# Bering Straits Coastal Resource Service Area
# Coastal Management Plan

## Public Review Draft
### June 2005

## Chapter 6: Resource Inventory and Analysis

## 6.1 Introduction

This chapter updates the previous resource inventories and analyses and describes areas designated by the Bering Straits Coastal Resource Service Area (CRSA). New information has been added to the resource inventory and analysis, including scientific and local knowledge.

The Bering Straits CRSA establishes a number of designated areas in this plan revision. New restrictions in the ACMP regulations adopted in 2004 require that districts designate areas in order to establish enforceable policies for certain subjects. This plan revision establishes area designations for subsistence, historic and archaeological resources, natural hazards, and important habitats under provisions in 11 AAC 114.250. While the designations address certain subjects, this does not mean that a designated area must be used exclusively for those purposes, and many areas have multiple designations.

This chapter supplements the previous resource inventory and analysis. The primary purpose of this supplement is to provide backup for areas designated under 11 AAC 114.250 and for the enforceable policies in Chapter 4 (11 AAC 114.270). In addition, this chapter provides new scientific information and local and traditional knowledge.

The resource inventory describes coastal resources and uses. The resource analysis provides information about sensitive areas, conflicts among uses and why an issue is a unique concern to the CRSA. Designated areas are also described in this chapter, and Chapter 7 provides more in-depth information about these areas.

The previous resource inventory and analysis was presented in two separate volumes. This plan revision updates information for both the resource inventory and analysis by topic. This approach will allow the reader to obtain all the information about a particular subject in one place. For each subject area, area designations are discussed first followed by updates to the resource inventory and analysis.

The Bering Straits CRSA has 17 communities: Brevig Mission, Diomede, Elim, Gambell, Golovin, Koyuk, Mary's Igloo, St. Michael, Savoonga, Shaktoolik, Shishmaref, Solomon, Stebbins, Teller, Unalakleet, Wales, and White Mountain. Nome is surrounded by the Bering Straits CRSA, but it has a separate coastal management plan.

## 6.2 Previous Resource Inventories and Analyses

This chapter supplements the previous resource inventory and analysis found in two sources:

- 1) the 1984 Resource Inventory (Volume 1 Bering Straits CRSA Coastal Management Program)
- 2) the 1986 Resource Analysis (Volume 2).

The primary purpose of this chapter is to provide backup for areas designated under 11 AAC 114.250, support the enforceable policies (11 AAC 114.270), and to describe the coastal resources and uses. Much of the information on maps in the original resource inventory is still applicable. These maps are listed below.

- Map 1: 1:1,000,000 Historic Sites and Linguistic Boundaries
- Map 2: 1:500000 Subsistence Harvest Areas (A)
  1:500000 Subsistence Harvest Areas (B)
  1:500000 Subsistence Harvest Areas (C)
- Map 3: no scale Commercial Fishing Districts
- Map 4: no scale Reindeer Grazing Area
- Map 5: 1:1,000,000 Land Ownership
- Map 6: 1:1,000,000 Geologic Resources and Hazards
- Map 7: 1:1,000,000 Coastal Habitats
- Map 8: 1:1,000,000 Fish and Shellfish
- Map 9: 1:1,000,000 Birds
- Map 10: 1:500,000 Marine and Lands Mammals (A)
  1:500,000 Marine and Lands Mammals (B)
  1:500,000 Marine and Lands Mammals (C)

## 6.3 Requirements of the Resource Inventory and Analysis

Coastal district plans must include both a resource inventory and a resource analysis in their plans. Simply stated, the resource inventory describes major land and water uses, natural resources, cultural resources, and land ownership. The resource analysis includes a discussion of demands on coastal resources and habitats, conflicting uses and sensitivity of uses and resources to development impacts. More specific requirements for these plan elements are discussed below.

### 6.3.1 Resource Inventory Requirements

The resource inventory information in this chapter updates information about coastal resources and uses as well as meeting new requirements resulting from legislation passed in 2003 and the implementing regulations. The ACMP plan revision regulations require that plans include resource inventory information on the following subjects:

- Natural resources (fish and wildlife, water, wetlands, soils, minerals, forests, and habitats),
- Cultural, historic and archaeological resources,
- Resources important to subsistence uses, and
- Recreation resources.

This chapter provides the following information for these topic areas:

1) Summary of findings from **recent studies** about coastal uses and resources,
2) **Local knowledge** [11 AAC 114.240(d)],
3) **Background for the enforceable policies** [11 AAC 114.270(a)], and
4) **Descriptions or maps of**:
   - major land or water uses,
   - major land ownership, and
   - areas designated under 11 AAC 114.250 [11 AAC 114.270(h)(1)(B)].

## 6.3.2 Resource Analysis Requirements

New analyses, including those based on local knowledge, have been added to this chapter regarding the impacts of uses and activities. Specifically, this chapter updates information about impacts to coastal resources, uses and habitats, including:

- Demands: present and reasonably foreseeable needs and demands for coastal habitats and resources,
- Impacts: reasonably foreseeable direct and indirect impacts of uses,
- Suitability for Development: suitability of habitats and resources for development, including natural hazard areas,
- Sensitivity: Sensitivity of habitats and resources for development, and
- Conflicts: potential conflicts among competing uses.

Changes to the resource analysis are also necessary to meet new requirements for enforceable policies that address a matter regulated or authorized by a state or federal agency. The resource analysis must provide justification for two parts of the "three-part test" in AS 26.40.070(a)(2)(C). Specifically, it must demonstrate that coastal uses or resources are:

- Sensitive to development [11 AAC 114.270(h)(1)(B)], and
- of a unique concern to the district [11 AAC 114.270(h)(1)(B)].1

The third part of the test, demonstration that the use or resource is in a defined portion of the coastal zone, must be met in the resource inventory.

The determination of whether a specific area is suitable for development must be made on a case-by-case basis based on available information, including information in the resource analysis regarding sensitivity of environments and effects of potential conflicting uses.

## 6.3.3 Local and Traditional Knowledge

Local and traditional knowledge are an important source of information about biological, physical and social systems. Local and traditional knowledge, in combination with scientific knowledge, provide the basis for the resource inventory and analysis and for reviewing impacts of a proposed project.

[1] The DNR has stated that the term "unique concern" may be interpreted as "of particular concern" to the district. In other words, the district must have a specific interest in the coastal resource or use.

Local and traditional knowledge refers to information that is either gained through direct observation or passed down through generations. Examples of local knowledge include information about changes to the distribution or condition of subsistence species through direct observation. Traditional knowledge, on the other hand, involves information that is passed on through generations. For example, traditional knowledge reveals information about long-term patterns of distribution of species, such as caribou, in the CRSA. Another example of traditional knowledge includes information about ice hazards and methods for bowhead whales.

Local and traditional knowledge provides a valuable complement to scientific knowledge. Scientific knowledge often involves limited field observations and use of modeling to test hypotheses. Local knowledge, on the other hand, provides information from direct observations throughout the year. Traditional knowledge can provide valuable information about long-term trends.

Local and traditional knowledge is generally gathered during studies and during monitoring and enforcement of permitting. A study conducted for the CRSA found that residents are not likely to provide information about a project until it is underway (Galvin 1998).

Native and non-Native people have different perceptions about how local and traditional knowledge should be used. People from outside the region often believe that local knowledge should be verified, while people within the region may think it is disrespectful to question information provided by a reliable local source. While communities in the CRSA prefer to look at a project holistically, permitters tend to isolate project aspects during project reviews (Galvin 1998).

A growing trend to record and use traditional knowledge began in the 1990s. The Alaska Native Sciences Commission (ANSC 2005).

In order to take advantage of local knowledge during this plan revision, residents were encouraged to provide local and traditional knowledge during the public review of the draft plan.

## 6.4 Subsistence

Subsistence is the most important coastal resource and use for the people of the Bering Straits CRSA. This section begins with a description of the areas designated for subsistence use under 11 AAC 114.250. It continues with a supplement to the resource inventory and concludes with a supplement to the resource analysis. The 1984 Resource Inventory includes a description and maps of subsistence use (pp. 7-9) in the Resource Analysis (Chapter 2).

### 6.4.1 Designated Subsistence Areas

The CRSA designates all non-federal lands in the coastal zone as subsistence areas as provided in 11 AAC 114.250(g). Although the CRSA is unable to designate federal lands, subsistence occurs on these lands, and reviews for federal activities or federally permitted activities affecting land or water uses of the coastal zone must be consistent with the enforceable policies of the Bering Straits CRSA, including those established for subsistence areas. The boundaries of the coastal zone are depicted on 11 maps in Appendix C.

Subsistence users follow the resources, and subsistence use change from year to year and throughout time. Changes in migration patterns and population cycles of the Western Arctic Caribou Herd provide an example of both short- and long-term changes in availability of a subsistence resource. Long-term changes resulted in abandonment of the CRSA at the end of the 19th century. Recently, however, caribou have been expanding their territory back into the CRSA. Short-term changes occur from year-to-year when caribou change their migration paths and overwintering areas. During a year where one resource is not available, subsistence users will target another resource more heavily. Studies usually only cover a short period of time and will only record use for that time period. The designation of broad areas for subsistence use reflects this situation. Further justification for this designation is provided in this chapter and Chapter 7.

## 6.4.2 Subsistence Resource Inventory

The Bering Straits CRSA establishes subsistence as the highest priority use in the district. For most CRSA residents, subsistence is entwined throughout every aspect of their life. When not actually subsistence hunting, fishing or plant gathering, residents are preparing for these activities. Those who do not directly participate in subsistence gathering provide support to subsistence activities of others and share in the harvest. In addition to providing an essential source of food, subsistence provides a vital link to the cultural heritage of the people of the Bering Strait region.

Traditional foods provide important benefits to subsistence users. According to the Alaska Traditional Knowledge and Native Foods Database, over half of the protein, iron, vitamin B-12 and omega-3 fatty acids in the diet of some Alaska Natives comes from subsistence foods. Subsistence foods have nutritional benefits that make them preferable to many purchased foods because they are rich in many nutrients, low in fat, and contain more heart-healthy fats and less harmful fats than many non-Native foods. Alaska Natives eating subsistence foods have lower signs of diabetes and heart disease, and may help avoid cancer. Subsistence harvesting in the Bering Strait CRSA requires great expenditure of energy, which has positive benefits for avoiding obesity. Harvesting, preparing, eating and sharing traditional foods contribute to social, cultural and spiritual well being (ISER 2005).

### 6.4.2.1 Subsistence Use by Community

Information for the subsistence resource inventory is provided on a community-by-community basis for the 18 communities in the district. This overview of subsistence use by community is separated into 3 regions: Bering Strait area, western Seward Peninsula, and the Norton Sound area. Further information about subsistence by community may be found in the 1984 Resource Inventory (Volume I of the CMP, pp. 3-6.).

**Bering Strait Area**

**Diomede:** The community of Diomede is located on the west coast of Little Diomede Island in the Bering Strait, 135 miles northwest of Nome. It is only 2.5 miles from Big Diomede Island, Russia, and the international boundary lies between the two islands. Summer temperatures average 40 to 50 degrees Fahrenheit. Winter temperatures average from -10 to 6 degrees Fahrenheit. Annual precipitation is 10 inches, and annual snowfall is 30 inches. During summer months, cloudy skies and fog prevail. Winds blow consistently from the north, averaging 15 knots, with gusts of 60 to 80 mph. The Bering Strait is generally frozen between mid-December and mid-June. Some residents are interested in relocating the village, due to the rocky slopes and

harsh storms, lack of useable land for housing construction, and inability to construct a water/sewer system, landfill or airport.

Diomede is a traditional Inupiat Eskimo village inhabited by the Ingalikmiu peoplet. Residents depend almost entirely upon a subsistence economy for their livelihood. Seal, polar bear, blue crab and whale meat are the preferred foods. Mainland Natives come to Diomede to hunt polar bears. Seal and walrus hides are used to make clothing items, parkas, hats, mukluks, and furs and skins for trade. The Diomede people are excellent ivory carvers, and the city serves as a wholesale agent for the ivory. Villagers travel to Wales by boat for supplies. Diomede subsistence hunters also hunt bowhead whales, and they are a member of the Alaska Eskimo Whaling Commission (AEWC).

**Gambell:** Gambell is located on the northwest cape of St. Lawrence Island, 200 miles southwest of Nome, in the Bering Sea. Gambell is located closer to Russian than to mainland Alaska. It is just 36 miles from the Chukotsk Peninsula of the Russian Far East. Gambell has a maritime climate with continental influences in the winter. Winds and fog are common, and precipitation occurs about 300 days per year. The average annual precipitation is 15 inches, including 80 inches of snowfall. The Bering Sea freezes during mid-November, with break-up at the end of May. Average summer temperatures are 34 to 48 degrees; average winter temperatures are -2 to 10 degrees, extremes from -30 to 65 degrees Fahrenheit have been recorded.

When the Alaska Native Claims Settlement Act (ANCSA) was passed in 1971, Gambell and Savoonga opted to obtain title to the 1.136 million acres of land in the former St. Lawrence Island Reserve rather than to be part of the Bering Straits Native Corporation, the regional Native corporation. The island is jointly owned by Savoonga and Gambell. The isolation of Gambell has helped to maintain their traditional St. Lawrence Yup'ik culture, their language, and their subsistence lifestyle based upon marine mammals. Walrus-hide boats are still used for hunting.

Most Gambell residents are Yup’ik, and Siberian Yup’ik is spoken. The economy in Gambell is largely based upon subsistence harvests from the sea -- seal, walrus, fish and bowhead and gray whales. A 1997 ADFG study found that Gambell’s per capita harvest of bearded seals was 1.2 animals per person, which was three to six times higher than in the other 5 communities surveyed. Gambell hunters harvest seals in more months of the year than any of the other surveyed communities and seals accounted for more than 50% of the harvest of all species of seal under study (Georgette et al. 1998). Fox are also trapped for their fur. Some reindeer roam free on the island, but most harvesting occurs out of Savoonga. Ivory carving is a popular source of income. Gambell residents also hunt bowhead whales, and they are a member of the AEWC.

**Savoonga:** Savoonga is located on the northern coast of St. Lawrence Island in the Bering Sea, 164 miles west of Nome and 39 miles southeast of Gambell. Savoonga has a subarctic maritime climate with some continental influences during the winter. Summer temperatures average 40 to 51; winters average -7 to 11; and temperature extremes from -34 to 67 degrees Fahrenheit have been recorded. Average precipitation is 10 inches annually, with 58 inches of snowfall. The island is subject to prevailing winds, averaging 18 miles per hour. Freeze-up on the Bering Sea occurs in mid-November, with break-up in late May.

Savoonga is a traditional St. Lawrence Island community dependent on subsistence hunting of walrus, seal, fish and bowhead and gray whale, supplemented by some cash income. Savoonga is hailed as the "Walrus Capital of the World." Whale, seal, walrus and reindeer comprise 80% of islander's diets. Due to the island's isolation, most residents are bilingual -- Siberian Yup'ik is still the first language. Islanders today have successfully mixed the past with the present. As

mentioned under the discussion for Gambell, Savoonga decided not to participate in traditional ANCSA provisions, and instead opted for title to the 1.136 million acres of land in the former St. Lawrence Island Reserve. The island is jointly owned by Savoonga and Gambell. Savoonga residents also hunt bowhead whales, and they are a member of the AEWC.

**Wales:** Wales is located on Cape Prince of Wales, at the western tip of the Seward Peninsula, 111 miles northwest of Nome. It has a maritime climate when the Bering Strait is ice-free, usually June to November. After the freeze, there is an abrupt change to a cold continental climate. Average summer temperatures range from 40 to 50; winter temperatures range from -10 to 6. Annual precipitation is 10 inches, including 35 inches of snow. Frequent fog, wind and blizzards limit access to Wales.

Wales has a strong traditional Kinugmiut Eskimo whaling culture. Ancient songs, dances, and customs are still practiced. In the summer Little Diomede residents travel between the two villages in large traditional skin boats. The sale or importation of alcohol is banned in the village.

The economy of Wales is based on subsistence hunting and fishing, trapping, Native arts and crafts, and some mining. Whales, walrus, polar bear, moose, salmon, and other fish are used. Wales residents also hunt bowhead whales, and they are a member of the AEWC.

*Table 6-1: Subsistence Use by Wales Households in 1993*

| Resource | using | trying | harvesting | receiving | giving | Average Pounds | Per Capita Pounds |
|---|---|---|---|---|---|---|---|
| All Resources | 92.90 | 90.50 | 88.10 | 92.90 | 78.60 | 2267.87 | 744.14 |
| Fish | 90.50 | 64.30 | 59.50 | 76.20 | 54.80 | 300.85 | 98.72 |
| Salmon | 85.70 | 50.00 | 50.00 | 69.00 | 45.20 | 237.39 | 77.89 |
| Non-Salmon Fish | 71.40 | 54.80 | 45.20 | 52.40 | 42.90 | 63.46 | 20.82 |
| Land Mammals | 54.80 | 38.10 | 31.00 | 40.50 | 21.40 | 77.81 | 25.53 |
| Large Land Mammals | 50.00 | 31.00 | 16.70 | 40.50 | 16.70 | 76.96 | 25.25 |
| Small Land Mammals | 19.00 | 19.00 | 19.00 | 0.00 | 9.50 | 0.84 | 0.28 |
| Marine Mammals | 81.00 | 54.80 | 47.60 | 78.60 | 59.50 | 1768.62 | 580.33 |
| Birds and Eggs | 59.50 | 42.90 | 42.90 | 38.10 | 23.80 | 35.39 | 11.62 |
| Marine Invertebrates | 85.70 | 76.20 | 76.20 | 40.50 | 64.30 | 70.92 | 23.27 |
| Vegetation | 71.40 | 66.70 | 64.30 | 40.50 | 28.60 | 14.29 | 4.69 |

*Source: ADFG Division of Subsistence: http://www.subsistence.adfg.state.ak.us/*

**Western Seward Peninsula**

**Brevig Mission:** Brevig Mission is located at the mouth of Shelman Creek on Port Clarence, 5 miles northwest of Teller and 65 miles northwest of Nome. Brevig Mission has a maritime climate with continental influences when the Bering Sea freezes. Summer temperatures average 44 to 57 degrees Fahrenheit, and winter temperatures average -9 to 8 degrees Fahrenheit. Annual precipitation averages 11.5 inches and annual snowfall averages 50 inches. Port Clarence is generally ice-free between early June and mid-November.

Brevig Mission is predominantly Inupiat Eskimo; residents subsist upon fish, moose, reindeer, seal, walrus and beluga whales. Brevig Mission residents divide their energies among the uplands and the coast, with subsistence activities ranging far into the open ocean where they hunt walrus and bearded seals. Their hunting areas and camp locations indicated an economy balanced among inland, coastal and marine subsistence activities (Conger and Magdanz 1990).

*Table 6-2: Subsistence Use by Brevig Mission Households in 1989*

| Resource | using | trying | harvesting | receiving | giving | Average Pounds | Per Capita Pounds |
|---|---|---|---|---|---|---|---|
| All Resources | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 2471.93 | 579.36 |
| Fish | 100.00 | 100.00 | 100.00 | 93.30 | 86.70 | 814.33 | 190.86 |
| Salmon | 100.00 | 80.00 | 80.00 | 66.70 | 60.00 | 503.21 | 117.94 |
| Non-Salmon Fish | 100.00 | 100.00 | 100.00 | 73.30 | 66.70 | 311.12 | 72.92 |
| Land Mammals | 86.70 | 53.30 | 40.00 | 80.00 | 33.30 | 108.96 | 25.54 |
| Large Land Mammals | 86.70 | 40.00 | 20.00 | 80.00 | 20.00 | 108.00 | 25.31 |
| Small Land Mammals | 33.30 | 26.70 | 26.70 | 6.70 | 13.30 | 0.96 | 0.22 |
| Marine Mammals | 86.70 | 80.00 | 73.30 | 80.00 | 53.30 | 1394.38 | 326.81 |
| Birds and Eggs | 100.00 | 86.70 | 86.70 | 60.00 | 73.30 | 80.76 | 18.93 |
| Marine Invertebrates | 26.70 | 26.70 | 26.70 | 0.00 | 6.70 | 6.16 | 1.44 |
| Vegetation | 93.30 | 93.30 | 93.30 | 33.30 | 73.30 | 67.33 | 15.78 |

*Source: ADFG Division of Subsistence: http://www.subsistence.adfg.state.ak.us/*

Migratory birds are hunted in the spring in the marshes between Cape Douglas and Port Clarence, along Port Clarence Spit, and along the length of Brevig Lagoon. Sea ducks, like king eiders, are hunted along the ice edge at the entrance to Port Clarence. In the late summer and fall, waterfowl are again hunted at Cape Douglas and Brevig lagoon, and in the Imuruk Basin area, including the lower Agiapuk River drainage, Duck Creek and the southern shore of Imuruk (Conger and Magdanz 1990).

Historically, Brevig Mission residents have traveled as far as Ikpek Lagoon, northeast of Cape of Prince of Wales, to hunt waterfowl and gather eggs. Waterfowl and gull eggs were also gathered around the lakes north of Cape Douglas, and along the length of Brevig Lagoon. Murre eggs were gathered at Fairway rock in Bering Strait, and additional egg gathering activity took place on small islands and in the environs of the village and camps (Conger and Magdanz 1990).

For the year 1988-1989, marine mammals accounted for 56.4 percent of the total edible weight of subsistence foods harvested by Brevig Mission households, followed by salmon (20.4 percent), other fish (12.6 percent), land mammals (4.4 percent), birds (3.3 percent), plants (3.3 percent), and shellfish (0.3 percent). In other years, the proportion of marine mammals in the diet might have been higher, because the 1989 spring hunt was poor. Of marine mammals harvested by Brevig Mission residents, walrus accounted for the most edible weight per household (821 pounds), followed by bearded seal (252 pounds), ringed seal (173 pounds), and spotted seal (144 pounds) (Conger and Magdanz 1990).

Of the fish, whitefish harvests per household totaled 154 pounds, followed by sockeye salmon (151 pounds), coho salmon (144 pounds), chum salmon (122 pounds), Dolly varden (57 pounds), saffron cod (56 pounds), and burbot (29 pounds). At 108 pounds per household, moose accounted for nearly all of the edible harvests of land mammals. The community harvested approximately 850 geese, 227 ducks, 376 ptarmigan, six cranes and three swans. Nearly two-thirds of the households utilized Canada and snow geese, and one-third emperor and white-fronted geese. Of 67 pounds of plants harvested per household, 57 pounds were berries, with the remainder made up of greens (9 pounds) and roots (1 pound) (Conger and Magdanz 1990).

**Mary's Igloo:** Mary's Igloo is located on the northwest bank of the Kuzitrin River, on the Seward Peninsula, northeast of Nome. It lies 40 miles southeast of Teller. The climate of Mary's Igloo is both continental and maritime. Temperatures range from -9 to 57; extremes from -65 to 99 have

been recorded. Average precipitation is 11 inches, with 50 inches of snowfall. Currently, Mary's Igloo is only occupied seasonally, but there is some interest in establishing a year-round community.

Natives of "Kauwerak," as the village was originally called, were Inupiaq Eskimos known as Kauweramiuts. This village was originally located about 15 miles downriver. By 1900, Kauwerak was abandoned, and most Natives moved to Teller or Nome because of the schools and employment opportunities. Some settled at the present site, which they called "Aukvaunlook," meaning "black whale."

There is no employment or commercial activity in Mary's Igloo. Some people are interested in re-building the community, near the old site of Kauwerak. Mary's Igloo is accessible by riverboat in the summer and by winter trails. Snowmachines and dog teams are used over a well-established trail to Teller. There is no connecting road and no air transportation accessibility.

**Port Clarence:** Port Clarence is west of Teller on the Seward Peninsula. It was built on the northern tip of a sand spit in Port Clarence. Summer temperatures average 44 to 57 degrees Farhenheit, and winter temperatures average from -9 to 8 degrees Fahrenheit. Annual precipitation is 11.5 inches, with 50 inches of snowfall.

The 1893 U.S. Census listed a collective village at this site with a population of 485, of which 236 were native and 249 were foreign. Their descendants are the residents of nearby Brevig Mission, Teller, and Wales. Port Clarence is currently a Coast Guard LORAN station.

**Shishmaref:** Shishmaref is located on Sarichef Island, in the Chukchi Sea, just north of the Bering Strait. Shishmaref is five miles from the mainland, 126 miles north of Nome and 100 miles southwest of Kotzebue. The village is surrounded by the 2.6 million-acre Bering Land Bridge National Reserve, and it is part of the proposed Beringian Heritage International Park. The area experiences a transitional climate between the frozen arctic and the continental Interior. Summers can be foggy, with average temperatures ranging from 47 to 54; winter temperatures average -12 to 2. Average annual precipitation is about 8 inches, including 33 inches of snow. The Chukchi Sea is frozen from mid-November through mid-June.

During October 1997, a severe storm eroded over 30 feet of the north shore, requiring 14 homes and the National Guard Armory to be relocated. Five additional homes were relocated in 2002. Other storms have continued to erode the shoreline, an average of 3 to 5 feet per year on the north shore. In July 2002, residents voted to relocate the community.

The Shishmaref economy is based on subsistence supplemented by part-time wage earnings. Villagers rely on fish, walrus, seal, polar bear, rabbit, and other subsistence foods. The Friendship Center, a cultural center and carving facility, was constructed for local artisans.

In a study of the subsistence harvest for 1988-1989, ADFG researchers reported that Shishmaref residents are oriented towards the ocean to a greater degree than most Seward peninsula communities. Hunting of bearded seal, walrus, and polar bear were major activities. The community also used extensive land areas for harvesting, but their local terrestrial environment was neither as diverse nor as productive as that of the two other Seward Peninsula communities, Brevig Mission and Golovin, that were studied during the same period (Conger and Magdanz 1990).

