Sea by barges and larger cargo ships and then taken upriver by smaller vessels.

3.4.8.4 Pipeline Systems

There are several major trunk pipeline systems that carry crude oil to the TAPS – Prudhoe Bay East, Prudhoe Bay West, Milne Point, Endicott, Lisburne, Kuparuk, Badami, and Alpine field (Map 3-2). These systems total approximately 415 miles in length and are of various types of crude oil carriers. All of these pipelines are built aboveground, elevated on vertical support members. There are numerous production pad feeder lines serving each of these TAPS gathering lines. Often pipelines are "bundled" with different crude and non-crude carriers occupying the same right-of-ways. Access roads run along each of the pipelines, except at Badami and Alpine field, to provide for operations, maintenance, and repair.

Either a new pipeline would be constructed to carry oil from planning area to existing pipeline systems in the PBU/KRU area or to production facilities to the Alpine field. Oil produced from the Alpine field is transported from the Alpine field to KRU through a 35-mile-long pipeline that is 14 inches in diameter. This pipeline from Alpine field CD-1 is currently carrying 100,000 barrels of oil a day to KRU and then on to TAPS Pump Station 1. The transport of oil from the planning area through this pipeline would depend upon the future production rates of the Alpine field and the capacity of the Alpine field sales oil line at the time oil was transported from the planning area. If the Alpine field sales oil line has insufficient capacity to carry oil from the planning area, a new pipeline would be constructed between the Alpine field and KRU to carry oil from the planning area. The pipeline would likely follow existing pipeline and road right-of-ways. From KRU, the oil would be transported to TAPS Pump Station No. 1 through the 22-mile-long Kuparuk pipeline. Oil flow capacity in the Kuparuk pipeline is 350,000 bbl per day, and the pipeline is currently transporting 325,000 bbl per day (USDOI BLM and MMS 2003). Production from the Alpine field, as well as additional discoveries in the NPR-A, could create a product flow in excess of the Kuparuk line's carrying capacity.

From Pump Station No. 1, the TAPS heads south for over 800 miles to an oil-transshipment terminal located at Valdez on Prince William Sound. The oil pipeline is 48 inches in diameter with a 30-foot-wide access road and work pad running adjacent to it. The TAPS throughput capacity is approximately 2.1 to 2.2 MMbbl per day. Currently, TAPS throughput is about 800,000 bbl per day (Alyeska Pipeline 2006). Declining throughput has reduced the number of pumping stations from an historic high of 11 to 6. The Valdez Marine Terminal has 18 crude-oil-storage tanks with a total capacity of 9.18 MMbbl.

3.4.8.5 NPR-A Facilities

Transportation facilities within the NPR-A are few. Apart from Nuiqsut, the only facilities are those at Lonely (two sites), Umiat, and Inigok (Map 3-44). At Lonely there is a de-activated, remote controlled United States Air Force (USAF) Dew-Line station that has from time to time doubled as an oil field-support base starting during the Navy exploration periods of the 50's, 60's and 70's up to the present. The USAF continues to hold an NPR-A Right-of-Way for the Lonely site however there are plans to relinquish this authorization in the future. A second site in the Lonely/Pitt Point area is a 15 acres gravel pad under lease from BLM to the Cook Inlet Regional Corporation (CIRI) and located approximately one mile west of the Dew-Line station. Both the Dew-Line station and the CIRI gravel pad may be accessed by the 5,200 foot airstrip at the station. Currently, there are no other facilities in the Lonely/Pitt Point area. Industry is interested in using the Dew-Line station site, including de-commissioned structures, for a logistical camp to support NPR-A.

The Umiat facility is a public airstrip operated by the State of Alaska. During summer months, the airstrip is maintained by UIC Oilfield Services, a private contractor, and there is little consistency in seasonal periods of operation. For instance, in winter 2005-2006 the airstrip was not maintained and, yet, in 2006-2007 it was an all-season operation providing fuel, lodging and meals.

Inigok, the third major airstrip, is located at a former Husky Oil drilling site. The airstrip, estimated to be 7,000 feet long by 100 feet wide, was constructed in 1977 and is an insulated gravel airstrip. Approximately 1 foot below the gravel surface, the runway is underlain by polystyrene foamboard. Below the foamboard to a depth of six feet from the runway top is a layer of permanently frozen sand fill (Kachadoorian and Crory 1988). Due the nature of its construction, the Inigok strip remains useable some 18 years after its abandonment and is routinely used by the BLM during the summer.

Barge traffic provides important transportation for NPR-A oil and gas activity as well as for villages in the area. The only active barge landing within the planning area is at the Lonely Dew-Line station. This site does not have a docking facility, but rather provides high ground best used during higher tides. To date it has been used to support oil and gas operations as well as supporting environmental clean up in the Pitt Point area. Barging has a very narrow window of accessability as sea ice is normally off shore only approximately 2-3 months each year, usually extending from August through October. Barge traffic at Cape Simpson, outside the planning area, has become very active during the past two years as FEX L.P. has conducted exploratory drilling in the Northwest NPR-A planning area. The Simpson site is on lands owned by the North Slope Borough and operated by UIC.

3.4.8.6 Overland Travel (Ice Roads and Packed Snow Trails)

Historically, the Iñupiat navigate from Barrow to the Nuiqsut region along a cluster of coastal and landfast ice routes. Weather and ice conditions often dictate the route used. Along these routes, they travel to Teshekpuk Lake, the Colville River Delta, and Nuiqsut. Since 1983, ice bridges have been constructed across the Colville River. The first bridge was built to facilitate drilling on a lease held by the ASRC. The second bridge, built by the people of Nuiqsut in 1984, helped the village respond to a fuel crisis (Smith et al. 1985). Since then, villagers or ConocoPhillips have annually constructed an ice road from Nuiqsut to Oliktok or the nearest oil-exploration ice road, whichever is closer. The road is created by blading the snow off the river's ice cover, once sufficient thickness has been reached. The road is used for the overland transport of fuel and other material; it also gives the residents access to the Dalton Highway. Beginning in the mid-1990s, ConocoPhillips has built the ice road from Nuiqsut to Kuparuk and Alpine most years.

Currently, all ice roads and snow trails (rolligon trails) in the NPR-A are constructed in support of oil and gas operations. In the past 5 years the miles of packed snow trails have far exceeded those of ice roads. Cost, time to build, and availability of water sources appear to limit usage of ice roads. These numerous routes are usually over previously used winter trails. These are not to be construed as public roads and the holder of the right-of-way is held accountable by BLM for any tundra damage that might occur.

In the case of the winter season 2006-2007, BLM granted two companies overlying rights-of-way entirely across the planning area; one right-of-way extended to the Barrow area. Two additional oil field service companies already have such authorizations. Residents of the North Slope were allowed the opportunity to drive the resultant snow trails as long as their travels did not encumber oil field operations. Use of the trail provided residents with significant economic opportunity to access the gravel road system at Kuparuk/Prudhoe Bay.

3.4.9 Economy

The reader is advised that North Slope Economy, 1962-2005, OCS Study MMS 2006-020, prepared for the Mineral Management Service by Northern Economics, Inc. in Anchorage, AK, April 2006 is incorporated by reference. The study provides a detailed description of the NSB economy, and is used in this section. Most recent data is presented when available.

The NSB includes the entire northern coast of Alaska and encompasses almost 90,000 square miles of territory equal to 15% of the land area of Alaska (NSB 2003a). The passage of the ANCSA in 1971, formation of the NSB in 1972, and development of the oil field at Prudhoe Bay have all influenced the economy of the North Slope. The oil and gas industry is an important sector in the Alaskan and North Slope economies, providing substantial revenues to the State and the NSB. The NSB provides public services to all of its communities and is the primary employer of local Alaska Native residents. The substantial increase in provision of public services and employment opportunities has improved the quality of life for residents of the NSB in terms of infrastructure, medical care, and educational opportunities. This rapid improvement in economic well-being, beginning during the 1970s, was followed by a shift in demographics. Population on the North Slope more than doubled between 1970 and 2000, from a population of 3,075 to 7,385 (USDOC 2000). In 2005, the population of the NSB was estimated to be 6,894, a decrease of 6.6% from 2000 (ADOLWD 2006). **Section 3.4.3.3, *Characteristics of the Population***, provides additional information on the population and ethnic characteristics for the NPR-A.

Commercial airline service is the primary transportation between villages, the city of Barrow, and the rest of the state. Personal travel is fairly restricted to snowmachine during the winter. Virtually all goods are shipped either by air or by barge during a limited season for water traffic in the Arctic. Electric utilities and homes in most villages use fuel oil or diesel for generation and heat. Barrow and Nuiqsut have natural gas for heating. The cost of living is among the highest in Alaska. The University of Alaska Cooperative Extension Service surveys food costs in twenty locations in Alaska. The quarterly survey for September 2006 showed a Barrow family of four spending 288% of the base Anchorage cost (base equals 119.29) for a 104 item food basket. Portland, Oregon is listed as 92.61 (UAF 2007).

After formation of the NSB in 1972, the influx of money for capital projects and employment opportunities in some of the smaller communities provided incentives to lure people back to their villages from larger population centers (Jorgenson 1990). Northeast National Petroleum Reserve-Alaska Final Amended IAP/EIS. Anchorage, AK) . Many of the Iñupiat who lived in Barrow returned to their home villages. The villages of Nuiqsut, Point Lay, and Atqasuk, which had been abandoned, were resettled in the 1970s. The return to small traditional villages reflected preferences of many Iñupiat for a more rural lifestyle, provided modern public services and facilities, and opportunities for employment were also available. However, over half of the NSB's population continues to live in Barrow.

