3.20 Birds

Up to 481 species of birds have been reported from Alaska. Because the pipeline and related facilities occur in such diverse and widespread areas, many of these species could occur in the vicinity of TAPS facilities. Of the birds reported in Alaska, 226 are known to breed within the state (Armstrong 2000; Gibson 1999; Gibson and Andes 2001). Many of the birds that occur in Alaska are migratory. Some of the migratory species that breed on the North Slope may overwinter in Prince William Sound and migrate through the TAPS ROW and adjacent areas (e.g., red-throated loon, yellow-billed loon, long-tailed duck, surfbird, and snow bunting) (TAPS Owners 2001a).

In the following subsections, descriptions of birds are presented separately for the TAPS ROW, Beaufort Sea, and Prince William Sound areas (Map 3.1-2). In reality, however, for many species, distinction among these areas (e.g., the northern portion of the TAPS ROW vs. Beaufort Sea and the southern portion of the TAPS ROW vs. Prince William Sound) is meaningless. The following discussions describe important groups of birds (e.g., waterfowl and raptors), as well as representative species within each group. The bird species addressed in more detail below are those that have one or more of the following characteristics: (1) have important habitats at or near TAPS, North Slope, or Prince William Sound; (2) are important for human use; and (3) use habitats common to other species (APSC 1993). Threatened, endangered, and protected bird species are addressed in Section 3.22.

Landbirds

Landbirds include bird species other than waterfowl, shorebirds, and seabirds that primarily inhabit terrestrial landscapes. These include the raptors, grouse and ptarmigan (see BPFWG 1999) and passerines (perching birds).

3.20.1 TAPS ROW

About 260 species of landbirds occur in Interior Alaska; 135 of these breed in the state. The most important habitats for the breeding species are coniferous and mixed forests at lower elevations, riparian areas, and deciduous shrublands and forests. Factors that can impact landbirds include timber harvest, insect outbreaks, fire management, development of transportation and utility corridors, oil and gas development, and mining (BPFWG 1999). Bird checklists (including species status and habitat preferences) for interior areas near the TAPS ROW can be found in Schauer (undated) for Dalton Highway; Sowl (1998) for Yukon Flats National Wildlife Refuge; Kessel (1986) for Interior Alaska near Fairbanks; BLM (1989b) for Copper River Basin and surrounding areas; U.S. Fish and Wildlife Service (USFWS undated-a) for Kanuti National Wildlife Refuge; and Isleib (1984) for Chugach National Forest.

3.20.1.1 Waterfowl, Seabirds, and Shorebirds

Four species of loons (yellow-billed, Pacific, common, and red-throated) breed near the ROW. Statewide population estimates for these species range from about 2,600 for the yellow-billed loon to about 70,000 for the Pacific loon (Groves et al. 1996). A few yellow-billed loons nest in the vicinity of the ROW (Sage 1971, 1974; McIntyre 1990; McIntyre et al. 1991). Common loons are uncommon breeders along the ROW. They nest primarily south of the Brooks Range on boreal lakes with generally one pair per lake (Gabrielson and Lincoln 1959; Groves et al. 1996). Pacific loons are common breeders in lakes at the northern end of the ROW and south of the Brooks Range (Gabrielson and Lincoln 1959; Johnson and Herter 1989). Red-throated loons are common breeders at the northern end of the ROW on the coastal plain and also can be found along the ROW between the Brooks Range and Chugach Mountains (Gabrielson and Lincoln 1959; Johnson and Herter 1989).

Both horned and red-necked grebes occur in the ROW area. Both species nest in Interior Alaska and are permanent residents in Prince William Sound. The red-necked grebe also nests in the North Slope (TAPS Owners 2001a). The horned grebe nests in freshwater ponds, sloughs, and lakes, while the red-necked grebe nests in freshwater lakes, marshes, and slow-moving rivers. Both species overwinter in inshore marine waters (Armstrong 2000).

Both tundra and trumpeter swans occur in the ROW area. Tundra swans usually nest near large ponds or lakes with emergent plant beds; trumpeter swans nest in undisturbed marshes adjacent to small lakes. About 10,000 tundra swans occur along the northern portion of the ROW and along the Arctic Coastal Plain (Rosenberg and Rothe 1994). Trumpeter swans breed along the ROW from south of the Brooks Range to the Valdez Marine Terminal (Gabrielson and Lincoln 1959). Several areas between MP 645 and MP 716 have been identified as nesting and brood-rearing concentration areas for trumpeter swans (APSC 1993). This region encompasses the drainages of the Gulkana, Copper, and Klutina Rivers. The 1995 statewide population of trumpeter swans was estimated at about 16,000. Approximately 59% of those were in the Gulkana and Lower Tanana land units, which encompass much of the southern ROW (Groves and Conant 1998).

Canada and greater white-fronted geese are common breeders around PS 1 and the northern end of the ROW, where they nest in isolated pairs on the tundra or on small islands in lakes and ponds (TAPS Owners 2001a). During spring migration, Canada, greater white-fronted, and snow geese aggregate in areas of early snowmelt that occur in the “dust shadows” along the Dalton Highway as far south as Atigun Pass. Brant (another type of goose) migrate to the oil fields from the west. During the spring migration, they stage along the Dalton Highway near PS 3 with greater white-fronted geese and snow geese (Montgomery 2002b). Areas of concentrated Canada goose and greater white-fronted goose nesting have been identified along the ROW between MP 0 and 78 (APSC 1993). The Canada goose is a common breeder south of the Brooks Range, in the Yukon and Tanana flats, and into the Copper River area (Gabrielson and Lincoln 1959). Although the greater white-fronted goose is an uncommon breeder south of the Brooks Range, some do nest on the Yukon Flats and Minto Flats (Gabrielson and Lincoln 1959). As many as 325,000 snow geese congregate in the Arctic National Wildlife Refuge (ANWR) during September (Rothe 1994). (See Section 3.20.2 for a discussion of snow geese that breed in the Beaufort Sea area.)

Ducks that occur along the ROW can be divided into arctic-nesting, boreal-nesting, and Pacific coastal species. The arctic-nesting species include long-tailed duck (formerly known as oldsquaw); northern pintail; and common, king, spectacled, and Steller’s eiders. Spectacled and Steller’s eiders are both federally listed as threatened species (see Section 3.22). Boreal-nesting species include common dabbling ducks, such as mallard, northern pintail, and green-winged teal, and diving ducks, such as white-winged scoter, lesser scaup, bufflehead, goldeneye, and canvasback. An important Pacific coastal species is the harlequin duck (TAPS Owners 2001a).

Almost any stream, river, pond, or lake that occurs along the ROW can provide habitat for waterfowl. Diving ducks generally nest on larger and deeper inland water bodies, major rivers, and along the coast. Broad meandering and braided floodplains (e.g., Tanana River) with numerous nearby lakes and streams provide important waterfowl nesting habitat (APSC 1993). Table 3.20-1 lists important waterfowl nesting and migration areas that occur near the ROW.

The sandhill crane is a rare breeder at the northern end of the ROW but is a more common breeder between the Brooks Range and Chugach Mountains (Gabrielson and Lincoln 1959; Johnson and Herter 1989). It nests in wet tundra, marshes, and muskegs. The ROW intersects the major migration route of sandhill cranes along the Tanana River at Delta Junction (MP 543–559) (APSC 1993). As many as 200,000 to 300,000 cranes pass through this area during the spring and fall migrations (TAPS Owners 2001a). The sandhill crane is Alaska’s largest game bird, although harvests are conservative because of the bird’s low reproductive rate (Paul et al. 1994).

TABLE 3.20-1 Important Waterfowl Concentration Use Areas near the TAPS ROW[a]

Milepost	Major Water Bodies	Use
135-150	Galbraith Lake	Migration
246-258	Wilson Creek/Chapman Creek/South Fork Koyukuk River	Nesting
261-276	Grayling Lake/Jim River	Nesting
302-309	Olson's Lake/Kanuti River	Nesting
336-351	Ray River/Yukon River	Nesting
369-371	Hess Creek	Nesting
377-379	Hess Creek/Fish Creek	Nesting
384-389	Erickson Creek	Nesting
392-393	Lost Creek	Nesting
397-401	Tolovana River	Nesting
412-413	Tatalina River	Nesting
437-439	Chatanika River	Nesting
458-460	Chena River	Nesting
462-520	Tanana River	Migration
520-526	Tanana River/Shaw Creek	Nesting, migration
525-535	Delta River	Migration
606-630	Summit Lake/Gulkana River/Paxson Lake	Nesting, migration
795-799	Lowe River, assorted creeks, Valdez Glacier drainages, Dayville Flats, Valdez Duck Flats	Nesting, migration

[a] Areas listed are those with portions within 2 mi of the TAPS ROW.

Source: APSC (1993).

Alaska contains more than 95% of the breeding seabirds in the continental United States. About 100 million seabirds reside in the marine waters of Alaska during a portion of the year, with about 1,300 seabird colonies identified in the state (Hatch and Piatt 2001). However, seabirds are not common along the ROW except during migration. Nevertheless, several species of seabirds do regularly occur in the vicinity of the ROW, including jaegers, mew and glaucous-winged gulls, kittiwakes, terns, guillemots, and murrelets (Gabrielson and Lincoln 1959; Isleib and Kessel 1973; Johnson and Herter 1989). Seabirds are discussed in more detail in Sections 3.20.2 and 3.20.3.

The nesting abundance of shorebirds on the southern coastal plain of the North Slope is highest in the area from the coast to approximately 15.5 mi south of PS 1. From there, shorebird abundance decreases rapidly toward the foothills of the Brooks Range. The most numerous breeding shorebirds in the foothills region are American golden-plover, pectoral sandpiper, and buff-breasted sandpiper (Hanson and Eberhardt 1981).

The shorebird community south of the Brooks Range differs markedly from that to the north. Shorebirds that dominate the tundra include several sandpiper species. Those that occur in the boreal forest zone include the semipalmated plover, lesser yellowlegs, and spotted sandpiper. These birds occur in and around small lakes, fens, or along rivers. Some arctic species, such as American golden-plover and whimbrel, occur in alpine tundra. The most widespread shorebirds along the entire ROW south of the Brooks Range are the lesser yellowlegs and common snipe (TAPS Owners 2001a).

3.20.1.2 Raptors

A number of raptors (e.g., hawks, falcons, eagles, and owls) regularly occur along the ROW. The peregrine falcon (both the American and arctic subspecies), rough-legged hawk, gyrfalcon, and golden eagle are cliff-nesting species and may all nest in the same general areas (APSC 1993). The bald eagle and the northern goshawk have been identified as species sensitive to disturbance during ROW developments (TAPS Owners 2001a).

The arctic and American peregrine falcons are discussed in Sections 3.22.1.4 and 3.22.1.5, respectively. However, it should be mentioned that peregrine falcon use areas are identified as zones of restricted activity (ZRAs) to protect them and other raptors that often use these areas. The peregrine falcon ZRAs that occur close to the ROW include Franklin Bluffs (MP 15-36), Sagwon Bluffs (MP 57-61 and 59-68), Slope Mountain (MP 113-116), Yukon River (MP 350-355), and Grapefruit Rocks (MP 417-418) (APSC 1993).

The rough-legged hawk is among the most common hawk species, particularly in northern and western Alaska (Ritchie 2002). It nests along drainages in the northern foothills of the Brooks Range and regularly occurs along the TAPS from Franklin Bluffs to Galbraith Lake. Gyrfalcons occur in mountainous areas along the ROW, from north of the Brooks Range along the Sagavanirktok River to the Chugach Mountains. They nest on rock formations, hillside outcrops, river bluffs, and isolated rock outcroppings in open expanses of flat and gently rolling terrain (APSC 1993). Gyrfalcons have also been found to nest on a number of man-made structures, including on top of the pipeline’s vertical support members (Ritchie 1991).

The bald eagle is more abundant in Alaska than elsewhere in the United States. The Alaska population is about 30,000 adults. Bald eagles occur along the Alaska coast, on offshore islands, and along interior rivers and lakes. They can be found along the ROW south of the Atigun Pass (APSC 1993). Bald eagle nest sites occur near the ROW on the Yukon, Tanana, Gulkana, Copper, and Lowe Rivers and their tributaries (Ritchie and Ambrose 1996). More than 8,000 bald eagles nest and winter in the Gulf of Alaska and the Prince William Sound area (Bernatowicz et al. 1996). A few winter in interior Alaska near the confluence of the Tanana and Delta Rivers (Ritchie and Ambrose 1987). Resource use (e.g., logging, mining, and oil production and transportation) and human encroachment into remote areas are among the major threats to bald eagles in Alaska (Daum 1994).

Golden eagles occupy mountainous habitats similar to those of gyrfalcons, but they also regularly nest in other habitats, including cliffs along the Yukon and Tanana Rivers. They can be found along the TAPS ROW from as far north as MP 38 to the coastal mountains near Valdez (TAPS Owners 2001a; Montgomery 2002b). Loss of undisturbed habitat and increasing human disturbance are the major threats to golden eagles in Alaska (Daum 1994).

The northern goshawk and sharp-shinned hawk nest along the ROW. The northern goshawk nests in birch and aspen trees; the sharp-shinned hawk uses middle-aged spruce trees (Clarke 1994). Nesting activities and productivity of the northern goshawk are variable, reflecting the cyclic abundance of major prey (McGowan 1975). Ospreys rarely occur along ROW but are known to nest in the Tanana and Susitna valleys in Interior Alaska (Schempf 1989), and they may also nest in the Copper River Basin (Cooper et al. 1991). Other raptor species, such as northern harrier and American kestrel, occur along the ROW and are relatively common where nesting habitat is available.

Snowy owls are common on the Arctic Coastal Plain (Pitelka 1974; Johnson and Herter 1989). When their primary food (lemmings) is abundant, they can be found nesting near the ROW. Short-eared owls nest on the ground in tundra habitats along the ROW. Other owls in Alaska, such as the great horned owl, northern hawk owl, and the boreal owl, are primarily woodland species and commonly occur along the ROW in forest habitats south of the Brooks Range (Armstrong 2000; TAPS Owners 2001a).

3.20.1.3 Grouse and Ptarmigan

Forest-dwelling grouse (ruffed and spruce) occur along the TAPS ROW between the Brooks Range and the Chugach Mountains, and sharp-tailed grouse occur in more open, grassy habitats between Fairbanks and Glennallen (Gabrielson and Lincoln 1959). They occur in the valleys of the Yukon, Upper Koyukuk, Upper Kuskokwim, Tanana, and Upper Copper Rivers. Fires maintain the brushy grasslands preferred by the sharp-tailed grouse (Ellison 1994). A sharp-tailed grouse display area occurs near MP 653 to 685 along the TAPS (APSC 1993).

Three species of ptarmigan (rock, willow, and white-tailed) are residents along the ROW. The first two species are common from the Arctic Coastal Plain to the Chugach Mountains, whereas white-tailed ptarmigan are restricted primarily to the higher elevations in the Alaska Range and the Thompson Pass area of the Chugach Mountains (Gabrielson and Lincoln 1959; Kessel and Gibson 1978; Anderson 2002). Rock and willow ptarmigan commonly use open tundra in the dust shadows of the Dalton Highway during spring migration (TAPS Owners 2001a).