*Table 6-3: Subsistence Use by Shishmaref Households in 1995*

| Resource | using | trying | harvesting | receiving | giving | Average Pounds | Per Capita Pounds |
|---|---|---|---|---|---|---|---|
| All Resources | 97.80 | 93.30 | 93.30 | 93.30 | 88.90 | 3171.68 | 792.92 |
| Fish | 93.30 | 84.40 | 84.40 | 82.20 | 75.60 | 630.11 | 157.53 |
| Salmon | 82.20 | 68.90 | 68.90 | 68.90 | 64.40 | 371.50 | 92.88 |
| Non-Salmon Fish | 91.10 | 77.80 | 77.80 | 68.90 | 66.70 | 258.61 | 64.65 |
| Land Mammals | 88.90 | 71.10 | 60.00 | 80.00 | 62.20 | 601.54 | 150.38 |
| Large Land Mammals | 88.90 | 68.90 | 53.30 | 80.00 | 62.20 | 596.18 | 149.05 |
| Small Land Mammals | 31.10 | 35.60 | 31.10 | 6.70 | 20.00 | 5.36 | 1.34 |
| Marine Mammals | 82.20 | 64.40 | 64.40 | 75.60 | 66.70 | 1765.80 | 441.45 |
| Birds and Eggs | 82.20 | 77.80 | 77.80 | 40.00 | 64.40 | 110.58 | 27.64 |
| Marine Invertebrates | 55.60 | 42.20 | 40.00 | 46.70 | 28.90 | 12.20 | 3.05 |
| Vegetation | 93.30 | 84.40 | 84.40 | 51.10 | 55.60 | 51.46 | 12.86 |

*Source: ADF&G Division of Subsistence: http://www.subsistence.adfg.state.ak.us/*

In Shishmaref, marine mammals accounted for 69.4 percent of the total harvest during 1888-1989, which was three times as much as any other resource category. Land mammals (15.6 percent), fish (6.4 percent), plants (3.4 percent), salmon (2.6 percent), birds (2.0 percent), and shellfish (0.7 percent) constituted the remainder of the subsistence harvest (Conger and Magdanz 1990).

Of the marine mammals harvested, bearded seal was the most heavily utilized, at approximately 680 pounds per household. Household use of other marine mammal species included walrus (578 pounds), spotted seal (299 pounds), ringed seal (226 pounds), polar bear (35 pounds), and ribbon seal (25 pounds). No whale harvest was reported, although some use of bowhead occurred. The oils and fats of marine mammals are staples in Shishmaref and other Seward Peninsula communities. Hides are made into waterproof footgear, parkas and hunting bags. Seal skins are used whole for rendering and storing blubber and oil (Conger and Magdanz 1990).

Unlike most other Seward Peninsula and Alaskan communities that depend on subsistence, Shishmarefuses relatively little salmon. For 1988-1989, only 69 pounds of salmon, compared with 170 pounds of other fish, was used per household. The non-salmon fish included 41 pounds of whitefish, 47 pounds of tomcod, 31 pounds of herring, 24 pounds of burbot, and smaller amounts of char, grayling, pike and flounder (Conger and Magdanz 1990).

Although Shishmaref residents had to travel more than 100 miles east to harvest caribou, caribou was a preferred meat and constituted the majority of land mammals harvested, at 227 pounds per household. Moose, available locally, accounted for 180 pounds per household. Some use of arctic hare, muskrat, red fox and edible portions of other species was also reported. Household harvest of birds focused on brant, Canada, snow and white-fronted geese, and also ducks, mainly pintailed and mallards.The total community harvest for 1988-1989 was estimated to be 951 geese, 1167 ducks, 17 sandhill cranes, and 1,113 ptarmigan. Eggs from ducks and gulls provided about 3 pounds to the average household. About 70 pounds of berries were utilized per household, plus 19 pounds of green plants and less than a half-pound of roots (Conger and Magdanz 1990).

**Teller:** Teller is located on a spit between Port Clarence and Grantley Harbor, 72 miles northwest of Nome, on the Seward Peninsula. The climate is maritime when ice-free, and then changes to a continental climate after freezing. Grantley Harbor is generally ice-free from early June to mid-October. Average summer temperatures range from 44 to 57 degrees Fahrenheit; winter

temperatures average -9 to 8 degrees Fahrenheit. Extremes have been measured from -45 to 82 degrees Fahrenheit. Annual precipitation is 11.5 inches, with 50 inches of snowfall.

Teller is a traditional Kawerak Eskimo village with a subsistence lifestyle. Many residents today were originally from Mary's Igloo. Seals, beluga whales, fish, reindeer and other local resources are utilized. Fish, seal, moose, beluga whale and reindeer are the primary meat sources. Over one-third of households produce crafts or artwork for sale, and some residents trap fox.

**Norton Sound Coast**

**Council:** Council, a seasonal fish camp, is located at the terminus of the Nome-Council Road, 60 miles northeast of Nome. It lies on left bank of the Niukluk River. Council has a continental climate with maritime influences when Norton Sound is ice-free. Its inland location gives greater daily variation in temperatures than nearby coastal communities. Temperatures range from -9 to 64 degrees Fahrenheit.

Historically, Council was a fish camp for the Fish River Tribe, who originally lived 12 miles downstream. Several Nome residents have homes in Council, used for summer subsistence food-gathering activities. Council is connected by road to Nome. There is a State-owned 3,000' long by 60' wide gravel airstrip, but it is not maintained in the winter. Air charter services are available from Nome. Dogsleds and snowmachines are the main means of transportation during the winter.

**Elim:** Elim is located on the northwest shore of Norton Bay on the Seward Peninsula, 96 miles east of Nome. It lies 460 miles northwest of Anchorage. Elim has a subarctic climate with maritime influences. Norton Sound is ice-free generally between mid-June and mid-November. Summers are cool and moist; winters are cold and dry. Summer temperatures average between 46 to 62 degrees Fahrenheit; winter temperatures average -8 to 8 degrees Fahrenheit. Annual precipitation is 19 inches, including about 80 inches of snow.

It is an Inupiat Eskimo village with a fishing and subsistence lifestyle. Residents rely on fish, seal, walrus, beluga whale, reindeer, moose and home gardens.

**Golovin:** Golovin is located on a point of land between Golovnin Bay and Golovnin Lagoon on the Seward Peninsula. It is 70 miles east of Nome. Marine climatic influences prevail during the summer when the sea is ice-free. Summer temperatures average 40 to 60 degrees Fahrenheit; winter temperatures average -2 to 19 degrees Fahrenheit. Extremes from -40 to 80 degrees Fahrenheit have been recorded. Average annual precipitation is 19 inches, with 40 inches of snowfall. Golovnin Bay is frozen from early November to mid-May.

Golovin's economy is based on subsistence activities, reindeer herding, fish processing and commercial fishing. Fourteen residents hold commercial fishing permits. The salmon fishery and reindeer herding offer some potential for cash income to augment subsistence food harvests. Fish, beluga whale, seal, moose and reindeer are the main sources of meat.

During a subsistence harvest study of Golovin residents by ADFG in 1988 and 1989, researchers found that they predominantly used coastal and inland habitat, rarely venturing into the open ocean in pursuit of marine mammals. Seals and belukha were harvested in Golovnin Bay and Golovnin Lagoon (Conger and Magdanz 1990).

*Table 6-4: Subsistence Use by Golovin Households in 1989*

| Resource | using | trying | Harvesting | receiving | giving | Average Pounds | Per Capita Pounds |
|---|---|---|---|---|---|---|---|
| All Resources | 100.00 | 100.00 | 100.00 | 100.00 | 87.90 | 2491.29 | 604.50 |
| Fish | 100.00 | 97.00 | 97.00 | 87.90 | 69.70 | 1000.93 | 242.87 |
| Salmon | 100.00 | 87.90 | 87.90 | 69.70 | 45.50 | 664.28 | 161.18 |
| Non-Salmon Fish | 93.90 | 90.90 | 90.90 | 69.70 | 66.70 | 336.65 | 81.69 |
| Land Mammals | 97.00 | 78.80 | 75.80 | 90.90 | 57.60 | 434.71 | 105.48 |
| Large Land Mammals | 97.00 | 63.60 | 60.60 | 90.90 | 54.50 | 417.88 | 101.40 |
| Small Land Mammals | 60.60 | 63.60 | 51.50 | 27.30 | 18.20 | 16.83 | 4.08 |
| Marine Mammals | 87.90 | 57.60 | 57.60 | 75.80 | 51.50 | 788.58 | 191.35 |
| Birds and Eggs | 100.00 | 90.90 | 90.90 | 60.60 | 63.60 | 101.41 | 24.61 |
| Marine Invertebrates | 90.90 | 66.70 | 57.60 | 66.70 | 42.40 | 44.21 | 10.73 |
| Vegetation | 97.00 | 93.90 | 93.90 | 48.50 | 45.50 | 121.45 | 29.47 |

*Source: ADFG Division of Subsistence: http://www.subsistence.adfg.state.ak.us/*

In Golovin, the 1988-1989 harvest included salmon (26.7 percent), other fish (13.5 percent), marine mammals (31.6 percent), land mammals (17.4 percent), birds (4.1 percent), plants (4.9 percent), and shellfish (1.8 percent). Of the fish harvested by Golovin residents, pink salmon provided the most edible weight, at 278 pounds per household, followed by chum salmon (239 pounds). Dolly varden (146 pounds), coho salmon (94 pounds), whitefish (83 pounds), saffron cod (55 pounds), king crab (44 pounds), Chinook salmon (33 pounds) and sockeye salmon (21 pounds) constituted the remainder of the average household fish usage for the year. The herring was generally harvested as herring roe-on-kelp (Conger and Magdanz 1990).

Beluga whale (332 pounds per household), spotted seal (235 pounds), bearded seal (191 pounds), and ringed seal (31 pounds) accounted for the most edible weight of marine mammals utilized by community households in 1988-1989. Of land mammals, residents reported average household harvests of 278 pounds of moose, 132 pounds of caribou, 10 pounds of snowshoe hare, and 8 pounds of brown bear (Conger and Magdanz 1990).

Eighty-five percent of households used brants and 76 percent used Canada geese, the two most commonly harvested migratory birds. The average household harvest of all geese totaled 40 pounds. Seventy-nine percent of households used pintailed-ducks and 55 percent used mallards, the two most commonly harvested ducks. Ptarmigan were harvested by 97 percent of households, which reported an average harvest of 16.3 pounds. Nearly 3 pounds of eggs, mostly murre and gull eggs, were utilized by the average household. The total bird usage for the community in 1988-1989 included 591 geese, 584 ducks, 957 ptarmigan, 106 sandhill cranes, 20 swans, and one loon (Conger and Magdanz 1990).

Plant use in Golovin included 96 pounds of berries per household, 25 pounds of green plants and under one pound of roots (Conger and Magdanz 1990).

**Koyuk:** Koyuk is located at the mouth of the Koyuk River, at the northeastern end of Norton Bay on the Seward Peninsula, 90 air miles northeast of Nome. Koyuk has a subarctic climate with a maritime influence. Average summer temperatures range from 46 to 62 degrees Fahrenheit; winter temperatures average -8 to 8 degrees Fahrenheit. Annual precipitation is 19 inches, including 40 inches of snowfall. Extremes from -49 to 87 degrees Fahrenheit have been recorded. Norton Bay is usually ice-free from May to October.

Koyuk is a traditional Unalit and Malemiut Eskimo village that speaks a dialect of Inupiaq. Residents maintain a subsistence lifestyle.

**Shaktoolik:** Shaktoolik is located on the east shore of Norton Sound. It lies 125 miles east of Nome and 33 miles north of Unalakleet. Shaktoolik has a subarctic climate with maritime influences when Norton Sound is ice-free, usually from May to October. Summer temperatures average 47 to 62 degrees Fahrenheit; winter temperatures average -4 to 11 degrees Fahrenheit. Extremes from -50 to 87 degrees Fahrenheit have been recorded. Average annual precipitation is 14 inches, including 43 inches of snowfall.

The original village, located 6 miles up the Shaktoolik River, was moved to the mouth of the River in 1933. This site was prone to severe storms and winds, however, and the village relocated to its present, more sheltered location in 1967.

The Shaktoolik economy is based on subsistence, supplemented by part-time wage earnings. Fish, crab, moose, beluga whale, caribou, seal, rabbit, geese, cranes, ducks, ptarmigan, berries, greens and roots are primary food sources.

**Solomon:** Although a few people inhabit this community year-round, Solomon is primarily a subsistence-use area used by Nome residents seasonally, mostly for fishing and waterfowl hunting. It is located on the west bank of the Solomon River 30 miles east of Nome and one mile north of Norton Sound. The climate is both continental and maritime. Summers are short, wet and mild; winters are cold and windy. Temperatures range between -30 and 56 degrees Fahrenheit. Annual precipitation is 16 inches, with 54 inches of snowfall.

A federally-recognized tribe is located in the community -- the Native Village of Solomon. During the 2000 U.S. Census, total housing units numbered 4, and vacant housing units numbered 2. Solomon is located along the Nome/Council road. A 1,150' long by 35' wide dirt/gravel airstrip is owned by the Solomon Village Corp. Charter flights are available from Nome. Snowmachines and dogsleds are important forms of transportation during the winter.

**St. Michael:** St. Michael is located on the east coast of St. Michael Island in Norton Sound. It lies 125 miles southeast of Nome and 48 miles southwest of Unalakleet. St. Michael has a subarctic climate with maritime influences during the summer. Summer temperatures average 40 to 60 degrees Fahrenheit; winters average -4 to 16 degrees Fahrenheit. Extremes from -55 to 70 degrees Fahrenheit have been recorded. Annual precipitation is 12 inches, with snowfall of 38 inches. Summers are rainy and fog is common. Norton Sound is ice free from early June to mid-November. St. Michael's population is largely Yup'ik Eskimo today, and many residents are descendants of Russian traders. Seal, beluga whale, moose, caribou, fish and berries are important staples.

**Stebbins:** Stebbins is located on the northwest coast of St. Michael Island, on Norton Sound. It lies 8 miles north of St. Michael and 120 miles southeast of Nome. The community has a subarctic climate with a maritime influence during the summer. Norton Sound is ice-free from June to November, but clouds and fog are common. Average summer temperatures are 40 to 60 degrees Fahrenheit; winter temperatures range from -4 to 16 degrees Fahrenheit. Extremes have been measured from -55 to 77 degrees Fahrenheit. Annual precipitation is 12 inches, including 38 inches of snowfall.

The Stebbins economy is based on subsistence harvests supplemented by part-time wage earnings. The commercial herring fishery has become increasingly important, including fishing on the lower Yukon. Residents subsist upon fish, seal, walrus, reindeer and beluga whale. Gardens provide vegetables during the summer months.

*Table 6-5: Subsistence Use by Stebbins Households in 1980*[2]

| Resource | using | trying | harvesting | receiving | Giving | Average Pounds | Per Capita Pounds |
|---|---|---|---|---|---|---|---|
| All Resources | | | 100.00 | | | 6311.61 | 996.57 |
| Fish | | | 100.00 | | | 3916.63 | 618.42 |
| Salmon | | | 75.00 | | | 2466.29 | 389.41 |
| Non-Salmon Fish | | | | | | 1452.00 | 229.26 |
| Land Mammals | | | 58.30 | | | 108.06 | 17.06 |
| Large Land Mammals | | | 8.30 | | | 59.58 | 9.41 |
| Small Land Mammals | | | 58.30 | | | 48.48 | 7.66 |
| Marine Mammals | | | 100.00 | | | 1968.33 | 310.79 |
| Birds and Eggs | | | 91.70 | | | 318.58 | 50.30 |

*Source: ADFG Division of Subsistence: http://www.subsistence.adfg.state.ak.us/*

**Unalakleet:** Unalakleet is located on Norton Sound at the mouth of the Unalakleet River, 148 miles southeast of Nome and 395 miles northwest of Anchorage. Unalakleet has a subarctic climate with considerable maritime influences when Norton Sound is ice-free, usually from May to October. Winters are cold and dry. Average summer temperatures range 47 to 62 degrees Fahrenheit; winter temperatures average -4 to 11 degrees Fahrenheit. Extremes have been measured from -50 to 87 degrees Fahrenheit. Precipitation averages 14 inches annually, with 41 inches of snow.

Unalakleet, with its traditional Unaligmiut Eskimo lifestyle, has a history of diverse cultures and trade activity. Both commercial fishing for herring, herring roe and subsistence activities are major components of Unalakleet's economy. Fish, seal, caribou, moose and bear are used.

**White Mountain:** White Mountain is located on the west bank of the Fish River, near the head of Golovin Lagoon, on the Seward Peninsula. It is 63 miles east of Nome. White Mountain has a transitional climate with less extreme seasonal and daily temperatures than Interior Alaska. Continental influences prevail in the ice-bound winter. Average summer temperatures range from 43 to 80 degrees Fahrenheit; winter temperatures average -7 to 15 degrees Fahrenheit. Annual precipitation is 15 inches, with 60 inches of snow. The Fish River freezes up in November; break-up occurs in mid to late May.

Historically, the Eskimo fish camp of "Nutchirviq" was located here. The bountiful resources of both the Fish and Niukluk Rivers support the area's residents. The entire population depends on subsistence hunting and fishing, and most spend the entire summer at fish camps. Salmon, other fish, beluga whale, seal, moose, reindeer, caribou, and brown bear are utilized. Construction outside of town and firefighting provide seasonal employment. Ivory and bone carvings contribute some cash.

[2] Harvest data was collected for 1980, before ADFG began tracking the other categories of resource use and sharing as reflected in these charts.

## 6.4.3 Subsistence Resource Analysis

This supplement to the resource analysis begins with a statement of why subsistence is a unique concern to the people of the CRSA. Next, the sensitivity of subsistence to development is discussed. The resource analysis supplement ends with a discussion of conflicting uses.

### 6.4.3.1 Unique Concern

Subsistence uses and resources are a unique concern to the district and its residents. Subsistence provides food and cultural sustenance for Bering Sea residents, and for many, it defines the essence of their existence. Because there are few full-time jobs in the region, subsistence resources and uses are necessary to meet traditional needs. Even for residents with full-time jobs, subsistence is an important part of their life. Anthropologist Robert J. Wolfe explained the unique concern about subsistence for the lower Yukon delta region; the explanation is equally descriptive of its importance to the residents of the Seward Peninsula area communities:

> Fishing and hunting activities are imbued with deep social and cultural meanings. The system of fishing and hunting has great historic time depth in this region and forms the basis of social order at the family and community levels. The primary social roles of family members revolve around the annual cycle of activities, usually harvesting by men, processing and storage by women, and essential support roles by children and elderly. The family and community are integrated by the enactment of these customary roles. As fishing and hunting draw upon traditional values, belief systems and ideological structures of the culture, they provide the fundamental structure underlying the psychological and emotional well-being of individuals (Wolfe 1983).

Activities that affect subsistence have the potential to have substantial effects to those people in the CRSA who depend on subsistence resources and the subsistence lifestyle.

"Volume 2 - Resource Analysis" of the Bering Straits Coastal Resource Service Area Board (1986) provides a substantively detailed explanation of the unique concern of subsistence to the residents of the Bering Straits CRSA in Section 2.2, pp. 2-1 – 2.5.

### 6.4.3.3 Sensitivity to Development

Any area used by subsistence users of fish and wildlife are considered sensitive by the CRSA. As well, almost all activities have the potential to conflict with subsistence resources and uses if they have to potential to disrupt fish and wildlife or subsistence uses. Almost every development activity has the potential to disrupt subsistence uses or resources. The most sensitive areas in the CRSA are identified in Section 6.6.3.2. Activities that could disrupt or displace subsistence uses or resources are discussed in the next section.

An analysis of the ability of subsistence resources to sustain harvest demands can be found in Volume 2 – Resource Analysis (Bering Straits CRSA 1986a), Section 2.4, pp. 2-9 to 2-11.

### 6.4.3.2 Competing Uses

Almost every activity has the potential to compete with subsistence use. Depending on the specific location of the activity, when it occurs and the magnitude and duration of the project. Economic development is important to residents of the CRSA because it provides jobs and wages. Development can also impact residents' utilization of wild foods.

Two kinds of subsistence issues exist, one where there is a direct impact to fish and wildlife resources and the other when there is increased conflict between different users (Behnke and Sheinberg 1997). Potential competing uses include: competition from commercial and sport harvest of the resources, stress to resources from overharvesting, trespass, habitat destruction or alteration, activities and resulting noise that drive animals away, natural disasters, increased predation on subsistence resources resulting from project effects that attract predators, and pollutants including the recent increase in long-distance transport of persistent organic pollutants.

**Competition Among Users:** Direct competition for resources occurs in the Bering Straits CRSA. In 1984 and 1989, Brevig Mission residents reported overlap in moose hunting areas with Teller and Nome hunters, resulting in a shorter hunting season than in communities to the north with less competition and hunting pressure. In 1989, competition between Brevig Mission and Wales for walrus hunting areas was also reported (ADFG 2005)

**Harvest Restrictions:** Bag limits and hunting seasons are set to manage fish and game species and that can affect subsistence users' ability to harvest particular species. An issue of concern cited by Golovin residents in 1989 focused on bag limits for brown bears which was set to control sport hunting of the bears, but which limited subsistence take to a level lower than required by community residents (ADFG 2005). Anthropologist Robert J. Wolfe points out that urban-based populations potentially place rural populations at a disadvantage in being better placed to organize the rules. That is, that urban-based hunters and fishers tend to be more mobile, greater in number, and politically better placed to affect regulations such as seasons, bag limits and harvest methods (Wolfe 2004).

**Competition between Subsistence and Non-subsistence Users:** Competition between subsistence and non-subsistence users extends beyond the district boundaries. For instance, seabirds are an internationally shared resource. Birds being harvested in one area may be part of a breeding population of another country (Denlinger and Wohl 2001). Alaska Native hunters of seabirds and marine mammals were allowed, after treaty negotiations, to continue to take animals traditionally a part of their diet but proscribed from harvest by non-Natives and or in other parts of the world.

Although the State of Alaska recognizes subsistence uses of fish and game as having priority over commercial and sport use of fish and game, should restrictions be necessary to preserve fish stocks or game populations, subsistence uses have an ambiguous status in regard to other uses of state lands. Subsistence is not recognized as a separate type of land use in state land planning classifications. The Alaska Department of Natural Resources is responsible for managing state lands for multiple use and to resolve or mitigate conflicts among competing uses deemed beneficial by the state. There is no requirement in the Alaska Administrative Code that new uses on state lands be assessed for their impacts on ongoing subsistence activities (Wolfe and Walker 1987).

**Roads:** The presence of roads is significantly associated with reduced subsistence productivity. Harvests of communities along Alaska's road-networked areas or marine highway system are 69% less than harvests by communities off the road network (Wolfe and Walker 1987). Roads can also increase access to or change use of a subsistence resource, as when a decline in chum salmon in the Pilgrim River in the Bering Strait CRSA in the early 2000s resulted in a shift of fishing effort and a change in preference from chum to sockeye salmon that could be harvested at Teller, which is accessible by road for Nome residents (Menard, personal communication 2004).

In addition to increased access, roads also can displace wildlife populations due to noise, traffic patterns and the introduction of people to areas previously not accessible.

**Vessel Traffic:** Increased marine vessel traffic due to oil development may affect the populations of marine mammals upon which the residents of such communities as Shishmaref depend. Jet boat traffic associated with a lodge on the Kachavik River was of concern to Golovin residents in 1995 as a potential threat to spawning salmon and a disruption to subsistence fishing (ADFG 2005).

**Secondary Effects:** A reduction of one resource from any cause may result in an increase in harvest of others.

**Oil and Gas:** Oil and gas projects can result in spills of oil or other pollutants into the habitats of species used for subsistence, or disrupt harvests during exploration or development activities, or by increasing vessel traffic. Oil and gas activities are discussed in more detail in sections 6.8.2.3 and 6.6.3.3.

**Mining:** Mining and associated development may damage wild resources by introducing contaminants into the environment, sediments into rivers and streams, disrupting permafrost, and/or by creating multiple other possible impacts. Large projects attract new residents to the region who may become competition for subsistence resources.

**Pollution:** Persistent organic pollutants (POPs) are human-made organic compounds that are able to bioaccummulate in living organisms. They can travel long distances and tend to migrate to northern climates because of strong south-to-north air flows. Contaminants have been found in the fatty tissues of many northern species, including marine mammals. When humans consume animals contaminated by POPs, the chemicals accumulate in their bodies. Potential health effects from POPs include neurological, neurodevelopmental, reproductive, endocrinal, and immune systems effects. Many cause cancer or promote potential tumors.

Contaminated sites from military installations or activities in the last century may cause impacts to humans, land mammals, fish and birds through soil and surface water in which petroleum, PCBs, dioxin and other toxins may be present. Unexploded ordinance, buried construction waste, including asbestos, and abandoned equipment have been discovered at various locations on the Seward Peninsula. According to the Alaska Department of Environmental Conservation (DEC), for instance, large areas at Northeast Cape are contaminated by petroleum in the soil and groundwater. An estimated 180,000-gallon diesel fuel spill in 1969 impacted a nearby river drainage in which PCBs are also present. Dolly Varden sampled from the drainage contain PCBs at concentrations above ingestion levels recommended by the USEPA (DEC 2005).

Additional impacts to subsistence resources are discussed in Volume 2 – Resource Analysis (BS CRSA 1986a) at Section 2.3, pp. 2.5 – 2.9. Other competing uses described under section 7.6.3.3 (Fish, Wildlife and Habitats) also apply to subsistence.

# 6.5 Cultural, Historic and Archaeological Resources

The discussion of cultural, historic and archaeological resources begins with a description of areas designated for this resource. It continues with an update to the resource inventory and ends with a supplement to the resource analysis. The information in this supplement summarizes information in the 1984 resource inventory (pp. 1-2) and Chapter 5 of the 1986 resource analysis.

## 6.5.1 Designated Areas for Cultural Historic and Archaeological Resources

The CRSA designates all non-federal lands in the coastal zone as important for the study and understanding of history and prehistory. Although the CRSA is unable to designate federal lands, subsistence occurs on these lands, and reviews for federal activities or federally permitted activities affecting land or water uses of the coastal zone must be consistent with the enforceable policies of the Bering Straits CRSA, including those established for subsistence areas.