Another factor that contributed to the population increase, particularly in Barrow, was the in-migration of non-Iñupiat into the NSB. The percentage of non-Natives in the population of the NSB increased from 17% in 1970 to 27% in 1990, and was 26% in 2000 (USDOC 2000). ADOLWD estimated a continued increase to almost 30% in 2005 (ADOLWD 2005). The Iñupiat Eskimo comprise the majority of the population (71.7%). Caucasian (15.5%), Filipinos (7.5%), and Pacific Islanders (1.9%) are the other primary ethnic groups represented (Shepro and Maas, 2003).

Beginning in the mid-1970s, employment opportunities in the oil and gas and construction sectors resulted in an influx of nonresident workers on the North Slope. While total earnings in the North Slope region increased significantly during this time, most of these dollars were earned by nonresidents and were not re-spent in the local regional economy. However, indirect effects from government expenditures and oil and gas development expanded the private support section (e.g., telecommunications, utilities, trade, finance, insurance and real estate). Economic activities in the region are still driven primarily by oil field activities, public expenditures, and the construction sector.

While household and per capita incomes have increased on the North Slope, these increases have been offset, to some extent, by the high cost of living in the region. Surveys indicate that subsistence resources continue to be of economic and cultural importance to residents, but the adoption of modern technology has raised the cost of participating in subsistence activities. While North Slope residents generally agree that the overall quality of life in their communities has improved, and the percent of families with income below the poverty level has declined over the years, residents continue to express concern about the social, cultural, and biological effects of rapid economic development in the region.

3.4.9.1 NSB Revenues

The NSB is a unique area in Alaska, in part because of wealth derived from oil reserves and the relative lack of private industry sectors outside of North Slope oil enclaves. Property taxes on oil and gas property are the primary source of revenue for the NSB. These accounted for over 98% of tax revenue in 2005. (ADCDCA 2006). Other revenue sources include enterprise revenue, state and Federal education revenue, state safe communities revenue, and local revenues such as gaming and rental property revenues.

Oil and gas property is exempt from local municipal taxation, but the state levies a 20-mill tax against this property. Each municipality with oil and gas property within its boundaries is reimbursed an amount equal to the taxes which would have been levied on the oil and gas property, up to the 20-mill limit (ADR 2006a). The 2005 property tax rate for the NSB was 19.03 mills (ADCDCA 2006). Since the 1980s, the NSB property tax base has consisted mainly of high-value property owned or leased by the oil industry in the Prudhoe Bay area. Figure 3-8 and Table 3.4-C show property tax and oil and gas tax revenues for the NSB for 1990 through 2005.

A critical issue facing the NSB is the growing shortfall in revenues due to the decline in assessed value resulting from depreciation of petroleum-production related facilities. The real property assessed valuation for the NSB has declined from $11.5 billion in 1992 to $194 million in 2005 (NSB 2005). The full value determination of real property was $10.36 billion in 2005.

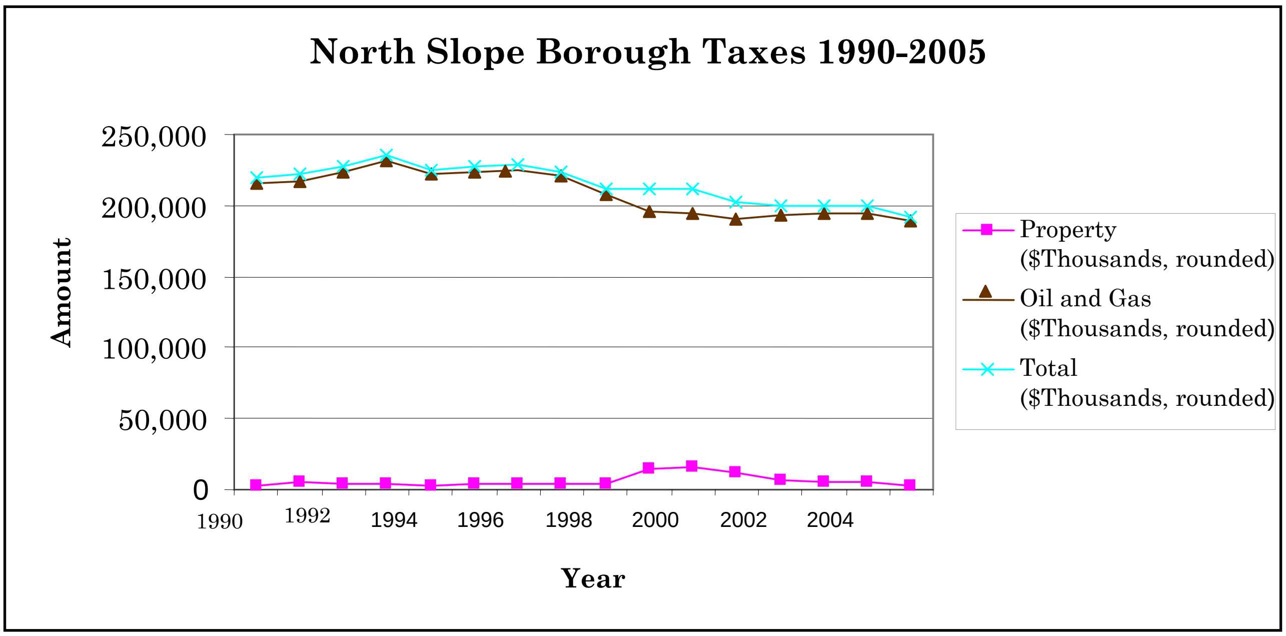


Figure 3-8. Tax in the NSB (Source: ADCDCA2006)

Table 3.4-C. Property Tax and Oil and Gas Tax Revenues for the North Slope Borough during 1990-2005

Year	Property ($)	Oil and Gas ($)	Total ($)
1990	2,984,359	216,134,219	219,118,578
1991	5,561,345	216,842,467	222,403,812
1992	3,552,225	223,813,149	227,365,374
1993	4,255,116	231,659,172	235,914,288
1994	2,008,578	222,765,775	224,774,353
1995	3,753,201	223,520,017	227,273,218
1996	3,533,180	224,756,637	228,289,817
1997	3,564,942	220,362,787	223,927,729
1998	4,484,168	207,190,459	211,674,627
1999	15,113,289	196,398,867	211,512,156
2000	16,416,808	195,095,348	211,512,156
2001	12,008,846	189,954,310	201,963,156
2002	6,239,417	193,019,738	199,259,155
2003	4,961,057	194,692,108	199,653,165
2004	5,595,083	194,209,446	199,804,529
2005	2,317,232	188,969,166	191,286,398
Source: ADCDCA 2006			

According to Alaska Statute 29.45090(a), the NSB is limited in the taxes it can levy for the municipal operating budget, but not in what it can levy to pay for debt service. The NSB's primary means of receiving revenues from oil development is to borrow money for capital expenses and then levy taxes for debt service. Because of the tax structure, the NSB has had an obvious incentive to embed operating and maintenance type activities in capital projects (since debt for the former is limited, while debt for the latter is not). However, as the assessed value of oil and gas properties declines, bonding capacity is also expected to decline to the point that bond proceeds will not be sufficient to support capital commitments.

Future assessed values could be higher than current projections if industrial infrastructure e is built in the NSB. In the near term, a decline in tax revenues and bonding capacity is anticipated.

3.4.9.2 Employment

Figure 3-9 shows total employment on the North Slope from 1965 to 2005, including oil-industry workers at Prudhoe Bay. Before incorporation of the NSB in 1972, information on employment was limited to Barrow. In 1968, the Barrow area was expanded to include communities such as Anaktuvuk Pass and Wainwright, which accounts for the sharp rise in total employment from 777 individuals in 1967 to 2,218 in 1968. Between 1975 and 1980, employment estimates describe a wider area: the North Slope Division. The employment estimates shown are for 1980 to the present for the NSB.

Total employment for all industries on the North Slope increased during the following periods:

- 1974 to 1976 - coinciding with construction of the TAPS and Dalton Highway.
- 1980 to 1983 - coinciding with an increase in NSB-related construction projects.
- 1999 to 2001 - moderate growth in the mining and service sectors coinciding with the construction of the Alpine field and North Star facilities.