3.20.1.4 Passerines

More than 170 species of passerines (also known as perching birds or songbirds) have been recorded in Alaska (Gibson 1999). At least 70 species occur regularly along the TAPS ROW. Migrant passerines arrive in habitats along the ROW during late March through June (Ritchie 2002) and begin breeding soon after arrival. Most young fledge by August and begin their southward migration soon thereafter (TAPS Owners 2001a). Only a few species (e.g., common raven, redpolls, American dipper) are year-round residents at the northern end of the ROW. The common raven is closely associated with areas of human habitation (Johnson and Herter 1989).

The number of breeding passerine species is greater in the foothills of the Brooks Range than in the coastal plain of the North Slope because more shrub habitats are available (Johnson and Herter 1989). The most numerous passerines in the foothills of the Brooks Range are savannah sparrow, yellow wagtail, American tree sparrow, Lapland longspur, and white-crowned sparrow (Gabrielson and Lincoln 1959).

In general, the number of resident and migrant breeding bird species increases in the more southern sections of the ROW, with upwards of 20 species breeding in some of the interior forest habitats (Spindler 1976; Benson 1999; Anderson et al. 2000). White-crowned sparrows and dark-eyed juncos are ubiquitous, occurring commonly in all regions south of the Brooks Range. Alder flycatcher, Swainson’s thrush, and American robin are similarly widespread but are less numerous in the upper elevations of the Alaska Range (TAPS Owners 2001a). Other characteristic passerines by region are as follows: (1) interior forests – orange-crowned, yellow-rumped, and Wilson’s warblers; (2) Alaska Range – American tree sparrow, cliff swallow, Wilson’s and arctic warblers; (3) Copper Plateau – cliff swallow, yellow-rumped and Wilson’s warblers; and (4) Pacific Coastal Mountains – orange-crowed, yellow-rumped, and Wilson’s warblers and hermit thrush (TAPS Owners 2001a).

Changes in forest cover and conditions caused by timber harvest (e.g., for the logging industry or urban growth) and insect infestations likely have a negative effect on the distribution of a number of passerines and other landbird populations, particularly within south-central and southern coastal portions of Alaska. These changes have been beneficial to some species such as woodpeckers. However, no landbird species or their habitats are threatened with extirpation in Alaska (BPFWG 1999). Factors responsible for the status of the rare and endangered bird species are discussed in Section 3.22.

3.20.2 Beaufort Sea

About 240 species of birds occur throughout the North Slope, with about 180 of them breeding in the area (Johnson and Herter 1989). The total number of birds approaches 10 million. The only known regular winter residents are the common raven, snowy owl, glaucous gull, willow ptarmigan, and gyrfalcon (Johnson and Herter 1989). The barrier islands, reefs, spits, beaches, and shallow lagoons along the Beaufort Sea provide shelter to thousands of molting birds (e.g., long-tailed duck, eiders, scaup, and brant) and nesting sites for gulls, eiders, terns, shorebirds, and passerines (see BLM 1972). Within the North Slope area, waterfowl nesting may occur on any pond or lake and, especially, within the Sagavanirktok River floodplain (APSC 1993).

Waterfowl, seabirds, and shorebirds are the most common breeding birds along the Beaufort Sea. The most abundant marine and coastal species are the red phalarope, long-tailed duck, glaucous gull, and common eider (ADNR 1999). Passerines and other birds are scarce (BPFWG 1999). For the most part, the birds found along the northern portion of the TAPS (as described in Section 3.20.1) are the same as those of the Beaufort Sea area. This section provides a brief overview of some of those species.

The yellow-billed loon is an uncommon breeder on the Arctic Coastal Plain, where it primarily breeds on the Colville River Delta and in the National Petroleum Reserve-Alaska west of the TAPS (Sjolander and Agren 1976; Johnson and Herter 1989). Tundra swans are common breeders across the Arctic Coastal Plain of Alaska and at the northern end of the ROW (Johnson and Herter 1989). Tundra swans nest in relatively low densities across the entire coastal plain but occur in highest densities on the major river deltas (Colville, Sagavanirktok, and Canning Rivers) (Johnson et al. 1998; Anderson et al. 1999). They are most sensitive to disturbance during nesting (May to early July) and during brood-rearing (July–September) (Bergman et al. 1977; Derksen et al. 1981). Potentially adverse influences on the productivity of swans in the oil-field region include the weather, predation, and oil-field activities (Ritchie and King 2000).

Four species of eiders nest on the coast of the Beaufort Sea. The spectacled and Steller's eiders are both listed as threatened and are addressed in Section 3.22. Common eiders nest in colonies along the coast, on barrier islands, sand spits, and tundra ponds near driftwood or clumps of grass. Harsh winters and lack of open water occasionally cause deaths of spring migrants. However, predation by foxes, ravens, and gulls on eggs and young is the major factor regulating the abundance of common eiders in the oil-field production area (Johnson 2000b). King eiders are solitary breeders on islands and peninsulas in tundra lakes and ponds. More than one million eiders (mostly common and king) have been recorded passing Point Barrow in the late summer on their way to molting areas (Rothe and Arthur 2000).

Canada geese, greater white-fronted geese, snow geese, and brant nest on the Arctic Coastal Plain and in the northern section of the ROW (Johnson and Herter 1989, see Section 3.20.1). Brant and snow geese nest in colonies of a few to several hundred pairs at traditional coastal sites in the Prudhoe Bay area (Johnson 1991, 2000a; Murphy and Anderson 1993; Stickney et al. 1994; Sedinger and Stickney 2000). Canada geese are unevenly distributed across the Arctic Coastal Plain and reach their highest densities in the Prudhoe Bay area (Johnson and Herter 1989). They prefer to nest on small islands in ponds and lakes that provide safety from predators (Murphy and Anderson 1993). Greater white-fronted geese are the most common breeding geese on the Arctic Coastal Plain, declining in abundance to the east of Prudhoe Bay (Johnson and Herter 1989). This species nests on the tundra, often away from ponds or lakes. Brant are strongly associated with coastal habitats during nesting and brood-rearing. Brant colonies of 25 to 100 or more pairs are located near the coast in Prudhoe Bay and on Howe Island (Stickney et al. 1994). Snow geese nest primarily in a large colony of 300 to 500 pairs on Howe Island in the outer Sagavanirktok River delta. However, several small snow goose colonies have become established from the Colville River Delta to the Kukpowruk River Delta (west of the National Petroleum Reserve-Alaska) (Johnson 2000a; Ritchie et al. 2000), and a few nest in isolated pairs on the tundra (Johnson 1991, 2000a). During spring migration, snow geese regularly stage in the dust shadow of the Dalton Highway (TAPS Owners 2001a).

The long-tailed duck is the most common waterfowl species that nests in the Beaufort Sea area. They frequently nest in clusters or colonies, utilizing barrier island shorelines, lagoons, and nearshore areas during molting (ADNR 1999).

Glaucous gulls nest in colonies on barrier islands and drained lake basins on the tundra, as well as in isolated pairs on tundra ponds (Johnson and Herter 1989). They are scavengers and predators on waterfowl and other seabirds and also consume fish. Domestic and industrial developments along the North Slope have resulted in increases in juvenile gull survival (Patten 1994). However, current solid waste management practices now minimize the potential of this increase in gulls from becoming a problem along the TAPS and in the oil fields.

The Arctic Coastal Plain is an important breeding area for many species of shorebirds. At least 18 species breed in the Arctic Coastal Plain between the Colville and Canning Rivers, and approximately 20 other species occur as migrants or vagrants (Troy 2000). The most common shorebird species that nest in the area are the dunlin, pectoral sandpiper, semipalmated sandpiper, red phalarope, and red-necked phalarope (Hanson and Eberhardt 1981; BLM 1998a). Nest success strongly regulates shorebird population recruitment. A primary determinant of nest success is predation, especially by arctic fox. Other predators include arctic ground squirrel, lemmings, red fox, brown bear, short-tailed weasel, wolverines, jaegers, glaucous gulls, and common raven (Troy 2000). Shortly after spring migration, shorebirds and waterfowl disperse to nesting grounds on moist tundra and marshlands (ADNR 1999). Coastal tundra lakes, ponds, and river deltas are important areas for waterfowl and shorebird molting and for staging before and during fall migration (MMS 1996).

More than 30 species of passerines have been recorded on the coastal plain, and at least 8 species breed there (Johnson and Herter 1989). The most abundant breeding passerine on the coastal plain is the Lapland longspur (Johnson and Herter 1989; TERA 1993). Other common breeding species on the coastal plain are common and hoary redpolls, snow bunting, and savannah sparrow (Johnson and Herter 1989; Johnson et al. 2000). Snow buntings will nest in oil field structures and equipment in order to get their nests off the ground and away from predators (Montgomery 2002b). Ravens occasionally nest near the coast, primarily on buildings and other structures, including those in the Prudhoe Bay and Kuparuk oil fields (Johnson and Herter 1989; Ritchie 1991; Day 1998).

River corridors contain most of the tall shrub stands in the North Slope (BLM 1998a). While these locations make up only a small percentage of the area, they contain the highest diversity of landbirds in northern Alaska (BPFWG 1999). The present distribution of most tundra birds is believed to reflect their various adaptations to arctic fox predation (see Burgess 2000).

3.20.3 Prince William Sound

Bird checklists for the Gulf of Alaska/Prince William Sound area can be found in Andrew et al. (1997) for Seward, Alaska; NPS (1997) for Kenai Fjords National Park; and USFWS (undated-b) for the Alaska Maritime Refuge. At least 278 species of birds have been reported from the Prince William Sound and the Gulf of Alaska (Gabrielson and Lincoln 1959; Isleib and Kessel 1973; DeGange and Sanger 1987). The Copper River Delta is an important migratory staging area for shorebirds and other species of waterfowl; more than 16 million migrate through the area each year (National Wildlife Federation 2002). Prince William Sound is an important overwintering area for seaducks, especially scoters, cormorants, harlequin ducks, Barrow’s goldeneye, and mergansers. More than 20 species of raptors have also been recorded in Prince William Sound and the Gulf of Alaska (Gabrielson and Lincoln 1959; Isleib and Kessel 1973). The bald eagle is one of the most abundant raptors of this region.

At least 45 species of shorebirds and 45 species of seabirds occur in the Prince William Sound and Gulf of Alaska region (Armstrong 2000). A number of these species do not breed in the area, indicating the importance of the region for both migration and nesting (TAPS Owners 2001a; Anderson 2002). However, 28 species of seabirds do breed in the region (Isleib and Kessel 1973; Gould et al. 1982; DeGange and Sanger 1987). A significant portion of the world’s population of both marbled and Kittlitz’s murrelets occur in Prince William Sound (Agler et al. 1998). The region is especially important to nesting gulls and alcids (i.e., murres, guillemots, murrelets, and puffins), particularly in Prince William Sound and on the Kenai Peninsula. The Barren Islands, located at the mouth of Cook Inlet, have the largest seabird colonies in the northern portion of the Gulf of Alaska (Boersma and Parrish 1996). The total population of seabirds in the Prince William Sound and Gulf of Alaska region may approach 2 million birds during summer, when the breeding number is added to the large number of nonbreeding albatrosses and sooty and short-tailed shearwaters summering from colonies farther south and the nonbreeding northern fulmars, storm-petrels, gulls, and alcids from Alaska (Isleib and Kessel 1973).

Suitable nest sites and prey availability are the most important controlling factors governing seabird distribution and abundance (Hatch and Piatt 2001; Suryan and Irons 2001). Predators also have a controlling influence on the abundance of seabirds (Hatch and Piatt 2001).

3.21 Terrestrial Mammals

A total of 107 mammal species occur in Alaska; this section describes those terrestrial mammals that occur along the TAPS ROW and in the Beaufort Sea area. Terrestrial mammals that frequent the Prince William Sound area including river otter (*Luta canadensis*), brown bear (*Ursus arctos*), black bear (*Ursus americanus*), red fox (*Vulpes vulpes*), Arctic fox (*Alopex lagopus*), gray wolf (*Canis lupus*), coyote (*Canis latrans*), mink (*Mustela vison*), wolverine (*Gulo gulo*), moose (*Alces alces*), mountain goat (*Oreamnos americanus*), and the Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) also occur within the southern portion of the TAPS ROW; therefore, a separate section on the Prince William Sound is not provided. The marine mammals that receive protection under either the Endangered Species Act or the Marine Mammal Protection Act and that occur in the Beaufort Sea or Prince William Sound are discussed in Section 3.22.

Alaska has been divided into Game Management Units (GMUs) for management of wildlife species. The TAPS ROW passes through portions of five GMUs — GMU 26 (North Slope), GMU 24 (Koyukuk River), GMU 20 (Tanana Valley), GMU 13 (Nelchina Basin), and GMU 6 (Prince William Sound). Two other game management units are near the ROW — GMU 25 (Upper Yukon) and GMU 11 (Wrangell Mountains) (Map 3.21-1).

3.21.1 TAPS Row

In the following discussion addressing mammal species that occur along the ROW, emphasis is placed on species that (1) have key habitats near the ROW, (2) can be affected by operation and maintenance of the TAPS, (3) are important to humans (e.g., sport and subsistence harvest), and/or (4) are representative of other species that share important habitats. Threatened, endangered, and protected mammal species are discussed in Section 3.22.

3.21.1.1 Moose

Moose have broad habitat requirements that include breeding (rutting) grounds, winter feeding areas, calving grounds, and summer feeding areas (APSC 1993). Most moose make seasonal migrations between these areas; such migrations can range up to 60 mi. Moose are most common in open country (e.g., recently burned areas) that contains willow and birch shrubs, on timberline plateaus, and along major rivers of south-central and Interior Alaska (Rausch et al. 1994). Winter range includes climax willow stands in river valleys and shrub habitats. The peak calving period is mid-May to early June. Calving habitat includes open meadows interspersed with stands of black spruce, alder, willow, and sedges, or shallow lakes and ponds with emergent and aquatic vegetation. Calves are weaned by the fall breeding period (late September to early October) (APSC 1993). Important moose habitat areas near the TAPS ROW are listed in Table 3.21-1.

Key Habitats

Key habitats are areas considered to be important for maintaining healthy terrestrial mammal populations. Examples of such areas are: concentration areas (general), calving concentration areas, caribou insect relief areas, Dall sheep lambing areas, mineral lick areas, migration corridors or movement zones, and winter use concentration areas (APSC 1993).

In fall and winter, moose consume willow, birch, and aspen twigs. Spring foods include sedges, horsetail, pond weeds, and grass. Summer foods include aquatic vegetation, forbs, and leaves of willows, birch, and aspen (Rausch et al. 1994).