Cultural, historic and archaeological resources are found throughout the district, and it is likely that undiscovered sites could be found anywhere in the district. Known archaeological resources are considered to be a small fraction of sites that have not yet been discovered. People have occupied the region for at least 12,000 years, and the area has been used extensively for settlement and subsistence hunting and fishing. Known historical and archaeological sites have been documented in almost 150 different townships within the CRSA (see Map 5-1 in 1986 resource analysis). While the most likely places to find undiscovered archaeological sites would appear to be along the coast and rivers, it is likely that other areas harbor undiscovered sites. The entire region has been used extensively for subsistence hunting and fishing, and rivers and waters have changed throughout time. Since waters under the Bering Land Bridge were once exposed, it is likely that archeological sites of significance could be located in these areas.

### 6.5.2 Resource Inventory: Cultural, Historic and Archaeological Resources

This supplement to the resource inventory begins with a discussion of the Native people who live in the region and continues with an overview of the major historical periods. The inventory ends with a discussion of resources in the CRSA.

#### 6.5.2.1 Native Culture

The Native people of this region survived in the harsh environment of north Alaska because of their ability to adapt and a deep respect for fish and wildlife. The Bering Straits CRSA includes both Inupiaq and Yupik Eskimos. Today, Inupiaq people are located in Unalakleet north to Shishmaref including King and Diomede Islands. In the 19th century, the Inupiat boundary was smaller, more north and west than today. Yup'ik Eskimos are located south of Unakaleet including St. Lawrence Island. There are approximately 21 groups of Eskimo Natives in this region with separated by cultural, linguistic and geographic factors.

The people in St. Lawrence Island speak Siberian Yup'ik, and the people of the inland areas speak Central Yup'ik. Additionally, there are many dialects of these languages. Map 1 of the 1984 Resource Inventory illustrates the location of linguistic boundaries.

The Native people perceive of the region view themselves as an integral part of the environment. Visitor, on the other hand, are considered "observers" (Hooks et al. 1983).

Traditionally, the people of the region lived in subterranean house. Most villages had one or more mens' houses (kazgi). These houses served as centers for tribal government and as areas where culture and traditions were passed on to young people. Women entered the kazgi to participate in community ceremonies, trading and to serve food.

Today, people live in wood houses and may modern conveniences including oil heat, electricity and running water. Most people in this region, however, still spend a good part of their life pursuing subsistence activities. Snowmachines and boats may have replaced snow machines and kayaks, but subsistence is still an important means to feed families.

#### 6.5.2.2 Historical Periods

**Pre-Recorded history:** A widely-accepted theory postulates that the first humans to reach the Americas came from Asia across the Bering Land Bridge between 10,000 to 15,000 years ago (Bering Straits CRSA 1986). During this period, lower sea levels exposed the area between what is not the Bering Straits CRSA and Russia. This theory, however, is not accepted by all who live in the CRSA, and this discussion is not meant to discredit their beliefs. The earliest archaeological record in the Alaskan Arctic is about 11,000 years old.

Four major periods before contact with Europeans and Americans are defined by tool style and settlement patterns: 1) Full-time tundra hunting (9,000 B.C. – 6,000 B.C.E, 2) adaptation to taiga forests (6,000 B.C. – 2200 B.C.E.), 3) development of seasonal and year-round coastal hunting and fishing (2200 B.C.E. – 500 A.D.), and 4) prehistoric Eskimo culture (500 A.D. – 1778).

Sea level stabilized at its present level between 5,400 and 4,200 years ago. Beginning in the 16$^{th}$ century B.C.E., inland groups became more dependent on caribou, and coastal groups became dependent on marine mammals and fish. Around 1000 A.D., the Western Thule culture developed in Northwest Alaska with an emphasis on whaling on coast and caribou hunting inland.

An extensive trading network allowed people in a village to focus harvest of local resources that could be traded with other villages. Products from Siberia, such as iron, tea and tobacco, reached the region long before Russians explored the area.

During this period, larger villages were surrounded by many smaller villages and seasonal hunting and fishing areas. Villages were relocated whenever it was necessary to respond to changing animal migration patterns, flooding, landslides, and changing river courses.

**European Contact:** Vitus Bering sailed through Bering Strait in 1728, although he did not have any contact with local residents. On his second voyage in 1741, he initiated Russian fur trading in Alaska. Active trading, however, was not prevalent until the 1820s – 1830s. In 1833, the first non-Native settlement in the region, St. Michael Redoubt, was established.

By the late 1770s, the fur trade interested other nations. Explorers from Spain, England France and the U.S. visited the area.

**American Period:** The U.S. purchased Alaska from Russia in 1867. The St. Michael trading post was purchased by the Alaska Commercial Company shortly after the U.S. purchased Alaska. This community became a major trading post and later as a staging area for mining.

Commercial whaling began in the mid-1800s. Between 1848 and 1885, 3,000 American whaling ships carrying 90,000 men passed through Bering Strait. The commercial whaling industry introduced the concept of wage labor into the region.

Eventually, the whale populations became depleted and substitutes for whale products led to the demise of the commercial whaling industry. As caribou populations became depleted during the 1870s – 1880s, most villagers moved to the coast.

In 1884, Congress passed the first Organic Act which provided for a government in Alaska and money for education. Sheldon Jackson served as General Agent for Education in Alaska, and he hired missionary teachers from various church groups. This resulted in a patchwork of religions throughout the region that persists today. In response to irregular school attendance by many students, boarding schools were established.

In 1892, Sheldon Jackson arranged for the importation of 1,280 reindeer from Russia to the Seward Peninsula to supplement declining subsistence resources. A school in Port Clarence was established to teach reindeer herding to the residents of the region. The industry was dominated by non-Natives, however, until the markets for exporting reindeer meat faltered during the 1920s and 1930s. In 1939, a new policy was established that allowed only Natives to own reindeer. This new policy resulted in a greater importance of reindeer herding among Native people.

**Mining Period:** After a whaler found silver ore in Golovin Bay in the late 1870s, mineral interest in the region increased. Also gold found in Fish River and Ophir Creek, and in 1898, gold was discovered in what is now Nome. By the summer of 1899, 3,000 people came to the area, and by1900 when beach gold deposits discovered, another 15,000 people arrived to prospect for gold. During this period, the idea of a cash economy became strengthened. By 1910, the most accessible mineral deposits were depleted, and few miners remained in area.

**Diseases:** Between the mid-1800s and early 1900s, smallpox, diphtheria and influenza epidemics killed thousands of area residents. These diseases had particularly severe effects to Native people who had not yet developed resistance. In 1918 influenza epidemic spread throughout the area. Shishmaref was spared effects from the epidemic because they did not allow people to enter village. Because many villages were nearly wiped out, some settlements were abandoned and people moved to regional centers.

**Commercial Fishing:** During the early 1900s, commercial fishing began for herring and salmon in the Norton Sound area. In 1906, herring was commercially fished in Grantley Harbor, and 1909 in a fishery developed in Golovin Bay. In 1917, the Arctic Fish Company caught salmon in Golovin Bay and salted salmon export. Fishermen came from Scandinavia to participate in the commercial fisheries. Commercial herring fishing stopped in 1940s, and it did not resume until the Japanese began fishing in the area in 1963. Beginning in the 1960s, local residents began commercial fishing, and this activity continues today.

**WWII:** The second world war resulted in more attention to the area by the U.S. government. Military centers were established in Nome, St. Lawrence Island, and Unalakleet. Nome became the point of departure for lend-lease airplanes flown to Andyr. Eskimo scouts, a group of volunteers, were established to monitor the remote coastline of the region.

**Increase Local Control:** Beginning it 1971, several acts increased the ability for Native people to control their own destinies. The Alaska Native Claims Settlement Act (ANCSA) provided money and land to the people of the region. The act restructured political systems and created Native corporations. The Alaska National Interest Lands Conservation Act established subsistence protection for federal lands. The ACMP, passed in 1977, established a means for the people of the region to develop a CRSA to manage coastal uses and resources.

**Oil Revenues**: With the discovery of oil on the North Slope, Alaska began spending more money in rural Alaska. This resulted in more local jobs and capital improvement projects including local roads, airports, sewer systems and other public facilities.

**Current Period:** During recent years, there has been a decrease in state-funded projects in rural Alaska an in revenue sharing. As well, there has been a decreased emphasis in opportunities for local control. For example, changes to the ACMP in 2003 and 2004 have resulted in a decreased ability for the CRSA to manage its coastal resources and uses.

### 6.5.2.3 Cultural, Historic and Archaeological Resources

There are many cultural and archaeological sites throughout the region. Most of the archeological sites have not been excavated. Native people, the certain places may have significance that may not be readily apparent to newcomers to the area. The meaning of specific sites is passed on through generations through traditions. Former village sites, campsites and landmarks may have a special meaning that affects how these lands are used or avoided. Many of these sites may not have tangible boundaries. While many recognize that sites with artifacts may have spiritual importance, the importance of other sites may not be understood. For example, sites such as shaman burial grounds and former villages may have spiritual or ceremonial importance. Some people believe that alteration of certain sites may result in supernatural retribution. Visitors may unknowingly violate a sacred site.

The oldest known settlement at Cape Denbigh, known as Iyatayet, was occupied between 5000 to 7000 B.C.E. Remains at Wales are estimated to be as old as 2000 B.C.E. The Birnirk Memorial Mound is dated at 500 A.D.; Sites near Solomon and Teller 100 B.C.E; and 35 village sites on St. Lawrence 500 B.C. to 1700 A.D. Other archaeological sites identified in the Resource Inventory include 16 sites near Nome and 13 sites near Shishmaref. Because the area has not been systematically inventoried, many more undiscovered sites are expected to exist.

Historic resources include sites related to the Russian occupation as well as early U.S. occupation. The gold rush towns of Council and Solomon are examples of important historic resources. Antique machinery can be found throughout the region including the “Last Train to Nowhere” located on the Council Road. Several sites on the region are on the National Register of Historic Places such as the Discovery Saloon in Nome, the Carrie McLaine Home, the Lindbloom Placer Claim, the Cape Nome Roadhouse, and the Solomon Roadhouse.

The National Park Service (NPS) has promoted interest in cultural through several programs. In 2004, the NPS implemented an archaeological mentoring program. This 3-year program will involve students from area villages in ongoing field work in national park lands. As part of its work on the Beringia project, the NPS is working with Russian and Alaskan elders in the Beringia region to share indigenous knowledge about cultural materials in the Smithsonian Institution. Other projects sponsored by the NPS include translations of contemporary

archaeological papers for the Beringia region, King Island song and dance preservation, a synthesis of archaeology of the region, a summer language camp on St. Lawrence Island, and a volume about Inupiaq nations of Northwest Alaska (NPS 2005).

## 6.5.3 Cultural, Historic and Archaeological Resources Resource Analysis

The resource analysis begins with a description of why these resources are a unique concern to the district. It continues with a discussion of why cultural, historic and archaeological resources are sensitive to development and ends with a discussion of conflicting uses.

### 6.5.3.1 Unique Concern

Cultural, historic and archaeological resources are a unique concern to the CRSA and its people, because it defines who they are. These resources are important on a personal and family basis as well as a cultural basis. An individual's or family's identity is closely related to their connection to the Inupiat and Yup'ik cultures, and the continuance of the culture is dependent on the ability of individuals and families to relate to their heritage.

### 6.5.3.2 Sensitivity to Development

Archaeological and historic resources are extremely sensitive to development. Any ground-disturbing activity has the potential to destroy or disrupt such sites. Even minor disturbance to a site can have serious consequences because the context of where an artifact is found can provide important information to archaeologists and historians.

Native culture is also extremely sensitive to development. Large-scale development can have social and cultural effects such as affecting access to subsistence resources, increasing competition for subsistence resources, producing noise or other disruptions, resulting in trespass to private cabins and Native allotments, and increasing a cash economy which can result in a decrease in importance of traditional activities.

### 6.5.3.3 Conflicting Uses

Any activity that has the potential to alter or destroy historic or archaeological resources is a potentially conflicting use. The following discussion addresses three common concerns.

- **Undiscovered Sites:** The inadvertent destruction of a site that has not yet been discovered is an important concern.
- **Removal of Artifacts:** The purposeful removal of artifacts from archaeological sites can destroy valuable information and insights about previous inhabitants. This practice, however, has resulted in a income to individual residents of several villages.
- **Vandalism:** Destruction of historic or archaeological sites can also have serious consequences to the resources.
- **Trespass:** Visitors may unknowingly trespass on private lands or use areas that are avoided by Native people due to spiritual significance.
- **Loss of Culture:** Cultural loss occurs when oral traditions are not passed on through generations. It also occurs when young people do not learn the traditional languages.

A number of practices can minimize impacts of conflicting uses. Requirements for archaeological surveys or consultation before development can reduce the instances of damage to sites. Establishment of museums throughout the region give local people a sense of pride, provide a safe repository for artifacts, and give visitors something to do while in a village. The development of brochures can emphasize the importance of preserving cultural, historic and archaeological resources. In addition, brochures can be an effective way to promote Inupiat and Yup'ik values to people in the region as well as visitors. Language programs in area schools can insure that Native languages and dialects are not lost.

# 6.6 Biological Resources and Habitats

This section begins with a description of important habitat areas designated by the Bering Straits CRSA. It continues with a supplement to the resource inventory and analysis for fish, wildlife and habitats.

## 6.6.1 Important Habitat Designations

The CRSA has established a number of areas as habitat areas as provided in 11 AAC 114.250. These areas include:

- Sensitive biological resources indicated on the Environmental Sensitivity Index (ESI) Maps for Northwest Alaska (Maps 13–30), including areas identified as sensitive bird, marine mammal, terrestrial mammal, fish and invertebrate habitat (Appendix E),
- Important habitats identified in Most Environmentally Sensitive Areas (MESA) maps 9-11, including waterfowl nesting concentrations, waterfowl spring and fall concentrations, waterfowl molting concentrations, seabird colonies, beluga whale concentrations, walrus haulout concentrations, herring spawning areas, harbor seal haulout concentrations, and sea lion haulout concentrations (Appendix F), and
- All anadromous fish streams including a 1000-foot buffer around these streams (as identified in the Fish Distribution Database maintained by the Alaska Department of Fish and Game – Appendix G).

These are incorporated into the Ceñaliulriit Coastal Management Plan revision. The MESA and ESI maps are included in this draft of the plan. The Fish Distribution Database included with this plan revision identifies the anadromous waters which are designated as important habitat areas.

## 6.6.2 Biological Resources and Habitat Resource Inventory

This supplement to the resource inventory begins with a description of the major kinds if biological resources in the CRSA: fish and shellfish, marine mammals, land mammals, birds, vegetation, and threatened and endangered species. Information about biological resources in located in the 1984 Resource Inventory (pp. 20-28).

### 6.6.2.1 Fish and Shellfish

The fish discussed in this section are vital to the region's subsistence lifestyle and ecological balance. The shallow Arctic waters have important pelagic and benthic food webs, but the benthos plays a much greater role in productivity and turnover than in marine ecosystems at lower latitudes (Grebmeier and Dunton 2000). The region's residents utilize marine, anadromous and freshwater species of fish.

The original Information for this section was obtained from the *Wildlife Narratives* prepared by the ADFG. It has been updated with information from the *Alaska Wildlife Notebook* series, also prepared by the ADFG, and studies published by the U.S. Fish and Wildlife Service.

**Anadromous Fish**

Salmon, as well as several other species of anadromous fish, are found in most of the river systems of the CRSA, including the Serpentine, Arctic, Agiapuk, Kuzetrin, Kongurok, Sinuk, Nome, Solomon, Niukluk, Fish, Tubutuluk, Koyuk, Inglutalik, Ungalik, North, Unalakleet, Chirosky, Kogak, Piknuktalik, Shaktoolik, and Golsova rivers, some of which are fished far inland by residents of the Bering Straits CRSA. Additional rivers support anadromous fish but not all have been catalogued by the ADFG (ADFG 1986). Individual species of anadromous fish are discussed below.

**Sheefish:** Sheefish are the largest members of the whitefish family. A small population of sheefish spawns in the Koyuk River and winters in Norton Bay.

**Whitefish:** Broad and humpback whitefish and least cisco are common in the slow-moving waters of sloughs and interconnected lakes (i.e. Selawik Flats) in the district. They are also found in the lower reaches of large rivers and in nearshore marine waters such as Port Clarence and Golovin Bay. Round whitefish occur more commonly in lakes and streams. Bering ciscos are found in Port Clarence and Grantley Harbor. They spawn from late September to early October along sand and gravel bottoms of freshwater bodies and may overwinter in deep rivers or lakes or in estuarine areas such as Hotham Inlet and Grantley Harbor. Adult whitefish feed on snails, clams, midges, caddis flies, and mites.

**Pink Salmon:** Pink salmon are the smallest of the Pacific salmon. While mature pinks occasionally reach a weight of 6.4 kg (14.1 pounds), most are less than 1.4 to 2.0 kg (3 to 4.4 pounds). After one winter in freshwater and a second winter in the ocean, pink salmon reach sexual maturity. This results in genetically distinct "odd" and "even" year stocks. Pink salmon prefer to spawn in gravel, but they are highly adaptable, and successfully spawn even in fractured bedrock without gravel. Resident fish, including Dolly Varden, rainbow trout, and grayling prey upon pink salmon fry. Pink salmon school in the nearshore waters upon reaching the sea, and they feed in the estuaries for about a month before migrating to offshore waters. Immature pink salmon range throughout the northeast Pacific and the central and western Bering Sea for 12 to 16 months. Their homeward migration begins in the spring.

**Chum Salmon:** Chum salmon are the most abundant salmon in the region. Most spawning occurs in small stone- and sand-bottomed riffles. Generally, only summer-run chum salmon enter streams along the northern Bering Sea and Arctic coast. Fall-run fish occur in the southern Bering Sea and Gulf of Alaska (NOAA 2005). Chum salmon school and feed in estuaries and nearshore waters during the summer and move to offshore feeding grounds by mid-August. Chum salmon primarily feed on crustaceans and other small forms of marine life.

**Arctic Grayling:** Arctic grayling are distributed widely in most clearwater streams and in some of the deeper lakes. Grayling move considerable distances between overwintering, spawning, and summer feeding areas. After overwintering in deep rivers and lakes, adults migrate to spawning streams about the time of ice breakup, when small streams are at or near peak flow conditions.

After spawning, adults remain in streams to feed, often moving to upstream locations or into small tributaries. In late spring, after the adult migration, juveniles migrate upstream to summer feeding areas. Grayling feed primarily on invertebrates (mostly insects), and on small fish and salmon eggs to a lesser extent. Adults and juveniles winter in deep, large rivers or lakes, or in smaller streams if there is sufficient water quality and instream flow.

**Dolly Varden:** Dolly Varden occur in small, isolated mountain streams in the Kotzebue and Norton Sound drainages, and on St. Lawrence Island. They feed on small fish, fish eggs, fish carcasses, and invertebrates. Adult anadromous char consume a majority of their annual diet in nearshore marine waters where they feed on small fish and invertebrates.

**Arctic Char:** Arctic char are found in the deep lakes of the Brooks Range and Seward Peninsula, and spawn in September and October.

**Freshwater Fish**

**Northern Pike:** Pike inhabit the slow-moving waters of sloughs and interconnected lakes (i.e. Selawik Flats) in the district. While present in rivers, most pike live in lakes. Pike overwinter in deep lakes and rivers and travel to spawning areas after breakup. Pike spawn in the shallows of bays and marshes characterized by early ice breakup, quiet water, and an abundance of aquatic vegetation. They spend the early summer and fall in the relatively warm slow moving sloughs, meandering rivers, ponds, and the shallows of lakes.

**Burbot:** Burbot are found in the cool, deep lakes and rivers in parts of the CRSA. Burbot move into tributaries following spawning, presumably to feed, before retreating to deep lakes rivers. They are also found in summer in interconnected lakes and sloughs in lowland areas. Adult burbot may live over 15 years and reach 72 cm (28 inches) or more in length. Burbot feed primarily at night on small fish.

**Marine Fish**

**Herring:** Herring occur in both Norton Sound and Kotzebue Sound. Herring enter estuarine habitats, such as in the areas near Golovin, Teller, Nome and Solomon, in late May and early June to spawn. Spawning coincides with ice break-up. Juveniles are abundant in northern Kotzebue Sound throughout June and July and later move to offshore feeding grounds. Herring feed on zooplankton and are important prey for marine mammals, birds, salmon, and bottomfish. Yellowfm sole are known to feed on herring eggs.

**Yellowfin Sole:** Yellowfin sole inhabit coastal waters from British Columbia to the Chukchi Sea and Bering Strait. The greatest concentration of yellowfin sole occurs in the eastern Bering Sea, south of St. Matthew Island. Yellowfin is a small, slow-growing fish.

**Red King Crab:** The region's red king crab inhabit the continental shelf out to the continental slope and are found in Norton Sound and in the area extending beyond St. Lawrence Island. Red king crab prefer water depths less than 110 m with a sand or mud bottom (NPFMC 1998).

Spawning and rearing areas are critical habitat as they support high concentrations of both male and female crabs at highly sensitive times (as the female crab are without their shells). Spawning occurs in about 20 percent of Norton Sound. Larvae are more sensitive to water quality degradation than adult crab.

**Blue King Crab:** There are concentrations of blue king crab around King Island, Little Diomede and in the waters near the community of Wales.

### 6.5.2.2 Marine Mammals

A wide variety of marine mammals occur in the waters of the district. The most important species are described below. More information about marine mammals may be found in Volume 1, Bering Straits CRSA Resource Inventory, on page 28. Additional information may be found in the *Alaska Habitat Management Guide* (AHMG), Arctic Region, Volume I (ADFG 1986).

**Bowhead whales**: The Bering Sea stock of Bowhead whales, also referred to as the western Arctic stock or the Bering-Chukchi-Beaufort stock, has been studied more extensively than any other of the four stocks of bowhead whales. From April through June, these whales migrate north and east, following leads in the sea ice in the eastern Chukchi Sea until they pass Point Barrow where they travel east toward the southeastern Beaufort Sea. They can be found offshore from Sledge Island to Kotzebue Sound from March to May. Most of the summer (June through September), bowhead whales range through the Beaufort Sea, but very few bowhead whales are found in the Chukchi Sea in summer. However, there have been enough sightings to indicate that some whales do not migrate to the Beaufort Sea, at least during some years. Between early September to mid-October, bowhead whales migrate west out of the Beaufort Sea. From mid-September to mid-October they are seen in the northeast Chukchi Sea, some as far north as latitude 72N. Whales migrate from Point Barrow into the Chukchi Sea heading toward Wrangel Island. When they reach the Siberian coast, they follow it southeast to the Bering Strait. By early winter (late October and November), they arrive in the Bering Sea where they remain until the following spring migration.

**Beluga whales:** Beluga whales are found in seasonally ice-covered waters throughout arctic and sub arctic regions. With the exception of those in Cook Inlet and adjacent waters of the northern Gulf of Alaska, most beluga whales in Alaska waters are thought to winter in the Bering Sea in open leads and polynyas in the pack ice. In spring and summer, they are found in coastal areas or the offshore pack ice. Beluga whales use the waters of Norton Sound, including summer concentrations in Pastol Bay, Norton Bay and Kotzebue Sound. They migrate along the coast of the CRSA from June to October or November.

**Pacific Walrus:** The Pacific walrus is distributed along the continental shelf of the Bering and Chukchi Seas. In winter, they mostly occur in polynyas and open leads in two major concentrations, one south of St. Lawrence Island and the other in Bristol Bay. In the summer, most follow the retreating pack ice migrating north into the Chukchi Sea.

Commercial exploitation of Pacific walruses began in the 18$^{th}$ century, when the population is estimated to have been 200,000 to 250,000 animals. The population has fluctuated during the past 150 years, according to the U.S. Fish and Wildlife Service, possibly shrinking to as low as 50,000 animals in the 1950s. Joint surveys conducted by the United States and Russia over the past 25 years have estimated the population to be as high as 246,000 animals. The most recent aerial survey counted 201,000 animals, but did not cover portions of the Chukchi Sea because of a lack of ice (USFWS website 2005).

Walrus migrate along the coast near Nunaktuk Island to Cape Espenberg. The actual location of these concentrations is somewhat dependent on the extent of ice in the Bering Sea, which the

animals use as a resting platform when not engaged in other activities such as breeding and feeding.

Beginning usually in mid-April, the sea ice starts to melt and recede northward, and the majority of the walruses move with it. As benthic feeders, walrus use their sensitive whiskers to feel for food while traveling along the sea floor. Their diet consists primarily of mollusks, crabs, salt worms, shrimp, other crustaceans, and octopus. Occasionally walrus may consume other pinnipeds such as spotted, ringed, and bearded seals (Pielou 1994).

**Spotted Seals:** Spotted seals are widely distributed along the continental shelf of the Beaufort, Chukchi, Bering, Okhotsk seas and south to the northern Yellow Sea and west to the Sea of Japan. Spotted seals winter in the Bering Sea along the ice edge. According to the National Marine Fisheries Service (NMFS), a reliable estimate of spotted seals is unavailable. After a review of research, the agency concluded that a very rough estimate of 59,214 could be made based on a corrected count from aerial surveys conducted over the Bering Sea pack ice and over haulout sites in the spring. The stock assessment was revised in March, 2002 (NMFS 2005).

**Ringed Seals:** Ringed seals are the most widely distributed and abundant seals in the northern hemisphere, and are closely associated with ice. Estimates vary, but a 2000 estimate for the area from Shishmaref to Barrow of 245,048 is accepted by NMFS as reasonable (NMFS 2005).

**Bearded Seals**: Many of the bearded seals that inhabit the Bering and Chuikchi seas probably winter in Bristol Bay. Pups are born from March through mid-May, with the peak occurring in late April. According to NMFS, there is no reliable estimate of the population of bearded seals in Alaska, and data from aerial surveys flown during 2000 is awaiting reconciliation (NMFS 2005).

**Ribbon Seals:** Ribbon seals are found in the open sea, on pack ice and rarely on shorefast ice. They range northward from Bristol Bay in the Bering Sea into the Chukchi and western Beaufort seas. They may summer in the Chukchi Sea; however, further study is necessary to determine the nonbreeding seasons (NMFS 2005).