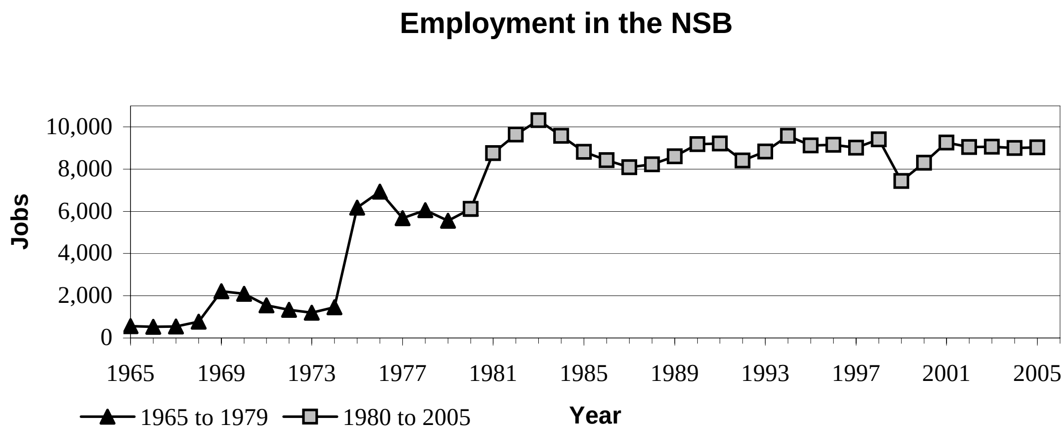
The sharpest declines in total employment occurred between 1983 and 1987 and between 1988 to 1989, as a result of declines in construction and mining sector jobs. Near-record employment losses occurred in 1999 when oil industry employment fell below the 8,000 level for the first time since 1983 because of the decline in oil prices from $19 a barrel in 1997 to $12.55 in 1998.

Employment rebounded by late 2000 and reached a 10-year high in 2001 because of the development of the Alpine and North Star oil fields. However, as work on these projects neared completion by late 2001, employment began to fall steeply, declining by 8%. By 2003, employment fell to levels as low as those seen in 1999 (Fried and Windisch-Cole 2003). Employment in the Borough increased slightly in 2005.

In 2004, nonresidents made up 28% of all workers in the oil industry in Alaska (Hadland 2006). Nonresidents earned $220.4 million or 26% of total oil industry wages in 2004. The earnings paid to nonresident workers in the oil and gas extraction and oilfield service industries was 24.9% and 28.2% of the total industry respectively. Slightly more than 1% of the NSB labor force was employed in the oil industry. That employment was considerably less than 1% of the total for the North Slope Oil industry (MMS 2006a).

Oil industry employment has a very narrow definition, and as a result, many of the thousands of jobs that service the oil and gas industry are not classified as oil industry employment. These jobs, which include catering, security, construction contracting, transportation, engineering, and other support services, account for 27% of the more than 6,000 jobs at Prudhoe Bay. According to the University of Alaska-Anchorage, almost 25% of all jobs in the state can be attributed to petroleum (Fried and Windisch-Cole, 2003).

As illustrated in Figure 3-9 and 3-10, the number of workers in the NSB is higher than the total population of the region. The North Slope has the highest concentration of oil industry workers in the state, accounting for nearly half of the North Slope's wage and salary employment. However, very few oil workers reside in the North Slope, a total of 23. Among Alaska residents working on the North Slope, according to Census 2000, 1,541 were residents of Anchorage, 813 were residents of the Mat-Su Borough, and 755 were residents of the Kenai Peninsula.



Note: Employment figures in the first data series (1965 to 1979) pertain to the Barrow-North Slope Division, while the figures in the second data series (1980 to 2005) pertain to the NSB. Source: ADOLWD 2006

Figure 3-9. Total Employment in the North Slope Region, 1965 to 2005

While Alaska produces 12.6% of the nation's oil, it does so with only 2.6% of the industry's U.S. workforce (EIA 2006). Larger fields do not necessarily need more workers than small fields. Economy of scale is one of the reasons for the state's relatively small workforce. Prudhoe Bay, the largest oil field in the nation, accounts for 45% of the North Slope's production. Kuparuk is the second largest field in Alaska, followed by the Alpine field near Nuiqsut. Because of their remoteness, many of Alaska's oil fields are considered marginal or noneconomic. These fields would be viable in a more populated, less remote environment.

Table 3.4-D. Estimated Number of Resident Jobs by Sector, North Slope Communities, 2003 Source: MMS 2006

Sector	Anatuvuk Pass	Atqasuk	Barrow	Kaktovik	Nuiqsut	Point Hope	Point Lay	Wainwright
Federal Government	1	0	45	1	0	10	2	2
State Government	2	0	22	0	1	0	1	0
City Government	12	1	21	3	5	14	2	8
NSB Government	51	20	464	27	29	44	24	48
NSB School District	30	20	194	21	27	62	29	44
NSB CIP	0	0	4	0	2	0	1	3
Oil industry	3	0	14	1	3	2	0	0
Private Construction	4	0	23	5	3	1	4	4
ASRC	3	0	69	5	3	1	4	3
Village Corporation	19	27	87	18	37	60	9	38
Finance	0	0	5	0	0	0	1	0

Sector	Anatuvuk Pass	Atqasuk	Barrow	Kaktovik	Nuiqsut	Point Hope	Point Lay	Wainwright
Transportation	0	0	48	0	1	3	1	1
Communications	0	0	8	0	0	0	0	0
Trade	0	1	27	0	0	2	0	1
Service	4	0	103	0	0	0	1	0
Ilisavik College	0	0	58	0	0	2	1	1
Other	2	3	132	3	10	25	5	18

Unemployment in the North Slope Borough

Figure 3-10 shows employment characteristics for residents of the NSB, including the size of the average annual labor force, and the number of individuals employed and unemployed. In 1990, the unemployment rate was 3.5% and the lowest rate in the last 25 years. Table 3.4-D shows where people were employed, by industry. The unemployment rate nearly tripled between 1990 and 2002, from an annual average of 3.5% in 1990 to an annual average of 9.6% in 2005. The increase in the unemployment rate, after 1998, can be attributed to layoffs in the petroleum industry and declines in NSB-related construction activities. Employment on the North Slope has not been particularly responsive to the price of oil.

In simple terms, unemployment rates are calculated by dividing the number of people looking for work by the total number of available workers in the labor force. Unemployment rates in the double digits usually indicate a depressed or stagnant economy, while a rate under 4% is considered full employment. However, there are limitations in interpreting this information, because no differentiation can be made between full-time and part-time jobs. In addition, it does not account for individuals who are underemployed or the discouraged worker who is involuntarily unemployed but has given up actively seeking employment. Some Alaska economists do not think that the discouraged-worker hypothesis applies to the NSB. In a mixed cash-subsistence economy, people who do not have cash jobs for part of the year may not take one if offered (USDOI BLM 2004c).

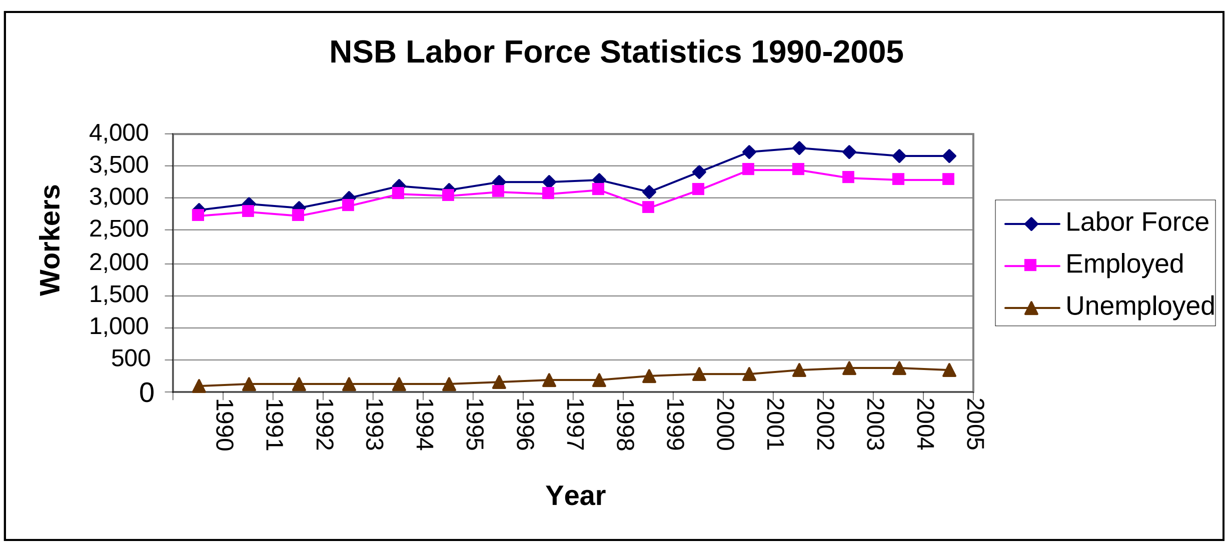


Figure 3-10. NSB Labor Force Statistics

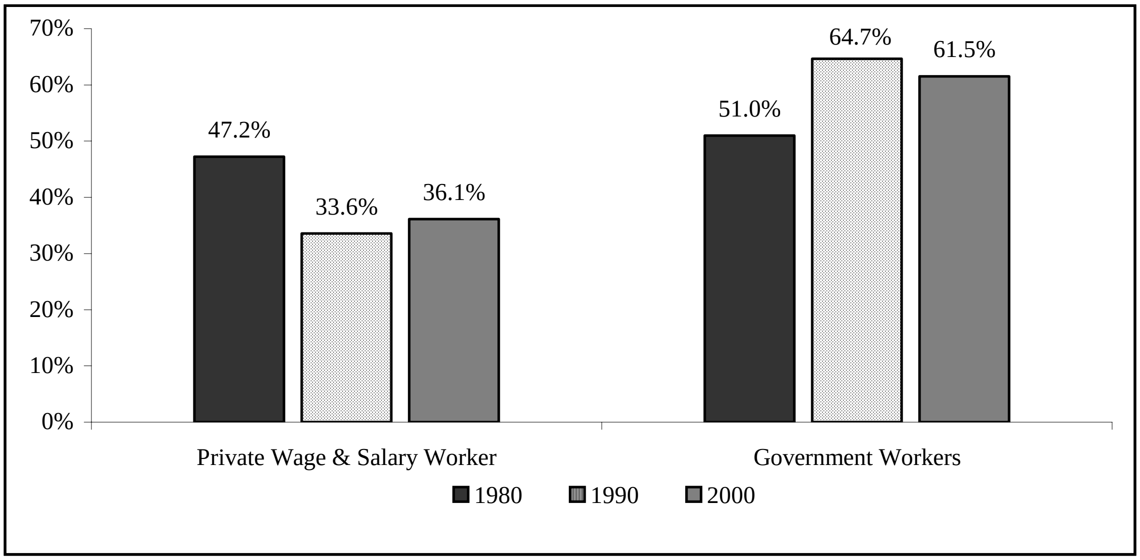


Figure 3-11. Share of Employment by Type of Worker, 1980, 1990, and 2000
Source: USDOC 1980, 1990, 2000