Moose are widely distributed along the ROW from the Sagavanirktok River valley near PS 2 to the Valdez Marine Terminal. Winter concentration areas occur along much of the ROW, and calving concentration areas also occur on or near the ROW. Moose sometimes use the workpad or access roads as seasonal or daily travel corridors (APSC 1993). The elevated portion of the TAPS intercepts snow or forms a

TABLE 3.21-1 Important Moose Habitat Areas near the TAPS ROW[a]

Habitat Area	TAPS Mileposts
Winter concentration areas	57-113, 271-279, 285, 295, 302-309, 349-394, 411-434, 436-471, 490-498, 518-526, 493-503, 535-574, 627-660, 691-714, 719-750
Calving areas	411-423, 436-439, 462-471, 490-503, 525-527, 719-728
Rutting areas	411-423, 436-439, 494-498, 627-646, 724-728

[a] Areas listed are those that include portions within 2 mi or less from the TAPS ROW.

Source: APSC (1993).

windbreak, resulting in less snow and more exposed vegetation directly under the pipeline in some areas. This condition can attract moose in winter. Moose also frequent buried portions of the TAPS in the spring because snow melts earlier there (TAPS Owners 2001a).

Population increases of moose occur in response to mild winters, low predator numbers, relatively low harvest by humans, and events or activities (e.g., wildfires and tree harvesting) that favor the growth of browse (Ballard et al. 1987, 1991; Tobey 1996a). Moose declines occur as a result of severe winters, predation, fire suppression, and overharvest (TAPS Owners 2001a). Collisions with vehicles are an additional source of mortality. However, roadkills have not been identified as a significant factor on moose population size along the TAPS (TAPS Owners 2001a).

More people hunt moose than any other game species in Alaska (Rausch et al. 1994). The most important moose hunting areas are those with easy road access and proximity to human population centers. These include GMU 13 in south-central Alaska and GMU 20B. The latter includes the Fairbanks area and has extensive road systems (Ballard et al. 1991; Dale 1996; Tobey 1996a). Moose hunting in GMUs 24 and 26B (northern Alaska) is influenced by the presence of the Dalton Highway. The Dalton Highway Corridor Management Area (DHCMA) extends about 5 mi on each side of the Dalton Highway from the Yukon River north to the Prudhoe Bay Closed Area. The DHCMA is closed to sport hunting with firearms, but game may be taken with bow and arrow. Residents of the DHCMA and six nearby villages are permitted to use firearms in the management area. No motorized vehicles, except aircraft, boats, and licensed highway vehicles, may be used to transport game or hunters within the DHCMA. All hunters traveling on the Dalton Highway must stop at check stations operated by ADF&G within the DHCMA (ADF&G 2002). Table 3.21-2 presents harvest summaries for moose (and other species except caribou). Additional information on subsistence is presented in Section 3.24.

3.21.1.2 Caribou

More than 857,000 caribou (*Rangifer tarandus)* are distributed among 32 separate herds in Alaska. A caribou herd is a group of caribou that establishes a calving area distinct from any other group and calves there repeatedly (Skoog 1968). Caribou undertake seven distinct phases of activities over the year: spring migration, calving, post-calving aggregation, dispersal, fall migration/prerut, rutting, and wintering (Jakimchuk et al. 1987). Generally, caribou migrate in a north-south direction, but in some areas (e.g., north slope of the Brooks Range, the Ray Hills, and upper Copper River basin) seasonal movements occur in an east-west direction that force the caribou to cross the pipeline and related facilities (APSC 1993). Calving is highly synchronized as an adaptation to predation (Bergerud and Page

TABLE 3.21-2 Harvest Summaries for Alaska Wildlife (except caribou) within the Game Management Units (GMUs) That Are Crossed by or Occur near the TAPS ROW[a]

Species	GMU 6	GMU 13	GMU 20	GMU 24	GMU 25	GMU 26	State Total
American bison	0	0	74	0	0	0	104
Black bear	367	99	347	8	3	0	2,558
Brown bear	50	146	64	22	11	39	1,312
Sitka black-tailed deer	1,780	0	0	0	0	0	14,816
Moose	89	563	1,835	220	182	0	7,050
Mountain goat	72	4	0	0	0	0	453
Musk ox	0	0	0	0	0	9	137
Dall sheep	0	105	77	24	42	84	781
Gray wolf	13	269	309	75	48	48	1,574

[a] Data do not include unreported harvest, which may equal or exceed the reported harvest for some species. Data are for harvest year 2000-2001. The reported harvest includes firearm and archery harvests, resident and nonresident harvests, and subsistence harvest (Schwartz 2002).

Source: ADF&G (undated-b).

1987). Caribou feed on sedges, grasses, fungi, lichens, mosses, and leaves and twigs of woody plants (such as willows and birches) (USFWS 1998a). Most caribou must migrate to find adequate food resources. Some of the larger herds may migrate up to 400 mi between summer and winter ranges, while the smaller herds may not migrate at all. Caribou prefer treeless tundra and mountains, although several herds winter in the boreal forest. Calving usually occurs in mountains or open, coastal tundra (Valkenburg 1999). During spring and fall migrations, caribou tend to move along or near major river drainages (ADNR 1999).

Caribou inhabit the arctic tundra, mountain tundra, and northern forests (Valkenburg 1999). The Nelchina, Delta, Central Arctic, and Western Arctic caribou herds regularly occur in the vicinity of the ROW, either during the summer or winter, or during migrations to seasonal ranges elsewhere. Several other herds also occur in the vicinity of the ROW and the Dalton Highway (i.e., the Ray Mountains and White Mountains herds) and may encounter the ROW. Table 3.21-3 presents population estimates for these caribou herds. The traditional ranges of the Teshepuk Lake and Porcupine herds on the North Slope do not include the TAPS ROW, but they are near North Slope oil fields. Map 3.21-2 shows the distribution of caribou herds in the vicinity of the TAPS ROW. Herds are not totally independent and are not reproductively isolated. They have some overlap in summer, fall, or winter ranges, where some exchange of animals between herds occurs (Skoog 1968; Cameron and Whitten 1979; Bergerud et al. 1984; Cronin et al. 1997, 1998a).

Factors influencing herd size include hunter harvests, predation, weather conditions, and forage availability (Table 3.21-3). Results of long-term research on the Delta and adjacent caribou herds suggest that adverse weather can cause decreased production of calves and increased vulnerability to predation over a wide range of caribou densities. The absolute numbers and proportion of the western segment of the Central Arctic caribou herd that use the Kuparuk Oil Field area for calving has decreased from the 1980s through the early 2000s (Murphy and Lawhead 2000; Lawhead and Pritchard

TABLE 3.21-3 Caribou Herd Size, Harvest Summaries, and Limiting Factors for Herds Occurring near the TAPS ROW[a]

Herd	Herd Size in 2000	Harvest Summary[b]	Limiting Factors
Nelchina	30,000	1,084/3,209	Forage availability, weather, predation, hunter harvest
Delta	3,200	24/36	Weather, predation
Ray Mountains	2,000	4/2	Predation
White Mountains	700	49/26	Not known
Central Arctic	27,000	495/411	Not fully investigated
Western Arctic	430,000	18,327/21,803	Predation, starvation, disease, accidents, hunter harvest
Teshekpuk Lake	27,000	2,250/2,065	Similar to Western Arctic herd
Statewide	857,345	32,294/34,582	

[a] Herd size estimates from ADF&G (undated-a), harvest summaries from ADF&G (undated-b), and limiting factors from TAPS Owners (2001a) and references cited therein.

[b] 2000-2001 harvest year/five-year average harvest (1996-1997 through 2000-2001). Data do not include unreported harvest, which may equal or exceed the reported harvest. The reported harvest includes firearm and archery harvests, resident and nonresident harvests, and subsistence harvest (Schwartz 2002).

2002). However, it cannot be definitively concluded that the distributional shift in calving to areas south of the oil field is a disturbance-caused displacement related to oil field development and operation (Murphy and Lawhead 2000). Nevertheless, the Kuparuk Oil Field is still used annually by several hundred cows that have a high level of calf production that does not differ significantly in its calves/cows ratio from that in the nondeveloped areas south of the oil field (Lawhead and Pritchard 2002). To date, evidence does not suggest that caribou populations have been adversely affected by the oil industry in Alaska (Boertje et al. 1996; Valkenburg 1997; Cronin et al. 1998a,b, 2000).

Harvest summaries for the caribou herds are also provided in Table 3.21-3. The Nelchina herd has historically been one of the most important caribou herds in the state for hunting because of its proximity to large population centers and because the herd is easily accessible by road (Lieb 1989). In contrast, the Ray Mountains herd is lightly hunted because few people know about the herd, and it is largely inaccessible during the hunting season (Osborne 1995). Harvest from the Ray Mountains herd has averaged fewer than 10 caribou per year over the last 10 years (Woolington 1997a; Nowlin 1998). The BLM (1989a) indicates that most of the reported harvest of Ray Mountains herd caribou occurred along the Dalton Highway. In the northern portion of Alaska, most caribou harvesting by nonlocal hunters (those who do not live within northern Alaska) occurs between late August and late October, when caribou may be in the vicinity of the Dalton Highway. Subsistence harvest occurs throughout the year (TAPS Owners 2001a).

The distribution of the various caribou herds is summarized as follows:

- *Nelchina Herd:* Migration movements between spring/summer and fall/winter ranges require crossing the Richardson Highway and the TAPS ROW (Eide et al. 1986). APSC Security flight data indicate that the caribou continue to use their traditional migration route while transecting the ROW and Richardson Highway (TAPS Owners 2001a). Calving areas near the ROW occur between MP 627 and 660 (APSC 1993), a winter concentration area occurs from MP 659 to 693, and a migration area occurs from MP 602 to 680 (APSC 1993).

- *Delta Herd:* Although most of the Delta caribou herd occurs west of the ROW, a small portion of the herd occurs east of the Delta River, TAPS ROW, and the Richardson Highway in the areas of Iowa Creek and Donnelly Dome (APSC 1993; Eagan 1995; Valkenburg 1997; Valkenburg et al. 1999) (Map 3.21-2). A winter concentration area occurs near the ROW between MP 520 and 555 (APSC 1993).

- *Ray Mountains Herd:* During fall and winter, the herd moves to the northern side of the Ray Mountains, primarily in the Kanuti-Kilolitna drainage (Woolington 1997a). During autumn, Ray Mountains herd caribou occasionally have been observed in the vicinity of the TAPS ROW near PS 5 (APSC 1993), the Dalton Highway at Old Man, and near Caribou Mountain (Woolington 1997a).

- *White Mountains Herd:* All seasonal White Mountains herd habitats and ranges are east (approximately 20 mi at a minimum from about MP 520) of the ROW and Dalton Highway (Map 3.21-2). White Mountains herd caribou have not been reported crossing the pipeline or the highway. However, as illustrated by other Alaskan caribou herds, if this population increases, seasonal ranges may expand, and the White Mountains herd may then encounter the ROW and the Dalton Highway (TAPS Owners 2001a).

- *Central Arctic Herd:* Among the four caribou herds in the North Slope area (see Map 3.21-2), the Central Arctic herd is routinely exposed to oil and gas development facilities. This herd ranges from the Brooks Range to the Beaufort Sea, and from the Colville River east to the Canning River (Lawhead 1997). The primary calving areas for the Central Arctic herd lie between the Sagavanirktok and Canning Rivers in the area south of Bullen Point and in and around the Kuparuk and Milne Point oil fields. (Ballard et al. 2000; Murphy and Lawhead 2000). Lesser-used calving areas occur between the Eastern Channel and the Nechelik Channel of the Colville River and in the foothills of the Brooks Range south of the Colville River delta (ADNR 1999). Calving near the ROW occurs between MP 0 and 26, a winter concentration area occurs between MP 0 and 145, and migration areas occur from MP 100 to MP 105, 133 to 145, MP 146 to 156, and MP 173 to 243 (APSC 1993). The principal times when the Central Arctic herd encounters oil and gas field developments are during the periods of calving, post-calving aggregation, and dispersal (late May to mid-August) (TAPS Owners 2001a).

- *Western Arctic Herd:* During September and October, the Western Arctic herd caribou migrate as far south as the Seward Peninsula onto winter range and as far east as the TAPS ROW (APSC 1993; Woolington 1997b).

- *Teshekpuk Lake Herd:* Caribou from the Teshekpuk Lake herd winter over a wide range from the Arctic Coastal Plain to the Seward Peninsula, south of the Brooks Range (Philo et al. 1993; Carroll 1995). In some years, a portion of the herd winters on the Arctic Coastal Plain (Philo et al. 1993). The calving grounds and summer range of the herd are on the Arctic Coastal Plain (Philo et al. 1993; Carroll 1995). The principal calving grounds are located around Teshekpuk Lake, and the summer range extends across the coastal plain west of the Colville River delta (Philo et al. 1993; Carroll 1995). The calving and summer ranges of the herd are overlapped by recent oil and gas exploration leases in the northeastern part of the National Petroleum Reserve–Alaska (BLM and MMS 1998).

3.21.1.3 Musk Ox

Musk ox (*Ovibos moschatus*) were extirpated from Alaska by the early 1900s (Woolington 1997c; Reynolds 1998). They were reestablished in the state when musk ox from Greenland were introduced in 1935-1936 to Nunivak Island off Alaska's west coast (Reynolds 1998). The total number of musk ox on the Arctic Coastal Plain has increased steadily since reintroduction, and at least 800 musk ox now inhabit the North Slope, generally within the ANWR area (Reynolds 1998; Woolington 1997c). Factors influencing musk ox population size include dispersal of mixed-sex groups into other regions (which can initially affect calf production), predation by brown bears and gray wolves, declining forage availability from intraspecific competition, and weather (TAPS Owners 2001a).

Westward dispersal of the musk ox across the North Slope began in the early 1980s, with individual bulls and small numbers of mixed-sex groups being observed as far west as the Kuparuk and Prudhoe Bay oil fields (BLM and USACE 1988; USACE 1997; Reynolds 1998). In 1986, as many as 18 musk ox were repeatedly observed along the Sagavanirktok River north of Franklin Bluffs (BLM and USACE 1988). In addition, musk ox have been seen near the Dalton Highway and as far south as PS 3 (Thompson 1999; Stephenson and Hunter 1999). At present, the total distribution of musk ox on the Arctic Coastal Plain covers a linear distance of approximately 300 mi extending from the Colville River west of Prudhoe Bay to beyond the Babbage River in northwest Canada (Reynolds 1998). A breeding population has become established in the Itkillik-Colville Rivers area (Johnson et al. 1996). No geographical barriers to range expansion exist along the arctic coast, and the potential range for musk ox is extensive (Smith 1984). For musk ox to have expanded their range from ANWR to the Colville River, some animals had to cross the TAPS ROW or travel through the oil fields on the North Slope (TAPS Owners 2001a). However, no habitats important to musk ox are crossed by or occur near the TAPS ROW (APSC 1993). Only three musk ox were harvested in GMU 26 in 1999/2000 (Table 3.21-2).

During the snow-free season, musk ox generally use moist habitats and associated lush meadow and riparian vegetation (Klein 2000; BLM 1988). The most important summer habitats on the Arctic Coastal Plain are riparian, upland shrub, and moist sedge-shrub meadows, which provide preferred willow, forb, and sedge vegetation (Robus 1984; Johnson et al. 1996; BLM and MMS 1998). Musk ox use upland tussock areas and riparian drainages as calving habitat between late April and late June (Reynolds 1984; APSC 1993; USACE 1997).