**Polar Bears:** Polar bears are most abundant near coastlines and the southern edge of the ice, but they can occur throughout the polar basin. They make extensive movements related to the seasonal position of the ice edge. In winter, bears off Alaska commonly occur as far south as St. Lawrence Island and may even reach St. Matthew Island and the Kuskokwim Delta. During the summer, bears occur near the edge of the pack ice in the Chukchi Sea and Arctic Ocean, mostly between 70° and 72° north latitude. There is no current reliable estimate of polar bear abundance.

The main food of polar bears adjacent to Alaska is the ice-inhabiting ringed seal. Bears capture seals by waiting for them at breathing holes and at the edge of leads or cracks in the ice. They also stalk seals resting on top of the ice and catch young seals by breaking into pupping chambers in snow on top of the ice in the spring. Polar bears prey to a lesser extent on bearded seals, walruses, and beluga whales. They also feed on carrion, including whale, walrus, and seal carcasses they find along the coast. They occasionally eat small mammals, bird eggs, and vegetation when other food is not available.

#### 6.6.2.3 Land Mammals

The vast region of the CRSA supports roaming herds of caribou, some of the largest brown bears in the world, moose in the river valleys, Dall sheep in some of the rugged mountains, and a wide

array of small furbearers. Most of the information for this section was obtained from the ADFG *Wildlife Narratives* and has been updated with information from recent federal and state wildlife agency reports.

**Caribou:** The caribou is a medium-size member of the deer family. Both males and females grow antlers, distinguishing them from all other North American deer. Bulls, which weigh 160 to 180 kg (353 to 396 pounds), are considerably larger than cows which average 80 to 100 kg (176 to 220 pounds). Cows give birth in late May and early June to a single calf.

The Western Arctic Herd is the largest caribou population in Alaska, occupying the northwestern quarter of the state. The herd's summer range in the approximately 140,000 square mile range consists of the northern foothills and mountains of the Brooks Range west of the Trans-Alaska pipeline. The calving grounds are located near the center of this summer range. Important insect relief areas are from Point Lay to Cape Lisbourne and in the mountains. In their annual migration between summer and winter ranges, Western Arctic caribou travel through a variety of Brooks Range passes and along the western coastal plain and foothills (WACH Working Group 2003).

In most years since the mid-1980s, at least half of the herd wintered in the eastern third of the Seward Peninsula and in the Nulato Hills as far south as the Unalakleet River drainage. Since 1996 the herd expanded its winter range westward on the Seward Peninsula. Also, in the late 1990s, many Western Arctic caribou wintered in the upper Koyukuk River drainages and on the North Slope between Atqasuk, Wainwright and Umiat (WACH Working Group 2003).

The interagency team that cooperates on a management plan for the herd estimates that it numbered approximately 430,000 animals in 1999, after peaking at about 463,000 animals in 1996. However the size of the Western Arctic Herd can change rapidly. From 243,000 animals in 1970, the herd declined to about 75,000 in 1976. From 1976 to 1990, the herd grew at about 13% per year, but that growth slowed to only 1 – 3% between 1990 and 1996.

During the winter, caribou concentrate in areas where shallow snow cover allows them to reach lichens, grass, sedges, and shrubs. Lichens grow slowly, typically requiring over 50 years to develop a stand that can sustain caribou. Caribou often feed in different locations in successive years in an apparent adaptation to the slow growth of depleted lichen ranges.

Many interrelated natural factors limit caribou populations. Reproductive success, weather, predation, disease, parasites, insect harassment, and loss of animals to other herds largely determine herd size. Spectacular herd growth' may occur on good ranges. Equally staggering declines may occur when the number of caribou exceeds the carrying capacity of the range. "Silver thaw," a condition resulting in fairly thick ice forming over snow can essentially "lock-up" vegetation, and cause large numbers of caribou to starve to death. Diseases, such as the 1968 hoof-rot epidemic, are usually related to overpopulation. In addition to calving areas, winter range and migration routes are critical to the caribou's survival.

**Moose:** The moose is the largest member of the deer family. Mature bulls weigh 455 to 727 kg (1000 to 1600 pounds) and cows weigh between 363 and 544 kg (800 and 1200 pounds). Moose occur throughout the district, ranging from aquatic and riparian floodplain areas to sub-alpine willow-dominated areas. Sedge meadows, ponds and lakes with extensive aquatic vegetation, riparian and sub-alpine willow stands, and forested areas. Riparian areas along the major rivers and tributary streams are particularly important during winter. Calving occurs in late May and early June.

**Brown bear:** Like all bears, the brown bear has a bulky build; its size depends on sex, age, availability of food, climate, and geographic location. Exceptional males may weigh 600 kg (1,323 pounds), although most are considerably smaller. Mature females normally weigh only about half as much as males at the same age.

Brown bears primarily occur in upland and mountainous areas of the Northwest region, but may occur in lowland and coastal areas. Concentrations of bears may be found along rivers when spawning salmon are present, at beached marine mammal carcasses along the Chukchi Sea coastline between Cape Seppings and Cape Thompson, in reindeer calving areas, and in caribou calving grounds and migration corridors. Concentrations of bears are attracted to spawning salmon on the lower Noatak, Squirrel, Salmon, lower Flambeau and Eldorado, lower Kwiniuk, lower Tubutulik, lower Inglutalik, lower Ungalik, lower Shaktoolik, lower Egavik, lower North, and lower Unalakleet rivers. Spring concentration areas include Cape Espenberg to goodhope Bay coastline, Cape Rodney to Tiksuk River, coastline near Bluff, and coastline from Unalakleet to St. Michael.

**Musk oxen:** A small population of musk oxen can be found on the Seward Peninsula. Introduced to the area in 1970, the population was estimated to be 700 animals by ADFG in 1990. Musk oxen eat a wide variety of plants, including grasses, sedges, forbs, and woody plants. They are poorly adapted for digging through heavy snow for food, so winter habitat is generally restricted to areas with shallow snow accumulations or areas blown free of snow.

**Wolves and Foxes**: Wolves and foxes are found throughout the area. Arctic foxes occupy St. Lawrence Island and coastal areas, whereas arctic foxes generally occupy inland areas. Some red foxes den near the coast. Wolves and foxes select den sites where unfrozen, well-drained soils occur (e.g. dunes, river banks, moraines and pingos). Wolves may initiate den construction in mid-April. Pups are born from mid May through early June, and generally leave the den by mid-July, although dens may be occupied until August. Arctic and red foxes have a reproductive pattern similar to that of wolves.

**Aquatic Furbearers:** Beaver, mink, muskrat and rive otter are common inhabitants of aquatic and riparian floodplain and wetland areas, including marshes, ponds, lakes, streams and rivers.

#### 6.6.2.4 Birds

Migratory birds are important to the culture, life and economy of the CRSA. The Eskimos of northwest Alaska hunt geese, ducks, and other birds that occur seasonally, as well as the upland birds that are resident in the district. The information in this section was adapted from a 1996 ADFG, Division of Subsistence Technical Paper on use of birds in the northwest Arctic region, which relied heavily on local knowledge of the birds while resident in the region (Georgette 2000), and a 1996 Technical Paper on the subsistence use of birds in the Bering Strait Region (Paige et al. 1996).

A total of about 46,949 birds were harvested by households from the 15 communities during the composite of the years studied (not all communities were surveyed during the same year). The total included 13,277 seabirds, 11,662 ducks, 10,028 upland game birds, 9,627 geese, 1,816 sandhill cranes, 463 tundra swans, 62 shorebirds, and 19 snowy owls (Paige et al. 1996). The most commonly harvested species include are discussed below.

**Canada geese:** These are the most common geese in the northwest Arctic region. They arrive in late April or early May, and stay until September or October, feeding on berries and other vegetation. The birds nest throughout the region along lakes, islands and coastal lagoons, forming flocks on large lakes during their molt.

**White-fronted geese:** White-fronted geese are among the most common summer resident geese in the region. They are also among the first species to arrive in spring, nesting primarily in the Yukon-Kuskokwim Delta region along creeks, rivers, islands and chains of lakes. They migrate for the winter in late August.

**Snow geese:** Snow geese arrive in the region shortly after white-fronted and Canada geese, about the time when the tundra begins to have standing water. They are more common in coastal areas, but also migrate inland in small numbers. They generally do not nest in the region, but feed on old berries, cotton grass sprouts and any greening vegetation before continuing north.

**Emperor geese:** These are generally found only on the northern Seward Peninsula, nesting along the coast west of Deering, and feeding primarily on clams. They often remain in the region until October.

**Brant**: Brant geese are the last arrivals among geese in the region each spring, but migrate through to more northern nesting areas. More than 80% of the Pacific Flyway black brant nest on the Yukon-Kuskokwim Delta, an estimated 19,900 nests. A small number, estimated at about 200 birds, nest from the Seward Peninsula to Kasegaluk Lagoon, along the Chukchi Sea coast. (Pacific Flyway Council 2003).

**Tundra Swans**: These are abundant throughout the region and arrive in the spring after geese and cranes. Eastern tundra swans breed from northwest Alaska through the Canadian arctic (about 10,000 are from Alaska) and migrate across the continent to winter on the Atlantic coast. The western population of tundra swans nests along the west coast of Alaska from Kotzebue Sound to the Alaska Peninsula. Since 1970, the annual abundance of tundra swans has averaged approximately 60,000 birds.

**Sandhill Cranes:** The cranes are among the first to arrive in the region in spring, in late April or early May, and nest on the tundra throughout the region. They stay in the region until late August or September, and feed on berries, insects, and long worms.

**Eiders:** Four species of eiders are found in Alaska, and the common eider is the most abundant in the northwest Arctic. They arrive early in spring, where they follow open leads in the ice. They remain in the area as long as the ocean has ice-free areas, and feed on clams and snails. Spectacled eiders, an endangered species, are rare throughout the region, and spectacled eiders are even more rare.

**Other Ducks:** Northern pintails are one of the most numerous and among the earliest-arriving species in the region. They are fat on arrival. American wigeons, mallards, and northern shovelers are also common in the region during the summer. Ducks that arrive in a second wave in spring, in mid-May, include scoters, oldsquaw, scaups and mergansers. Harlequin ducks are found along the coast and in swift creeks.

**Loons**: Four species of loons are found in the northwest Arctic region: red-throated, Pacific, common, and yellow-billed. The yellow-billed is the largest and is more common along the coast

than inland. Because they need open stretches of water to land and take off, they arrive later in spring than many of the ducks. They nest on lake shores and islands.

**Murres and Puffins**: Murres and puffins are found in three general areas of the region: the Cape Thompson area north of Kivalina, Chamisso Island in southern Kotzebue Sound, and the coastal bluffs in the Deering area. Murres arrive early in spring if there are open leads in the sea ice. Puffins, of which horned puffins are the most common in the region, nest on cliffs where they burrow into soft mud and rock crevices.

**Eggs:** Wild bird eggs are collected by CRSA residents, who utilize a wide variety of them. Seabird, mostly gull and murre eggs, are harvested in quantity, 44,320 over the composite year studied by ADFG in the 1990s. Lesser quantities of geese, duck, crane and swan eggs were also harvested (Paige et al. 1996).

**Ptarmigan and Grouse:** These species are year-round residents of the CRSA. Willow ptarmigan are the most abundant upland bird in the region, generally wintering along creeks where willows are available as food. Rock ptarmigan are usually found in hills and mountainous areas, but are sometimes found in river valleys. Spruce grouse are found throughout forested areas in the region.

#### 6.6.2.5 Vegetation

Edible flora resources are dominated by berries. The most prominent of these are salmonberries, blueberries, cranberries and crowberries, although other species are utilized as well. Willow, fireweed, sourdock, wild celery, Labrador tea, and Eskimo potato are locally popular greens and roots for gathering (Georgette and Loon 1993). Table 6-6 lists some of the rare plants located in Northwest Alaska.

#### 6.6.2.9 Threatened and Endangered Species

Seven species that occur in the planning area are considered endangered by the federal government and three species are considered threatened. The endangered species include blue, bowhead, fin, humpback, North Pacific right, sperm, and sei whales. Threatened species include the spectacled and Steller's eiders, and the Steller sea lion, although the area is farther north than the usual range of the Steller sea lion (NOAA 2005).

### 6.6.3 Biological Resources and Habitat Resource Analysis

The resource analysis begins with a discussion why biological resources and habitat are a unique concern to the CRSA. It continues with a discussion of why these resources are sensitive to development, and it ends with a discussion of conflicting uses and effects of development.

#### 6.6.3.1 Unique Concern

Fish, wildlife, plants, and their habitats are a unique concern to the district because the people of the Bering Straits CRSA depend on these resources for their subsistence needs. Any development activity has the potential to affect biological resources and therefore affect the CRSA and its people.

### 6.6.3.2 Sensitive Areas and Resources

Biological resources and habitats are sensitive to development. Coastal habitats are supported and maintained by physical and ecological factors that could be affected by alterations or disturbances associated with development activities and land and water uses. Fish and wildlife resources of the CRSA are also sensitive to impacts from disturbance and adverse alterations to their habitats which decrease the function, stability, productivity, or access and use of these habitats.

The degree of sensitivity relates to a number of factors including the degree of disturbance from the development, the timing of the activity, the degree to which a species might be sensitive to development, and whether the species has a critical life stage that would be affected by the development.

Information about sensitive areas in the Bering Straits CRSA may be found in the 1984 resource inventory, the 1986 resource analysis, the Environmental Sensitivity Index Maps, and the MESA maps.

### 6.6.3.3 Conflicting Uses and Effects of Development

This part of the resource analysis addresses uses that can conflict with fish, wildlife and habitats. Human activities that affect these resources include the following:

- Disruption of seabird nesting sites,
- Bear-human interactions,
- Dredging and filling,
- Shoreline modifications,
- Water withdrawals,
- Siltation,
- Stream channel alteration,
- Blockage of fish movement,
- Material sites and mining,
- Settlements,
- Predation,
- Floating facilities,
- Causeways,
- ORV use,
- Introduced species,
- Blasting,
- Noise and other disruption,
- Terrestrial habitat alteration,
- Water pollution,
- Fish processing wastes,
- Marine debris,
- Aquatic farming,
- Transportation and Utilities,
- Oil and gas operations, and
- Grazing.

*Table 6-6 Known Rare Plants in the Northwest Arctic Area*

| Global Rank | State Rank | Scientific Name | Common Name* |
|---|---|---|---|
| G1 | S1 | *Douglasia beringensis* | |
| G2 | S2 | *Oxytropis kobukensis* | Kobuk Locoweed |
| G2 | S2 | *Rumex krausei* | |
| G2G3 | S2S3 | *Aster yukonensis* | Yukon Aster |
| G2G3 | S2S3 | *Douglasia alaskana* | Alaska Rockjasmine |
| G3 | S2S3 | *Artemisia senjavinensis* | Arctic Sage |
| G3 | S1 | *Claytonia arctica* | Arctic Springbeauty |
| G3 | S3 | *Oxytropis kokrinensis* | Kokrines Oxytrope |
| G3 | S3 | *Papaver walpoli* | Walpole Poppy |
| G3 | S3 | *Primula tschuktschorum* | Chukch Primrose |
| G3? | S2S3 | *Puccinellia wrightii* | Wright's Arctic Grass |
| G3G4 | S3S4 | *Primula anvilensis* | Anvil Mountain Primrose |
| G4 | S3 | *Asplenium trichomanes-ramosum* | Green Spleenwort |
| G4 | S3 | *Colpodium vahlianum* | Niokornak Arctic Grass |
| G4 | S1 | *Gentianopis detonsa* | Sheared Gentian |
| G4G5 | S1 | *Pleuropon sabinei* | Sabine-grass |
| G4T1T2Q | S1S2 | *Artemisia globularia* var *lutea* | |
| G4T2 | S2 | *Oxytropis arctica* var *barnebyana* | |
| G4T2 | S2 | *Ranunculus glacialis* var 1 | |
| G4T2T3Q | S2 | *Phlox richardsonii* ssp *richardsonii* | Richardson's Phlox |
| G4T3T4 | S2 | *Ranunculus glacialis* var *chamissonis* | |
| G5 | S1 | *Potentilla stipularis* | Circumpolar Cinquefoil |
| G5 | S3 | *Zannichelia palustris* | Horned Pondweed |
| G5? | S1 | *Pedicularis hirsuta* | Hairy Lousewort |
| G5T2?Q | S2? | *Corispermum ochotense* var *alaskanum* | |
| G5T4 | S1 | *Chenopodium glaucum* ssp *salinum* | |
| G5T5 | S2S3 | *Cypripedium parviflorum* | Small Yellow Lady's Slipper |

**Species Ranks Used by the Alaska Natural Heritage Program:**

**Species Global Rankings**

G1 Critically imperiled globally (5 or fewer occurrences)
G2 Imperiled globally (6-20 occurrences)
G3 Rare or uncommon globally (21-100 occurrences)
G4 Apparently secure globally, but cause for long-term concern (usually more than 100 occurrences)
G5 Demonstrably secure globally
G#G# Rank of species uncertain, best described as a range between the two ranks
G#Q Taxonomically questionable
G#T# Global rank of species and global rank of the described variety or subspecies of the species

**Species State Rankings**

S1: Critically imperiled in state (5 or fewer occurrences)
S2 Imperiled in state (6-20 occurrences)
S3 Rare or uncommon in state (21-100 occurrences)
S4 Apparently secure in state, but with cause for long-term concern (usually more than 100 occurrences)
S5 Demonstrably secure in state
S#S# State rank of species uncertain, best described as a range between the two ranks

*Source: Alaska Natural Heritage Program 2005*

**Disruption to Seabird Nesting Sites:** Most seabirds use land only to nest and raise their chicks. The time they are on land is considered a critical stage in their life history when they are extremely vulnerable. Nesting can be disrupted by loud noises or by disturbance by humans, dogs and introduced species such as rats. Successful nesting requires a constant temperature, and when exposed to the elements, eggs my die from either being too warm or too cold depending on the

conditions. Some seabirds nest in holes in the ground which can collapse from the weight of hikers.

**Bear-Human Interactions:** Human interactions with bears can affect their behavior and lead to fatalities. For example, increased fishing and hunting in remote areas can result in bear attacks that result in the death of either the bear or the humans. Purposely feeding bears or creating an attractive nuisance from landfills or inadequate storage of trash can create "garbage bears." Once a bear become habituated to garbage it may be necessary to destroy. Several strategies can reduce to prevent or mitigate negative bear human interactions. First, the use of electric fences can eliminate concentrations of bears around landfills. Programs to keep household garbage and recreational trash outside of the reach of bears have also been successful in some parts of Alaska.

**Dredging and Filling:** Dredging and filling operations affect coastal resources by:

- physical destruction of intertidal, wetland, upland, or benthic habitat and effects to the organisms that depend on these habitats.
- temporary increase in turbidity and a decrease in oxygen levels in water,
- suspension of toxic materials, heavy metals and other substances bound in sediments.
- modification of natural water circulation patterns
- Direct mortality of organisms swept into the dredge.

The impact of dredging operations depend on factors such as the method of dredging, composition of dredged material, the location and timing of operations, and the method of disposal of dredged materials.

**Shoreline Modifications:** Modifications to shorelines include bulkheads, riprap, breakwaters, causeways, piers, docks, and bridges. Unless designed properly, shoreline modifications can reduce the amount of habitat available, disrupt sediment transport, induce erosion or accretion, affect tidal circulation, and alter fish migration patterns. Structures that extend into marine waters can disrupt natural circulation and tidal flushing patterns.

Certain measures can reduce effects. For example, floating facilities and buildings on pilings generally have less impact on circulation, sediment transport and nearshore migration of fish. In some cases, breaches in causeways can reduce effects to circulation patterns and fish migration.

**Water Withdrawal:** Fresh water bodies throughout the CRSA provide important habitat for fish. Withdrawal of water can affect fish by reducing areas available for overwintering as wells as reducing inter-gravel water needed for proper development of salmon eggs. Salmon are sensitive to fluctuating water levels and low water can destroy incubation of eggs and alevins.

**Sedimentation:** Sedimentation includes the deposition of fine organic and nonorganic materials on the bed of a stream, lake, wetland, or marine waters. While siltation is the suspension of fine particles in the water column, sedimentation relates to the deposition of fine particles. Sedimentation can occur from erosion, from flattening the stream gradient, from other alterations that result in decreased stream velocity, from gravel operations, dredging, fill, and surface runoff.

Sedimentation can adversely affect coastal resources by smothering fish food such as algae and invertebrates, smother incubating salmon eggs and young fry, and altering vegetation growth. Other effects of erosion are addressed under the natural hazards section.

**Siltation:** Siltation, also called turbidity, is the addition of suspended solids to freshwater or saltwater. Long-term turbidity can adversely affect plant and animal life by reducing light and thereby affecting photosynthesis and the ability to sustain fish. Salmon may avoid spawning in turbid waters (Bission and Bilby 1982; Lewbel 1983). Turbidity can also result in increased water temperatures because suspended particles absorb more radiation from the sun than clear water. Turbidity can also affect the amount of dissolved oxygen in the water and the ability to sustain fish.

**Stream Channel Alteration:** Streams may be altered by channelization (straightening or shortening channels), diverting watercourses, widening or narrowing, changing stream gradients, and removing vegetation. Alterations to streams can result in changing water velocity. The natural meanders in a stream absorb energy and add to the creation of pools and riffles that are important for fish.

Alterations to streams can result to changes to habitat including:

- a reduction in desirable habitat (such as overhanging banks, logs, and overwintering areas)
- changes in distribution of streambed materials,
- changes to temperature and dissolved oxygen levels,
- blockages to fish migration,
- erosion, and
- changes to stream velocity, depth and gradient.

Projects that alter the spawning substrate can affect salmon because there is some indication that eggs size of certain populations of salmon match the size of the gravel substrate in particular areas of watercourses.

Low dissolved oxygen, especially at hatching time, high or low stream discharges, low temperatures, disturbance, and predation can significantly reduce survival through the migrating fry stage (Hunter 1959).

**Blockage of Fish Movement:** Blockage of fish movements can occur from physical obstructions, water velocity, thermal barriers, or pollution. Inadequate or improperly installed culverts and other drainage structures can impede movements of fish, especially juvenile fish. Culverts that are too small create a velocity barrier to fish passage. Bridges are generally preferred to culverts as long as bridge supports do not lead to increased velocity or accumulate debris.

**Material Sites and Mining:** Mining can have significant effects on coastal resources and uses. Gravel mining and placer mining can result in increased siltation that in turn adversely affects fish habitat including spawning areas. Untreated disposal of mining wastes can pollute ground water. In addition, mining operations can alter habitat. Instream mining can alter river flow and lead to erosion of stream banks.

**Settlement:** Development of previously vacant land or disposal of public land through sales or leases for settlement purposes can have adverse effects. New settlements can lead to conflicts with recreation or subsistence uses including increased competition for fish and wildlife resources. Use of land for settlement purposes will have some degree of habitat alteration and noise from activities can displace wildlife. Generally, concentrated areas for settlements will have less of an effect on resources than multiple individual lots dispersed over a large area. Another issues with settlement involves a greater potential for bear-human encounters.

**Predation:** Development activities can upset a natural predator-prey relationship. A number of examples of increased predation in Alaska result directly from human activities. For example, there is some evidence that the oil and gas infrastructure on the North Slope has resulted in increased predation of bird populations from an increase in predators that are attracted to areas habituated by humans (Natural Resource Council 2003). As reported at the 2005 Information Transfer Meeting for the Alaska Region of the Minerals Management Service, a study in progress has found that ravens near oil field infrastructure have a 90 percent success rate in producing fledglings, a much higher rate than in other areas of the region. Other examples of increased predation resulting from human activities include introduction of species, such as foxes and Norway rats, and an increase in predation of birds by gulls. In some areas of Alaska, the gulls have increased as a result of disposal of seafood processing wastes and discarding of bycatch (State of Alaska 2002).

The natural cycle of predator-prey relationships can deplete populations of species important to subsistence or sport hunting. While efforts to control predators, such as wolves, can help other species recover, they may conflict with opinions of some who oppose any form of predator control.

**Floating Facilities:** Floating facilities can result in effects to coastal uses and resources. First, grounding of facilities in certain kinds of tidelands can damage habitat. Floating facilities, such as docks, can inhibit public access. Also, disposal of human wastes and gray water can be an issue for floating facilities without adequate containment and disposal systems.

**Causeways:** The construction of causeways results in temporary increased siltation and permanent covering of benthic habitat. Additional effects of causeways include disruption of water circulation patterns and fish migration.

**Gravel Islands:** Gravel islands for drilling oil and gas can have localized effects including increased siltation during construction and habitat alteration in the site of the island. Past practices of using sand bags in plastic bags has been stopped because the bags washed up on shore after the island degraded. Migrating birds can strike facilities on islands.

**ORV Use:** Off-road vehicle use associated with development can adversely affect wildlife and habitat. Noise from the activities can displace wildlife, and use of vehicles in certain areas can result in damage to soils.

**Recreation Use:** As described in more detail under the section on recreation, recreation activities can affect coastal resources and uses, especially subsistence hunting and fishing. As well, intense use of areas can damage habitat, displace wildlife and lead to adverse bear-human encounters.

**Introduced Species:** Introduced species can affect natural ecosystems. Certain plant species are invasive and compete with native species. As well, introduced animal species can compete with native fish and wildlife. Of special concern is the potential for non-indigenous farmed salmon to escape to rivers and streams.

**Blasting:** Blasting can have adverse effects relating to noise disturbance and damage to animals through the shock wave. Underwater explosions can rupture swim bladders in fish. Pressure tests with live fish indicated a peak pressure of 40 to 50 pounds per square inch is usually fatal to fish with swim bladders (Hubbs and Rechnitzer 1952). Incubating salmon eggs are extremely sensitive to shock.

**Noise and Other Disruptions :** The effects of noise depend on the decibel level, amplitude, frequency and whether it is pulsed or non pulsed. Development activities in flat terrain or areas without physical barriers may be more disturbing than when activities are obscured by vegetation or topography. Loss of habitat due to noise can affect reproductive success.