The North Slope Borough as Employer

A primary goal of the NSB has been to create employment opportunities for Alaska Native residents. The NSB has been successful in hiring large numbers of Alaska Natives for NSB construction projects and operations. As a result, the NSB government itself is viewed as the primary local industry. The NSB employs many permanent residents directly and finances construction projects under its Capital Improvement Program, which employs additional NSB residents. The NSB pay scales have been equal to, or better than, those in the oil and gas industry, while working conditions and the flexibility offered by the NSB are considered by Alaska Native employees to be superior to those in the oil and gas industry. In addition, NSB employment policies permit employees to take time off (particularly for subsistence hunting).

Figure 3-11 compares employment in the NSB's government sector with employment in NSB's private sector for 1980, 1990, and 2000, according to U.S. Census data. In 1980, the government sector supported 51% of resident employment; by 1990 this share increased to about 65%, and by 2000 it accounted for about 62% of the jobs. In contrast, the share of private sector jobs decreased, from 47% in 1980 to about 36% in 2000.

North Slope Oil Industry Employment of North Slope Borough Alaska Native Residents

Very few Alaska Native residents of the North Slope have been employed in oil-production facilities and associated work in and near Prudhoe Bay since production started in the late 1970s. This historical information has relevance when assessing the potential economic effects of proposed oil and gas exploration and development on the North Slope Native population. A study contracted by MMS showed that 34 North Slope Natives interviewed comprised half of all North Slope Natives who worked at Prudhoe Bay in 1992, and that the North Slope Natives employed at Prudhoe Bay comprised less than 1% of the 6,000 North Slope oil-industry workers

(Marshall 1993). This pattern is confirmed by data from 1998, which found that 10 NSB Iñupiat residents were employed in the oil industry that year.

Census data from 2000 supports the continuation of this finding (USDOC 2000). Table 3.4-F shows the percentage of workers aged 16 and older who worked in their place of residence. Almost 94% of workers living in Barrow worked in Barrow. One hundred percent of the workers living in Atqasuk worked in Atqasuk. Approximately 4% of workers in Nuiqsut, 7% of workers in Kaktovik, 13% in Wainwright, 13% in Point Hope, and 16% in Point Lay worked outside of their place of residence.

Arctic Slope Regional Corporation (ASRC) is a major employer on the North Slope and TransAlaska Pipeline System. ASRC employed 1,463 (2002) persons through their corporation and subsidiaries. Although the corporation's highest priority is shareholder hire, only 240 jobs were held by them, while 1,113 jobs were held by non-shareholder, non-native persons.

Table 3.4-E. Distribution of Employment of Arctic Slope Regional Corporation in the NSB and on the TAPS Pipeline

Company(Location)	Total	Shareholders	Shareholder Spouses	Other AK Natives	Other Native Americans	Other
ASCG (Barrow)	16	3	2	0	0	11
ASRC (Barrow)	40	36	1	0	0	3
PMC-Village Clean Water	61	37	7	1	0	16
BCTV (Barrow)	3	2	0	0	0	1
Eskimos, Inc	19	13	4	0	0	2
AK Petroleum Contractors (Prudhoe Bay)	1107	89	25	10	28	955
Houston Contracting Co. (APSC Pump Stations)	109	2	0	21	0	86
Houston Contracting Co. (Prudhoe Bay)	6	1	0	0	0	5
TRI-Ocean (Prudhoe Bay)	2	0	0	0	0	2
SKW/Eskimos (Barrow)	17	9	2	2	1	3
Villages JV	65	35	4	2	0	24
Top of the World Hotel (Barrow)	18	13	0	0	0	5
Total	1463	240	45	36	29	1113

Source: USDOI MMS 2006

The NSB is concerned that the oil industry has not done enough to accommodate training of unskilled laborers, or to accommodate their cultural and economic needs to participate in subsistence-hunting activities. The NSB also is concerned that the oil industry recruits employees using methods common to western industry, and would like to see serious attempts by industry to hire NSB residents (USDOI BLM 2004).

In response to this situation, BP Exploration – Alaska initiated the Itqanaiyagvik Program, a training partnership with ASRC, Illisagvik College, and the NSB School District with a purpose of creating career pathways into the oil industry for Alaska Natives. The program began in 1998 and enhances secondary and post-secondary programs through new curriculum, internships, and job-shadowing opportunities, and provides long-term education and training for professional and craft jobs.

Table 3.4-F. Place of Residence and Work

Place	Anaktuvuk Pass	Atqasuk	Barrow	Kaktovik	Nuiqsut	Point Hope	Point Lay CDP	Wainwright
Workers 16 years and over	100	66	1,881	111	165	228	89	190
Living in a place (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Worked in place of residence (%)	78.0	100.0	93.8	92.8	96.4	87.3	84.3	87.4
Worked outside place of residence (%)	22.0	0.0	6.2	7.2	3.6	12.7	15.7	12.6

Source USDOC 2000

The Nuiqsut Public Hearing for the Northwest IAP/EIS in March 2003 provided additional insight to the oil-industry's employment of NSB-resident Alaska Natives. It was noted that ConocoPhillips has partnered with ASRC in offering training programs for North Slope residents interested in oil field maintenance and heavy equipment maintenance. Twenty North Slope residents spent the summer of 2002 working and training in these areas. ConocoPhillips has worked closely with Kuukpik Corporation, ASRC, and other companies to hire and train Alaska Natives. ConocoPhillips, in cooperation with Kuukpik Corporation, sponsors mentoring and training at the Alpine field for North Slope residents (USDOI BLM 2004.). Kuukpik Corporation hosts job fair events in the community to support and recruit local hire (Chinn, 2007). As a result of current development of the Alpine field, Nuiqsut has received a number of economic benefits and employment opportunities, including the following:

- Contracts totaling approximately $250 million were awarded to Kuukpik (the Nuiqsut Village Corporation) and its joint-venture businesses. ConocoPhillips Alaska, Inc., currently has contracts with several Kuukpik Corporation joint ventures, including Nanuq (construction); Kuukpik/Arctic Catering (catering); CGG Vertitas (seismic); Kuukpik/LCMF (surveying); Kuukpik/Carlile (trucking), Kuukpik/Purcell (security), Kuukpik Drilling, and Northern Air Cargo. The Doyon Corporation is contracted for drilling services, and CCI is contracted for oil spill response services.
- As of June 2003, four Nuiqsut residents were working full-time in the Alpine field operations group and six full-time in the construction group.
- Seasonal work opportunities have been made available to residents of Nuiqsut and other communities in the area. During the first five months of 2003, ConocoPhillips Alaska, Inc., reported employing approximately 100 local residents, predominantly Iñupiat.

- Ongoing jobs are held by Nuiqsut residents, including one monitor for the ConocoPhillips Alaska, Inc., air quality/meteorology monitoring station in Nuiqsut; and two subsistence monitors (Chinn, 2007).
- Increased economic activity within Nuiqsut related to ongoing Alpine field operations includes increased occupancy at the Kuukpik Hotel, an office space lease from the city of Nuiqsut for the ConocoPhillips Alaska, Inc., and storage of ice road equipment.

Bernice Kaigelak has lived in Nuiqsut since resettlement in 1973 and has experienced many changes since then. She feels that ConocoPhillips has broken its promises for jobs at the Alpine field, and thinks that 3 or 4% of the 500 residents of Nuiqsut work at the Alpine field (USDOI BLM 2004). Eli Nakapigak agreed with Ms. Kaigelak's comments. He added that eight years ago, then Secretary of the Interior Bruce Babbitt and Alaska Governor Tony Knowles held a pubic hearing in Nuiqsut. They promised the village jobs as a result of allowing exploration and development in the planning area. At that time, Nuiqsut had 14% unemployment; today unemployment is nearly the same at 15%. Mr. Nakapigak wondered when promises to Nuiqsut will be kept (USDOI BLM 2004.)

Personal Income

Personal income is the income received by people from all sources: private sector and government wages, salary disbursements, other labor income, farm and nonfarm self-employment income, rental income, personal dividend income, personal interest income, and transfer payments. Per capita personal income is the annual total personal income of the residents of an area divided by their resident population. Per capita personal income can be a measure of economic well being because the amount of goods and services that people can afford is often directly related to their personal income.