Between late November and the end of February, musk ox frequently use riparian and dry tundra habitats such as ridges and bluffs. Winter forage depends largely on snow depth and hardness (Klein 2000). In late winter, musk ox feed on windblown vegetated bluffs that have shallow snow cover (Wilson and Klein 1991; Klein et al. 1993; USACE 1997). On the coastal plain, these areas are distributed in narrow bands along creeks, rivers, and the coastline. During winter, musk ox reduce their movements and activity; once they move to a winter area, they seldom leave it unless disturbed (Wilson and Klein 1991). Musk ox forage on the TAPS ROW in winter between PS 2 and 3 and also just south of PS 3. They concentrate on the workpad, perhaps because there is less snow cover, more grassy plants, or possibly more concentrated forage because of fertilization done in the course of revegetation (Montgomery 2002a).

3.21.1.4 American Bison

The Delta and Copper River herds of the American bison (*Bison bison*) occur in the vicinity of the ROW. The Delta herd ranges from Donnelly Dome to Big Delta in GMUs 20D and 20A, and the Copper River herd is distributed east of the Copper River in the northwestern portion of GMU 11 (APSC 1993). Good bison range is limited in Alaska, thus large numbers cannot be sustained (Griffin and Johnson 1994).

Most bison have predictable, periodic movements. Seasonal movements are associated with the search for food, calving and rutting areas, and mineral licks. Bison also move daily to obtain water. Weather, especially high winds, may also necessitate short-term movements. Summer range habitats can include upland dry meadows with open forests, margins of wet areas with forest, and areas with well-drained alluvial soils. Winter range includes bogs, stream banks, and margins of sloughs and ponds (see APSC 1993).

The most recent precalving herd estimate for the Delta herd was 361 bison (Hicks 1998). The most important limiting factor for this herd is harvest by humans (Taylor 1994; DuBois and Rogers 1999). Table 3.21-2 provides bison harvest summaries. There are no records of predation on Delta bison, although wolves, brown and black bears, and coyotes occur in the area. Drowning, hunting-wounding losses, and accidents are other potential limiting factors on bison numbers. Winter severity is not considered a major mortality factor (Taylor 1994; DuBois and Rogers 1999). The greatest potential for nonhunting mortality to bison in the Delta herd is disease transmitted from domestic livestock in the area (Taylor 1994). Kiker and Fielder (1980) reported that fewer than 10 bison in the Delta herd are killed annually in vehicle collisions.

Calving habitat in the lower and middle Delta River area is the only key bison habitat close to the TAPS ROW (MP 548 to 578). A major area for bison movement also occurs in this area (MP 545 to 566) (APSC 1993). The Delta herd is migratory; the bison move alone or in groups of up to 50 animals (DuBois 1995; DuBois and Rogers 1999). The herd normally travels to the floodplain of the Delta River from mid-February to March, crossing the Richardson Highway and the TAPS ROW. In early spring (April-May), cows move to secluded meadows near the Delta River to give birth (Hemming and Morehouse 1976; APSC 1993; DuBois and Rogers 1999). This area is west of the ROW between PS 9 and 10. During summer, the herd ranges along the Delta River floodplain and adjacent uplands, southwest of Delta Junction between Black Rapids Glacier and the mouth of the river (DuBois and Rogers 1999). During this period, bison are frequently visible from the Richardson Highway (TAPS Owners 2001a). In July, August, or September, the herd migrates from the Delta River, again crossing the ROW and the Richardson Highway, onto the Delta Junction bison range and private agricultural lands, where they stay for most of the fall and winter (DuBois and Rogers 1999).

Bison are grazing animals, and in the Delta area only limited amounts of preferred foods, such as grasses and sedges, are available along rivers and in recent burns (Campbell and Hinkes 1983; Berger 1996; DuBois and Rogers 1999). The availability of winter forage was an important limiting factor for the Delta bison (ADF&G 1976), but agriculture (e.g., barley production) has augmented natural forage for bison.

The Copper River herd population estimates range from 75 to 87 individuals (McDonald 1998a; Tobey 1994, 1998). The management objective for this herd is to maintain a minimum of 60 overwintering adults (Tobey 1998). Limiting factors for this herd include winter severity (i.e., snow depth) and the potential for winter starvation; accidental death (e.g., falling off steep bluffs that border the Copper River); drowning (due to winter ice conditions and/or crossing attempts); and harvest by humans (Tobey 1998). Predation by wolves, black bears, and brown bears is likely; however, no research has been conducted on predation rates on Copper River herd bison (TAPS Owners 2001a).

The current range for the Copper River herd is bounded by the Dadina River on the north, the Kotsina River to the south, the Copper River on the west, and the Wrangell Mountains to the east. Most of the range consists of black spruce forest, with bison frequenting swamps, sedge openings, grass bluffs, and river bars (Tobey 1998). Before 1990, there were very few reports of Copper River bison crossing the river, and observations of animals along the west bank of the Copper River in GMU 13 were infrequent. Recently, however, bison have been reported grazing in hay and crop fields in the Kenny Lake area west of the Copper River and just east of the ROW (Tobey 1998).

3.21.1.5 Dall Sheep

Dall sheep (*Ovis dalli*) occur in the vicinity of the TAPS ROW in the Chugach Mountains (GMUs 11 and 13D), the Alaska Range (Delta Controlled Use Area in GMUs 13B, 20A, and 20D), and the Brooks Range (GMUs 24 and 26B). Dall sheep are generally nonmigratory, but may make extensive movements between summer and winter ranges. They will remain in some areas (e.g., Atigun River Valley) throughout the year (APSC 1993). Factors that can potentially limit Dall sheep populations include winter severity and predation by wolves, coyotes, bears, wolverines, and golden eagles (Sinnott 1996a). Harvest summaries for Dall sheep are presented in Table 3.21-2.

In GMU 13D, Dall sheep are most abundant between the Nelchina and Klutina glaciers west of the ROW, and are also present in the Tonsina Controlled Use Area adjacent to the ROW. Dall sheep occur in the mountainous areas below about 9,800 ft in elevation, although concentrations vary among drainages. During the winter, Dall sheep in the Chugach Mountains are found in relatively snow-free areas and on windblown ridges above 2,950 ft in elevation. Lambing areas are often found in steep terrain with southern exposures (TAPS Owners 2001a).

Within the Delta Controlled Use Area, lambing and mineral lick areas occur adjacent to and within 9.3 mi of the ROW. These areas occur both east and west of the pipeline, north of PS 10 (APSC 1993). Winter range for the Dall sheep is provided by the area's moderate climate, including high winds, warm temperatures, and low snow depths. The greatest threats to Dall sheep habitat in the Delta Controlled Use Area are mining activities and military exercises on state lands (DuBois 1996a).

In the eastern Brooks Range, the highest densities of Dall sheep occur in the northern drainages that provide favorable weather and habitat conditions during winter (Stephenson 1996). Drainages such as the Junjik, East Fork Chandalar, and Hulahula Rivers may also inhibit Dall sheep movements, resulting in discrete subpopulations in the Brooks Range. Several lambing areas and mineral licks occur between PS 4 and 5. These areas occur both east and west of the pipeline (less than 8 mi), and overlap the ROW in some areas. Dall sheep movement zones associated with lambing areas have been identified west of the ROW near Chandalar and Atigun Pass. The sheep may cross the Dalton Highway in these areas (APSC 1993). Rare instances of mortality from vehicles have been reported (Jakimchuk et al. 1984).

A number of lambing areas occur less than 2 mi from the ROW (MP 114–115, MP 142–146, MP 144–147, MP 148–166, MP 173–179, MP 182–185, MP 187–200, MP 202–205, MP 206–109, MP 214–221, MP 568–588, and MP 719–712) (APSC 1993). Following lambing, ewes, lambs, and yearlings tend to concentrate around mineral lick areas. A number of mineral licks also occur within 2 mi of the ROW (MPs 115, 140, 145, 154, 158, 162, 164, 166, 169, 173, 176, and 218) (APSC 1993). Several special areas near the ROW have been established, in part, to protect Dall sheep habitat (e.g., lambing areas) and mineral licks (BLM 1989a). These areas include the Snowden Mountain Area of Critical Environmental Concern (ACEC) (east of the ROW and Dalton Highway at MP 190–200); Nugget Creek ACEC (north of the ROW at MP 216–221): and Poss Mountain ACEC (about 4 mi east of the ROW at MP 217–219) (APSC 1993). These areas are in the Brooks Range near the ROW and the Dalton Highway and are used year-round by Dall sheep (BLM 1989a).

3.21.1.6 Sitka Black-Tailed Deer

Sitka black-tailed deer occur throughout GMU 6, which is at the northern limit of their range and at the southern end of the TAPS ROW. When climatic conditions favor expansion, these deer can be found more than 30 mi inland along the Copper River corridor (APSC 1993). The deer population in GMU 6 is stable (Griese 1989a; Nowlin 1997). Highest deer densities occur on islands, and the lowest densities occur on the mainland in areas surrounding Prince William Sound. Deer density decreases rapidly with distance inland from Prince William Sound (Nowlin 1997). Population estimates are not available for GMU 6 or for areas in the vicinity of the ROW (TAPS Owners 2001a).

Factors that limit deer distribution, habitat use, and population numbers include snow depths and duration; wolf predation; availability of mature conifer-forest habitat, which provides deer wintering areas; clear-cutting and selective timber management practices; parasites; and hunting. During periods of high deer densities, a number of deer under 2 years of age often become infested with lungworm (Merriam et al. 1994). Harvest summaries are presented in Table 3.21-2. Although deer may be present in the vicinity of the southern end of the ROW, this area has not been identified as being important deer habitat (APSC 1993).

3.21.1.7 Mountain Goat

Mountain goats are found near the TAPS ROW south of the Alaska Range in GMUs 6, 11, and 13D. In south-central Alaska, they are generally confined to the Chugach and Wrangell Mountains. Mountain goats stay in or near steep, broken terrain (Johnson 1994b). Mountain goats in Subunit 6D, which is bisected by the ROW, have increased to the west of the ROW and the Richardson Highway, yet have declined to the east (Nowlin 1996a). They occur near Thompson Pass, where they are found in very rugged and broken terrain with cliffs, ledges, pinnacles, and talus slopes. No habitats important to mountain goats occur near or are crossed by the ROW (APSC 1993).

Old-growth forest provides important winter habitat for mountain goats (Schoen and Kirchhoff 1982; Fox et al. 1989; Nowlin 1996a). During the summer, goats frequent high alpine mountains, where they eat grasses, sedges, and low shrubs (APSC 1993). Although female goats seek isolated areas to give birth, the availability of winter habitat is the most important seasonal requirement for the species (TAPS Owners 2001a). Mountain goat populations are limited by winter severity and snow depths (Adams and Bailey 1982; Swenson 1985), predation (Nowlin 1996a), and availability of winter habitats (Fox et al. 1989). Natural causes of mortality (e.g., predation) primarily affect yearlings and goats over 8 years old; goats in their prime are more prone to hunting mortality (Smith 1986). Harvest summaries are provided in Table 3.21-2.

Near the ROW in GMU 11, mountain goats are distributed south of the Chitina River in that portion of the Chugach Mountains from the Copper River east to the Canadian border (Tobey 1996b). This area directly east of and adjacent to the ROW may provide the most suitable goat habitat in GMU 11 (Tobey 1996b). Goats from GMU 11 east of the ROW sometimes cross the pipeline and mix with goats from GMU 13D (TAPS Owners 2001a). In GMU 13D, mountain goats are primarily found in the Chugach Mountains adjacent to and west of the ROW (Sinnott 1996b). The population in GMU 13D is limited by winter weather and predation (Sinnott 1996b). The northernmost range of the mountain goat in Alaska is in the Talkeetna Mountains north of the Chugach Range (Ballard and Whitlaw 2002).

3.21.1.8 Brown Bear

Brown (grizzly) bears occur throughout most of Alaska except for several island groups (Eide et al. 1994). They are present in all GMUs crossed by the TAPS ROW and occur across the North Slope (TAPS Owners 2001a). Brown bear concentration areas (i.e., areas of higher densities) include the Sagavanirktok and Atigun River valleys. A brown bear concentration area also occurs between MP 613 and 621 (Summit Lake-Gulkana River-Paxson Lake area) (APSC 1993). More than 31,000 brown bears occur in Alaska (ADF&G 2000b). Brown bear abundance depends upon productivity of the environment. In areas of low production, such as the North Slope, brown bear densities are as low as one bear per 300 mi^2. In areas north and south of the Alaska Range (central Alaska), brown bear densities are intermediate at one bear per 15 to 23 mi^2. Highest densities of one bear per square mile have been reported for Admiralty Island, where food is readily available (Miller et al. 1997).

Brown bears are omnivorous. They feed on berries, grass, sedges, horsetails, roots, insects, fish, ground squirrels, and ungulate neonates (newborns). Brown bear spring and berry concentration areas occur between MP 182 and 247 and between MP 561 and 574 (APSC 1993). In some areas they also prey on domestic animals, carrion, and garbage (Eide et al. 1994). Brown bears feed on salmon from mid-May through August and use both salmon and berries from September through early November. Denning begins in late October, with most bears denned by mid-December (APSC 1995a). Ballard et al. (1982) reported that brown bears in the Nelchina Basin entered dens in late October. Bears generally emerge from dens in late March (depending on weather conditions). From mid-April to late July they can be found in grassland areas, such as grass flats, sedge meadows, and saltwater bogs (APSC 1995a), and old-growth upland forests (Schoen and Beier 1990). In late summer, they occur within old-growth riparian areas (Schoen and Beier 1990).

After emergence from dens, most brown bears (except females with newborn cubs) move to river bottoms to feed on sprouting plants, remaining berries, and ungulate neonates; and to scavenge the carcasses of animals such as moose and caribou that have died during the winter (Ballard et al. 1982; Miller 1987; Tobey 1995; Ballard and Whitlaw 2002). During the spring, females with cubs remain at higher elevations to reduce contact with other bears (TAPS Owners 2001a). Adult male brown bears have been implicated as a cause of cub mortality (see Shideler and Hechtel 2000). During summer and fall, bear distribution and movements are determined by the presence of salmon and by moose and caribou distributions (Miller 1987; Tobey 1995).

Sources of brown bear mortality include legal and illegal harvests, kills in defense of life and property, accidents, and nonhunting and natural causes (e.g., predation by other bears) (Nowlin 1995; McDonald 1998b; Tobey 1995). Harvest summaries for brown bears are presented in Table 3.21-2. Habitat disturbance (e.g., logging) in valley bottoms and riparian areas used as travel corridors are also detrimental to brown bears (USFWS 1995a).