Nesting waterfowl and seabirds are particularly vulnerable to startling noises. Egg mortality may result from abandonment of nests or increased susceptibility to predation. Exposed eggs can become overheated or chilled. Molting birds are more susceptible to disturbance because they are under considerable physiological stress during the flightless period.

The physical presence of equipment, machinery, vessels, vehicles and human beings can alter the behavior of wildlife. The species most sensitive to disturbance in the BBCRSA include ducks, geese, shorebirds, seabirds, harbor seals, and sea lions. Johnson et al. (1989) have compiled a synthesis of information on the effects of disturbance and noise on sea lions and harbor seals.

**Terrestrial Habitat Alteration:** Project activities can affect terrestrial habitats by altering their productivity, changing vegetation composition or converting the habitat to other uses. Activities of concern include clearing, excavation, development of material sites, waste disposal, dredge spoil, fill areas for roads or other facilities, development of port and harbor facilities, and residential and commercial developments. The loss or alteration of habitats is most critical for wildlife populations in areas important for feeding or seasonal use.

**Water Pollution:** The waters of the CRSA are vulnerable to pollution from oil and petroleum products. Sources of such pollution include chronic discharges or one-time spills. Marine vessel fuel, lubricants and refined petroleum products are transported through the CRSA.

The toxicity of oil to individual fish and shellfish species is well document in laboratory studies, but extensive fish kills after oils spills have not been observed. Sub-lethal effects are poorly understood. It is not known if fish can detect and avoid spills. There is some evidence that oil spills in anadromous fish streams can interfere with the homing ability of salmon (Maynard and Weber 1981; Thorsteinson 1984). Sub-lethal effects of oil on fish and shellfish may include changes in organ tissues and physiology, increase vulnerability to disease, decreased growth, and interference with the reproductive process (Rice 1981; Lewbel 1983).

Birds are particularly vulnerable to oil spills. When coated with oil, bird feathers lose their insulating qualities and the birds may die of exposure or drown. If oiled birds attempt to clean their feathers, they may ingest oil and die from its toxic effects. When bird eggs are contaminated with oil, their hatchability is reduced, and hatched birds have a large proportion of deformities which ultimately lead to death. Seabird nesting sites, resting locations, and pelagic feeding areas are all extremely sensitive to oil pollution, as are waterfowl feeding, nesting, molting, and staging areas (Thorsteinson 1984; Starr et al. 1981).

**Contamination:** Effects of chemical contaminant exposure may be contributing to the decline of spectacled eiders (Somateria fischeri) nesting in coastal areas of western Alaska. In an evaluation of chemical exposure and potential effects in 20 male eiders collected near St. Lawrence Island, the contaminants that were found included metals, trace elements, chlorinated organics, and (137)Cesium ((137)Cs). A few samples had trace concentrations of chlorinated organic compounds. Despite elevated metal concentrations, the apparent good health of the St. Lawrence Island birds suggests that should these contaminants be a factor in population declines, they likely

act by decreasing fecundity or survival of young rather than via direct health impacts on adult male spectacled eiders (Trust et al. 2000).

**Fish Processing Wastes:** Disposal of fish processing wastes by floating and onshore processors in waters can have serious consequences to marine habitats. Historically, up to 60 percent of wastes were discharged in to the marine environment, but improvements have reduced discharges. These measures include recovery of fish oil, installation of fish meal plants, and use of smaller mesh screens for discharges.

Three primary effects result from the discharge of fish processing wastes include an increase in total suspended solids (TSS), an increase in biological oxygen demand (BOD) that reduces available oxygen, and an increase in oil and grease. The degree of impacts relate to the amount of waste that is discharged, the type of seafood being processed, the degree of natural flushing at the discharge location, and the type of habitat at the discharge site.

In addition to the effects discussed above, disposal of fish processing wastes can lead to an increase in predators, such as gulls, that also feed on young of other bird species and compete with them for habitat (State of Alaska 2002).

**Marine Debris:** Marine debris affects coastal resources by increasing mortality or damage to fish and wildlife that become entangled with the debris. This debris often originates from floating vessels. A lack of law enforcement, resistance to degradation by some materials, limited landfill space in Alaska, and a lack of ease for proper disposal of materials all contribute to this problem.

**Aquatic Farming:** Aquatic farming has the potential to conflict with fish and wildlife and their habitat. While finfish mariculture is not allowed in Alaska waters, it occurs in the waters of British Columbia, and at the time this plan was written, there was a proposal to allow mariculture in federal waters. Depending on the type of mariculture, the following effects may occur:

- Exclusion of other uses in areas used for mariculture.
- Noise from movement of pens.
- Accumulation of fecal wastes under pens.
- Escape of non-indigenous fish to nearby streams.

**Oil and Gas:** Oil and gas exploration and development can significantly affect coastal resources and uses. The most important effect would be from an oil spill, especially an offshore spill. Other effects include displacement of wildlife, recreation, subsistence, and commercial fishing activities. Seismic exploration activities can displace fish and marine mammals and interfere with commercial fishing operations. Other effects resulting from facility construction would be similar to other developments. Pipelines have the potential to disrupt wildlife migration, especially when associated with roads. Subsea pipelines can interfere with fishing operations, especially when the pipelines are not buried.

**Transportation and Utilities:** Construction of transportation and utility facilities can have significant effects to coastal uses and resources. Roads result in physical changes to the habitat itself by displacing animals and disrupting migration paths. An effort in Louisiana to link wildlife migration corridors focused on providing access under roads where the natural corridors had been cut off.

Roads produce noise which can affect some animals. Roads also change drainage patterns and improperly placed culverts can be a barrier to fish migration, especially young coho salmon that

use small tributaries for rearing. Erosion and runoff can result during road construction leading to increased suspended solids in water bodies. In addition, roads provide access for hunters and fishermen to areas previously not easily accessible. This access can lead to new pressures on fish and wildlife populations.

Other utility facilities also affect coastal resource and uses. Hydroelectric projects can affect coastal resources by altering stream flows and blocking fish passage. Impounded water bodies will change the habitat. Utility corridors for pipelines and transmission lines can disrupt wildlife migration. Facility construction can damage or destroy unmarked graves, archaeological sites and historic sites.

**Spruce Beetle Kill:** Forests in the region are being affected by an outbreak of spruce beetles. This situation may provide opportunities for harvest of the trees for local or regional use.

### 6.6.3.4 Cooperative Management

Beginning in the 1970s and 1980s, a greater emphasis was placed on involving local people in the management of coastal uses and resources. The Alaska Coastal Management Act, passed in 1977, provided the ability of the residents of the region to create a coastal resource service area specifically for involvement of local people in the management of coastal resources. Also, in 1977, the Alaska Eskimo Whaling Commission was established to influence the management of whaling. Four communities in the CRSA are members of the commission: Savoonga, Gambell, Diomede, and Wales. In 1988 two other organizations were established to help management marine mammals: the Alaska Beluga Whale Committee and the Eskimo Walrus Commission. In addition, the Kawerak, Inc. established the Reindeer herders Association to assist reindeer herders.

### 6.6.3.5 Relationship between Uplands and Marine Systems

There is a close connection between land and water systems in Alaska. Activities occurring far from the ocean can have a direct and significant impact on marine waters. The amount of freshwater and its chemical composition directly affect saltwater areas, especially estuaries and nearshore areas. Any activity in a watershed that affects the quantity of freshwater or its chemical composition will have an effect on the marine waters.

Nutrients that enter marine waters from freshwater come from a variety of sources including detritus from waterbodies far from the ocean. The slow decomposition of pacific salmon provide an influx of nutrients, and some of these nutrients are exported to marine waters. Wipfli et al. (2002) found that invertebrates and detritus from forested headwater streams were exported downstream year-round. The connectivity between these habitats is an important ecological factor.

The greater the number of salmon that return to a stream, the greater the nutrient load of the river. Nutrients are spread to the land through ingestion by carnivores. These nutrients eventually leach through the soil and return to the stream either directly or through the decomposition of streamside vegetation (Wipfli et al. 1999, Wipfli 1997). Carcasses of dead salmon and other animals that prey on salmon act as a “slow-release” fertilizer that provides nutrients to the freshwater throughout the year (Wipfli 1998).

Freshwater inflow to estuaries provides a critical factor for the productivity of the ecosystem. The inflow of freshwater to determines what species can be supported in an estuary. The influx of river water creates an estuarine circulation pattern – the less dense riverine water override denser marine waters resulting in a mixing of the bottom layer of water. Estuaries are important because they provide important breeding and nursery habitat. The amount of freshwater, the amount of sediments and the amount of nutrients in the water are all important factors. Estuaries are important to survival of salmon (Emmett and Schiewe 1997). For example, the interface between the freshwater and saltwater is considered a critical habitat in the Columbia River system (Casillas 1999).

The mechanisms by which the Columbia River estuary and plume affect juvenile salmon survival have not been quantified, but likely include provision of food, refuge during transport away from coastal predation, and improvement of estuarine conditions for subyearling fish. Since the Columbia River estuary and plume have been significantly altered from historical conditions and hatchery stocks may be affected differently than natural stocks, the system's altered state likely contributes to the overall reduction of salmon. The impact of hydrosystem effects on reducing spring river flow and suspended particulate matter transport on salmon production in the estuarine and coastal plume environment may be large, as flows in most years may now be sub-optimal for salmon production.

# 6.7 Commercial Fishing and Seafood Processing

This section supplements the original resource inventory and analysis. Commercial fishing and seafood processing is discussed on pages 9 – 11 of the 1984 Resource Inventory and pages Chapter 9 of the 1986 Resource Analysis.

## 6.7.1 Commercial Fishing and Seafood Processing Resource Inventory

The main fisheries in the region are for salmon, herring and king crab. Commercial fisheries are managed by the federal and state government. With some exceptions, the federally managed fisheries are those occurring within the Exclusive Economic Zone (EEZ), from 3 to 200 miles offshore, and the state fisheries are within the 3-mile limit.

The National Marine Fisheries Service (NMFS), a part of the National Oceanic and Atmospheric Administration (NOAA) is responsible for federal fisheries. The North Pacific Fisheries Management Council (NPFMC) provides direction to NMFS. Several international treaties also guide management of the fisheries including the International Pacific Halibut Commission (IPHC), the North Pacific Anadromous Fish Commission, and the Pacific Salmon Treaty.
The ADFG manages state fisheries with management responsibilities divided among the Board of Fish, the Division of Commercial Fisheries, the Division of Sport Fish, and the Division of Subsistence. This section provides an inventory of the fisheries relevant to the Bering Straits CRSA as of 2005.

### 6.7.1.1 Salmon Fisheries

Salmon fishing has been an important fishery for the Bering Straits CRSA for many years. All 5 species of Pacific salmon are present in the CRSA.

During the 1980s and 1990s, an increase occurred in the size of the runs of chinook, coho and pink salmon throughout the district. In the late 1990s and early 2000s, however, there has been a decline in the abundance of chinook and coho salmon. The 2004 coho salmon runs improved throughout much of Norton Sound. Chum salmon have declined in abundance, however, particularly in northern Norton Sound. The Alaska Board of Fish determined the Nome, Golovin and Moses Point Subdistricts chum salmon stocks to be stocks of concern in 2000 and 2004. Pink salmon have developed a strong return on even-numbered years and a weak return on odd-numbered years. This strong-weak cycle did not occur prior to 1985. When pinks are abundant there are insufficient markets for them; when their numbers are low there is an insufficient number to allow a commercial fishery (ADFG/CF 2004).

The area is managed through 6 subdistricts: Nome, Subdistrict 1, Golovin, Subdistrict 2, Moses Point, Subdistrict 3, Norton Bay, Subdistrict 4, Shaktoolik, Subdistrict 5, and Unalakleet, Subdistrict 6. Commercial fishing began in 1961 in the Unalakleet and Shaktoolik Subdistricts, a year later in Golovin, Moses Point and Norton Bay Subdistricts, and in 1964 in the Nome Subdistrict (Menard and Jones et al. 2005). Both the Shaktoolik and Unalakleet Subdistricts, which share a common boundary, consistently attract commercial markets due to larger volumes of fish and better transportation services (ADFG/CF 2004).

The 2004 Norton Sound commercial salmon fishery yielded an above average coho salmon run that allowed for a normal commercial fishing schedule of two 48-hour periods per week from late July until early September in the Unalakleet and Shaktoolik Subdistricts. The commercial coho harvest for those subdistricts was the third highest in ten years. The chinook harvest was poor, continuing a consistent trend of several years. There were no chinook salmon fishing periods in the Shaktoolik and Unalakleet Subdistricts for the second year in a row. There were subsistence restrictions on the Unalakleet River. The chum salmon run in the Shaktoolik and Unalakleet Subdistricts was average, but there has been little interest in commercial chum salmon fishing. The pink salmon run was a record, but there has been no buyer interested in pink salmon since 2000 (ADFG/CF 2004).

#### 6.7.1.2 Pacific Herring

The Norton Sound Management Area offers commercial spawn-on-kelp, sac roe and bait fisheries for herring. In 2004, no permit holders registered as participants in the spawn-on-kelp fishery. There were no openings and no wild kelp was harvested. Similarly, there was no sac roe fishery since the buyers contacted indicated that they would not be purchasing in Norton Sound (ADFG/CF 2004).

The only herring fishery that occurred in 2004 was conducted by king crab permit holders. A total of 9.5 tons of herring were reported caught for use as bait (ADFG/CF 2004).

#### 6.7.1.3 Red King Crab

The open access commercial crab fishery was allocated 326,500 pounds of king crab. Two companies, including a Nome processor, were registered to buy king crab in Norton Sound during the open fishery. Some nonlocal and Unalakleet fishers sold their catch to an Anchorage buyer or in dockside sales. The harvest for this portion of the fishery in 2004 was 312,472 pounds, with local boats accounting for 79 percent of the total harvest (Kohler 2004).

A red king crab harvest was conducted under the CDQ program described below. The estimated legal male crab abundance for 2004 was 4.4 million pounds, and increase of 30 percent over 2003. Crab populations are expected to increase in 2005 but decrease in 2006 and 2007. For 2004, the CDQ harvest quota was set at 26,500 pounds prior to the season. The Norton Sound and Lower Yukon CDQ groups divided the CDQ allocation and only fishers operating under the authority of the CDQ group could participate in that portion of the crab fishery (Kohler 2004).

*Table 6-7: Commercial Salmon Catches By Species, Norton Sound District, 1995 – 2004.*

| Year | Chinook | Sockeye | Coho | Pink | Chum | Total |
|---|---|---|---|---|---|---|
| 1995 | 8,860 | 128 | 47,862 | 81,644 | 42,898 | 181,392 |
| 1996 | 4,984 | 1 | 68,206 | 487,441 | 10,609 | 571,241 |
| 1997 | 12,573 | 161 | 32,284 | 20 | 34,103 | 79,141 |
| 1998 | 7,429 | 7 | 29,623 | 588,013 | 16,324 | 641,396 |
| 1999 | 2,508 | 0 | 12,662 | 0 | 7,881 | 23,051 |
| 2000 | 752 | 14 | 44,409 | 166,548 | 6,150 | 217,873 |
| 2001 | 213 | 44 | 19,482 | 0 | 11,100 | 30,849 |
| 2002 | 5 | 1 | 1,759 | 0 | 600 | 2,365 |
| 2003 | 12 | 16 | 17,058 | 0 | 3,560 | 20,646 |
| 2004 | 0 | 40 | 42,016 | 0 | 6,296 | 48,352 |
| 10-Yr Avg | 3,734 | 41 | 27,356 | **248,400 | 13,951 | 181,531 |

** Even years only for pink salmon

*Source: ADFG, Division of Commercial Fisheries, www.cf.adfg.state.ak.us 2005*

### 6.7.1.4 Community Development Quota Program

The Western Alaska Community Development Quota (CDQ) program was developed in 1992 to extend the economic opportunities of productive fisheries in the Bering Sea and Aleutian Islands (BSAI) area to small, rural communities. The Norton Sound Economic Development Council manages the CDQ program for the area. The CDQs include groundfish, crab and halibut fisheries under a quota system. The CDQ groups are required to manage their catch to stay within all of their CDQ allocations of harvestable species (DCED 2002).

Quotas are assigned under the program for halibut, four stocks of king crab, two stocks of tanner crab, sablefish, turbot, Pacific cod, pollock, Atka mackerel, yellowfin sole and other flatfish, rockfish, and Pacific ocean perch. Prohibited species under the program include some halibut, salmon and crab stocks. Any catch of these stocks, and incidental catch of prohibited stocks, are counted in the CDQ's quotas (DCED 2002).

The fishery resources of the CDQ program are under federal jurisdiction, but the program is implemented by the State of Alaska. Allocations are made based on a percentage of the estimated biomass of a species and in consultation with the North Pacific Fisheries Management Council (DCED 2002).

Annual CDQs or specific harvest quotas are determined each year as the National Marine Fisheries Service (NMFS) establishes fishing limits for the fisheries of the BSAI. The harvest

quotas include amounts of fish harvested as target species (those intended to be caught) and bycatch species (those taken as incidental harvest) in directed or target fishing operations. Some bycatch species have market value and are processed and sold, and others are discarded as waste or are prohibited from being retained (NSEDC 2005).

Annual CDQ and target fisheries for red king crab in Norton Sound and halibut in IPHC area 4D/E are predominantly reserved for local fishermen in the BSCRSA region. Annual CDQ of most other groundfish species and the greater Bering Sea CDQ crab fisheries are harvested and processed with a variety of industry partners (NSEDC 2005).

The groundfish CDQ for Norton Sound for 2003-2005 include allocations in both the Bering Sea and the Aleutian Islands, although the fishing effort is targeted at particular areas. In the Bering Sea only, NSEDC has a quota for pollock (32,800 mt), yellowfin (300 mt) and rock (200 mt) sole, and Greenland turbot (25 mt), The halibut harvest (180,000 pounds) will be conducted as a nearshore fishery utilizing locally owned fishing vessels and legal hook and line gear. Savoonga and Nome fishers are expected to be the major participants in this fishery. In the Aleutian Island, NSEDC's quota includes Atka mackerel (605 mt), to be caught across three fishing districts. Sablefish and Pacific cod will be harvested in both the Bering Sea and Aleutian Islands, at 88,000 pounds of sablefish in the Berin Sea and 220,000 pounds allowed form the Aleutian islands. Pacific cod may be harvested at 2,800 mt total from the two areas (NSEDC 2005).

Over the years NSEDC has developed a number of business relationships and harvesting agreements with fishing companies (industry partners) and vessels for harvesting and processing annual CDQ. Most of these partners have participated in the CDQ program and have worked with NSEDC since the various fisheries of the CDQ program started, however some are newer. Some of these industry partners are partially owned by NSEDC. As a rule, NSEDC and harvesting partners work cooperatively together and share in revenues generated from the sale of CDQ-related product through royalty payments, profit sharing and/or ownership interests, and gain additional employment opportunities (NSEDC 2005).

## 6.7.2 Commercial Fishing and Seafood Processing Resource Analysis

The resource analysis begins with a discussion of why commercial fishing and seafood processing are a unique concern to the district. It continues with a discussion of why these resources are sensitive to development. The analysis ends with a discussion on competing uses and adverse effects.

Commercial fishing is an important component of the cash economy in many villages. Commercial fishing activities are sensitive to the health of the fisheries stocks and the habitat they utilize, loss of access to fishing areas, contamination and loss in confidence in the seafood product, and associated social and economic effects.

The members of Norton Sound Economic Development Council (NSEDC) communities have historically depended on fishing for both income and subsistence. The two fisheries that have traditionally supported area residents have been salmon and herring. However, the impact that these two fisheries now have to the economy and subsistence has declined. An increase in salmon populations would benefit subsistence, however, the market for wild salmon has declined in the face of competition from farmed salmon. The herring stocks, formerly a booming springtime industry for Norton Sound residents, also can no longer provide an income for residents. In recent

years, fish prices may not cover the cost of gear and supplies for participation in the fisheries (NSEDC 2005).

Two recent fisheries developments, king crab and halibut fisheries, have improved the outlook for fishermen. Other fisheries that may provide a benefit to the region in the future include shrimp, blue king crab, and marine and freshwater whitefish (NSEDC 2005).

The benefits provided as a result of the CDQ program, as developed by the NSEDC, include scholarships and training opportunities for community residents, fisheries research and development, a revolving loan program, a large vessel loan program, an investment company, seafood processing, and ownership or part-ownership in several seafood catching and processing vessels (NSEDC 2005).

In 1999, the NSEDC Board of Directors introduced the Community Benefit Share Program as an integral part of NSEDC's efforts to help build an ongoing fisheries-related economy in the region. This program utilizes a portion of the annual distribution from Bering Sea fisheries-related investments (second-generation funds) to directly benefit NSEDC member communities by remitting funds directly to the member community. The remittance is equal to each community and made to the member communities' city government (NSEDC 2005).

The Shoreside Infrastructure Improvements Program allows NSEDC to provide assistance and funding for renovation and new construction of fish processing facilities, dock or harbor facilities, and other infrastructure, in accordance with NSEDC's capital investment guidelines.
Through this program, NSEDC has invested in shoreside infrastructure throughout the region since 1993 including Shaktoolik fish processing plant improvements, construction of a new fish processing facility in Unalakleet, Nome Eskimo freezer plant upgrades, Savoonga and Koyuk ice delivery systems, a small halibut processor in Savoonga, Savoonga beach access improvements, construction of a floating dock in Nome, Small Boat Harbor Improvements in Nome, construction of the Norton Sound Seafood Center in Nome, a $3 million capital contribution to the Nome Harbor Improvements Project, purchase of fish processing equipment in Unalakleet, and the purchas of processing equipment for the Teller Fish and Meats Processing Plant, a large vessel trailer in Nome to haul out and launch vessels. These projects are all instrumental in supporting salmon, crab and halibut commercial fishing in the region (NSEDC 2005).

### 5.7.2.1 Unique Concern

Commercial fishing and seafood processing are a unique concern to the Bering Straits CRSA because the fisheries play an essential role in the local economy as well as a contribution to the identity of the communities. District residents are highly dependent on fish as a staple of subsistence, and the commercial seafood harvests offer an opportunity to harvest simultaneously for subsistence and to earn cash to support other subsistence harvesting activities. For many residents, fishing is a way of life.

### 6.7.2.2 Sensitivity to Development

Commercial fishing and seafood processing are sensitive to development because anything that affects the production of fish or the quality of fish affect those who engage in commercial fishing and seafood processing activities. Fish may be affected by alterations to their habitat including activities in streams, lakes and marine waters that affect habitat quality as well as blockage to fish movement. As well, any activity that could affect water quality could potentially affect fish and

the ability to market seafood products. Habitats that are especially sensitive to development are identified in sections 6.6.1, 6.6.2 and 6.6.3.2.

### 6.7.3.3 Competing Uses and Adverse Effects

Concerns for protection of the wild resources harvested commercially for the benefit of CRSA residents include ecological issues such as bycatch, climate change, and sustainability.

#### 6.7.3.3.1 Impacts

Fish are sensitive to disturbance from human activities, and may be extremely vulnerable in certain areas or during certain times of year (spawning, rearing, and migration). Damage to spawning and rearing habitat, and blockage of fish migration in anadromous fish streams are of particular concern. Other species, such as shellfish, may not be able to leave an area of disturbance.

Access to resources are necessary for successful harvest; restricted access may require use of alternative resources, crowd harvesting in remaining areas, and result in higher costs associated with their harvest. Restrictions or loss of access can result from petroleum exploration activities, dredge and fill, and construction of port and harbor facilities. Certain resources may only be available for commercial harvest over a short period of time, and loss of access may severely reduce harvest levels.

Real or perceived contamination of commercial fishery resources can adversely affect the markets for fish. Concerns about contamination from petroleum product spills, waste discharges and mining activities can create public health concerns, and affect market and consumer confidence in fish and shellfish products. Loss of availability and confidence in resources directly result in social and economic effects to commercial fishermen.

A reduction in commercial fishing harvest or low prices also can create economic and social impacts. Reduced income may jeopardize the ability to maintain commercial fishing gear and create economic hardship to individuals and communities through reduced cash income. Social effects of reduced commercial fishing catch, such as those documented in the aftermath of the *Exxon Valdez* spill, can also impact families and communities.

**Habitat Destruction:** The major cause of the loss and degradation of salmon populations elsewhere is the destruction of their habitat. When rivers are dammed, or re-channeled, when lakes are polluted or become eutrophic, when road construction erodes sediments into streams, or the riparian zone is paved over, then salmon inevitably disappear (Adkinson and Finney 2003). Many of the potential impacts to salmon and other fish habitat, such as dredging and filling, shoreline modification, blockage of fish passage, and water pollution are discussed in Section 6.6.3.3.

Habitat threats to salmon were caused by human presence in the Yukon River drainage beginning in the early 1900s with mine exploration and development. Later hydraulic mining and large scale dredges disturbed extensive acreages, which has also occurred in the Bering Straits CRSA. Hydraulic mining washed large quantities of overburden and sediment into downstream spawning and rearing habitats. Some of the mines operating and in development today are sited in potential acid-generating deposits (Salomone and Bergstrom 2004).

Mining activity, particularly gold mining which occurred prior to 1991, may have reduced the ability of the river drainages to produce salmon. Specific river reaches may have been impaired to a greater degree by mining. Depending on the drainage, the relative level of damage ranges from severe to low to unknown (Bergstrom and Whitmore 2004).

Logging in drainages associated with the area river systems can cause increased runoff, increased temperature fluctuations, loss of spawning and rearing habitat, increased siltation and turbidity, and other effects. These effects can be stabilized or moderated with sufficient streamside vegetation (Salomone and Bergstrom 2004).

**Keystone Species:** Some species are bellweather species that signal the relative health of an ecosystem. Some are also critical to the health of an ecosystem that relies on their function. Walleye pollock is such a species. Juvenile walleye pollock prey upon zooplankton (which are also the primary foods for Pacific ocean perch and Pacific herring). In the eastern Bering Sea, adult pollock have been found to prey primarily upon small pollock, as do large-mouthed species such as arrowtooth flounder, Greenland turbot, and Pacific halibut. Many other species, such as sculpins and skates, prey upon pollock. Juvenile pollock occupy a key position in the Bering Sea ecosystem by transmitting energy from zooplankton to larger fishes (Mito et al. 1999).