Figure 3-12 shows annual per capita personal income (in 2000 dollars) for residents of the North Slope, compared to that of Alaska residents as a whole, for 1969 through 2004. Starting in 1984, the real per capita income in the region began to decline, recovering slightly from 1988 to 1989, and then declining again in 1992. Despite this overall decline in per capita income, North Slope residents have generally enjoyed higher real personal per capita incomes than the statewide average. On the other hand, the statewide average real per capita income has been more stable than that of the North Slope. This is to be expected, as regional economies that are not highly diversified tend to be more sensitive to internal and external economic changes.

While per capita personal and household income are high, the cost of living in the region may be the highest in the nation. Any discussion of the "economic well-being" of residents of the North Slope should take into consideration that the high cost of living offsets the higher income levels earned. In 2003, a typical market basket in Barrow cost 93% more than in Anchorage. The cost difference in the market basket, in consumer goods, and construction materials is the result of high transportation cost.

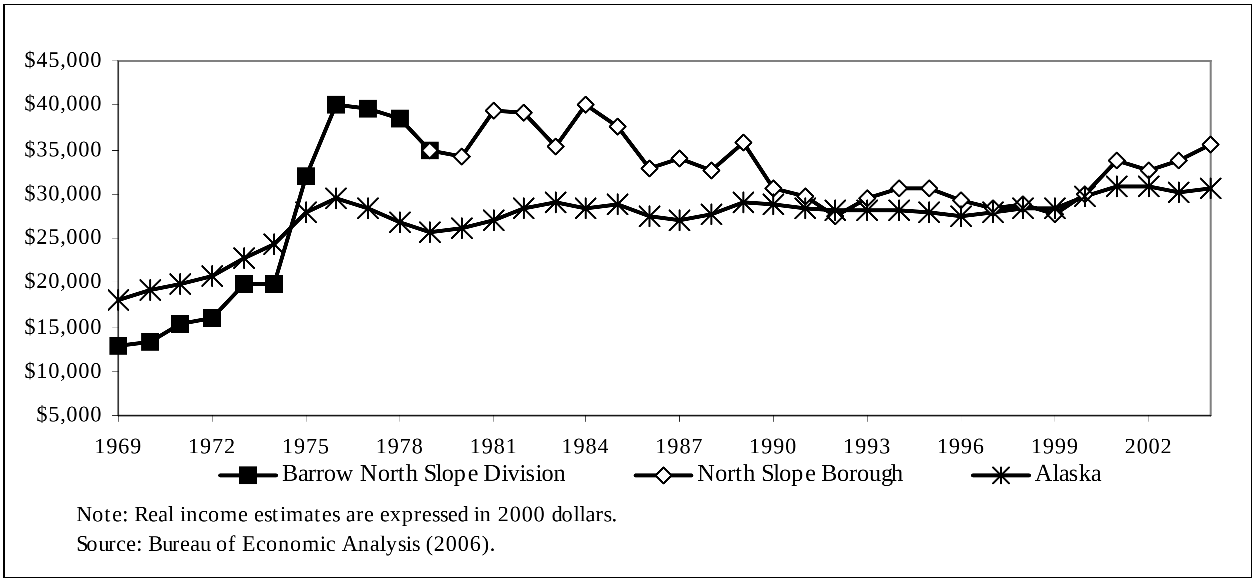


Figure 3-12. Per Capita Real Personal Income, Barrow-North Slope Division, North Slope Borough, and Alaska, 1969 to 2004.

Village Profiles

Data used in the following village profiles was taken largely from the North Slope Borough 2003 Economic Profile and Census Report, prepared by Carl E. Shepro and David Maas, et al. of Circumpolar Research Associates, for the North Slope Borough, July, 2004. The village profiles are based upon surveys conducted in 2003, a continuation of household surveys commissioned by the Borough in the past. Census 2000 data, and in some cases various State of Alaska data is used where survey data is lacking, or for the purpose of comparison.

Barrow is a first class city under Alaskan law, allowing the power of taxation, although unused. The population of 4,429 in 2003 has recently trended downward. It is 61.3% Iñupiat, with approximately 20% of the population speaking the Native language fluently. Barrow is a hub and economic center of the North Slope Borough.

The primary private employer Arctic Slope Regional Corporation, and subsidiaries employ 5.2% of the workforce providing services to oil field operations. Borough, state, and Federal agencies provide 57% of total employment. The midnight sun attracts tourists, and arts and crafts provide cash income. Seven residents hold commercial fishing permits. Fourteen oil and gas industry jobs on the North Slope are held by Barrow residents. In 2003, total full time employment was 1,461; temporary, seasonal, or part-time employment was 456; and 460 workers were unemployed. Shepro and Maas (2003) reported a 19.4% unemployment rate. The labor force participation rate, including all people working or looking for work, was 54.1% in 2003.

The Shepro and Maas census did not collect income data for the town of Barrow. Census 2000 reports Barrow per capita income at $22,902, and household income $67,097. The reader may refer to Figure 3-12 for comparison of North Slope Borough and Alaska per capita income. The U.S. Census also reported 73 households in Barrow or 8.6% at the poverty level.

Subsistence activities are important to Barrow residents, as indicated in the Subsistence Section of this report. Shepro and Mass surveyed 492 households in 2003. Their findings showed an average of $3,787 for each household on an annual basis. (Shepro and Mass 2004)

Anaktuvuk Pass is a remote Brooks Range village. There are no taxes levied by the village which has status as a 2nd class city, providing the power of taxation. The population of 346 in 2003 has recently trended downward. It is 88.3% Iñupiat, with approximately 17% of the population speaking the Native language fluently.

Economic and employment opportunities are limited in Anaktuvuk Pass, due to its isolation. Hunting and trapping for skins and hides, guiding hunters, and making traditional caribou skin masks or clothing provide income. Some residents have seasonal employment outside of the community. The North Slope Borough including its school district is the largest employer. Government employment totaled 73 of 99 workers in the village in 2003. Arctic Slope Regional Corporation, and subsidiaries employed 3 persons providing services to oil field operations. Three oil and gas industry jobs on the North Slope were held by local residents. In 2003 total full time employment was 59; temporary, seasonal, or part-time employment was 64; and 34 workers were unemployed. Shepro and Maas (2003) reported a 20.1% unemployment rate.

The Shepro and Maas census reported per capita income as $11,437 and household income as $40549 in 2003. Census 2000 reports per capita income at $15,283, and household income $52,500. The reader may refer to Figure 3-12 for comparison of North Slope Borough and Alaska per capita income. Shepro and Maas reported 29 of 77 households are below the federally–established poverty level. The U.S. Census also reported 2 households in Anaktuvuk or 3.2% at the poverty level.

Subsistence activities are important to Barrow residents, as indicated in the Subsistence Section of this report. Shepro and Mass surveyed 63 households in 2003. Their findings showed an average of $2,868 for each household on an annual basis. (Shepro and Mass 2004)

Atqasuk is a remote village on the west central North Slope. There are no taxes levied by the village which has status as a 2nd class city, providing the power of taxation. The population of 250 in 2003 has recently been stable. It is 91.4% Iñupiat, with approximately 22% of the population speaking the Native language fluently.

Education and other government services provide the majority of full-time employment in Atqasuk. Subsistence activities provide food sources. Residents trap and sell furs to supplement cash income. Air travel provides the only year-round access, while land transportation provides seasonal access.

The North Slope Borough including its school district is the largest employer. Government employment totaled 41 of 72 workers in the village in 2003. No residents held jobs with either Arctic Slope Regional Corporation or the oil and gas industry job on North Slope. In 2003, total full-time employment was 51; temporary, seasonal, or part-time employment was 21; and 13 workers were unemployed. Shepro and Mass reported 14.8% unemployment in 2003. The labor force participation rate, including all people working or looking for work, was 47.8% in 2003.

The Shepro and Maas census reported per capita income as $29,036 and household income as $59,833 in 2003. Census 2000 reports per capita income at $14,732 and household income $66,607. The reader may refer to Figure 3-12 for comparison of North Slope Borough and Alaska per capita income. Shepro and Maas reported 29 of 77 households are below the federally–established poverty level. The U.S. Census also reported 2 households in Anaktuvuk or 3.2% at the poverty level.

Subsistence activities are important to Barrow residents, as indicated in the Subsistence Section of this report. Shepro and Mass surveyed 63 households in 2003. Their findings showed an average of $2,868 for each household on an annual basis (Shepro and Mass 2004).

Nuiqsut is a remote village near the Colville River. There are no taxes levied by the village which has status as a 2nd class city, providing the power of taxation. The population of 416 in 2003 has recently been stable. It is 92% Iñupiat, with approximately 29% of the population speaking the native language fluently.

Education and other government services provide the majority of full-time employment in Nuiqsut. Subsistence activities provide food sources. Residents trap and sell furs to supplement cash income. Air travel provides the only year-round access, while land transportation provides seasonal access.

The Kuukpik Native Corporation and the North Slope Borough including its school district are the largest employers. Government employment, including part-time or temporary, totaled 44 of 98 workers in the village in 2003. Arctic Slope Regional Corporation and subsidiaries employed 3 persons providing services to oil field operations. Three oil and gas industry jobs on North Slope were held by local residents. In 2003 total full-time employment was 74; temporary, seasonal, or part-time employment was 56; and 33 workers were unemployed. Shepro and Mass reported unemployment of 17%. The labor force participation rate, including all people working or looking for work, was 79.5% in 2003.