3.21.1.9 Black Bear

Black bears occur throughout most of the forested portions of Alaska (Johnson 1994a). They are present in all GMUs crossed by the TAPS ROW. However, they are infrequent in the northern third of the state (i.e., GMUs 24 and 26B) (TAPS Owners 2001a). Black bears are widely distributed along the pipeline in forested areas south of the Atigun Pass (e.g., MP 306–463, MP 627–660, and MP 691–800); with black bear concentration areas occurring between MP 226–237, MP 397–403, MP 412–418, and MP 778–800 (APSC 1993). They prefer open forests. Highest population densities generally occur in mixed habitats of semiopen forests with herbaceous plants, lush grass, succulent forbs, and fruit-bearing shrubs (APSC 1993). Black bears use coniferous forest and alder-dominated mountain slopes during the nondenning period. During spring and fall they use shrub zones to feed on berries and succulent vegetation (Miller 1987; Tobey 1996c). They are also associated with settlement areas such as Coldfoot, Livengood, and Valdez (APSC 1993). Rugged terrain and dense shrubs are used for escape cover and den sites. Black bears often use streams with dense riparian shorelines as travel corridors to feeding areas (USFWS 1995b). Home range can vary from 1 to 100 mi^2. Black bears are omnivorous. They consume freshly sprouted vegetation, carrion, ungulate neonates, fish, berries, and insects (Johnson 1994a; Ballard and Whitlaw 2002).

Factors that influence black bear numbers include harvest by legal and illegal kills (including kills in defense of life and property), food abundance, adverse weather, habitat quality and quantity, and competition and predation by brown bears (Alt 1984; Boudreau 1996; DuBois 1996b; USFWS 1995b; Griese 1989b; Nowlin 1996b). Harvest summaries for the black bear are presented in Table 3.21-2.

3.21.1.10 Gray Wolf

The gray wolf is present in all GMUs crossed by the TAPS ROW (TAPS Owners 2001a), with more than 7,500 wolves occurring throughout Alaska (ADF&G 2000b). In 1994-1995, there were about 7,500 to 10,000 wolves in 700 to 900 packs (ADF&G 2001c). Wolf populations fluctuate over time in response to the availability of prey and to wolf-control activities (Woolington and McNay 1997). Predator-control projects have occurred in the past in an effort to increase the number of moose and caribou (see TAPS Owners 2001a). Causes of wolf mortality can include hunting and trapping, predation by other wolves, accidents, injuries, starvation, drowning, and rabies (Ballard et al. 1987; Ballard and Krausman 1997; Zarnke and Ballard 1987). Harvest summaries are provided in Table 3.21-2.

Ballard et al. (1987) determined that distribution and movement patterns of wolves in GMU 13 were dependent on prey availability. They also found that wolf territory size was primarily a function of moose density, with an average pack territory of about 600 mi^2. Generally, wolves do not follow migrating caribou out of pack territory (Ballard et al. 1987; Stephensen and Boertje 1994). A number of wolf territories in GMU 13 are bisected by the ROW and the Richardson Highway (Ballard et al. 1987). Several wolf packs maintain territories near the ROW in GMU 20A (Ballard and Gipson 2000).

Wolves are found throughout GMU 24 in all habitat types and near human settlements (Woolington and McNay 1997). Highest wolf densities are found in the northern and southern portions of the unit rather than in the central area, which has the lowest density of resident ungulates (hooved mammals such as caribou and moose) (Woolington and McNay 1997).

Highest wolf densities in GMU 26B are found in the Brooks Range and its foothills. On the coastal plain, wolves seasonally prey on the most available ungulate species: caribou during spring and summer, and moose and Dall sheep during winter (Garner and Reynolds 1986). Two wolf-den sites have been documented near the ROW within the foothills of the Brooks Range and the Arctic Coastal Plain. One occurs at Atigun Pass and the other just north of PS 3. Both sites occur in river drainages adjacent to the ROW and the Dalton Highway (APSC 1993).

3.21.1.11 Other Species

Thirty-nine native species of furbearers (e.g., species that are of primary economic importance for their fur rather than as a food resource) and small mammals (species of rodents, shrews, bats, and other mammals that are generally not of a size large enough to be readily used for their fur or meat) occur along the TAPS ROW (TAPS Owners 2001a). Several of the species are harvested for fur or, less commonly, food. These species include snowshoe hare (*Lepus americanus*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), coyote, Arctic fox, red fox, marten (*Martes americana*), ermine (*Mustela erminea*), least weasel (*Mustela nivalis*), mink, wolverine, river otter, and lynx (*Lynx canadensis*). Some other species (e.g., marmots) are used by Alaska Natives for food and fur (Curby 1994). The ADF&G manages the harvest of furbearers through both hunting and trapping regulations. Small mammals in Alaska that may occur in areas that the ROW crosses include 10 species of shrews, 7 species of voles, and 4 species of mice (Osborne 1994a,b; Jarrell et al. 2001). These species are important food resources for a number of carnivorous birds and mammals.

Beavers have blocked culverts or otherwise modified drainages across or near the pipeline that have led to flooding and washouts (APSC 1993; Trudgen 1999). Nevertheless, beavers are an ecologically important species that dramatically alter drainage patterns, which can enhance aquatic productivity, provide overwintering habitat for fish, create waterfowl habitat, and increase wetland and riparian vegetation. However, beaver dams may block stream access to anadromous fish such as salmon (Shepherd 1994).

3.21.2 Beaufort Sea

For this FEIS, the terrestrial portion of the Beaufort Sea is considered to be the Arctic Coastal Plain north of the foothills of the Brooks Range. This area encompasses most of the North Slope oil fields, ANWR, and NPR-A. A portion of the TAPS (primarily from MP 0 to 58 [PS 2]) occurs within this area.

About 15 species of terrestrial mammals occur within the North Slope area (Gilders and Cronin 2000). Terrestrial mammal species numbers that occur along the Beaufort Sea are limited because of habitat constraints associated with long, harsh winters. The most abundant or predominant mammal species that occur in this area include the Arctic shrew (*Sorex arcticus*), brown lemming (*Lemmus sibiricus*), Arctic fox, brown bear, caribou, moose, and musk ox. The following discussion highlights pertinent information on these mammal species as it relates to their occurrence along the Beaufort

Sea. More detailed information on several of these species is presented in Section 3.21.1.

A breeding population of moose became established in the North Slope in the 1940s and 1950s (Carol 2002), and their habitat use and distribution are seasonal. During some years, moose range to the coast during the summer (Noel and Olsen 1999a,b). In winter they are limited to inland riparian and shrub habitats (Coady 1980). In some years, habitat use is limited primarily to riparian areas on a year-round basis (Mould 1979). Within the North Slope, moose may occasionally disperse across the tundra, but usually are found in varying elevations in the Brooks Range foothills.

The moose population within the North Slope increased to more than 1,500 individuals in 1991 (Carol 2002). From 1991 through 1996, the population decreased by about 75%. It is speculated that this decline was due to a combination of factors (e.g., exceeding carrying capacity, a harsh winter and competition from hares, copper deficiency, physiological stress from insects following a harsh winter, and high predator densities). The moose population has been increasing in the past several years because of such factors as an increase in available browse and the physiological condition of the moose (Carol 2002).

The caribou is an important component of the arctic landscape because of its high value to subsistence and sport hunters, indigenous Native cultures, the general public, and the functioning of terrestrial ecosystems (Murphy and Lawhead 2000). Four caribou herds occur across the North Slope: the Western Arctic herd, the Teshekpuk Lake herd, the Central Arctic herd, and the Porcupine herd (Map 3.21-2). These herds have distinct calving areas, but sometimes overlap during other times of the year (Cronin et al. 1998a). Herd size and harvest summaries for the Western Arctic, Teshekpuk Lake, and Central Arctic herds are presented in Table 3.21-3. The size of the Porcupine herd was estimated at 130,000 in 2000, and the reported Alaskan harvest for the 1999-2000 year was 388 (ADF&G undated-a, 2000b). All four herds have increased in numbers since the mid-1970s. The Porcupine herd was 105,000 in 1977 (Cronin et al. 1998a). The Western Arctic herd has grown from 64,000 in 1976 to 430,000 in 2000; the Teshekpuk Lake herd from 3,500 in 1978 to 27,000 in 2000; and the Central Arctic herd from about 5,000 in 1975 to 27,000 in 2000 (Cronin et al. 1998a; ADF&G undated-a).

Calving areas for these herds are mostly within 30 mi of the coast. Caribou often wander great distances during seasonal migrations (Bergerud and Page 1987). In mid-summer, caribou are often harassed by mosquitoes, warble flies, and nose bot flies. In response to this harassment, caribou will move from inland feeding areas to windswept, vegetation-free coastal areas (particularly river deltas), gravel drilling pads and roads, on river bars and bluffs, and even into the Beaufort Sea, where these insect pests are less abundant. Caribou will move to the coast and back to inland feeding areas within a matter of hours or days, depending on the level of insect harassment (Ballard and Whitlaw 2002).

During their spring and fall migrations, caribou tend to move along or near major river drainages. Generally, the winter ranges for all four herds include the northern foothills of the Brooks Range (ADNR 1999). The winter range for the Porcupine herd also includes the Yukon Territory and the south side of the Brooks Range, while the Western Arctic herd winters over much of northwest Alaska (Cronin et al. 1998a). Movement and distribution of caribou over their winter range reflect their need to avoid predators or their response to strong winds or snow conditions (which influence availability of forage) (BLM and MMS 1998).

Caribou of the Central Arctic herd migrate north each spring from their winter range in the Brooks Range and its northern foothills to calving grounds and summer range on the Arctic Coastal Plain between the Canning and Colville Rivers. Small numbers of the Central Arctic herd spend the winter on the coastal plain (e.g., less than 10 per 40 mi^2) (Carruthers et al. 1987); thus, the region encompassing the existing oil fields is not considered important winter range (Carruthers et al. 1987; Murphy and Lawhead 2000). Census data indicate that about half of the Central Arctic herd tends to spend the calving and insect seasons west of the Sagavanirktok River, including the area with existing oil-field development, and the other half of the herd ranges east of the Sagavanirktok

River (Lawhead 1988). Regular interchange of animals probably occurs between the east and west ranges (Cronin et al. 1997, 2000).

Mosquito-harassed caribou on the coastal plain coalesce into large groups and move upwind (generally northward) to reach relief habitats, which include cool and windy coastal beaches, low bluffs, sparsely vegetated river bars and deltas, and oil field gravel roads and pads (White et al. 1975; Roby 1978; Dau 1986; Lawhead 1988; Pollard et al. 1996). Caribou in the western range of the herd frequently encounter oil field infrastructure during these movements (White et al. 1975; Curatolo and Murphy 1986; Murphy and Curatolo 1987; Pollard et al. 1996; Cronin et al. 1998b). The location of mosquito-relief habitat varies with weather conditions (primarily air temperature and wind speed), and mosquito-harassed caribou apparently move only as far as necessary to reach insect-free locations on any given day (Lawhead 1988). When mosquito harassment abates, caribou move from the coast to inland areas with better forage (Smith 1996).

Before oil-field development, bears were uncommon on the North Slope. However, by 1997 their numbers increased to 60 to 70 bears within the oil production areas (density of nearly one bear per 100 mi^2) (Shideler and Hechtel 2000). However, densities as high as six bears per 100 mi^2 occur in some habitats such as barrier islands and nearshore coastal areas. Brown bears have large home ranges (e.g., up to 5,200 mi^2) and can travel over 30 mi per day (ADNR 1999). Brown bears travel along major drainages on the North Slope and feed extensively in riparian areas. They also frequently den along riverbanks (see ADNR 1999). Relatively high densities of arctic ground squirrels, relatively abundant denning habitat, and access to human garbage apparently have allowed the bear population to increase to relatively high densities in oil development areas in comparison with other Arctic Coastal Plain habitats. Most of the brown bears in the oil field complex use natural dens, but some use man-made structures (Shideler and Hechtel 2000). The bears in the oil field areas are not an isolated population, and there is movement of animals among different areas of the North Slope (Cronin et al. 1999 and references cited therein).

Brown bears with access to garbage and human foods in oil fields have relatively large average litter sizes and low cub mortality compared with other bear populations on the Arctic Coastal Plain (Shideler and Hechtel 2000). However, relatively high subadult and adult mortality offset these benefits. Shideler and Hechtel (2000) suggested that oil field bears that had become habituated to the presence of humans were consequently more vulnerable to harvests by humans when they moved away from oil fields.

Shideler and Hechtel (2000) indicated that agency and industry regulations (such as prohibition of hunting and firearms within the oil fields, education about bear safety, training in how to handle bear problems, and strict regulations against the feeding of bears) have successfully reduced the effects related to the oil fields on bears. Bear-proof garbage containers are currently being installed in the oil field complex, and access to the North Slope Borough garbage landfill has been eliminated with chain link and electric fencing. Shideler and Hechtel (2000) anticipated short-term increases in mortality of bears habituated to anthropogenic food sources, but in the long term they expected the bear population would be characteristic of natural populations not exposed to oil fields.

Riparian areas are the preferred habitat for musk ox in summer. In winter and spring, musk ox occur in uplands adjacent to river drainages (including the Sagavanirktok) that provide forage of tussock sedges and have less snow cover than the riparian areas. Calving occurs in the southern portion of the Arctic Coastal Plain on windblown banks with riparian areas and in upland sites in the foothills (see ADNR 1999).

Several furbearers, including the Arctic fox, gray wolf, and wolverine, occur within the coastal plain area of the Beaufort Sea. The Arctic fox occurs in the treeless coastal areas of Alaska from the Aleutian Islands north to Point Barrow and east to the Canadian border (Stephenson 1994). Dense aggregations of Arctic foxes can occur in winter in the vicinity of large marine-mammal carcasses and at village dumps, where garbage is available (Chesemore

1975). Arctic foxes are highly adaptable and readily habituate to human activities when not harassed. They readily consume human foods or garbage and quickly learn to exploit these resources (Burgess et al. 1993). However, primary foods are small mammals, such as brown lemmings and tundra voles (*Microtus oeconomus*), and birds (particularly ptarmigans). Being omnivorous, they also consume berries. Arctic fox predation is considered to be the main cause of nest loss for noncolonial shorebirds and passerines in the North Slope (see Burgess 2000). They will venture out into the Beaufort Sea ice during winter to feed upon the remains of polar bear (*Ursus martimus*) kills (Stephenson 1994; Tannerfeldt 2001). Food scarcity is the most significant population-limiting factor for Arctic foxes (Underwood and Mosher 1982). Fox numbers in the Beaufort Sea area often vary in response to cyclic changes in the size of lemming and vole populations (see ADNR 1999).

Arctic fox dens are typically excavated into low mounds on the tundra. The foxes prefer sites that have a history of use. However, they are capable of denning under skirted buildings, in abandoned human structures, in utility corridor structures, and even in abandoned vehicles (Burgess 2000). The density of Arctic fox dens in the Prudhoe Bay area (one primary den per 4.6 to 5.0 mi^2) is higher than in adjacent areas on the North Slope (about one primary den per 11.6 to 15.4 mi^2) (Burgess 2000). The number of young produced varies considerably from year to year and is highly correlated with lemming density. Arctic foxes are the main vectors of rabies in the Arctic (Winkler 1975; Crandell 1975). Rabies outbreaks are often associated with periods of high-density Arctic fox populations (TAPS Owners 2001a). The Arctic fox is the most important terrestrial furbearer species in the Arctic because of its numbers and circumpolar distribution (Tannerfeldt 2001).