Pollock are also consumed by sea lions and some seabirds, and may constitute a critical element of these forager's diets. The pollock fishery in the Bering Sea, which accounts for 75 percent of all shore-based processing, had an allowable catch of 1.3 million fish in 2003 (Witherell et al. 2000). Most of the 1.5 million tons of pollock harvested in the Bering Sea is processed into surimi, fish sandwich patties, and fish sticks. The fishery comprises approximately one-third of all U.S. seafood landings at an estimated ex-vessel value of $750 million in 2003 (SWAMC 2003). Thus pollock are a keystone species for both the humans and nonhumans in the Bristol Bay ecosystem.

Human competition for pollock impacts the number available for other users. Biologists are also studying whether disturbances from fishing operations themselves may affect the availability of pollock as prey for non-human foragers. Disturbed fish may move deeper into the water column to form smaller, denser aggregations, which may adversely affect the foraging behavior of Steller sea lions. This may also be true for other forage fish such as capelin, a fattier fish important to seabirds (Wilson et al. 2003). Bycatch is also an issue; on average, a single trawl net load of 100 mt of pollock, half of which are undersized for the processing equipment to manage, meant that 110,000 pounds of juvenile pollock were thrown back (MSSP 1995). Use of bottom trawl gear to fish for pollock was prohibited in 1999 (Witherell et al. 2000).

Human effects on a fishery can in turn affect human use of a fishery. The pollock fishery has been affected by management measures designed to protect Steller sea lions. In 1990, roe-stripping of pollock was prohibited, and the Bering Sea pollock fishery was divided into roe and non-roe fishing seasons. In 1998, NMFS determined that the pollock fishery jeopardized the recovery of the Steller sea lion population, and pollock fishing near sea lion haulouts was restricted and the fishing season adjusted for the benefit of the sea lions (Witherell et al. 2000).

**Invasive Species:** The escape of farmed Atlantic salmon from British Columbian fish farms is a concern because of potential competition for food, the potential to spread diseases or parasites, and impacts to habitat. Sea lice can be transmitted from farmed fish to wild. The potential exists for a "foreign" species to act as a vector for contaminants in freshwater ecosystems important to anadromous fish. Adkinson and Finney reference this possibility in a paper on the future of Alaskan salmon runs. Levels of organic pollutants that were higher in a sockeye salmon nursery

lake than in a nearby lake that salmon could not access suggest that the contaminants were transported by returning adult salmon (Adkinson and Finney 2003).

**Bycatch:** The incidental catch of nontargeted species is a significant problem. Some 300 million pounds of edible fish are caught and discarded overboard each year. Of the bycatch of out-of-season fish up to 90 percent are dead or mutilated (MSSP 1995). Chinook and chum salmon are caught incidentally in Alaskan groundfish fisheries. From 1990 to 2001, an average of 37,819 chinook salmon and 69,332 other salmon species were incidentally caught in the BSAI groundfish trawl fisheries (Witherell et al. 2002).

Norton Sound bound summer chum salmon are caught as incidental bycatch in the Bering Sea groundfish fishery, and the allowance of this catch for subsistence may increase the overall subsistence chum harvest (Salomone and Bergstrom 2004). Given the high participation by susbsistence users in the commercial fisheries, an unknown proportion of the bycatch is utilized by residents of the BSCRSA communities (Fall et al. 2003).

Seabirds are also incidentally caught, typically while diving for forage fish (Livingston 2001).

# 6.8 Energy Facilities

This section provides an update to the resource inventory and analysis for energy development includes and update to the 1984 Resource Inventory (p. 13) and the 1986 Resource Analysis (Chapter 6).

## 6.8.1 Energy Facilities Resource Inventory

The resource inventory includes information about diesel generation, hydroelectric resources, wind generation, and oil and gas.

### 6.8.1.1 Diesel Generation

Nome is the second largest energy consuming census area in rural Alaska, and all electric power is currently generated by diesel fuel. Nome Joint Utilities System produces 60% of the electrical energy in the census area—more than 10 times the amount of energy produced by the second largest utility, Unalakleet Valley Electric Cooperative. Alaska Village Electric Cooperative maintains systems in 10 of the remaining 14 communities. Power production and diesel consumption peaks in winter months when residences and facilities require more lighting and heating (DCCED 2005)

### 6.8.1.2 Hydroelectric Resources

There are currently no hydroelectric power facilities in the Bering Straits CRSA. Potential projects have been identified near Brevig Mission, Elim, Nome, Teller, and Wales. In its 6-year *Local Economic Development Plan*, the community of Elim has identified the development of a small hydropower project as a priority, along with other alternative energy sources (Elim 2004).

#### 6.8.1.3 Wind generation

Almost every location along the Western and Northwestern coasts of Alaska qualifies as a candidate wind site. Several communities are estimated have Class 7 wind power resources, with between 400 and 1000 watts per square meter. These sites include Brevig Mission, Wales, and Gambell. With the exception of Golovin, Stebbins and White Mountain, where present estimates indicate wind power of about Class 3, (150 to 200 watts per square meter), the region appears to have good to very good wind energy potential, with typical wind power densities of Class 5 and 6 (250 to 400 watts per square meter). Due to the viability of wind energy in most of the region, sites with wind power densities of lower than Class 4 deserve more extensive investigation before their potential is abandoned. In many locations, it is common for the communities and the data collection instruments to be sheltered by nearby hills (DCCED 2005)

Several efforts are underway to develop the wind resources of this area. A technology development project is underway in Wales. The purpose of this project is to demonstrate the viability of high penetration wind-diesel systems to significantly displace diesel fuel and reduce diesel run time. Resource monitoring programs are underway in Nome and Brevig Mission. The Alaska Energy Authority is working with the Alaska Village Electric Cooperative to encourage the development of a self-supporting series of wind projects in this region (DCCED 2005)

#### 6.8.1.4 Oil and Gas

Oil and gas resources are discussed in the in the 1984 Resource Inventory (p. 14, p. 18) and the 1986 Resource Analysis (Chapter 6). The geology of the region is discussed in the Resource Inventory (p. 17). There has been little interest in onshore exploration for oil and gas in the region, and it is not thought to be especially conducive to oil and gas formations.

Two sedimentary basins in the CRSA have some potential for oil and gas: The Hope Basin and the Norton Basin. Norton Basin is considered to have better potential for oil and gas than Hope Basin. Industry has not showed much interest for onshore areas that have been leased.

Exploration in the Outer Continental Shelf (OCS) has occurred in the 1980s. Lease Sale 57, held in 1983 for the Norton Basin Planning Area, resulted in the sale of 59 leases. Six exploratory wells were drilled by Exxon and ARCO during 1984 and 1985, but no commercial quantities of oil or gas were found. A proposed sale in 1986 was cancelled due to lack of interest. The current 5-year oil and gas leasing program for the Minerals Management Service includes provisions for sales in both the Norton Basin Planning Area and part of the Hope Basin Planning Area (MMS 2002).

### 6.8.2 Energy Facilities Resource Analysis

The resource analysis begins with a discussion of why energy resources are a unique concern to the CRSA. It continues with a discussion of uses and resources that are sensitive to energy development. The analysis ends with a discussion on conflicts related to energy development.

#### 6.8.2.1 Unique Concern

Energy facilities are a unique concern to the CRSA for because they have the potential to supply power to the region and reduce costs of power generation. In addition, energy facilities could

potentially provide economic diversity. Lastly, the effects of development of energy resources could adversely impact other coastal uses and resources.

### 6.8.2.2 Sensitivity to Development

Sensitive areas are identified in Section 6.6.3.2. Energy development can have significant impacts on sensitive areas as discussed in the next section. In addition, energy resource development can affect other uses such subsistence ad recreation.

### 6.8.2.3 Energy Development Conflicts

Chapter 6 of the 1986 Resource Analysis addresses potential conflicts with energy development. The analysis identified 6 concerns: harm to fish, marine mammals, birds, plants; oil spill cleanup ability; commercial fishing conflicts; local hire; increase in cost of local goods; and adverse impacts to subsistence. This discussion addresses these issues in a slightly different format. Table 6-1 in the 1986 Resource Inventory outlines expected impacts to birds in Norton Sound from oil and gas development.

**Diesel Generation:** Generation of electricity by diesel fuel is expensive. This type of generation often produces noise and a certain amount of air pollution. Residents of Golovin have noticed that seals stopped inhabiting the waters close to the villager after installation of a new power generation plant. Pollution from diesel generation would not likely be a significant problem due to the size of the plants and dispersal of exhaust.

**Hydroelectric Generation:** Hydroelectric generation can have significant effects if the project is of a large scale. The projects planned for the CRSA are small-scale and would likely only have localized effects. Such effects include a reduction in water flow.

**Effects of Oil and Gas Exploration and Development**

**Habitat Effects:** The most obvious effect of oil and gas development is the reduction in habitat due to oil field infrastructure. As a result of new technology, the actual footprint of oil and gas facilities is much smaller than two decades ago, but facilities can be spread over a large area. A large amount of gravel is still needed for drill pads, facility sites and roads. The construction of roads and pads can affect hydrology, vegetation, and animal populations up to several kilometers from the development.

**Noise:** Noise from oil and gas activities have significant effects to wildlife migration and human activities. Concerns offshore include the migration of marine mammals, including whales, walrus, and seals. Noise also affects onshore subsistence activities and distribution and migration of caribou. Subsistence hunters on the North Slope report that caribou have adverse reactions to low-flying airplanes. As discussed in the section on caribou below, noise from roads can affect distribution of calving caribou and the migration patterns of other caribou. Noise originates from helicopter and fixed wing aircraft, diesel generators, compressors, and pile drivers. Different species of birds and mammals have various levels of tolerance. Startled seabirds knock young and egg from nests as a result of sudden noises (Starr et al. 1981). Strong or persistent noise can cause bears to abandon newborn cubs; caribou and moose most sensitive during calving; marine mammals depend on underwater acoustics for communication; and walrus flee haulouts in response to low-flying aircraft. King Islanders claimed that low-flying aircraft servicing COST wells in Norton Sound drove walrus from traditional migration routes. There is some indication

that bearded seals less sensitive to aircraft during the summer. Loud, sudden and erratic noise causes the most response and avoidance. Reportedly, belugas fled a barge 1.5 miles away. Bowhead whales have been observed to small power boats with high-pitched engines but not as sensitive to large vessels (Starr et al. 1981). Golovin residents have reported that seals avoid area since a noisy generating plan was installed.

**Seismic Surveys:** Offshore seismic surveys use high pressure air guns. These noises can affect the migration of bowhead whales and may disturb other marine mammals. A recent innovation, 3-dimensional seismic testing, results in a need for greater density of offshore arrays and onshore trails. Although an early study found that whales were affected only up to 4 miles, more recent studies have verified local knowledge that whales are affected at much greater distances, some up to 12 miles from the seismic operations.

Onshore seismic surveys record how sound waves are reflected through the ground from surface "thumpers." Although conducted during the winter, local residents are concerned that seismic surveys may be affecting animals.

**Subsistence Impacts:** Oil and gas activities can affect subsistence uses and resources. The effects on subsistence can include reduced access, displacement of animal populations. As explained in the section about caribou, oil field activities can affect migration of caribou. Offshore noise from drilling and seismic operations can deflect whale migrations. There is a current speculation of NSB residents that future subsistence use access may be restricted as a result of new security measures. Impacts to subsistence, however, have been reduced through lease sale mitigation measures, permit stipulations, ACMP alternative measures, and measures proposed by applicants. Voluntary agreements between subsistence users and oil companies on the North Slope have been successful in reducing impacts.

**Aesthetic Effects:** Energy development can adversely affect aesthetic values by transforming the landscape. Pipelines have a high-degree of reflectivity. Oil development can result in more aircraft and a reduction of areas for solitude. These activities can affect viewsheds, recreational use, and the quality of the subsistence use experience.

**Off Road Travel:** Early exploration activities resulted in damage to tundra. Today, the use of specialized tundra vehicles and ice roads reduce the damage to the tundra. Some damage to tundra occurs, but the effects are far less than previous practices of off-road travel or construction of gravel roads for exploration activities.

**Roads:** Roads have the potential to affect animal populations and migration patterns. Dust from roads can lead to earlier melting or areas adjacent to roads known as thermokarst (Walker et al. 1987). They can also result in an increase in visitors and hunters. As discussed under the section on caribou, roads can affect migration of caribou and calving caribou.

**Pipelines:** Pipelines can affect caribou migration, especially when they are grouped together, raised, less than 5 feet, and closely situated to active roads. Highly reflective pipelines may be a deterrent to animals. Companies are reluctant to bury onshore pipelines due to potential damage to permafrost and the difficulty to inspect for corrosion and leaks.

**Solid Waste:** Oil and gas development can generate a significant amount of solid waste.

**Abandoned Infrastructure:** The obligation to restore lands on federal and state lands is unclear. It is not likely that much of the infrastructure will be eventually removed, because companies are

not required to remove structures until a unit has ceased production. To date, no units have ceased production, and bonds are inadequate cover costs of removing pads (GAO 2002; NRC 2003).

**Predation:** An increase of food from humans can lead to greater populations of predators in the oil fields including brown bears, arctic foxes, ravens, and glaucous gulls. These species prey on bird eggs, nestlings, and fledglings.

**Causeways and Islands:** Causeways and islands can affect fish migration and lead to temporary sedimentation.

**Water Quality:** Oil and gas activities can affect water quality from oil, seawater and produced water spills, disposal of muds and cuttings from offshore oil and gas exploration, sedimentation, thermal discharges, and discharges from desalination and seawater treatment plants.

**Air Quality:** Little research has been completed to quantify effects of air pollution from Alaska oil and gas development. For example, there is a perception from the residents of Nuiqsut that the air quality is affecting health, but little science has been completed to refute this claim.

**Ice Hazards:** Ice hazards can affect subsea pipelines, gravel drilling island, ice islands, and onshore facilities near the coast. Strudel scour, ice gouging, ice override and pile up can all affect oil facilities.

**Water Withdrawal:** Water withdrawal from fresh water lakes or marine areas can result in the entrainments of fish. As development moves west to deeper lakes, there is more of a potential for water withdrawal to affect overwintering fish.

**Social Impacts:** A number of social impacts can result from oil and gas development. The increase in standard of life may not be able to be sustained as oil field production declines. Stress about a possible spill has resulted in a cumulative effect (NRC 2003). Some evidence exists that residents in an area being developed for oil and gas can experience about potential reduction in subsistence resources, increased risk to hunters who must travel further from the village, and stress related to a continuing need to read documents and attend industry-related meetings (Ahmaogak 2001). A reduction in subsistence use would result in a lower standard of living for some residents. On the North Slope, oil and gas development has had a correlation with an increase in health effects including increases in diabetes, alcoholism and circulatory disease, asthma, and drug and alcohol abuse.

**Economic Impacts:** While oil and gas development significantly raises the standard of living, dependence on revenues from oil and gas can have negative effects when the infrastructure becomes depreciated.

**Caribou:** Oil field development can disrupt caribou migration and lead to increased predation. According to a 1994 report to the Alaska Caribou Steering Committee on the effects of North Slope oil development on caribou, the most important effects are impediment of movement though oil fields and displacement from calving areas (Cronin et al. 1994). Mitigation measures to reduce effects include: separation of roads from pipelines, raising the height of pipelines to 8 feet, regulation of traffic, use of convoys, monitoring caribou, burying pipelines, and avoiding calving areas during critical times.

**Cumulative Impacts:** Cumulative impacts of oil and gas activities are of great concern to the NSB. Assessment of cumulative impacts requires long-term studies and evaluation of impacts

form multiple stressors. Ecological systems that appear to be functioning can suddenly collapse from stressors once the system reaches a threshold. Section 7-14 discusses cumulative impacts in more detail.

**Oil Spills:** Both a large oil spill and chronic smaller oil spills can have significant impacts to other coastal uses and resources. An offshore spill would have the greatest adverse effects, and a spill in broken ice could have devastating results. An oil spill in broken ice presents one of the greatest risks for environmental damage. Oil spill drills have repeatedly demonstrated that existing technology is not sufficient to adequately remove oil from certain broken ice conditions.

A major concern to the CRSA would be a loss of subsistence resources resulting from a spill including mortality or species as well as impacts to fish and wildlife habitat. Compensation for lost subsistence resources is not assured. More than 15 years after the *Exxon Valdez* oilspill, users of Prince William Sound still have not been compensated for losses.

The EIS for the 1985 OCS lease sale estimated there would be a 60% chance of a major oil spill (DOI 1985). Spills in Eastern Norton Sound in open water (July-October) would likely be deposited on the northern shore of the sound. A spill in Western Norton Sound would likely to be carried into Northern Bering Sea. There is a wind shift in the area during Novermber and December.

In addition to crude oil spills, other fluids can be discharged to the environment including diesel oil, diesel, crankcase oil, saline water, produced water (from oil and gas separation), and other chemicals.

**Commercial Fishing:** Offshore oil and gas activities have the potential to adversely affect commercial fishing activities. In addition to a possible spill, other effects include conflicts with increased vessel traffic, conflicts between fishing gear and unburied subsea pipelines, and conflicts with seismic surveys.

**Local Hire:** Local Hire: A small percentage of NSB residents work in the oil fields. This situation results from a number of factors. Many of the jobs require specialized skills that may not be available in the local employment pool. The work schedules require employees to be away from home during extended periods, and they may not accommodate leave for subsistence activities. In addition, transportation services focus on bringing people from Anchorage and Fairbanks rather than to and from the local villages.

A 1997 Legislative Audit found that lease requirements requiring reporting of resident hire can result in more local hire programs (Alaska Legislative Audit 1997).

## 6.9 Minerals and Materials

This section supplements information found in the 1984 resource inventory and the 1986 resource analysis. In addition to public lands, mineral resources in the region are located on some private lands. NovaGold holds title to some area with mining potential, and the Native corporations of Savoonga, Gambell, Elim and the Bering Straits Native Corporation have mineral rights for some lands.

## 6.9.1 Minerals and Materials Resource Inventory

The resource inventory includes information about mineral resources known to be present in the CRSA and mineral resource potential. This section provides an update of the minerals and materials resource inventory contained in the 1986 Resource Inventory, Volume I, pp.18-19. The resource inventory includes information about mineral resources known to be present in the CRSA and mineral resource potential.

The region has supported placer mining since 1900, and it has produced more than 6 million ounces of gold. A byproduct of the placer mining is the millions of tons of washed gravel and sand in the tailings piles (DCCED 2005). Today, some placer mining continues in the region.

In recent years, NovaGold Resources, Inc., has undertaken a program of exploration and development of two open pit gold mines in the BSCRSA, at Rock Creek and Nome Gold. The first annual gold production of 100,000 ounces is planned for late 2006 or 2007 at Rock Creek, a mine located seven miles from Nome. A resource of about 750,000 ounces of gold in about 10 million tons of ore (in veined slates) has been identified (DCCED 2005). The project area includes 14,000 acres of patented, private lands owned by NovaGold and partly on 20,000 acres of land leased from Bering Straits Native Corporation. NovaGold also has a surface use agreement with Sitnasuak Native Corporation. The company has expanded its exploration program to the nearby Big Hurrah prospect, which would be developed as a separate open pit operation expected to yield an estimated 100,000 ounces of gold (NovaGold 2005)

A second exploration program by NovaGold is under way at Nome Gold which is located on patented private lands owned by the Alaska Gold Company, a wholly-owned subsidiary of NovaGold. The Company is undertaking a preliminary economic assessment study to evaluate restarting gold production from the historic deposits of the famous Nome goldfields. The area has historically produced nearly 5 million ounces of gold over the last 80 years from shallow, flat-lying sand-and-gravel deposits. The study will assess the viability of a combined gold and aggregate production facility (NovaGold 2005)

The Nome Gold property currently contains a historic resource of 1.2 million ounces of measured and indicated gold resources and an additional 1.1 million ounces of inferred gold resource. This material is part of a 295 million tonne sand-and-gravel aggregate resource. Outside of the defined gold resource area, an additional sand-and-gravel resource of 847 million tonnes has been identified, for a total sand-and-gravel resource in excess of 1 billion tonnes. This is one of the largest sources of construction aggregate on the Pacific Rim, located on private lands with immediate access to a port (NovaGold 2005)

Additional gold vein prospects under exploration in the area include Mount Distin (Divide), and Daniels Creek, Bluff and Koyana Creek (DCCED 2005).

Deposits of tin and associated minerals have been identified at Cape Mountain, which was mined in the early 1900s, Potato Mountain, Lost River, Ear Mountain, and Kougarok. Polymetallic and base-metal veins occur at Serpentine Hot Springs and in the Omilak area. Uranium bearing prospects include Death Valley (estimated resource of 990,000 pounds) and Eagle Creek (DCCED 2005).

## 6.9.2 Minerals and Materials Resource Analysis

The resource analysis begins with a discussion of why minerals and materials are a unique concern to the CRSA. It continues with a discussion of sensitivity of other resources and uses to mineral development and ends with a discussion of conflicting uses and effects of mineral development on other resources and uses.

### 6.9.2.1 Unique Concern

Minerals and mining are a unique concern to the Bering Straits CRSA because of the importance that potential minerals developments have in diversifying the economy of the region and because of potential effects from mining to coastal resources and uses. While the benefits of mining will be shared with the private sector and the state's economy, the district and its residents will receive the biggest share of adverse impacts.

### 6.9.2.2 Sensitive Areas

Almost all coastal resources and uses are sensitive to mining, depending on the size of the operation, timing of activities and methods used to process and transport the ore. Sensitive habitats in the district are identified in section 6.6.1 and 6.6.3.2, and many adverse effects from activities associated with mining are discussed in section 6.6.3.2.

### 6.9.2.3 Effects of Mining and Conflicting Uses

Mineral development can affect coastal resources and uses in a number of ways including the following:

- Water pollution including surface and groundwater contamination due to acid mine drainage, elevation of heavy metals, effluent drainage from tailings impoundments, mixing zones, cyanide solution leaks, seepage from cyanide heap leach processing and waste rock piles, and spills of chemicals and petroleum products used in mining operations,
- Fish and wildlife kills and habitat displacement,
- Fugitive dust from uncovered mining operations including trucks transporting ore,
- Effects to aquatic habitat from water withdrawals,
- Increased sedimentation from placer operations,
- Effects on subsistence resources and uses, including effects from roads and marine transportation facilities,
- Alternation to stream courses and subsequent erosion,
- Inadequate reclamation plans and plans for long-term treatment of water in tailings ponds,
- Inadequate bonding requirements to ensure reclamation plans are implemented,
- Potential for dam failure from tailings impoundments,
- Erosion,
- Inadequate baseline studies,
- In adequate inspections and monitoring of mining operations,
- Inadequate enforcement of state and federal regulations, and
- Inadequate opportunities for citizen and local government involvement in reviews of mining projects.

Many of these potential problems can be substantially reduced or eliminated through best management practices and adequate plans of operation. The ACMP has played a strong role in the past in ensuring that local governments have a seat at the table during reviews of mining projects. Additional discussion of some of the activities

# 6.10 Natural Hazards

This section updates the 1984 Resource Inventory (pp. 19-20) and the 1986 Resource Analysis (p. 8-4). It begins with a description of natural hazard designations and continues with supplement to the resource inventory followed by additional information for the resource analysis.

## 6.10.1 Natural Hazards Area Designations

The CRSA designates three types of natural hazard areas under 11 AAC 114.250 for all non-federal lands within the district's coastal zone:

- **Flooding and Erosion:** All areas within the 100-year flood area along inland rivers and within one-half mile of the coast.
- **Permafrost:** All areas a natural hazard area for permafrost, and
- **Ice Hazards:** All offshore areas within the CRSA for ice hazards.

## 6.10.2 Natural Hazards Resource Inventory

The update to the resource inventory describes the natural hazards that are most important to the Bering Straits CRSA. The hazards discussed here include flooding and erosion, permafrost, ice hazards, earthquakes, offshore sediment instability, and landslides and avalanches. No volcanic action or tsunamis have been reported in the area.

### 6.10.2.1 Flooding and Erosion

Flooding and erosions are the most serious natural hazards that threaten the region. Severe coastal flooding has destroyed several villages and even forced some to relocate. Coastlines are subject to storms, storm surges and flooding. Coastlines more vulnerable during ice free part of year because when the water is frozen, wave action is not present. As described in the section on climate change, global warming is expected to lead to increased coastal erosion because of higher water levels and an increase in the ice free portion of the year. Shishmaref is an example of a community in the region that is considering moving its location as a result of coastal erosion. Beach erosion is a continuing problem in other area such as Brevig Mission, Gambell, Shaktookik, Unalakleet, Teller, Stebbins, and Wales. Rates between 1-4 meters per year have been recorded in areas where there are sea cliffs with unconsolidated deposits.

Flooding of lowlands from rivers occurs during spring snowmelt and after heavy rainfall. Ice jams can cause flooding after they break up. Cause dams on rivers that break and flood areas below. Examples of flooding hazards in the region include the airstrip near Council and Mary's Igloo. Communities with a low potential for river flooding include Unalakleet, Solomon, White Mountain, and Koyuk. Unalakleet, however, has had problems with erosion long the river mouth.

In July 2002, the community of Shishmaref voted to relocate the community as a result of coastal erosion. During October 1997, a severe storm eroded over 30 feet of the north shore, requiring 14 homes and the National Guard Armory to be relocated. Five additional homes were relocated in 2002. Other storms have continued to erode the shoreline at an average of 3 to 5 feet per year on the north shore.

### 6.10.2.2 Permafrost

The entire Bering Straits CRSA is subject to permafrost, although in some areas the top layer of the land may thaw. All soils are subject to thermal degradation, and ice rich fine-grained soil is the most problematic. Melting permafrost can result in lakes or depressions.