The Shepro and Maas census reported per capita income as $13,633 and household income as $59,907 in 2003. Census 2000 reports per capita income at $14,876 and household income $48,036. The reader may refer to Figure 3-12 for comparison of North Slope Borough and Alaska per capita income. Shepro and Maas reported 18.4% of households are below the federally–established poverty level. The U.S. Census also reported 3 households in or 3.2% at the poverty level.

Subsistence activities are important to local residents, as indicated in the Subsistence Section of this report. Shepro and Mass surveyed 50 households in 2003. Their findings showed an average of $6,704 for each household on an annual basis (Shepro and Mass 2004).

Economic opportunities in **Wainwright** are influenced by its proximity to Barrow and the fact that it is one of the older, more established villages. Air travel provides the only year-round access, while land transportation provides seasonal access. There are no taxes levied by the village which has status as a 2nd class city, providing the power of taxation. The population of 556 in 2003 has recently trended lower. It is 93.6% Iñupiat, with approximately 69% of the population speaking the native language fluently.

Education and other government services provide the majority of full-time employment in Wainwright.

Most year-round positions are in borough services. Residents trap and sell furs to supplement cash income, and sale of local Eskimo arts and crafts supplement income, but the North Slope Borough including its school district is the largest employers. Government employment totaled 105 of 264 workers in the village in 2003. Arctic Slope Regional Corporation and subsidiaries employed 3 persons providing services to oil field operations. No oil and gas industry job on North Slope is held by a local resident. In 2003 total full-time employment was 105; temporary, seasonal, or part-time employment was 70; and 46 workers were unemployed. Shepro and Mass reported a 17.4% unemployment rate. The labor force participation rate, including all people working or looking for work, was 67.8% in 2003.

The Shepro and Maas census reported per capita income as $13,633 and household income as $59,907 in 2003. Census 2000 reports per capita income at $16,710 and household income $54,722. The reader may refer to Figure 3-12 for comparison of North Slope Borough and Alaska per capita income. Shepro and Maas reported 18.4% of households are below the federally–established poverty level. The U.S. Census also reported 10 households in or 8.5% at the poverty level.

Subsistence activities are important to local residents, as indicated in the Subsistence Section of this report. Shepro and Mass surveyed 50 households in 2003. Their findings showed an average of $4,504 for each household on an annual basis (Shepro and Mass 2004).

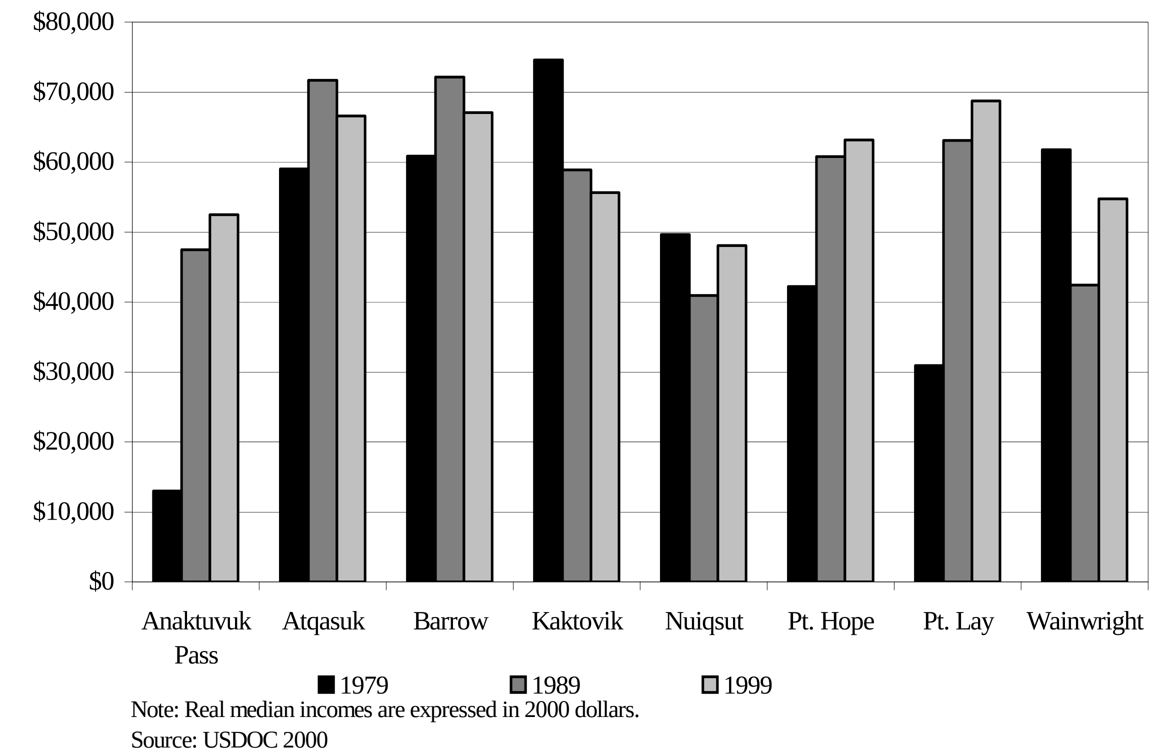


Figure 3-13. Real Median Household Income in North Slope Borough Communities, 1979, 1989, and 1999

3.4.9.3 State Revenue

The state receives revenues from oil and gas activities in the NPR-A, but these revenues are treated differently than those from other state or Federal lands. Federal law designating the NPR-A in 1980 established a requirement that 50% of lease sale revenues, royalties, and other revenues be paid to the State of Alaska (42 USC § 6506a), and the other 50% be paid to the

General Fund of the U.S. Treasury. The 50% distribution does not apply to severance, property, and conservation taxes that are levied by the state. The NPR-A monies paid to the state are to be used for: 1) planning, 2) construction, maintenance, and operation of essential public facilities, and 3) other necessary provision of public service by subdivisions of the state most severely impacted by development of oil and gas leased under the section (ADCCED 2006). The state began receiving these monies in 1983.

The state generally receives income from oil and gas leases twice a year and makes these funds available as grants to eligible municipalities in the following state fiscal year. The state places these revenues in the National Petroleum Reserve – Alaska Special Revenue Fund (AS 37.05.530). The ADEC administers the fund and grants under the National Petroleum Reserve – Alaska Impact Mitigation Program (19 AAC § 50). Funds not issued as grants by the end of each fiscal year are distributed in the following manner: 50% to the Permanent Fund, 0.5% to the Public School Fund, and 49.5% to the General Fund.

Municipalities may apply for grants each year for planning, construction, and maintenance of essential public facilities or for provision of other necessary public services, by demonstrating present or future impact from oil and gas exploration, production, or transportation and by meeting certain eligibility requirements (19 AAC § 50.050).

From 1987 to 1998, over $10 million was awarded by the State of Alaska in the National Petroleum Reserve – Alaska Impact Mitigation Program. From FY 1999 through 2005, an additional $83.6 million was awarded to North Slope communities under the program. (ADCDCA 2006). In the past 3 years, these funds were used to pay administrative salaries; build and maintain facilities in North Slope communities; upgrade equipment; conduct fish, waterfowl, gull, fox, and caribou surveys; monitor subsistence harvest; assess the impacts to fish from hydrocarbons; and provide health care training and education. Specific projects funded by the program are listed in the ADCCED report cited earlier.

Capital projects for communities in the NSB may also be found on the Department of Community and Economic Development Rural Alaska Project Identification and Delivery System Database at http://www.dced.state.ak.us/cbd/commdb/CF RAPIDS.htm.

In Barrow, $42 million of National Petroleum Reserve – Alaska grant money has funded 58 projects during this period. Atqasuk has received approximately $1.2 million in funding for eight projects from 1993 through 2004. The state also receives monies for oil and gas activities from the BLM and MMS. Between FYs 1948 and 2002, the BLM and MMS distributed almost $426.8 million to Alaska from Federal onshore leases.

When the Federal government offers tracts of land for lease in the NPR-A, BLM provides public notice that funding may become available for National Petroleum Reserve – Alaska Impact Mitigation grants, and requests communities to submit project proposals through grant applications. The 1999 Lease Sale in the planning area produced $38.6 million in bonus bids and approximately $1.7 million annually in rentals due to the state. The Federal government has transferred all but $3 million of these funds to the state. The $3 million is in escrow pending Kuukpik Village Corporation land selections in the planning area. The Federal government estimates future annual rentals due to the state from the 1999 Northeast NPR-A Lease Sale to be $2 million.

In 2002, BLM awarded leases on approximately 60 tracts in the Northeast NPR-A totaling 579,269 acres. BLM estimates the initial lease fees to be $63.8 million. The lease sale produced $31.9 million in bonus bids due to the state.

3.4.9.4 Federal Revenues

The 1999 Lease Sale in the planning area resulted in $38.6 million in first year bonus bids and $1.7 million in first year rentals for the Federal government. The Federal government estimates future annual rentals due to the Federal government from the 1999 Northeast NPR-A lease sale to be $2 million. The 2002 Lease Sale in the planning area resulted in $31.9 million in first-year bonus bids for the Federal government.