Although they have high birth rates, gray wolves also have high mortality rates, and they are seldom abundant within the Arctic Coastal Plain. Hunting and trapping are the major controlling influences on wolf numbers; with secondary influences being disease, malnutrition, accidents, and predation by other wolves. The primary prey of wolves are moose and caribou. However, they are opportunistic and will also prey on small mammals, fish, and birds (see ADNR 1999).

Wolverines are found primarily in the more remote areas of Alaska. They occur throughout the North Slope, but primarily in the Brooks Range and foothills (see BLM and MMS 1998). They frequent all types of terrains and will often utilize rivers as territorial boundaries. Wolverines will travel great distances in search of food. They generally feed on medium and small mammals, birds, and carrion of moose and caribou. Only rarely will they kill a moose or caribou (see ADNR 1999).

The river otter has recently been reported as far north on the Sagavanirktok as MP 83. They use overwintering fish resources and travel northward on the river ice (Montgomery 2002a).

3.22 Threatened, Endangered, and Protected Species

Designated species receive protection under a variety of federal regulations. Regulations pertinent to the TAPS ROW renewal include the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act, and Magnuson-Stevens Fishery Conservation and Management Act. In addition, the State of Alaska maintains lists of endangered species (5 Alaska Administrative Code [AAC] 93.020) and species of special concern (ADF&G 1998). Species protected under the ESA and MMPA and species listed by the state that could occur in the vicinity of the TAPS or in areas of potential cumulative impact (Beaufort Sea and Prince William Sound) are listed in Table 3.22-1. The following text describes those species that are currently listed, proposed for listing, recently delisted, or considered candidates for listing under the ESA; protected under the MMPA; or listed by the state as endangered or as a species of special concern. Essential fish habitat protected under the MSFCMA is discussed in Section 3.19, migratory birds and bald and golden eagles are discussed in Section 3.20.

Special Terms Applicable to Protected Species

Endangered species: Any species that is in danger of extinction throughout all or a significant portion of its range (ESA).

Threatened species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (ESA).

Candidate species: A species for which the USFWS currently has substantial information on hand to support the biological appropriateness of proposing to list the species as endangered or threatened (ESA).

Critical habitat: Specific areas on which are found those physical and biological features essential to the conservation of a listed species (ESA).

Depleted stock: A species or population that is below its optimum sustainable population (MMPA).

Species of Special Concern: Any species or subspecies of fish or wildlife or population of mammal or bird native to Alaska that has entered a long-term decline in abundance or is vulnerable to a significant decline due to low numbers, restricted distribution, dependence on limited habitat resources, or sensitivity to environmental disturbance (5 AAC 93.020).

3.22.1 TAPS Row

Three species of animals listed as threatened or endangered under the ESA may occur along the TAPS ROW: spectacled eider (threatened), Steller's eider (threatened), and Eskimo curlew (endangered). Both the Arctic peregrine falcon and American peregrine falcon, formerly listed as threatened and endangered, occur along the TAPS ROW. The Arctic and American peregrine falcons were delisted in 1994 and 1999, respectively (59 FR 50796; 64 FR 46542), but are still being monitored to ensure that their populations are secure. During this monitoring period, peregrine falcons are treated similarly to candidates for listing. No ESA-listed plant species are found along the ROW.

Listed Species Most Likely to Occur along the TAPS Row

Spectacled eider: ESA listed as threatened.

Steller eider: ESA listed as threatened.

Both occur in wetland areas along the coast of the Beaufort Sea.

TABLE 3.22-1 Threatened, Endangered, and Protected Species That Could Occur in the Vicinity of the TAPS or in the Beaufort Sea or Prince William Sound

			Occurrence in Project Area			
Common Name	Species	Status[a]	TAPS	Beaufort Sea	Prince William Sound	Comments
Birds						
Spectacled eider	*Somateria fischeri*	ESA-T AK-SC	Yes	Yes	No	Nests in coastal arctic and subarctic wetlands with shallow ponds and lakes. Areas of highest abundance are more than 100 mi west of the TAPS ROW, but species is found at relatively low densities in the northernmost portions of ROW. Winters in the Bering Sea. Areas of designated critical habitat are located on the western coast of Alaska and in the Bering Sea.
Steller's eider	*Polysticta stelleri*	ESA-T AK-SC	Yes	Yes	Yes	Nests in arctic coastal wetlands, mostly on the western North Slope near Barrow. Occurs in very low density in the Prudhoe Bay area near the northern portion of the ROW. Winters in Alaska from the eastern Aleutian Islands to Cook Inlet but occasionally found in Prince William Sound. Areas of designated critical habitat are located on the western coast of Alaska and the Alaska Peninsula.
Eskimo curlew	*Numenius borealis*	ESA-E, AK-E	Former	No	Former	Probably extinct. Previously nested in arctic tundra of Alaska and Canada. Wintered in South America.
American peregrine falcon	*Falco peregrinus anatum*	ESA-DM AK-SC	Yes	No	Yes	Nests throughout interior forested areas of Alaska, mainly on cliffs along rivers or near lakes. Winters in southern United States south to Argentina.
Arctic peregrine falcon	*Falco peregrinus tundrius*	ESA-DM AK-SC	Yes	Yes	Yes	Nests in treeless tundra areas of northern Alaska, Canada, and Greenland, mostly along rivers. Winters in southern United States south to Argentina and Chile.

TABLE 3.22-1 (Cont.)

Common Name	Species	Status[a]	Occurrence in Project Area: TAPS	Beaufort Sea	Prince William Sound	Comments
Olive-sided flycatcher	*Contopus borealis*	AK-SC	Yes	No	Yes	Nests in coniferous forest of Alaska south of Brooks Range, usually near openings and water. Winters in South America.
Gray-cheeked thrush	*Catharus minimus*	AK-SC	Yes	No	Yes	Nests in predominantly coniferous forests and mixed forests of Alaska south of Brooks Range. Winters in northern South America.
Townsend's warbler	*Dendroica townsendi*	AK-SC	Yes	No	Yes	Nests in coniferous forest of Yukon River valley and southern Alaska. Winters from Mexico to Nicaragua.
Blackpoll warbler	*Dendroica striata*	AK-SC	Yes	No	Yes	Nests in predominantly coniferous forests and mixed forests of Alaska south of Brooks Range. Winters in South America.
Mammals						
Bowhead whale	*Balaena mysticetus*	ESA-E MMPA-D AK-SC	No	Yes	No	Winters in the Bering Sea, migrates north in spring, and summers in the eastern Beaufort Sea. Number of bowhead whales in the Alaska portion of the Beaufort Sea is relatively low except during migration. Population has been increasing over the last several decades.
Gray whale	*Eschrichtius robustus*	ESA-D MMPA-P	No	Yes	Yes	Spends summer feeding in the northern Bering, Chukchi, and Beaufort Seas. Winters mainly along coast of Baja California.
Fin whale	*Balaenoptera physalus*	ESA-E MMPA-D	No	No	Yes	Found seasonally off the coast of North America and Hawaii. In Alaska, they are found in the summer in the Bering Sea and Gulf of Alaska and as transients during migration in Prince William Sound.

TABLE 3.22-1 (Cont.)

Common Name	Species	Status[a]	Occurrence in Project Area: TAPS	Occurrence in Project Area: Beaufort Sea	Occurrence in Project Area: Prince William Sound	Comments
Beluga whale	*Delphinapterus leucas*	MMPA-P (Chukchi and Beaufort Sea stocks); MMPA-D (Cook Inlet stock)	No	Yes	Yes	Five stocks in Alaskan waters. Beaufort Sea and eastern Chukchi Sea stocks occur in Beaufort Sea area in summer; Cook Inlet stock occurs in Prince William Sound area in winter. Number of beluga whales in Alaska portion of Beaufort Sea is relatively low except during migration. Population is stable or increasing.
Minke whale	*Balaenoptera acutorostrata*	MMPA-P	No	No	Yes	In North Pacific, occurs from Bering and Chukchi Seas south to near the equator. Relatively common, but not abundant, in the Bering and Chukchi Seas and in the inshore waters of Gulf of Alaska. Migratory in northern portion of range.
Humpback whale	*Megaptera novaeangliae*	ESA-E MMPA-D AK-E	No	No	Yes	Occurs worldwide in all oceans but less common in Arctic waters. Winters in temperate and tropical waters of the North and South Hemispheres. In Alaska, occurs in Bering Sea and Gulf of Alaska. Feeding aggregations occur in Prince William Sound during the summer.
Killer whale	*Orcinus orca*	MMPA-P	No	Possible	Yes	Found in all oceans of the world but prefers the colder waters of both hemispheres. In Alaska, occurs along entire coast from Chukchi Sea, Bering Sea, along Aleutian Islands, Gulf of Alaska, and southeast Alaska.
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	MMPA-P	No	No	Yes	Found throughout temperate North Pacific Ocean. In east North Pacific, occurs from Gulf of California north to Gulf of Alaska and rarely in the southern Bering Sea.
Harbor porpoise	*Phocoena phocoena*	MMPA-P	No	Possible	Yes	Frequents coastal waters of the Chukchi Sea, Bering Sea, Gulf of Alaska, and west coast of North America.

TABLE 3.22-1 (Cont.)

Common Name	Species	Status[a]	Occurrence in Project Area: TAPS	Occurrence in Project Area: Beaufort Sea	Occurrence in Project Area: Prince William Sound	Comments
Dall's porpoise	*Phocoenoides dalli*	MMPA-P	No	No	Yes	Widely distributed across entire North Pacific Ocean over continental shelf and deep oceanic waters. In Alaska, found in Gulf of Alaska and off coast of Bering Sea.
Steller sea lion	*Eumetopias jubatus*	ESA-E MMPA-D AK-SC	No	No	Yes	Ranges along North Pacific Rim from northern Japan to California, with centers of abundance in Gulf of Alaska. In Alaska, found in Bering Sea, Gulf of Alaska, and southeastern Alaska. Three haulout areas in Prince William Sound have been designated as critical habitat.
Harbor seal	*Phoca vitulina*	MMPA-P	No	No	Yes	Inhabits coastal and estuarine waters off Baja California, north along west coasts of North America, Gulf of Alaska, Aleutian Islands, and southern Bering Sea.
Spotted seal	*Phoca largha*	MMPA-P	No	Yes	No	Occurs in continental-shelf waters of the Beaufort, Chukchi, and Bering Seas. Occupies coastal habitats as ice retreats in summer. In Beaufort Sea, most common in western and west-central portions from July to October.
Ringed seal	*Phoca hispida*	MMPA-P	No	Yes	No	Occurs in all seas of the Arctic Ocean, where it occupies ice-covered waters year-round. Common in the Beaufort Sea but at lower densities than in other portions of their range.
Ribbon seal	*Phoca fasciata*	MMPA-P	No	Possible	No	Inhabits North Pacific Ocean and adjacent portions of Arctic Ocean. In Alaska, ranges from Bristol Bay into the Chukchi and western Beaufort Sea; found on pack ice and rarely on shorefast ice.
Bearded seal	*Erignathus barbatus*	MMPA-P	No	Yes	No	Occurs over the continental shelves of the Bering, Chukchi, and Beaufort Seas. Year-long resident of Beaufort Sea, but less common in winter or in areas of fast ice. Rarely hauls out onto land.

TABLE 3.22-1 (Cont.)

Common Name	Species	Status[a]	Occurrence in Project Area: TAPS	Occurrence in Project Area: Beaufort Sea	Occurrence in Project Area: Prince William Sound	Comments
Pacific walrus	*Odobenus rosmarus*	MMPA-P	No	Yes	No	Inhabits continental-shelf waters of Bering and Chukchi Seas. Found occasionally in Beaufort Sea as stragglers in summer.
Sea otter	*Enhydra lutris*	MMPA-P	No	No	Yes	Occurs in nearshore waters from Aleutian Islands to California. More than 90% of the world's population occurs in Alaskan waters from the Aleutian Islands to southeastern Alaska. The Aleutian Island distinct population segment is considered a candidate for listing, and the Alaskan stock has been petitioned for listing as depleted under the MMPA.
Polar bear	*Ursus maritimus*	MMPA-P	No	Yes	No	Ranges widely year-round across entire Beaufort Sea area on land, fast ice, and pack ice. Occurs at low population density throughout its range.

[a] Notation: ESA = listed under the Endangered Species Act with the following qualifiers, E = endangered, T = threatened, D = delisted, DM = delisted but being monitored; MMPA = listed under the Marine Mammal Protection Act, with the following qualifiers, D = depleted, P = protected; AK-SC = Alaska species of special concern.

Sources: Angliss et al. (2001); Ferrero et al. (2000); Hall (1979); USFWS (1999a,c, 2001a,b); Page and Gill (1994); Ambrose et al. (1988); Cade (1960); Armstrong (1995).

3.22.1.1 Spectacled Eider

Spectacled eiders are diving ducks that nest in arctic Russia and western and northern Alaska and winter in the Bering Sea; they spend most of their year in marine waters (USFWS 1999a). This species was listed under the ESA as threatened throughout its range in 1993 (58 FR 27474). Reasons for decline of the spectacled eider are not well understood, but lead poisoning from the ingestion of spent shot; subsistence hunting; predation by foxes, gulls, and ravens whose populations are enhanced near human settlements; contaminants; commercial fishing; and complex changes in the food web of marine wintering areas have been suggested as possible contributing factors or obstacles to recovery (USFWS 1996, 1999a). The spectacled eider is the ESA-listed species that is most likely to occur in the vicinity of the TAPS (only along the northernmost segment on the Arctic Coastal Plain).

The USFWS recently designated critical habitat for the spectacled eider in Alaska (66 FR 9146). These areas include (1) breeding areas of the Yukon–Kuskokwim Delta (1,078 mi^2), (2) molting areas of Norton Sound (4,087 mi^2), (3) molting areas of Ledyard Bay (5,390 mi^2), and (4) wintering areas in the Bering Sea adjacent to St. Lawrence Island (28,436 mi^2). The spectacled eider was originally listed because of drastic declines (96%) on breeding areas in the Yukon–Kuskokwim Delta. It is not known if such a decline has occurred on the North Slope, but this portion of the population is relatively stable at present (Larned et al. 2001). The breeding population on the North Slope is currently the largest breeding population of this species in North America, but because the area is much larger than that of the Yukon–Kuskokwim Delta, population density is lower (USFWS 2001a).

Spectacled eiders nest in low-lying, coastal arctic and subarctic wetlands dominated by grasses and sedges with numerous shallow ponds and lakes (USFWS 1999b). Nests are located near water. On their nesting grounds, spectacled eiders feed primarily by dabbling in shallow fresh or brackish ponds or flooded tundra (USFWS 1999b). Foods taken include mollusks, insects, crustaceans, and seeds, especially those of pondweed. The winter diet is less well known but apparently includes amphipods, mollusks, and crabs (USFWS 1999b).