Permafrost presents challenges to development in Alaska's coastal zone. Improper construction techniques will result in damage to buildings, pipelines, roads and habitat. Travel of off-road vehicles, including seismic trains, can damage the tundra. Road construction can lead to dust transported to the adjacent tundra. The darker service results in greater thermal retention that can lead to thermokarst, or transformation of the tundra to water.

Although permafrost represents the most widespread hazard in Alaska, the definition of natural hazards in 11 AAC 112.990 does not include permafrost. Over 80% of the state is covered by permafrost, and permafrost is recognized as a natural hazard in the scientific literature. A number of institutions have developed extensive research on permafrost including the U.S. Army Corps of Engineers' Cold Regions Research and Engineering Laboratory and the Permafrost Laboratory at the University of Alaska Geophysical Institute. The Permafrost Task Force of the U.S. Arctic Research Commission found that "the potential for melting of ice-rich permafrost constitutes a significant environmental hazard in high-latitude regions" (Arctic Research Commission 2003). A study focusing on Alaska found that coastal areas with permafrost may be much more sensitive to change than inland areas (Romanovsky et al. in progress).

### 6.10.2.3 Ice Hazards

Ice hazards are considered a major hazard for offshore development. During freeze up and break up, ice has the greatest mobility. Ice pileup, a phenomenon occurring during certain times of the year, can damage offshore structures. Ice gouging occurs when large pieces of ice are scour the ocean floor. It occurs between beyond shorefast. Gouging could affect offshore facilities not buried deep enough (or not buried).

### 6.10.2.4 Earthquakes

Earthquakes have occurred in the CRSA, and based on previous experience, future earthquakes between 6 to 7 on the Richter scale. Onshore earthquakes are generally stronger than those occurring offshore in the region. The largest recorded earthquake in Norton Sound was registered 4.2. Earthquakes in Norton Sound are a concern for oil and gas development, but the potential for a major earthquake in Hope Basin is much lower. Faulting is also a concern, but there has been little recent movement along faults.

### 6.10.2.5 Offshore Sediment Instability

Surface and near-surface marine soils may be subject to instability or liquefaction from gas accumulations. An area about 25 miles south of Nome has been identified as subject to carbon

dioxide accumulation. The hazard only applies to structures place on the seafloor. Biogenic methane accumulations in North Sound may also be of concern.

#### 6.10.2.6 Landslide and Avalanches

Development located near steep slopes could be subject to avalanches or mass wasting. The only settlement in the CRSA located in a steep area is the community of Diomede. Other areas within the region with steep slopes could be a concern if development activities are proposed.

### 6.10.3 Natural Hazards Resource Analysis

The resource analysis begins with a discussion of why natural hazards are a unique concern to the CRSA. It continues with a discussion of resources and uses that are sensitive to natural hazards followed a discussion of effects of natural hazards.

#### 6.10.3.1 Unique Concern

Natural hazards are a unique concern to the CRSA because they have the potential to harm human health and affect developments. The CRSA is most concerned that development projects be designed to minimize effects of natural hazards on development, especially the potential for release of petroleum products and hazardous materials and potential adverse effects to human health and safety.

#### 6.10.3.2 Sensitivity to Natural Hazards

All coastal resources and uses are sensitive to adverse effects from natural hazards. Depending on the severity of a hazard, activities may be precluded and human health and safety may be adversely affected.

#### 6.10.3.3 Climate Change

Climate change is an important concern to the  and its residents because the effects of a changing climate lead to increased erosion, changes in the numbers and distribution of fish and wildlife, and the viability of subsistence and commercial fishing activities. The effects of climate change are magnified in the Arctic region.[3] While it may not be possible to affect global warming patterns at the local level, coastal districts can ensure that applicants for development projects include appropriate designs to respond to the effects of climate change.

While some historical changes in climate have resulted from natural causes and variations, there is worldwide scientific consensus that the global temperature is rising at a rate unprecedented in the experience of modern human society (ACIA 2004). The scientific community continues to gather evidence about climate change and currently experienced and expected effects on the habitats and the biota upon which humans and other living creatures depend. Biological responses to temperature change can be studied by examining historical episodes of warming and cooling, both temporary and long-term. Impacts of the current climate shift, which is expected to continue and even accelerate, are already in evidence in many parts of the globe, but particularly in northern latitudes.

[3] The annual average arctic temperature has increased at twice the rate as other areas (ACIA 2004).

Rising global temperatures are expected to trigger impacts to marine and other ecosystems, including many that will affect the resources and uses in the coastal zone of Alaska. Impacts that can be expected to affect the Ceñaliulriit CRSA include a rise in sea level, changing wind and deep-ocean circulation patterns, ocean stratification and resource productivity, shifts in species distributions, outbreaks of disease and harmful algal blooms. The number of variables and unknowns make it impossible to predict the timing, duration or severity of specific impacts, the 1°C rise over the past century and the expected 3 °C over the next century will cause effects such as those briefly discussed below.

Traditional ecological knowledge is the system of knowledge gained by experience, observation, and analysis of events that is transmitted among members in of a community. In the subsistence economy, traditional ecological knowledge is used to find, harvest, process, store, and sustain natural resources that are needed for food, clothing and shelter. It also includes the ability to recognize, avoid and get out of dangerous situations. Traditional ecological knowledge is built on recognizing patterns in the environment in order to understand migrations and cyclic events that can be relied upon for food and safety (Twitchell 2001).

Impacts from global warming are likely to change the landscape, habitats, and potentially migration routes, predator-prey relationships, health and availability of traditionally used fish, wildlife and plants. Subsistence harvest patterns and use, and social and cultural relationships may change dramatically.

In a nutshell, climate and oceanography play major roles in controlling biological processes and populations of fish and wildlife important to humans. This set of climatic conditions is known as a "regime." A regime at any point in time is determined by several processes that occur simultaneously but on different time schedules. Regimes of interest here include the El Nino/La Nina Southern Oscillation, the Pacific Decadal Oscillation and global warming (EVOS 2005).

The cycle works as follows: Large-scale physical processes change the heat content of the atmosphere and ocean, thereby altering currents and climate, which in turn change populations of fish, birds and mammals (EVOS 2005) Alaska's climate has warmed about 4°F since the 1950s, 7°F in winter, with much of this warming occurring in a sudden regime shift around 1977. The state has grown wetter, with a 30 percent increase in average precipitation between 1968 and 1990. The growing season has lengthened by about 14 days. Drastic reductions in sea ice and permafrost have occurred along with the warming. Models predict continued warming, including an increase in temperature by 1.5 - 5°F by 2030 and 5-18° by 2100. An increase of precipitation by 20–25 percent is expected for the northwestern region of the state, but soils are actually expected to become drier because of warmer temperatures (Parson et al. 1999).

Changes resulting from global warming that are likely to affect subsistence and lead to coastal erosion. Specific effects of global warming are discussed below.

**Altered Food Web and Land Resources:** As much as the top 30 feet of discontinuous permafrost is expected to thaw within this century, causing increased ground subsidence, erosion, landslides and damage to forests. Large scale transformation of landscapes is likely to include expansion of boreal forests into the tundra zone, shifts of forest types due to fire and moisture stress, and northward expansion of some commercially valuable species.

Reduced snow cover reduces insulation and shelter for a number of mammal species. The effect on forage species such as lemmings and voles affects the many species that depend upon them,

from snowy owls to weasels and ermine. Ice crust formation resulting from freeze-thaw events affects most arctic land mammals by encapsulating their food plants in ice, limiting foraging ability and sometimes killing the plants (ACIA 2004).

Another effect of reduced snow cover, as well as shorter river ice season, and thawing of permafrost, is a limiting of subsistence harvesters' ability to travel to gather food. Good travel conditions can improve hunting success, while poor ice and snow conditions decrease it (Wolfe et al. 1990).

Landscape level changes to vegetation in the tundra are likely to occur due to an increase in nitrogen availability as a result of warming. At least one decade-long experiment has shown that warming can reorganize the species mix in an affected area, primarily due to increased nutrient availability through changes in nitrogen mineralization. Shrubs increased, while mosses, forbs and lichens were reduced or eliminated. Because shrubs transpire but the declining species do not, the resultant evapotranspiration would affect surface waters, reducing ponds and runoff and drying wetlands. The declining species, which support caribou could greatly reduce caribou herds, a major subsistence staple in the region (Parson et al. 1999).

Canadian Inuit observations of a warming climate and its resulting impacts on caribou were examined during a 1996-2001project documenting traditional knowledge. The observations included that warmer temperatures create unpredictable weather that include more extreme heat days and sporadic freeze-thaw cycles. Caribou can die from heat and exhaustion that lead to suffocation, and they may starve when vegetation is unavailable due to ice coating their food supply. Thinner ice leads to more caribou drownings, and lower water levels in rivers affect water crossings. Lower water levels and earlier opening leads may cause caribou to shift their migration routes and caribou calving grounds. Rapid spring melt may have a similar effect by providing richer forage in different areas. Subsistence hunters are required to assess these impacts in order to successfully hunt and conserve the resource (Thorpe 2002).

**Altered Food Web and Marine Resources:** An international team of researchers reported in 2001 that there is considerable evidence that natural variability in ocean circulation and mixing plays an important role in generating fluctuations in marine productivity, as well as in the distribution of populations. Food availability and physical constraints – such as retention, concentration or enrichment processes that are associated with currents and turbulence – are now considered as important factors that affect larval survival, fish recruitment and ultimately stock abundance (Cury et al. 2001)

Shifts in food supplies associated with El Nino are blamed for reproductive failure among some seabirds (common murres, black legged kittiwakes), and adult mortality in others. In the fall of 1997, over 10 percent of the shearwater population in the Gulf of Alaska died – approximately 191,000 birds, from starvation when their staple food, euphausiid crustaceans, declined. Reductions in phytoplankton associated with climate change can be expected to cascade up the ecosystem, affecting populations of zooplankton, which in turn affect the small fishes, and then larger fishes. Many seabirds and marine mammals that prey on fish will be strongly affect by such changes (Matthews-Amos and Bernstrom 1999), as will large-mouthed fish such as halibut and pollock (Mito et al. 1999).

Climate change has the potential to affect marine fisheries significantly. Most fish have a fairly narrow range of optimum temperatures related both to the species basic metabolism and the availability of prey species that have their own optimum temperature ranges. A species' range may expand, shrink or be relocated as a result of changes in ocean conditions (NOAA website

2005). The shift in predator-prey relationship may result in a die-off, even a crash in the population of a particular species.

For instance, the distribution of sockeye salmon is limited by water temperature. Sockeye can withstand a warmer summer temperature, but their metabolism slows in winter. Because the warmer winter water temperature causes an increase in metabolism, the fish require larger amounts of food. If sufficient food is not available, the fish starve. If the fish move down into deeper water, they must move back up the water column periodically to feed. If they migrate farther north, they are far removed form the freshwater systems in which they spawn (Matthews-Amos and Berntsen 1999; Finney et al. 2000).

Seabirds are vulnerable to global warming in several other ways. A rise in sea level will destroy nesting habitat for birds that colonize shorelines, those nesting in burrows may be flooded, an increase in storms may result in higher chick mortality, and water conditions, such as turbidity, salinity, currents, nutrients or depth, may affect survival. However, some bird species may prosper under the shift in climate, particularly if the changes enhance their specific food supply (Meehan et al. 2003).

During the 1982-3 El Niňo, there was a decline in some populations of seals and sea lions which has been attributed to the temperature shift. Changes in water circulation patterns, loss of available food fish due to a drop in phytoplankton, and the migration of the affected seals and sea lions to cooler waters (and farther from prey) contributed to the decline (NOAA 2005).

Climate change effects may have a greater impact when combined with other effects, For instance, polar bears accumulate chemical contaminants in their body fat by eating contaminated species lower on the food chain. During a poor feeding season, as fat reserves are used, the contaminants are released into the body. Polar bears in some parts of the arctic have been observed to have less fat in recent decades as sea ice break-up occurs earlier, forcing them ashore and to fast for increasingly longer period (ACIA 2004).

**Shifts in Species Distribution:** a shift in where species are found is predicted as a consequence of global warming. Temperature is a fundamental force in the make-up of most ecosystems, and species respond to changes in temperature, either directly or indirectly. Species that occur in Alaska that have been documented as affected by temperature change include walleye pollock and Pacific herring (Matthews-Amos and Berntsen 1999). Salmon run declines in the late 1990s in western Alaska were ascribed to warmer water temperatures in 1997 and 1998, when few salmon returned to spawn and those that did were smaller and arrived later than usual (Kruse 1998).

**Changes in predator-prey relationships:** Because different species respond differently to temperature changes, relationships among predators and prey could be disrupted if their ranges no longer overlap as a result of climate change (Matthews-Amos and Berntsen 1999). Climate-related changes are likely to cause cascading impacts involving many species of plants and animals. Compared to warmer regions, arctic ecosystems tend to have fewer species filling similar roles. Thus when arctic species are displaced there can be important implications for the species that depend upon them.

**Health effects on fish, wildlife and plants:** As discussed under ozone depletion below, to the extent that warming contributes to ozone depletion and increased exposure to UV radiation, fish in their larval stages, and mammals, particularly young mammals are at risk for lower survival, mutations (fish) and diseases such as skin cancer (mammals). Insects, bacteria and parasites that

were previously unable to survive in the cold climate may adversely affect animals newly exposed to them and lacking immunities.

**Ozone Depletion:** Satellite data collected in 1993 documented a decrease in ozone over the Arctic, and intensified monitoring of the ozone through the rest of that decade showed additional depletions. The cause is partly the use of halocarbons, particularly chlorofluorocarbons (CFCs) by humans and partly a result of greenhouse gas emissions, which, in the lower atmosphere causes warming temperatures, but at higher stratospheric altitudes lower temperatures. Both of these factors promote formation of polar stratospheric clouds which help convert chlorines into reactive forms that deplete ozone (Cahill and Weatherhead 2000).

The level of ultraviolet (UV) radiation that reaches the earth's surface is controlled by the amount of ozone in the atmosphere overhead. The effects of the radiation are enhanced by the low angle of the sun at high latitudes, ground reflectivity – called *albedo*, and partial cloud cover. Because UV levels are strongly affected by factors such as clouds and albedo (ground cover such as snow), climate change alone will alter UV levels (Cahill and Weatherhead 2000).

Exposure to UV radiation can cause health problems for both humans and animals, including cataracts, skin cancer, and a number of related skin diseases. Arctic ecosystems are particularly vulnerable to the effects of UV in spring, when ozone depletion is greatest as young organisms are developing. UV effects on the species at the bottom of the food web may be profound. Certain phytoplankton species are especially sensitive to UV and changes in their populations can ramify through marine ecosystems. Cod, herring, pollock, salmon, and other species that spawn in shallow waters, where larvae can be exposed to ambient radiation, are at great risk. Elevated UV levels can damage the larvae, and a crash in such populations can drastically effect ecosystems and fisheries (Cahill and Weatherhead 2000).

Compounding the problem is the potential for multiple impacts of environmental stressors on wild resources – pollutants, climate change, and water availability, for example. The effects of these combined with increased UV radiation may be more severe than the individual impacts. Recent research has shown that UV radiation enhances the toxicity of certain chemical compounds, particularly those associated with oil spills or petroleum contamination. "Photo-enhanced toxicity" can seriously injure or kill sensitive species (Cahill and Weatherhead 2000). Ozone depletion, which is expected to continue for more than another decade under the best of conditions, is likely to affect the subsistence foods and harvest of arctic residents, including those in the Ceñaliulriit CRSA.

**Melting Permafrost:** A task force commissioned by the U.S. Arctic Research Commission in 2002 found that permafrost plays three key roles in the context of climate changes: as a record keeper (temperature archive); as a translator of climatic change (subsidence and related impacts); and as a facilitator of climatic change (impact on the global carbon cycle). The potential for melting of ice-rich permafrost constitutes a significant environmental hazard in high-latitude regions (U.S. Arctic Research Commission Permafrost Task Force 2003).

Permafrost records temperature changes and other information about environmental changes; it has a memory of past temperatures. Temperature trends spanning a century or more can be recorded in thick permafrost. Analysis of data gathered from boreholes made by the U.S. Geological Survey in northern Alaska show that permafrost on the North Slope has generally risen by 2-4°C in the past century (U.S. Arctic Research Commission Permafrost Task Force 2003).

Thawing of ice-rich permafrost may result in settlement of the ground surface, which often has severe consequences for human infrastructure and natural ecosystems. Melting of glaciers in Alaska and elsewhere will increase the rates of coastal erosion in areas of ice-rich permafrost, already among the highest in the world. Sediment input to the Arctic shelf derived from coastal erosion may exceed that from river discharge. Thawing effects to the active layer of permafrost may alter the activities and functions of the permafrost. Soil moisture content has an important effect on its thermal qualities, soil heat flow and the vegetation is supports (U.S. Arctic Research Commission Permafrost Task Force 2003).

Permafrost can facilitate further climate change through the release of greenhouse gases. Considerable amounts of carbon are trapped in the upper layers of permafrost; an increase in the thickness of the thawed layer of permafrost could release large quantities of CO 2 and CH 4 to the atmosphere. This could amplify regional and global warming. A further problem in some areas in the Alaskan arctic is the presence of a significant number of sites where contaminants were buried in previous decades. Contaminants are mobile in the active layer of permafrost and some can be mobile within frozen ground. When permafrost thaws, the ground becomes permeable, allowing contaminants to spread laterally and reach other layers (U.S. Arctic Research Commission Permafrost Task Force 2003).

The thawing of permafrost will cause changes in hydrology. Where it has a high ice content, thawing can result in severe, uneven subsidence of the surface, called thermokarst, which has been observed to exceed 16 feet (Parson et al. 1999). Flooding or draining of an area may result from permafrost melt, affecting the uses of the surface.

**Diminished sea ice:** Sea ice is a prominent feature of the coasts in the district and adjoining marine ecosystems, and it strongly influences coastal climate, ecosystems, and human activities. Declines of ass much as 3 percent per decade since the 1970s have been reported. The area of multi-year ice has declined by 14 percent since 1978 (Parson et al. 1999).

Arctic sea ice has also thinned over the past few decades. Local observations of thinning by 3.3 feet to 6.5 feet have been reported for several years, and recent submarine ice data has documented evidence of large-scale thinning over the entire Arctic basin. Sea ice retreat allows larger storm surges to develop in the increased open water areas, increasing erosion, sedimentation, and risk of inundation in coastal areas. Coastline where permafrost has thawed is made more vulnerable, and the combination of factors can cause intensified erosion (Parson et al. 1999).

Oral histories recounted by residents of Hooper bay and Kwigillingok tell of several incidences of winter storm surges that pushed sea ice several miles inland, resulting in the razing of settlements and modification of land. Arctic explorer E.W. Nelson is quoted as having encountered sea ice several miles inland in the 1880s. The storm surges and resulting ice movements introduced salt water into freshwater bodies, and residents of the two communities expressed concern that pollutants could also be introduced to inland waterbodies in similar circumstances (Stickney 1984). While a warming climate indicates a reduction in sea ice, the risk of storm surges and their resultant damage is increased as the protection of the ice is withdrawn.

Loss of sea ice threatens large-scale change in marine ecosystems, threats to populations of marine mammals that depend on the ice and subsistence livelihoods that depend on them (Parson et al. 1999). However, with an increase in vessel traffic the threat of oil spills increases, and with it the potential for long term damage from hydrocarbons persisting in coastal ecosystems (ACIA 2004).

One benefit that may be expected from the loss of sea ice includes opening of transportation routes where they were previously non-navigable due to ice (Parson et al. 1999).

**Shoreline Erosion:** Storms systems along coasts produce high winds that in turn generate large waves and currents. Storm surges can temporarily raise water levels by as much as 23 feet, increasing the vulnerability of shorelines and floodplains to changes to tidal ranges in rivers and bays, and changes in sediment and nutrient transport which drive beach processes (Field et al. 1999). The retreat of sea ice facilitates storm damage to shorelines to the extent that communities may be required to relocate inland at very substantial cost.

**Threats to estuarine health:** Estuaries are among the most productive coastal ecosystems, critical to the health of fisheries. Warmer spring and fall temperatures alter the timing of seasonal transitions, which has a broad effect on ecologically important processes and impacts fisheries and marine populations. The amount and timing of freshwater flow into estuaries greatly influence salinity, stratification, circulation, sediment and nutrient deposits. A load of excess nutrients and contaminants can potentially cause harmful algal blooms and low oxygen conditions that affect the ability of estuaries to be nurseries for juvenile fish and shellfish habitat (Field et al. 1999). Nutrients and sediments transported to estuaries as a result of thawing permafrost may heighten the negative effects.

**Wetlands:** Many shallow streams, ponds and wetlands in the artic may dry out under a warming climate, especially as permafrost melts. As permafrost thaws, ponds connect with the groundwater system, and may drain unless resupplied by snowmelt and summer precipitation. In some areas, this may affect fish migration. Alternatively, warming of surface permafrost above frozen ground that subsequently collapses may create wetlands, ponds and drainage networks. This would increase sediment deposits to water bodies such as rivers and lakes (ACIA 2004).

Changes to the water balance of northern wetlands are especially important because most wetlands in permafrost regions are peatlands, which may absorb or emit carbon depending on the depth of the water table. An increase in temperature may reduce water storage in peatlands, causing them to switch from emitting carbon dioxide into the atmosphere to absorbing it. However, the reverse might happen; warming and drying could cause decomposition to happen faster than photosynthesis could result in increased carbon dioxide emissions. A combination of a temperature rise and elevated groundwater levels could increase methane emissions and lead to further warming. The science is not yet definitive on this subject (ACIA 2004).

### 6.10.3.4 Conflicting Uses

Natural hazards conflict with coastal development activities under two major circumstances. First, facilities constructed in areas subject to hazards can result in loss of life or property. Examples include construction of buildings in areas subject to erosion or flooding. Second, development activities can cause adverse effects by exacerbating the effects of a natural hazard or by causing a hazard. For example, alteration to streams and stream banks can cause erosion and flooding. Siting an oil storage facility or hazardous substances in a hazard prone area can lead to an oil spill. As well, siting offshore drilling operations in areas of high ice hazards could result in an oil spill and significant damage to coastal resources and uses.

# 6.11 Recreation and Tourism

This section updates the 1984 resource inventory and the 1986 resource analysis for recreation and tourism. No areas have been designated by the CRSA either for tourism or for recreation under 11 AAC 114.250. While tourism has the potential to expand the economy, the decision to develop tourism is a local decision. Many people in the region are concerned about how an increase in tourism and recreation opportunities for people outside the region would impact resources and uses, especially subsistence.

## 6.11.1 Recreation and Tourism Resource Inventory

This supplement to the resource inventory includes a summary of area attractions and possible strategies for expanding tourism. Recreation and tourism are considered to be one of the few opportunities for expanding economic opportunities in rural Alaska. Due to the cost of traveling to areas within the Bering Straits CRSA, the potential market for tourism is limited.

Recreation is generally considered a non-Native phenomenon in the CRSA because culturally, outdoor activities are associated with subsistence use activities. Thus, the market for expanding recreation and tourism activities is from outside of the CRSA.

A 2003 study on Nome tourism indicated that tourism adds $3.7 million to the Nome economy each year, with a multiplier effect of $4.9 million (DOTPF 2004). The study estimated that 20-year growth projects for this sector for the region to be between $3.6 million and $14.6 million. Independent travelers spend more time and money than typical tour group visitor. Recreation and tourism are addressed in the 1984 Resource Inventory (pp. 12-13).

### 6.11.1.1 Attractions

The Bering Straits CRSA has a rich Native culture, world-class fishing and hunting resource, untouched wild lands, gold rush history, and varied opportunities for birding and wildlife viewing. Tour packages are available to Nome, but most travel to areas within the CRSA is by independent travelers.

The 2003 Nome tourism study categorizes visitors into 9 groups: small groups, birders, special events attendees (e.g., Ititarod), air package tours, hunters and fishermen, business travel, winter adventure, expedition cruise, and those visiting friends and relatives.

**Native Culture:** The traditional Native culture is an attraction to many tourists visiting Alaska. Native dancing and crafts are often elements of organized packages. In addition to tour packages, other events feature Native culture including arts and crafts exhibitions, culture camps, and festivals. The Village of Wales revived a traditional Kivgiq celebration in 1999. Since then it has held the Kingikmiut Dance Festival each year. The last Kivgiq celebration was held in Wales in 1943. Savoonga has an annual Walrus Festival in May.

**Hunting and Fishing:** Currently, hunting and fishing draws few visitors to the region. Some lodges exist in the region to support hunting and fishing by visitors. There are sport fishing lodges near Unalakleet (Silvertip), Council (Camp Bendeleben) and at Salmon Lake. The Nome, Sinuk and Niuluk rivers are important for fishing and are accessible by road. The Unalakleet River is also popular for sport fishing. Most sport hunting occurs along Nome-Council road and in the

Imuruk Basin. In addition, coastal wetlands are used to hunt for ducks and geese, and brown bear hunting occurs along Koyuk River, Ungalik and Unalakleet river drainages.

**Wild Lands:** The CRSA includes large expanses of undeveloped land. Although wilderness tourism is not well developed, there is a potential to attract more visitors, especially to areas such as the Bering Land Bridge National Preserve. The Unalakleet River has been designated as a National Wild and Scenic River.

**History:** Remnants from the gold rush era provides an attraction for some visitors to the area. The road system from Nome provides access to the gold rush towns of Council and Solomon.

**Wildlife Viewing:** Birding is an important attraction to the region. Birders come earlier in the region and stay longer than many other groups. The NPS has partnered with the U.S. Fish and Wildlife Service and the National Audubon Society to product a booklet about *Important Bird Areas of the Bering Sea.* A number of rare birds are located in the region.

**Other:** A number of other opportunities for tourism exist in the CRSA.

- Expedition cruises are a growing sector in the region.
- Hot springs, such as Serpentine Hot Springs and Pilgrim Hot Springs could be developed to attract visitors.
- The Iditarod Race is one of the most well know dogsled races in the world, and many people come to Nome for the annual event.
- The sale of sale of ivory carvings and other crafts provides villagers with one of the most important sources of income from tourists. Tourists on expedition cruises spend an average of $100 per person on Native arts and crafts (DOTPF 2004).