3.4.10 Public Health

This section will summarize the current health status of the North Slope Iñupiat, the changes which have taken place over the past 50 years, and the important determinants of public health in the North Slope communities.

North Slope residents, the NSB, the Alaska Inter-Tribal council, the Iñupiat Community of the Arctic Slope, the EPA, and the National Research Council have advocated strongly for the inclusion of a more systematic appraisal of human health concerns in the IAP/EIS process (National Research Council 2003). The NSB has stated that this concern is more pressing now because of the recent rapid increase in lease offerings, and the unanticipated interest in offshore leasing in the Chukchi Sea. In response to this concern and in cooperation with interested stakeholders, we have added an analysis of human health concerns to this IAP/EIS.

For the analysis of public health we have chosen a definition of “health” from the World Health Organization. This is perhaps the most widely quoted definition in common usage in the field of public health:

A State of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity.”(World Health Organization 1946).

The disease and mortality figures discussed in this IAP/EIS are age-adjusted unless otherwise specified.

3.4.10.1 General Health Status

The past 50 years have witnessed profound changes in AI/AN health status. Since 1950 the overall health of Alaska Natives including the North Slope Iñupiat – as measured by indicators including infant mortality, age-adjusted overall mortality, and life expectancy at birth – has improved significantly. However, over the same time period cancer, chronic diseases (such as diabetes, hypertension, and asthma), and social pathology have increased. Regional data available since 1979 suggest that more recent general trends in health status in the North Slope mirror statewide trends.

Much of the improvement in general mortality and life expectancy is attributed to decreased rates of infectious diseases such as tuberculosis. Until the 1950s, infectious disease was the leading cause of mortality in this population, with tuberculosis causing over 45% of deaths (Lanier et al. 2002; Day et al. 2006). A study in 1989 revealed that the proportion of deaths caused by infectious diseases had fallen to 1.3% (Bjerregaard, Young et al 2004). Infant mortality, an indicator of overall population health, was at nearly 90/100,000 in 1960 (compared with 25/100,000 in the general U.S. population.); by 1970 it had already fallen to 26 per 100,000, and as of 2000 stood at 9.5 per 100,000, compared with 7/100,000 for the U.S. population (Goldsmith et al. 2004). Life expectancy at birth for Alaska Natives was only 46.6 years in 1950, and has climbed to 69.5 years as of 1998 (Goldsmith et al 2004).

The most rapid improvement in general health indicators occurred in the 1950s and 1960s, corresponding with the initiation of the first comprehensive public health strategies for the control of TB and other infectious diseases. As gauged by overall mortality and life expectancy, health status on the North Slope has continued to improve. Since 1979, all-cause mortality has declined roughly 20% (Goldsmith 2004; Bjerregaard, Young et al 2004; Day et al 2006).

Early improvements in public health were facilitated by a combination of region-wide increases in general socio-economic status (a powerful determinant of health); improved housing, sanitation, and health care; and specific infection control efforts. Since 1979, much of the continued improvement in mortality figures can be accounted for by decreasing mortality from unintentional injuries, the second leading cause of death in Alaska Natives, with a decline of roughly 40% between 1979 and 1998. Much of this change can be attributed to local health departments' injury prevention programs and the efficacy of local alcohol control and local prohibition ordinances (Lanier et al. 2002; Goldsmith et al. 2004).

But despite these improvements in overall mortality figures, significant disparities remain in terms of overall health status, and cancer, social pathology, and chronic diseases are rapidly increasing. Health disparities in between Alaska Natives and American Indians and the general U.S. population constitute one of the top priorities in current public health efforts. Life expectancy at birth for Alaska Natives remains significantly lower than for the general population (69 compared with 76 years.) Since 1979, Alaska Native mortality rates remain roughly 1.3 higher than the U.S. population, and on the North Slope, overall mortality rates are roughly 1.5 times higher than the U.S. population. Rates of assault, domestic violence, and unintentional and intentional (homicide and suicide) injury and death in the North Slope remain far higher than in the general U.S. population, despite the improvements noted above in unintentional injuries (Lanier et al. 2002; Day et al. 2006; Goldsmith et al 2004; U.S. Department of Health and Social Services 2006).

Public testimony on prior EISs in the North Slope region has indicated a persistent concern that regional industrialization may be at the root of some of the public health disparities described above. For example, testifying in 2001 on the MMS' Liberty DEIS, Rosemary Ahtuangaruak, a former health aide who received advanced training as a physician's assistant, stated:
Increased incidents of community social ills associated with rapid technological and social change cause problems with truancy, vandalism, burglary, child abuse, domestic violence, alcohol and drug abuse, suicide, and primarily the loss of self-esteem. This has materialized during transient employment cycles. The influx of construction workers bring their own problems to a village impacted by oil development activities already. Historically, from past experience, we know that the incidents of alcohol and drug use increase dramatically (USDOI MMS 2001).

Similarly, then North Slope Borough Mayor George Ahmaogak noted that:

"The benefits of oil development are clear — I don't deny that for a moment. The negative impacts are more subtle. They're also more widespread and more costly than most people realize. We know the human impacts of development are significant and long-term. So far, we've been left to deal with them on our own. They show up in our health statistics, alcohol treatment programs, emergency service needs, police responses –you name it." (Ahmaogak 2004).

These issues are discussed in more detail in the following section.

3.4.10.2 Patterns of Illness

To understand the evolution of Iñupiat health status and the reasons behind the present-day disparities in general health indicators, it is useful to examine the prevalent health issues among the North Slope Iñupiat communities individually. Please see Table 3.4-G for a summary of recent disease rates for the North Slope, in the comparison with other Alaska regions and the general U.S. population.

Cancer

Both the incidence and the mortality rates for cancer have increased roughly 50% since 1969, and cancer is now the leading cause of death on the North Slope. Three cancers – breast, colon, and lung – account for much of the overall increase. By a small margin, North Slope Alaska Natives have the highest incidence of cancer in Alaska, at 579/100,000, compared with 461/100,000 for the general U.S. population. Cancer mortality rates for Alaska Natives as a whole are also significantly higher than the US. This trend holds true in the North Slope region, where mortality from cancer is 303/100,000 on the North Slope, compared with 163/100,000 in the US population. This is a disparity of great concern to health care providers in the state (Lanier et al 2002; Day et al. 2006; Goldsmith et al. 2004; Lanier, Kelly et al 2003).

A substantial percentage of the increase in lung cancer, and possibly breast and colon cancer to a lesser extent, may be attributable to smoking, although no studies have demonstrated this definitively (Day et al 2006). The disparate mortality rates are less well understood.

The possible contribution of environmental factors such as contaminants in subsistence resources is of great concern to local residents, but there are no data to substantiate or refute this concern conclusively. Current public health efforts focus on smoking cessation efforts, early detection, as well as surveillance of carcinogens in subsistence foods, and curtailing exposure to known carcinogenic compounds as much as possible.

Psychological and Social Problems

Social and psychological problems – including alcohol and drug problems, unintentional and intentional injury (a high percentage of which are associated with alcohol use), depression, anxiety, and assault and domestic violence – are now highly prevalent on the North Slope (as they are in many rural Alaska Native and Arctic Inuit villages in Canada and Greenland) and cause a disproportionate burden of suffering and mortality for these communities. Suicide, which was historically rare, has undergone dramatic shifts. Overall suicide rates have increased markedly since 1960 (Kraus and Buffler 1976, Hicks and Bjerregaard 2006), and the prevalence of suicide on the North Slope in recent years has been estimated at roughly 45/100,000, more than four times the rate in the general U.S. population (Alaska Department of Vital Statistics 2006.). Before 1960, suicide was exceedingly rare, and had been thought to occur primarily among elderly individuals. Since then, suicide has not only increased in frequency, it has undergone a complete demographic shift, and is now a phenomenon confined primarily to youth. The rate of suicide among young Iñupiat men in the Alaskan Arctic has been documented as high as 185/100,000, nearly 16 times the national rate (Wexler 2006). Domestic violence and child abuse are also now generally acknowledged as epidemic problems in rural Alaskan and, internationally, in other Arctic indigenous communities as well. Arrest data from the U.S. Department of Health and Social Services in 2000-2003, for example, show rates of rape and assault on the North Slope from 8-15 times the national rate (U.S. Department of Health and Human Services 2006). Homicide rates have dropped more than 50% since 1979, but remain markedly higher than the U.S. white population. Alcohol and substance abuse are thought to contribute substantially to rates of these problems (Lanier et al 2002, Day et al 2006; ANTHC 2006).

Research in circumpolar Inuit societies suggests that social pathology and related health problems, which are common across the Arctic, relate directly to the rapid socio-cultural changes that have occurred over the same time period (Bjerregaard and Young 2004; Curtis and Kvernmo 2005; Goldsmith 2004).

Injury Rates

Injury – including unintentional (or accidental) injury, suicide, assault, and homicide – is the second leading cause of death in the North Slope. Unintentional injury mortality has declined 43% since 1979, but mortality from unintentional injury remains 3 ½ times more common for Alaska Natives than U.S. whites (Lanier et al 2002, Day et al 2006). As discussed above, suicide rates increased dramatically in the 1960s-1970s, and since 1979 have remained relatively constant and dramatically higher than the overall U.S. rates. Injury is the second leading reason for hospitalization after childbirth. Figures from the Alaska Trauma Registry indicated that the hospitalization rate for injuries on the North Slope was the highest in the state, at 141/10,000 residents, and over twice the state average. Alcohol has been estimated to be involved in up to 40% of injuries and traumatic deaths in Alaska Natives (ANTHC 2006).