Spectacled eiders return from their wintering grounds to northern Alaska in late May or early June. Males leave in mid- to late June at the onset of nesting, while females leave from late June through mid-September, depending on their breeding success. After leaving the coastal plain, spectacled eiders molt in a few locations in eastern Russia or Ledyard Bay in northwestern Alaska before continuing on to staging areas near St. Lawrence Island and wintering areas in the central Bering Sea (Petersen et al. 1999; TERA 1999). Spectacled eiders from all three main breeding areas (Yukon–Kuskokwim Delta, North Slope, and arctic Russia) congregate during the winter in a 3,000-mi^2 area of the Bering Sea (USFWS 2001a). Additional information on breeding biology and status of the spectacled eider is summarized in reports by the USFWS (1996, 2001a).

The abundance of spectacled eiders decreases from west to east across the Arctic Coastal Plain of Alaska. Most high-density areas are over 100 mi west of PS 1, and relatively few spectacled eiders occur east of the Shaviovik River to the east of TAPS (Larned et al. 1999). About 100 pairs of spectacled eiders occur in the Prudhoe Bay area (TERA 1997). Larned et al. (2001) summarized spectacled eider abundance across the Arctic Coastal Plain. Approximately 40 mi of the ROW is in the region surveyed, and spectacled eider abundance in the ROW area was considered relatively low. Larned et al. (2001) indicated that the best habitats for spectacled eiders along the TAPS were at the northernmost end, near PS 1. Surveys of the TAPS region south to approximately MP 7 from 1991 to 1997 (TERA 1996, 1997) found a few spectacled eiders near the TAPS ROW but none within 0.6 mi. Spectacled eiders may occur farther south than the areas covered by current surveys, although densities probably are low. Along the TAPS, the southernmost report of a spectacled eider is at MP 12 (Hohenberger et al. 1981).

3.22.1.2 Steller's Eider

The Steller's eider is a diving duck that occurs in three distinct breeding populations — two in Russia (Atlantic and Pacific) and one in Alaska. Most of the world's population of Steller's eider nest in arctic Russia and winter in waters adjacent to the Alaska Peninsula (USFWS 2001b). These ducks spend most of the year in shallow, nearshore marine waters (USFWS 1999c). The Alaska population breeds along the western and northern coast of the state.

The Alaska breeding population of the Steller's eider was listed as threatened in 1997 (59 FR 35896) because of a substantial population decline (Kertell 1991; Quakenbush and Cochrane 1993). Reasons for that decline are not known, but possible factors include lead poisoning from the ingestion of spent shot, especially in the Yukon–Kuskokwim Delta; hunting; predation by ravens, gulls, and foxes in breeding areas; increased shipping traffic and disturbance of feeding flocks in marine areas; and contaminants affecting food availability in the Bering Sea (USFWS 1999c). Disturbance and loss of nesting habitat from oil and gas development may have occurred in Siberia (USFWS 1999c).

Critical habitat for the Steller's eider was recently designated by the USFWS (2001b) in the following areas: (1) breeding areas of the Yukon–Kuskokwim Delta (989 mi^2); (2) molting and staging areas of Kuskokwim Shoals (1,472 mi^2); (3) molting and staging areas of Seal Islands (24 mi^2); (4) molting and wintering areas of Nelson Lagoon (206 mi^2); and (5) molting and wintering areas of Izembek Lagoon (140 mi^2). All of these areas are in southwestern Alaska on the coast of the Bering Sea, away from the TAPS. The TAPS ROW and facilities are east of this area.

The historic breeding range of the Steller's eider was discontinuous from the Aleutian Islands, the Alaska Peninsula, the Yukon–Kuskokwim Delta, and the Seward Peninsula; in northwestern Alaska from Point Lay to Barrow; across most or all of the Arctic Coastal Plain of northern Alaska; and across most of arctic Russia (Kertell 1991; Quakenbush et al. 2000). Currently, most Steller's eiders in Alaska breed primarily near Barrow, but the total breeding range probably extends from Point Lay to near the Colville River Delta (Day et al. 1995; Quakenbush et al. 1995).

Steller's eiders spend most of the year in shallow, nearshore marine waters where they feed by diving and dabbling for benthic organisms (USFWS 1999b). Foods of the Steller's eider include amphipods, crabs, mussels, clams, snails, insects, and some plant material. Information on their preferred nesting habitat is sparse. On the Yukon–Kuskokwim Delta, they historically nested in the vegetated intertidal zone of the central delta (King and Dau 1981). In arctic Alaska, they nest in low-centered polygons and shallow ponds with emergent grasses and sedges, wet meadows, lakes, and drained lake basins (Quakenbush and Cochrane 1993; Quakenbush et al. 2000; Obritschkewitsch et al. 2001). After the breeding season, Steller's eiders migrate to sheltered estuaries along the coast of the Bering Sea, where they molt (USFWS 1999b). Most of the world's Steller's eider population spends the winter in shallow, nearshore, marine habitats along the Alaska Peninsula and from the eastern Aleutian Islands to Kodiak Island and lower Cook Inlet (USFWS 1999b,c, 2001b).

The Steller's eider has been recorded occasionally in the Prudhoe Bay area, and a female with young was seen in that area in 1993 (USFWS 1998b). During the summer, Steller's eiders are likely to occur only at the northernmost end of the TAPS near Prudhoe Bay. In winter, small groups are occasionally found in the Gulf of Alaska and Prince William Sound (USFWS 1998b) and are regularly found during annual Christmas Bird Counts near Kodiak Island and in lower Cook Inlet (USFWS 1998b). A few individuals have been seen near Prince William Sound (near Seward and Cordova) but not in any other areas of the Sound (USFWS 1998b).

3.22.1.3 Eskimo Curlew

Once numerous, the Eskimo curlew is now either extinct or on the verge of extinction (Page and Gill 1994). Although it was observed regularly in northern Alaska, nesting was never documented (Gabrielson and Lincoln 1959).

Potential breeding habitat occurs in a narrow band along the northern foothills of the Brooks Range (Gill et al. 1998).

In the mid 1800s, huge flocks of Eskimo curlews migrated between nesting areas in the Arctic and wintering grounds in South America. The Eskimo curlew population had already declined to low numbers before its distribution or much of its breeding biology was described (Gollop et al. 1986). The last documented sighting of an Eskimo curlew was in Texas in 1962 (Ambrose 2002). The cause of the Eskimo curlew's decline is unknown, but over-hunting, habitat change through conversion of wintering and staging areas to agriculture, changes in prey availability, and climate change have been suggested as factors (Faanes and Senner 1991). Of these, the only factor that may have operated on the breeding grounds was climate change, including colder conditions (perhaps resulting in poor reproduction) during the period of decline.

3.22.1.4 Arctic Peregrine Falcon

The Arctic peregrine falcon, formerly listed as endangered and then reclassified as threatened, was delisted on October 5, 1994 (59 FR 50796). For a 5-year period after delisting, the USFWS monitors populations to ensure that the species is secure. During the monitoring period, the species is treated similarly to a candidate for listing. The USFWS identifies the Arctic peregrine falcon as a delisted species that is undergoing monitoring.

Arctic peregrine falcons nest in northern Alaska from the U.S.-Canada border to Norton Sound on the Bering Sea. They occur along the TAPS ROW on the Sagavanirktok River and its tributaries between late April and mid-September. Incubation of eggs begins in late May, hatching occurs in early July, and young fledge in late August (Cade 1960; Ritchie 1987). Arctic peregrine falcons winter mainly in South America (Hickey and Anderson 1969). Peregrines are primarily cliff-nesters and regularly use river bluffs and cliffs in the northern foothills of the Brooks Range (Cade 1960). They occasionally use lower-quality habitats, such as low coastal bluffs and banks of lakes and rivers on the Arctic Coastal Plain. They prey mainly on birds.

Nesting Arctic peregrine falcons have been recorded on the Sagavanirktok River within 1 mi of the TAPS ROW. The Colville River and its tributaries and the Sagavanirktok River are the core breeding areas for peregrines in northern Alaska. Concentration areas for nesting peregrines include Franklin and Sagwon bluffs, but nesting also has been documented as far south as Slope Mountain (Wright and Bente 1999; APSC 1993). During the 1970s, peregrines in northern Alaska were reduced to about 35% of the 1950s breeding population because of pesticides (Ambrose et al. 1988). Fewer than five pairs nested along the Sagavanirktok River in the mid-1970s (Roseneau et al. 1976), but by 1998, the number of nesting pairs along the river had increased to more than 25 pairs (Wright and Bente 1999).

3.22.1.5 American Peregrine Falcon

The American peregrine falcon, formerly listed as endangered and reclassified as threatened, was delisted on August 25, 1999 (64 FR 46542). For a 5-year period after delisting, the USFWS will monitor populations to ensure that the species is secure. During the monitoring period, the species is treated similarly to a candidate for listing. The USFWS identifies the American peregrine falcon as a delisted species that is undergoing monitoring.

The American peregrine falcon occurs throughout much of North America from the subarctic boreal forests of Alaska and Canada south to Mexico. In Alaska, their range is restricted primarily to the interior portions of the state (Ambrose et al. 1988). They occur along the TAPS ROW south of the Brooks Range and nest in the Yukon River basin along the Yukon, Koyukuk, and Tanana Rivers and their tributaries. Nesting has not been documented south of the Alaska Range along the TAPS, although suitable habitat appears to be present (Cade 1960). Most birds that breed in Alaska winter in South America.

American peregrine falcons are present in Alaska from late April to late September.

Incubation begins in mid-May; young hatch in late June and fledge in August. American peregrine falcons nest on riparian cliffs and dirt bluffs in the area, but occasionally use rock outcrops in uplands adjacent to major rivers (Ritchie and Rose 1999). Peregrine falcon nesting areas near the TAPS ROW include the middle Yukon River, the Tanana River between Fairbanks and Delta Junction, and some tributaries in the Tanana-Yukon uplands (White et al. 1977). Nesting habitat for peregrines and other raptors includes Grapefruit Rocks near the pipeline at MP 417–418 between Livengood and Fairbanks.

Between the late 1960s and 1985, the American peregrine falcon population in Interior Alaska declined to at least 55% of historical numbers (Ambrose et al. 1988). The lowest levels occurred in the 1970s, and numbers began to increase by the late 1970s. The population has continued to increase and presently exceeds the population size of the 1960s (Haugh 1976; Ritchie et al. 1998).

3.22.2 Beaufort Sea

Although the Beaufort Sea is not in the direct region of influence of the TAPS, listed and protected species that occur there are discussed in this section because they could be affected by the cumulative impact of the TAPS and other activities on the North Slope (Table 3.22-1). The Beaufort Sea supports several marine mammals that are listed under the ESA or that are protected by the MMPA. These species are the focus of this section. The spectacled eider, Steller's eider, and Arctic peregrine falcon, listed under the ESA (or in the case of the peregrine falcon, recently delisted), could occur on the coast of the Beaufort Sea. They are discussed in Section 3.22.1.

Marine mammals that occur regularly in the Beaufort Sea include the bowhead whale, gray whale, beluga whale, Pacific walrus, spotted seal, ringed seal, bearded seal, and polar bear. Each of these species is discussed in this section. In addition, the harbor porpoise, killer whale, and ribbon seal reach the northern limit of their summer distribution in the northeastern Chukchi Sea, occurring irregularly and in low numbers in the extreme western part of the Beaufort Sea near Point Barrow. Others, such as the Pacific walrus and spotted seal, occur regularly in the western Beaufort Sea and decrease markedly farther east, the former mainly as individual stragglers east of Pitt Point and the latter as stragglers east of Oliktok Point. Ringed seals, bearded seals, and polar bears, all of which move extensively, are present year-round. Bowhead and beluga whales are normally present from late April to mid-October. Bowhead whales, bearded seals, ringed seals, and polar bears are important subsistence species for hunters from Barrow, Nuiqsut, and Kaktovik. Beluga whales are taken sporadically when available.

Listed Species Most Likely to Occur in Beaufort Sea

Spectacled eider: ESA listed as threatened.

Steller's eider: ESA listed as threatened.

Bowhead whale: ESA listed as endangered; MMPA listed as depleted.

Ten additional species of marine mammals are know to occur or could occur in the Beaufort Sea and are protected under the MMPA.

3.22.2.1 Bowhead Whale

Bowhead whales are found in seasonally ice-covered areas of the Arctic and near-Arctic (Angliss et al. 2001). Five stocks are recognized; the Bering Sea (Western Arctic) stock is the largest of the five designated stocks of this species and the only stock found in U.S. waters. The Western Arctic stock is classified under the ESA as endangered and under the MMPA as depleted. A recent analysis indicates that delisting of the Western Arctic stock is warranted (Shelden et al. 2001).

The Western Arctic stock was estimated at 10,400 to 23,000 whales before decimation by the commercial whaling industry in the last half of the 19th century, and perhaps 3,000 when whaling ended in 1914 (Woodby and Botkin 1993). This stock has slowly increased since then and in 1993 was estimated at 8,000 whales

(Zeh et al. 1994). The estimated rate of increase from 1978 to 1993 was 3.2% (Zeh et al. 1996) and occurred despite continued harvest and industrial activity in the Beaufort Sea. The bowhead whale continues to be an important subsistence resource, and 44 to 66 bowheads have been harvested annually in Alaska since 1993.

Bowhead whales winter in the Bering Sea, migrate north in spring, and summer in a broad area from Amundsen Gulf and the eastern Beaufort Sea to the eastern part of the East Siberian Sea. The spring migration begins in late March to early April, depending on ice conditions. The first bowhead whales usually arrive near Barrow in mid-April, but ice cover can affect the date of arrival (Krogman et al. 1989). From there, bowhead whales travel to the eastern Beaufort Sea, where they spend the summer feeding on zooplankton. An unknown portion of the population migrates along the Russian coast to feeding grounds in the western Chukchi Sea (Bogoslovskaya et al. 1982). Whales that summer in the eastern Beaufort Sea begin the first part of the fall migration in late August or early September and are usually out of the Beaufort Sea by late October (Treacy 1988-1998; Moore and Reeves 1993). The number of bowhead whales in the Alaskan portion of the Beaufort Sea is relatively low except during spring and fall migration.

Increased oil and gas exploration and development in the Arctic will increase the risk of adverse effects on bowhead whale populations (Angliss et al. 2001). Bowhead whales appear to be sensitive to noise from offshore drilling platforms and seismic survey operations (Angliss et al. 2001; Richardson et al. 1995) and actively avoid seismic operations during their fall migration (Angliss et al. 2001). The fact that the bowhead whale population has increased in size over the last several decades suggests that the impacts of the oil and gas industry on individual survival and reproduction are likely to be minor (Angliss et al. 2001).