#### 6.11.1.2 Limitations to Tourism Development

The market for tourism development in the CRSA is extremely limited because of competition with areas that are cheaper to visit with greater amenities. Most travelers to the region visit Nome or areas on the Nome road system. The cost of reaching other areas of the CRSA limits most potential travelers. In addition, tourism is limited as a result of the lack of lodging, insufficient facilities, inadequate marketing, and the lack of local guides. Potential conflicts with tourism and village life also present limitations for tourism because of a lack of local support in some communities.

#### 6.11.1.3 Strategies for Tourism Development

Although considerable challenges exist, expansion of the tourism sector is a promising way to expand economic development. Strategies should be developed and implemented with consideration of conflicts with village way of life and subsistence activities. Some of the strategies discussed here were proposed in the Nome tourism study, and other strategies were inspired from examples in other areas of Alaska.

- Create a regional tourism working group.
- Create partnerships with other cities, such as Kotzebue, and the Nome Convention and Visitors Bureau.
- Obtain grants for job training, including customer service training.

- Encourage local residents to become tour guides and hunting and fishing guides and partner with local lodges.
- Establish community festivals and events.
- Develop museums and cultural centers in villages.
- Expand participation in programs that market Native arts and crafts.
- Renew marketing efforts for air package tours (they have been steadily dropping in recent years).
- Develop Native culture camps to expose visitors to Inupiat and Yup'ik values and subsistence culture.
- Encourage business travelers to spend additional time in the region.
- Expand winter recreation opportunities such as snowmachining, dogsledding and skiing.
- Encourage visitors to Nome for the Iditarod race to visit other parts of the region.

## 6.11.2 Recreation Resource Analysis

The analysis begins with a discussion of why tourism and recreation are a unique concern to the district. It continues with a discussion about the sensitivity of coastal resources and uses to tourism and recreation development. The analysis ends with a discussion of competing uses and effects from tourism and recreation. The 1986 resource inventory includes a short discussion about recreation in Chapter 10.

### 6.11.2.1 Unique Concern

Recreation and tourism is a unique concern because expansion of this industry has the potential to diversify the economy of the CRSA. As well, the impacts of tourism and recreation are a concern to the CRSA and the resident of the region.

### 6.11.2.2 Sensitivity with other Resource and Uses

Recreation and tourism activities have the potential to conflict with subsistence and result in overharvest of fish and wildlife. The levels of tourism in the foreseeable future will not likely have a substantial effect on fish and wildlife populations, there could be effects to village privacy and potential conflicts with subsistence.

Recreational activities, especially ecotourism and dispersed recreation, areas sensitive to development of other resources. Resource development could make tourism less desirable in areas around the development.

### 6.11.2.3 Adverse Effects of Tourism

The primary benefit of tourism is an expanded economic base. Expanded recreation and tourism can have negative effects, however. Some of these effects are discussed here.

**Few Local Benefits:** Currently, residents outside of Nome receive few benefits from tourism. Other than the sale of ivory carvings and other crafts, few tourist dollars reach village residents. For instance, many lodges in Alaska hire workers from outside the area.

**Conflicts with Subsistence:** While there are currently no widespread conflicts with subsistence, some localized areas are experiencing problems. There are growing conflicts between subsistence

and sport fishermen on Unalakleet and Nome Rivers. Sport hunting or fishing efforts are not likely to significantly affect fish and wildlife populations in the near future. Increased recreational hunting and fishing, however, could result in more cabins, lodges and camps that have a potential to conflict with subsistence activities.

**Aircraft Disturbance:** An increase in airplane or helicopter traffic could adversely impact wildlife. Noise disturbance would not likely have a significant effect to wildlife populations at expected tourism increases. Noise from aircraft can also disturb residents of villages.

**Trespass:** Some areas of Alaska have experienced an increase in trespass over private lands and unauthorized use of cabins.

**Resource Development:** An increase in competition for fish and wildlife resources, especially those located in area important for subsistence, can result in conflicts.

# 6.12 Reindeer Herding

This supplement to resource inventory and analysis begins with a history of the industry and a description of the importance of reindeer herding. It continues with an update to the resource analysis.

## 6.12.1 Reindeer Herding Resource Inventory

This section supplements the 1984 Resource Inventory (p. 11). It includes a history of reindeer herding in the CRSA, a discussion of the economic importance of the industry and a brief description of the Reindeer Herders Association.

**History:** Reindeer herding in Alaska began at the end of the 19$^{th}$ century as a way to respond to declining populations of caribou. Ideal habitat and a lack of competition by other ungulates lead to a population explosion. At the peak, there were an estimated 600,000 reindeer in Alaska. Numbers of reindeer began declining in 1933. By 1950, the Alaska population of reindeer crashed to about 25,000. During the 1980s, the population stabilized at about 25,000 animals across 12-15 herds. By 2001, however, there was only an estimated 9,000 reindeer, and the industry faced a major crisis (Jensletten and Klokov 2002).

Sheldon Jackson, the first General Agent for Education in Alaska, arranged for the importation of 1,280 reindeer from Russia to the Seward Peninsula in 1892. A school in Port Clarence was established to teach reindeer herding to the residents of the region. Native residents were trained by Siberian and Saami reindeer herders.

During the mining boom in the area, there was a local market for reindeer meat. Private companies began to dominate the industry, however, especially the Loman brothers of Nome. The reindeer population expanded dramatically over the next 40 years. A lack of competition by other ungulates provided ideal conditions for expansion of the reindeer population.

The collapse of the market for reindeer meat resulted from a number of factors. The end of the gold rush, the depression, and a decline in the reindeer population due to overgrazing led to the decline. The banning of non-Native ownership of reindeer was another factor. In addition to the decline of the reindeer populations, Congress passed the Alaska Reindeer Act that excluded non-

Native ownership of reindeer. Private reindeer, grazing rights and equipment were transferred to a government trust (Bering Straits CRSA 1984).

Herders are allocated separate permit areas for grazing. The major reindeer grazing areas are located on the Seward Peninsula, Baldwin Peninsula, Shaktoolik, Stebbins, and St. Lawrence Island. Helicopters have been used to herd the reindeer twice each year.

Throughout time, other ungulates began to inhabit the CRSA. In the late 1940s, moose began to reoccupy the Seward Peninsula. Muskox were reintroduced to the region in 1970, and caribou have expanded their territory as wolf populations declined. The Western Arctic Caribou Herd (WACH) began to recover from a low of 75,000 in 1975 to 463,000 animals in the late 1990s.

The WACH migrates in spring and fall between the North Slope and Unalakleet. As the caribou extend their habitat to reindeer grazing areas, many reindeer have left the area as they join the caribou on their migration out of the area. Since 1991, 6 herds have been wiped out in the eastern part of Seward Peninsula and 5 other herds near the interior of the Seward Peninsula devastated.

**Economic Importance:** Throughout the years, reindeer herding has provided an important contributor to the economy in a place with few industries. At its peak, between 1928 and 1930, the industry exported 2,500 tons of reindeer meat. Although the numbers of reindeer declined considerably in subsequent years, reindeer herding none-the-less provided income and meat to village residents. In addition to sale of meat, byproducts also provided an important income to herders in the CRSA. Soft antlers, blood, vicera, and fur are byproducts of the industry. After Korea banned import of velvet antlers in 2002, the industry received another setback.

**Reindeer Herders Association:** The regional Native nonprofit organization, Kawerak Inc., established the Reindeer Herders Association to assist reindeer herders in the production and marketing of reindeer meat and byproducts. The association has 21 members and an executive committee with five officers. It meets once a year. The association manages special programs such as a grant program that funded radio collars to monitor locations of reindeer and caribou.

## 6.12.2 Reindeer Herding Resource Analysis

The analysis for reindeer herding supplements the original 1986 Resource Analysis (Chapter 4). It begins with a discussion of why this resource is of unique concern, and it continues with a discussion of why the resource is sensitive to development. This supplement ends with a brief discussion of conflicting uses.

### 6.12.1.1 Unique Concern

Reindeer herding is a unique concern to the CRSA because it provides income to local residents as well as a food source.

### 6.12.1.2 Sensitivity to Development

Reindeer herding is sensitive to other uses of the land, especially those that would displace the reindeer from their pasture areas.

#### 6.12.1.3 Conflicting Uses

The primary conflicting use with reindeer herding relates to the expanding migration of the Western Arctic Caribou Herd. The native caribou compete with the reindeer for grazing on permitted pasture land. In addition, migrating caribou attract predators into the grazing area. Perhaps the most important effect is that the reindeer follow the caribou as they migrate out of the area. One of the most successful measures to prevent the migration of reindeer is to herd the reindeer to areas outside the current caribou habitat. This practice, however, can potentially lead to conflicts with other reindeer herders and potential overgrazing.

## 6.13 Transportation and Utilities

Air transportation in the Bering Straits CRSA provides the only year-round connection between villages and with areas outside the region. During ice-free times of the year, water provides an important mode of travel between villages as well as for delivery of freight. During the winter, travel by snow machine over winter trails is an important mode of transportation. No large-scale utility corridors currently exist in the CRSA, but it is possible that they may be developed in the future. This section begins with a supplement to the resource inventory and continues with a supplement to the resource analysis.

### 6.14.1 Resource Inventory

This supplement to the resource inventory for transportation and utilities includes information about air, water and land transportation and potential utilities. The information about transportation in the 1984 resource inventory is incorporated into this plan revision (p. 13). Unless otherwise noted, the information in this inventory was obtained from the Northwest Alaska Transportation Plan (DOTPF 2004).

#### 6.12.1.1 Air Transportation

Air transportation provides the most important year-round mode of transporting people and goods to the villages. The communities of Nome and Unalakleet are connected to Anchorage by daily jet services. Nome is the primary hub for passenger travel, and Unalakleet is a hub for mail and passenger travel to nearby communities. All communities have airports except for Diomede which is only accessible by helicopter and boat.

Nome receives several flights each day from Anchorage either directly or through Kotzebue. All communities in the CRSA are served by daily flight service from Nome using prop planes. There are about 25,000 enplanements at the Nome airport, and 20 million pounds of mail and 400 tons of air freight arrive at the airport each year.

Unalakleet serves primarily as a mail hub, but it also provides daily flights to the communities of Koyuk, Stebbins, St. Michael and Shaktoolik. Unalakleet is linked to Anchorage by jet service with one flight per day. About 4 million pounds of mail pass through the airport each year, and about 6,000 enplanements occur at the airport.

Villages benefit by a special 4$^{th}$ class rate and the bypass mail system. The high cost of transporting materials to the villages of the CRSA is offset by a special 4$^{th}$ class rate by the U.S.

Post Office. Shippers pay only about 10% of the actual cost of delivering packages. The bypass mail system enhances the efficiency of delivering freight to the villages by allowing certified distributors to package deliveries by air without going through a post office. Deliveries are required to be at least 1,000 pounds, and a postal inspector inspects the goods at the airport.

The cost of air transportation is related to the runway length because of limitations to the size and types of aircraft that can use smaller runways. Airports at Nome, Unalakleet, Gambell, and Shishmaref have runways 4,500 or longer. Improvements are need for the airports at Brevig Mission, White Mountain, Elim, Koyuk, Stebbins, Teller and Unalakleet (crosswind runway) to bring these airstrips up to the minimum length of 4000 feet.

#### 6.12.1.2 Water Transportation

Water transportation provides an important mode of transportation between the villages using small boats. Most heavy freight is distributed to the communities during ice-free times of the year using barges. The unimproved barge landing facilities in most communities provides an obstacle to delivery of freight.

More than 90% of Alaska's population lives within 10 miles of a major navigable waterway, and most goods arrive to Alaska communities through waterborne commerce. Because Nome has the only moderately deep port in the region, much of the barge service to communities in the CRSA first arrives in Nome. After freight is sorted in Nome, it is transferred to smaller barges for distribution to area communities. The additional handling is estimated to double the cost of freight delivery. In 2009, 71 tons of materials and 600,000 -800,000 gallons of fuel were reshipped to other communities from Nome.

Nome has the only major boat moorage area and repair facilities in the region. A commercial fishing fleet based out of Nome as a result of the community development quota system.

Although Nome has the best harbor in the region, St. Michael is the only other community with a suitable harbor. Other sites that have potential for port development including Port Clarence, Cape Nome, Cape Darby and Grantley Harbor.

#### 6.12.1.3 Land Transportation

Few roads exist in the CRSA, but an extensive winter trail system links communities with each other and with areas outside of the region. The largest road network in the district is a 230-mile gravel road system that connects Nome with Teller, Solomon and the seasonal villages of Council and Mary's Igloo. This road is not maintained during the winter. A smaller road connects Stebbins to St. Michael.

The lack of an extensive road system increases the importance of the winter trail system. The most well-known trail is the 1,151 mile Iditarod trail from Anchorage to Nome. This trail connects the villages of Unalakleet, Shaktoolik, Koyuk, White Mountain, Koyuk, and Elim. Other important trails include links between the following communities:

- Shishmaref and Kotzebue;
- Shishmaref and Deering, Wales, Brevig Mission and Mary's Igloo;
- Koyuk to Buckland;
- Unalakleet to Kaltag; and

- a coastal route between Stebbins and St. Michael, Unalakleet, Shaktoolik, Koyuk, Elim, Golovin, White Mountain and Solomon.

Subsistence access by snow machines in winter and ATVs in summer give community residents important access to subsistence resources. This access is not limited to the trail system.

The 2004 *Northwest Alaska Transportation Plan* reports that residents of the region are generally supportive of new road connections that would reduce freight costs. Communities have specifically requested roads to connect Savoonga and Gambell and Golovin with White Mountain and Elim. Some residents of the region, however, are concerned that new roads connecting the communities in the region to areas outside the region will result in increased conflicts with subsistence resources and uses.

The transportation plan proposes construction the Yukon River Highway that would connect communities in the CRSA with a road to the Interior of Alaska. One route would proceed south from Kaltag to Unalakleet and then continuing to Shaktoolik. Another route would connect Koyukuk with Nome through the communities of Koyuk and Council.

## 6.13.2 Resource Analysis

This supplement to the resource analysis for transportation and utilities begins with a discussion of why these facilities are a unique concern. It continues with a discussion of sensitive areas, and concludes with a discussion of conflicting uses. This information supplements the 1986 resource analysis (pp. 8-1 – 8-4)

### 6.13.2.1 Unique Concern

Transportation is a unique concern to the CRSA because residents depend on reliable transportation opportunities for travel within and outside the region. Utilities are important to the CRSA because they provide basic services including distribution of power. Expansion of utility and transportation systems in association with development projects are important to the region because of possible effects to subsistence and fish and wildlife resources as well as opportunities to expand the economy,

The CRSA places great importance on improvements to transportation needs. Improvements are needed to area airports as well as improved barge service and associated infrastructure. While some communities desired improved roads, including links to other communities, other villages prefer not to be connected by road to areas outside the region.

### 6.13.2.2 Sensitivity to Development

Coastal resources and uses are sensitive to development of transportation routes and facilities and utility corridors. The specific activities that can conflict with coastal resources and uses are discussed in more detail in the next section. Sensitive habitats are discussed in detail in section 6.6.3.2 and in Chapter 7.

### 6.13.2.3 Conflicting Uses and Effects of Transportation and Utilities

Transportation and utility facilities and corridors add to the quality of life of CRSA residents. Transportation allows residents to travel within the region and to points beyond. During emergency response activities, speed is critical and an effective transportation system is desirable. An expanded transportation system would reduce freight costs by reducing the need to repack or sort freight at intermediate points.

While transportation and utilities have many benefits, they also have the potential to conflict with other uses and resources. The two categories of concerns of the CRSA relating to transportation and utilities include: 1) economic, social and environmental effects of transportation improvements, and 2) the effects on fish and wildlife and subsistence resources and harvests. This section outlines some of the effects most commonly associated with transportation and utilities. Many activities associated with transportation and utilities, such as dredge and fill activities, are discussed in more detail in section 6.6.3.3.

**Vessel Traffic:** Vessels have the potential to affect coastal resources and uses in several ways. Noise and the presence of watercraft can disturb marine life. An oil spill from a vessel would have serious consequences to biological resources, subsistence, recreation, and tourism. Ice breakers have the potential to alter migration patterns of marine mammals and birds through creation of artificial leads.

**Water Circulation:** Structures in marine waters including docks, causeways and artificial islands have the potential to change circulation patterns and change patterns of sediment transport, affect beaches and barrier islands. Fish migration may be altered by causeways, and out-migrating fry might have a higher risk to predation if they are diverted to deeper waters.

**Erosion and Sedimentation:** Road construction can lead to increased erosion and result in sedimentation to waters. Increased turbidity can reduce the levels of dissolved oxygen and affect biological resources. Subsea pipelines also may lead to temporary turbidity.

**Natural Hazards:** Transportation facilities, including roads, have the potential to exacerbate flooding, erosion and other natural hazards.

**Habitat Loss:** The actual construction and placement of ports terminals, airstrips, roads, pipelines and utility corridors can lead to loss of habitat. Powerlines cand result in bird mortality.

**Noise:** Noise from aircraft, vessels and roads can displace fish and wildlife from habitats and affect migration patterns.

**Dust:** Dust from roads is a problem in the area because it adds to respiratory problems, and it results in contamination to subsistence resources, especially drying fish and game (DOTPF 2004). On the North Slope, dust adjacent to roads has been linked to early snowmelt and a change in the plant communities. Hard surfacing or dust retardant chemicals can reduce these problems.

**Subsistence:** Many people in the region are concerned that roads would provide new access to subsistence resources that would result in increased competition for fish and game (DOTPF 2004). In addition to possible depletion of resources, residents are concerned that increased access would result in harvest restrictions by state and federal managers. New roads, however, could open up new areas for local subsistence access

**Recreation:** New transportation facilities can open up new areas for recreation use, but such roads could have adverse effects to those seeking a wilderness experiences.

**Oil and Gas Facilities**: Oil and gas development in Norton Sound our Hope Basin would most likely require a pipeline system to an onshore terminal. Onshore oil and gas facilities would include pipelines, drill pads and oil and gas separation facilities.

# 6.14 Major Land Ownership and Demographics

The State of Alaska is a major landowner in the CRSA along with the federal government and Native corporations. The area is sparsely populated. In addition to Nome, which is outside of the CRSA, there are 17 communities populated year-round, and two communities used seasonally. Most of the populations are Inupiat and Yup'ik Eskimo.

## 6.14.1 Land Ownership

Most of the land is owned by the state and federal government and Native Corporations. No cities were eligible to select land under the state's Municipal Entitlement Act, but they are able to obtain land under a provision of the Alaska Native Claims Settlement Act (ANCSA).

Land ownership has traditionally been a foreign concept to Inupiaq and Yup'ik people. The original residents, however, respected tribal territory and historic use patterns according to kinship. Land use has primarily revolved around subsistence use. During the last century, the land has been used for reindeer herding and in some areas, mining. Seafood processing plants are located in a few villages. This section supplements the 1984 Resource Inventory (pp. 15-16) and the 1985 Resource Analysis (Chapter 11).

### 6.14.1.1 State Lands

The State of Alaska is a major landowner in the CRSA. The primary areas where it owns or has selected lands are between Deering and Koyuk and areas around Nome and north to Wales. The Northwest Area Plan includes three management units in the CRSA that are described below. Management guidelines for these lands are outlined in the Northwest Area Plan (DNR 1989)

- **Management Unit 4: Norwest Seward Peninsula.** The state owns the central part of the peninsula and the upper drainages of the Nuluk, Arctic, Serpentine, Kougarok, American, and Agiapuk rivers, tidelands, and submerged lands. The most common use of this are is for subsistence.
- **Management Unit 5: Southwest Seward Peninsula**. State lands include areas along the coast between Safety Sound to Rocky Point, tidelands and beds of navigable waters.
- **Management Unit 6: Norton Sound.** State lands are limited to uplands north of the Koyuk River, the tidelands, and the beds of navigable rivers.

### 6.14.1.2 Federal Lands

Most of the federal land in the area is managed by the Bureau of Land Management (BLM) and the National Park Service. Some coastal areas are managed by the U.S. Fish and Wildlife Service.

**National Wildlife Refuges:** Portions of two wildlife refuges are located in the CSRA. A small part of the Yukon Delta National Wildlife Range is located in the southwest corner of the refuge near Stebbins and St. Michael. The Alaska Maritime National Wildlife Refuge occupies some offshore islands, pires and capes and headlands including an area in Safety Sound about 20 miles from Nome.

**Bureau of Land Management**: The Bureau of Land Management owns most federal lands not managed by the National Park Service or Fish and Wildlife Service. The Fairbanks office is responsible for lands North of Shaktoolik, and the Anchorage office is responsible for south of Shaktoolik. Settlement is not allowed on BLM lands, but lands may be used for mineral and oil and gas development.

**National Park Service:** The Bering Land Bridge National Preserve, managed by the National Park Service, is located in the northern part of the Seward Peninsula. 2,5 million acres.

**Outer Continental Shelf:** Waters seaward of the state's 3-mile limit are considered the Outer Continental Shelf (OCS), and these waters are managed by the Minerals Management Service.

**Other Designations:** About 65 miles of Unalakleet River has been designated as a national wild and scenic river. In addition the Iditarod Trail has been designated as a National Historic Trail. The federal areas of the trail are managed by the BLM. Port Clarence is occupied by the U.S. Coast Guard as a LORAN station.

#### 6.14.1.3 Private Lands

Most private lands in the area are owned by Native corporations as a result of the Alaska Native Claims Settlement Act. The Bering Straits Native Corporation (BSNC) is the regional corporation, and it is entitled to about 293,430 acres as well as the subsurface land rights to most of the village corporations (about 2.24 million acres). The BSNC has selected lands with good mineral potential including areas near the Lost River.

There are 16 village corporations in the CRSA: Brevig Mission, Council, Golovin, Inalik/Diomede, King Island, Koyuk, Mary's Igloo, Nome, St. Michael, Shaktoolok, Shishmaref, Stebbins, Teller, Unalakleet, Wales, and White Mountain. These village corporations are a part of the BSNC. Most village corporation land is located around the village. Because of their small size, an exception was made for King Island and Diomede Island, and they selected land near Cape Woolley and Tin City respectively. The total land entitlement for the villages is 1.8 million acres.

Rather than chose to become a standard village corporation under provisions of the ANCSA, Savoonga, Gambell and Elim chose to select surface and subsurface land to the land that was formally a reservation. By choosing this option, these villages received more land but they did not receive any of the $962.5 million cash settlement as provided by ANCSA.

Native allotments comprise most of the other private lands. Allotments may be up to 160 acres each. These lands are held in trust by the federal government.

#### 6.14.1.4 Municipal Lands

Although none of the communities in the CRSA are entitlted to land under the state's former Municipal Land Entitlement Program, they are able to obtain land under Section 14(c)(1) of ANCSA. Under that provision, may receive up to 1,280 acres of land to the local municipality from local village corporation.

Most of the communities have established local economic development plans with the assistance of the Community Services Division of Kawerak, Inc.: Brevig Mission (1993), Diomede (2000), Elim (2004), Gambell (2003), Golovin (2003), Koyuk (2004), Savoonga (2003), Shaktookik (2003), Shishmaref (1998), St. Michael (2004), Stebbins (2004), Teller (1998), Wales (2003), and White Mountain (2003). A few communities have developed comprehensive plans including Shaktoolik (1995), Unalakleet (2002) and White Mountain. Specialized plans have also been completed for some communities such as water, utility and solid waste plans (many communities), and transportation plans (Elim, Unalakleet and White Mountain). White Mountain has completed a strategic plan, Shismaref has completed a strategic relocation plan, and White Mountain has completed a Visioning Plan.

#### 6.14.1.5 Settlements and Changes to Land Ownership

Changes in land ownership and disposal of land for settlements can potentially affect coastal resources and uses. Access to lands could be limited for both recreation and subsistence use. New areas for settlements have the potential to displace wildlife and reduce habitat. In addition, new settlements may increase the need to provide utilities and other services. Potential new settlements could be located in Pilgrim Hot Springs and Mary's Igloo. State land classified for disposal includes areas new Pilgrim Hot Springs and Grand Central Rivers. The village of Shishmaref is considering relocating because of threats from severe erosion. Potential settlements could be associated with minerals development (e.g., the Lost River area). This issue is discussed in more detail in the 1986 Resource Analysis (pp. 11-1 – 12-2).

### 6.14.2 Demographics and Economy

The Bering Straits CRSA coastal district includes the area adjacent to Norton Sound and the Seward Peninsula as well as St. Lawrence Island and Little Diomede Island. The district includes 3,263 miles of coast with a coastal area of 20,314 square miles. An estimated 5,808 people live in the CRSA. The population in this region is expected to grow by 1.58% each year through 2025 (DOTPF 2004).

There are seventeen year-round communities within the Bering Straits CRSA. Fifteen communities are second class cities (Brevig Mission, Diomede, Elim, Gambell, Golovin, Koyuk, Savoonga, Shaktoolik, Shishmaref, St. Michael, Stebbins, Teller, Unalakleet, Wales, and White Mountain), and two communities are unincorporated (Port Clarence and Solomon). Two former communities are occupied seasonally (Mary's Igloo and Council). Most residents from King Island now live in Nome. Appendix D provides a community profile for these villages, and additional descriptions of the villages may be found in the 1984 Resource Inventory (pp. 3-6).

Although the subsistence economy dominates the region, residents have needs for cash for heating oil, fuel, fishing and hunting equipment, snowmachines, boats, traps, guns, and for travel.

The cash economy involves commercial fishing, arts and crafts, reindeer herding, small businesses, government jobs, Native corporations, and transfer payments. In addition, some people receive income from ivory carving and production of other Native crafts such as dolls, baskets, kiviut, and skin sowing products (p. 12 Resource Inventory). As discussed in the previous section, almost every community has developed a local economic development plan.

There are 20 tribes and 20 village corporations in the CRSA. The regional Native Corporation is the Bering Straits Native Corporation, and the regional Native nonprofit corporation is Kawerak Corporation.

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