Injury rates are sensitive indicators of social strain in villages. Unintentional injury rates are high in the North Slope not only because of the challenges of life in Arctic Alaska, but also because of factors such as high rates of alcohol and substance abuse, and risk-taking behavior in youth (ANTHC 2006). Many health care professionals in the region have speculated, in fact, that the high rates of "accidental" injuries in younger people may actually reflect abnormal risk-taking behavior related to latent suicidality.

Diabetes and Metabolic Diseases

Diabetes, obesity, and related metabolic disorders were previously rare or non-existent in the Iñupiat. Diabetes rates in the North Slope are low compared with other Alaska Native groups – and extremely low compared with all American Indians – but have begun to climb quite rapidly (Murphy, Schraer et al 1995; ANMC Diabetes Program). The prevalence of diabetes in the North Slope is estimated at only 2.4% compared with the U.S. rate of roughly 7%. However, between 1990 and 2001, the rate of diabetes climbed roughly 110%, nearly 3 times the rate of increase in the general U.S. population (ANMC Diabetes Program). Subsistence diets and the associated active lifestyle are known to be the main protective factors against diabetes. The increase in diabetes is felt to reflect increased use of store-bought food, and a more sedentary lifestyle, potentially against the backdrop of a baseline genetic susceptibility (Murphy, Schraer et al 1995; Naylor, Schraer et al 2003; Ebbesson, Kennish et al 1999).

Cardiovascular Disease

Cardiovascular disease rates, the second leading cause of death in Alaska, are significantly lower in Alaska Natives than in U.S. non-natives. In the North Slope, recent mortality figures show death rates roughly 10% less than the U.S. population (Day et al 2006). However, as discussed under “diabetes and metabolic diseases,” many of the risk factors are increasing, and smoking rates are already extremely high (Wells 2004). As in the case of diabetes, many public health researchers have explained the lower mortality from cardiovascular disease as stemming primarily from subsistence diets.

Chronic Pulmonary Disease

Chronic pulmonary disease mortality rates in Alaska Natives have climbed 192% since 1979. North Slope residents have the highest mortality in the State from chronic lung diseases, at nearly 3 times the mortality rate for the U.S. (130/100,000 compared with 45/100,000) (Day et al 2006). The disparate rates of increase and mortality from pulmonary disease are accompanied by high smoking rates, which many public health experts believe to be the primary explanation. Because there are no available data on local fine particulate concentrations, no data on hazardous air pollutants, no data on indoor air quality, and little data on intra-regional variation in other EPA criteria pollutants, it is impossible to estimate the possible contribution of environmental factors.

Table 3.4-G. Age-Adjusted Alaska Native Mortality Rates* by Service Region and U.S. 1999-2003, Both Genders Combined

Cause of Death	Barrow	Alaska Natives	Anchorage	Bristol Bay	Interior	Kotzebue	Mount Edgecumbe	Norton Sound	Yukon-Kuskokwim	U.S. all races
Cancer	303.7	245.4	370.2	285.1	222.4	246.3	277.7	275.6	258.9	195.7
Cerebrovascular Disease	78.9	64.4	115.5	97.7	58.8	80.4	80.9	59.5	57.4	57.7
Chronic Obstructive Pulmonary	130	67.8	123.3	73.2	60.4	49.8	53.3	70.5	67.4	43.9
Heart Disease	220.9	211.4	338.1	189.9	186.6	187.8	290.9	185.2	190.9	248
Suicide	35.6	36.3	32.8	-	66.9	88.6	11.6	88.8	44.5	10.7
Unintentional Injuries	112.3	116.1	118	180	132.8	125	58.6	140.5	119.6	36
Total - All Causes	1241.5	1133.4	1690.4	1124.1	1097.1	1029.6	1193.5	1234.8	1089.1	853.2

(-) Rates not calculated for fewer than 5 deaths; * Rates per 100,000; ** Data provided for all villages in service region, named for the town where clinical services are centered.
Data Source: Day, G, Provost, EM, Lanier AP. Alaska Native Mortality Update, December 2006.
US Data Source: SEER Stat

3.4.10.3 Determinants of Health

In recent years the field of public health has devoted much effort to the challenge of understanding and addressing health disparities between ethnic groups and social classes. The fact that health disparities tend to accrue predominantly in minority and low-income populations is an indication of the vulnerability of these groups to outside societal-level influences on health status.

An impressive body of data has demonstrated a direct association between measurable societal factors which have been collectively termed the "social determinants of health" (SDH) and disparate incidence, prevalence, and mortality rates for most diseases. The effects of the SDH on disparate rates of disease often persist even after controlling for standard risk factors such as smoking rates, cholesterol and blood pressure levels, and overall poverty. The SDH include factors such as income inequity within a society, the "social gradient" (or disparities of social class), stress, social exclusion, decreasing social capital (the social support networks which provide for needs within a group or community), unemployment, cultural integrity, and environmental quality. The World Health Organization provides an excellent review of the data regarding the importance of the SDH to the health status of populations (Wilkinson and Marmot, 2003), and much of the current focus within the U.S. Centers for Disease Control is on addressing health disparities through the determinants of health framework (see U.S. CDC Social Determinants of Health Working Group, online at http://www.cdc.gov/sdoh/).

The determinants of health status in North Slope Iñupiat communities are complex, and reflect a wide array of considerations, including genetic susceptibility, behavioral change, environmental factors, diet, and socio-cultural inputs. The identification of potential influences on, or "determinants," of health status is an essential step for public health programs seeking to address health disparities. With regard to oil and gas development, state, regional, and village-specific influences on health and health behavior can be identified.

At the statewide level, for example, the modernization and socio-economic change common to all of rural Alaska in the last 30 years are important influences on the evolution of health status through their effects on factors such as infrastructure, housing quality, family income, employment status, culture change, and availability of health care.

At the regional level differences exist between, for example, the NSB and other rural areas such as the NWAB in terms of family income and employment status, largely related to oil and gas revenues and employment opportunity. Again, these factors have well-recognized and often positive implications for human health. For example, one study noted higher suicide rates in the NWAB compared with the NSB over the study period (1970s), and concluded that this difference was linked to a period of economic depression and job loss in the NWAB at that time (Travis 1984).

Similarly, village-specific differences between communities may be identified as well. For example, alcohol prohibition, which has been demonstrated to reduce rates of suicide, homicide, and other social pathology, is present in the villages in the North Slope with the exception of Barrow, which allows importation but not sale of alcohol. Some residents of Nuiqsut, however, have observed that illegal importation of drugs and alcohol were facilitated by the ice road which connects Nuiqsut with the Alaskan road system (USDOI MMS 2001). Recognizing this as a potential problem, CPAI worked with community leaders to implement random searches of vehicles traveling the ice road. Although there are insufficient data to conclude whether this has caused health problems or aggravated social pathology, one report by the Alaska Criminal

Justice Council found that the rates of social service reports and arrests was higher in Nuiqsut than in most other villages in the region (Alaska Criminal Justice Council 2002). Nuiqsut residents also point to village-level socio-economic changes not limited to those provided by increased revenue from NSB oil tax revenue, but also deriving from local social and economic inputs from the Alpine oilfield, including shifts in the distribution of wealth secondary to Kuukpik corporation profits, oilfield-related employment, increased presence of oil workers in the village, the seasonal ice road connecting Nuiqsut with the road system in Alaska, and changes in hunting patterns and availability of game secondary to oil infrastructure (Galginaitis, personal communication). Few data exist to support or deny resident concerns regarding degradation of environmental quality and local health impacts, but in general, the field of public health addresses this concern through efforts to control exposure to environmental contaminants rather than through responding to specific increases in disease rates related to a known exposure.

Global warming has recently begun to be recognized as a rapidly evolving determinant of health status in the Arctic as well. A recent comprehensive, multidisciplinary review summarized the current and potential future impacts on human health in the Arctic from global warming. These effects include the emergence of new infectious diseases and spread of infections previously limited to temperate regions; increases in heat-induced illness and injury and decreases in cold-related problems; large-scale changes in the availability and nutritional value of subsistence resources leading to dietary and cultural change; permafrost melting and increasingly severe storms leading to large-scale erosion problems in towns, degraded infrastructure, and contaminated water supply; and rapid acculturation and cultural change (ACIA 2005). Many of these changes have already been observed and continue to evolve in the North Slope. For example, many villages are facing erosion problems and at least two are actively planning to relocate; and warming weather has resulted in less reliable ice conditions and higher risk to hunters and spring whalers. These changes will likely continue, and oil and gas development must be viewed within the context of an environment in which the baseline conditions are changing rapidly.

3.4.10.4 Summary

In summary, the health status of the North Slope Iñupiat people has improved significantly since the 1950s. However, this era has also witnessed the emergence of significant new diseases, most importantly cancer, cardiovascular and metabolic problems, social pathology, and health disparities.

While data generally does not exist to allow the direct attribution of a percentage of the burden of a particular illness to a specific development project, a consideration of regional health data and accepted mechanisms of health and disease will allow recognition of important risks associated with a project, and the development of effective mitigation strategies.