3.22.2.2 Gray Whale

The gray whale occurs as two stocks in the North Pacific Ocean — the western North Pacific ("Korean") stock, which breeds off the coast of eastern Asia, and the eastern North Pacific stock, which breeds along the west coast of North America. All populations of the gray whale were formerly listed as endangered under the ESA, but the eastern North Pacific population was delisted in 1994 (59 FR 31094) because it had recovered to its historic size (USFWS 1994a). Although protected by the MMPA (as are all whale species), the gray whale in the eastern North Pacific is not considered depleted. The most recent stock assessment indicated that the eastern North Pacific population has been increasing in recent years and is neither in danger of extinction nor likely to become endangered in the foreseeable future (Angliss et al. 2001).

Most of the eastern North Pacific stock of the gray whale spends the summer feeding in the northern Bering, Chukchi, and Beaufort Seas (Angliss et al. 2001). Gray whales feed primarily on benthic amphipods, but they also eat other benthic and pelagic invertebrates (Rice and Wolman 1971; Nerini 1984). Starting in October or November, these whales migrate from Alaska to their primary wintering and calving area along the west coast of Baja California. Their summer distribution is mainly limited to shallow waters of the continental shelf. During the summer, gray whales are abundant in the northeastern Chukchi Sea but occur irregularly in the Beaufort Sea. During annual whale surveys of the Beaufort Sea from 1987 to 1997, Treacy (1988-1998) saw gray whales in only 2 years. In 1988, a carcass washed on shore east of Deadhorse, and three animals were entrapped in newly formed shore ice at Point Barrow. In October 1997, three groups totaling nine whales were seen near Point Barrow. On occasion, gray whales occur farther east. Alaska Native hunters near Cross Island killed a gray whale in 1933; 30 were seen near Cooper Island, 21 mi east of Point Barrow, in October 1972; one was seen near Barter Island in September 1975; and three were reported off Tuktoyaktuk, Canada, in August 1980 (Maher 1960; Marquette and Braham 1982). These more recent sightings may reflect the increase and recovery of this once-depleted species, now estimated to number about 26,600 (Angliss et al. 2001).

3.22.2.3 Beluga Whale

Beluga whales are distributed throughout seasonally ice-covered Arctic and sub-Arctic waters of the Northern Hemisphere (Angliss et al. 2001). Five stocks are recognized in Alaskan waters — Beaufort Sea, Eastern Chukchi Sea, Eastern Bering Sea, Bristol Bay, and Cook Inlet. Only the Cook Inlet beluga whale stock is considered depleted. They are not listed as threatened or endangered under the ESA.

Beluga whales may occur in both offshore and coastal areas, depending on season (Angliss et al. 2001). In summer, concentrations are found in Cook Inlet, Bristol Bay, Norton Sound, Kasegaluk Lagoon, and the Mackenzie Delta. Most beluga whales from these areas overwinter in the Bering Sea, but those from Cook Inlet overwinter in the Gulf of Alaska. In winter, belugas occur offshore and in association with pack ice. In spring, they migrate to warmer coastal estuaries, bays, and rivers for molting and calving. Annual migrations can cover more than 1,000 mi.

Beluga whales are usually found in the Beaufort Sea from April to November, but they rarely overwinter there. Most beluga whales spend the summer in the eastern Beaufort Sea and Amundsen Gulf, but they are present in low numbers across the entire region. During early summer, they are common in the warm waters of Mackenzie, Kugmallit, and Liverpool Bays. Others occur in open water and in the distant pack ice (Harwood et al. 1996). Most young are born from mid-June to mid-July and nurse for 12 to 18 months (Burns and Seaman 1985). When migrating to wintering areas in the Bering Sea, most belugas travel in or near the front zone of the pack ice, but also through open water from the offshore ice margin to the coast (Burns and Seaman 1985; Treacy 1988-1998).

The Beaufort Sea stock, identified on the basis of where they spend the summer, is estimated to number about 39,000 whales (Angliss et al. 2001). The population is considered stable or increasing. Estimated annual subsistence take from the Beaufort Sea stock in Alaska and Canada is 184.

Belugas of the Eastern Chukchi stock, estimated at about 3,700 animals (Small and DeMaster 1995; Angliss et al. 2001), now summer mainly in and near the 170-km-long Kasegaluk Lagoon system near the settlement of Point Lay (Frost et al. 1993). At least some, and perhaps all, of these whales move north into the Beaufort Sea during late July to early August (Burns and Seaman 1985), at about the same time animals of the Beaufort Sea stock begin migrating west.

The responses of beluga whales to noise and disturbance are highly variable. Responses appear to be related to such factors as experience of the whales, activities of the whales, and type of disturbance. They have frequented areas near Anchorage port facilities in which small boat traffic was heavy. In Bristol Bay, they feed among the salmon fishing boats. In other areas they continue to return to favored bays and river mouths in spite of extensive hunting pressure. In deep ice-covered waters during spring, they swam away from large ships and icebreakers as far away as 35 to 50 km. In general, belugas are more tolerant of disturbance in open water than when their movements are constrained by sea ice (Burns and Seaman 1985; Cosens and Dueck 1993; Richardson et al. 1995).

3.22.2.4 Pacific Walrus

Pacific walrus mainly inhabit the continental shelf waters of the Bering and Chukchi Seas, where they feed on benthic organisms. They occasionally move into the eastern East Siberian Sea and the western Beaufort Sea (Ferrero et al. 2000). During the late winter breeding season, walruses occur in two major concentration areas of the Bering Sea (one in the Gulf of Anadyr and one in the southeastern Bering Sea). During the summer, most of the population migrates into the Chukchi Sea; however, thousands of animals, primarily adult males, congregate on or near terrestrial haulouts in the Gulf of Anadyr and in Bristol Bay.

All Pacific walruses are thought to belong to a single stock (Ferrero et al. 2000). Population estimates vary from year to year but have consistently been about 200,000 to 250,000 animals. The current population trend is not known, but the population has increased from a low of about 100,000 in the 1950s. The walrus is an important subsistence resource. An estimated 7,300 walrus were killed annually over the past four decades, but this number decreased in the 1990s. Although protected by the MMPA, the Pacific walrus is not considered depleted and is not listed as threatened or endangered under the ESA.

The usual eastern distribution limit of the Pacific walrus is in the vicinity of Point Barrow (Brooks 1954), although small numbers do move farther east. In most years, a relatively few walruses enter the Beaufort Sea and stay for a short period of time because the pack ice recedes north, well beyond the narrow continental shelf on which they forage. In the central Beaufort Sea, walruses are beyond the margin of their normal range and occur only occasionally and usually as individuals. In years when sea-ice remains near shore in summer, small herds occur as far east as Cape Simpson; individual stragglers have been observed as far east as the Yukon Territory in Canada (Bee and Hall 1956; Harington 1966; Youngman 1975).

3.22.2.5 Spotted Seal

Spotted seals occur along the continental shelf of the Beaufort, Chukchi, Bering, and Okhotsk Seas and south to the northern Yellow Sea and Sea of Japan (Angliss et al. 2001). Spotted seals migrate from the Chukchi Sea in October and pass through the Bering Strait in November. They overwinter in the Bering Sea along the ice edge. During spring, they are found along the southern margin of the ice and move into coastal habitats as the ice retreats.

All spotted seals are thought to belong to a single stock (Angliss et al. 2001). Reliable population estimates are not available; however, earlier estimates indicated that the Bering Sea population was about 200,000 to 250,000 animals. Spotted seals are an important species for Alaskan subsistence hunters, and estimated annual harvests range from 850 to 3,600 seals. They are not listed as a depleted stock under the MMPA, nor are they listed as threatened or endangered under the ESA.

Spotted seals occur in the coastal zone of the Beaufort Sea every summer, especially in the western and west-central portions. Spotted seals arrive after ice has cleared from the bays (usually July), and they depart with the onset of freezeup in early October. These far-ranging seals feed at sea, in coastal bays and lagoons, and in rivers during periods of high fish concentrations. They haul out on islands and sandbars. Haulout areas that are used regularly include Oarlock Island in Dease Inlet; areas of Smith Bay near the mouth of the Ikpikpuk River; and in the Colville River Delta. A few regularly ascend the Colville River as far upstream as the confluence of the Itkillik River.

3.22.2.6 Ringed Seal

Ringed seals have a circumpolar distribution and occur in all seas of the Arctic Ocean (Angliss et al. 2001). They are found in ice-covered waters and remain in contact with ice most of the year. They give birth on the ice in late winter and early spring. Ringed seals occur throughout the Beaufort, Chukchi, and Bering Seas as far south as Bristol Bay in years of extensive ice covering. An apparent overall northward movement occurs as the ice retreats in the spring and summer.

The entire ringed seal population in U.S. waters is considered one stock (Angliss et al. 2001). A reliable population estimate is currently not available, but rough estimates indicate the population is between 1 million and 3.6 million animals. Current population trends are not known, although there is no indication that the population is declining. Ringed seals are not listed as depleted under the MMPA or as threatened or endangered under the ESA.

Ringed seals are abundant and present year-round in the Beaufort Sea. They are most evident when floating sea ice is present. From autumn to early summer, the highest densities of ringed seals occur in fast-ice habitat. Pups are born from late March to May and are nursed for 4 to 6 weeks (Smith and Stirling 1975; Smith and Hammill 1981; Kelly 1988). Starting in late April, seals of all ages begin to haul out on top of the ice and snow to bask during the annual molt. Basking seals are most numerous in late May-June. Compared with other areas in Alaska, in the Beaufort Sea the density of ringed seals is low and varies annually.

Ringed seals are an important subsistence resource in the Beaufort Sea region (Angliss et al. 2001). Overall, annual harvests have been declining. An estimated 7,000 to 15,000 seals were harvested annually from 1962 to 1972, but by 1979 this number had dropped to about 2,000 to 3,000 in 1979 and 3,000 during the mid-1980s. A current reliable estimate of the annual harvest is not available.

3.22.2.7 Bearded Seal

Bearded seals have a circumpolar distribution that extends from the Arctic Ocean to Hokkaido in the western Pacific and generally in relatively shallow waters that are seasonally ice covered (Angliss et al. 2001). In Alaskan waters, bearded seals are found over the continental shelves of the Bering, Chukchi, and Beaufort Seas. Many of the seals that winter in the Bering Sea migrate north from late April through June and spend the summer along the ice edge in the Chukchi Sea. Bearded seals rarely haul out onto land.

The entire bearded seal population is considered one stock (Angliss et al. 2001). A reliable population estimate for the bearded seal is currently not available, but estimates from the 1970s indicated that the Alaskan population ranged from 250,000 to 300,000. Current population trends are not known, although there is no indication that the population is declining. Bearded seals are not listed as depleted under the MMPA or as threatened or endangered under the ESA.

Bearded seals are present year-round in the Beaufort Sea. They are considered common although not abundant during late spring through early autumn; relatively fewer occur during the months of heavier ice cover. Bearded seals are found in areas of moving ice where it overlies waters less than about 500 to 650 ft deep. In winter, they occur infrequently in the areas of fast ice (Burns and Harbo 1972; Frost et al. 1989; Frost and Lowry 1999). Bearded seals are benthic feeders.

Bearded seals are an important resource for Alaskan subsistence hunters (Angliss et al. 2001). The estimated average annual harvest from 1966 to 1977 was 1,784 seals. Reliable information on the current average annual harvest is not available. Relatively few are taken in the Beaufort Sea, except near Point Barrow.

3.22.2.8 Polar Bear

Polar bears have a circumpolar distribution in the Northern Hemisphere (Angliss et al. 2001). Two stocks are recognized in Alaska — the Beaufort Sea stock and Chukchi/Bering Sea stock. The Beaufort Sea stock ranges from Point Hope in the west to Bailie Islands, Canada, in the east. An area of overlap between the Beaufort Sea stock and the Chukchi/Bering Seas stock occurs between Point Barrow and Point Hope, centered near Point Lay. Polar bears occur at low densities throughout their range and range widely over large areas.

Accurate estimates of the size of the Beaufort Sea population have been difficult to obtain, but the current estimate is 1,765 bears (Ferrero 2000). This stock has increased at an estimated annual rate of 2% or more since passage of the MMPA in 1972 and is thought to now be at or near carrying capacity (Amstrup 1995; USFWS 1995). The average density in the region from Point Barrow to Cape Bathurst was estimated to be one bear per 141 to 269 km^2 in 1986 (Amstrup et al. 1986). Subsistence hunting results in an average annual take of about 32 animals (1.9% harvest rate) (Ferrero 2000). The polar bear is not listed as depleted under the MMPA or as threatened or endangered under the ESA.

In the Beaufort Sea, polar bears are present year-round, although their distribution shifts seasonally. Polar bears are widely distributed, occurring on land, fast ice, and pack ice. They are most abundant in areas where their principal prey (ringed seals) is most available. In summer, they are found mainly on the distant pack ice, although they are occasionally seen on land or swimming in open water at a considerable distance from the ice. In autumn, as the ice comes closer to the coast, some polar bears swim to shore and scavenge beached carcasses or the remains of bowhead whales taken by subsistence hunters.

Polar bears do not hibernate, but are active all winter. Pregnant females make dens in deep snowdrifts during late October to November. Of 90 dens in the Beaufort Sea region reported by Amstrup (1995), 48 were on drifting pack ice, 38 were on land, and 4 were on shoreline ice. Each female usually produces two cubs annually in December or January. Mother and cubs emerge from dens in late March to early April, and those that were on land go to sea. There has been continuing concern about the effects of anthropogenic disturbances on bears in maternity dens, but Amstrup (1995) reported that disturbances associated with capture and marking of study animals did not affect litter sizes or the growth and condition of cubs.

3.22.3 Prince William Sound

The Valdez Marine Terminal is located at the southernmost end of the TAPS on the coast of Port Valdez, an arm of Prince William Sound. Listed and protected species that are known to occur or could occur on Prince William Sound are listed in Table 3.22-1. Prince William Sound supports several marine mammals that are listed under the ESA or that are protected by the MMPA. Those species are discussed in this section. The Steller's eider, Arctic peregrine falcon, and American peregrine falcon, listed under the ESA (or in the case of the peregrine falcons, recently delisted) are discussed in Section 3.22.1.

Listed Species Most Likely to Occur in Prince William Sound

Steller's eider: ESA-listed as threatened.

Humpback whale: ESA-listed as endangered; MMPA-listed as depleted.

Fin whale: ESA-listed as endangered; MMPA-listed as depleted.

Steller sea lion: ESA-listed as endangered; MMPA-listed as depleted.

Nine species of marine mammals are abundant or common in Prince William Sound; other species are uncommon or rare in the Sound and are not discussed here. Species of marine mammals that inhabit marine waters outside Prince William Sound include blue whale, right whale, sei whale, sperm whale, and fur seal (USACE 1999). Several stocks of chinook salmon, sockeye salmon, and steelhead that spawn in rivers and streams of Washington, Oregon, and Idaho are listed under the ESA as threatened or endangered. As adults, these fish occupy oceanic habitats that include Alaskan waters. Green, loggerhead, leatherback, and Olive Ridley sea turtles are also ESA-listed and occasionally enter Alaskan waters. These fish and turtle species are unlikely to enter Prince William Sound and are not discussed here.

Killer whales are found worldwide in all major oceans but favor the colder waters of both the Northern and Southern Hemispheres (Matkin et al. 1997; Angliss et al. 2001). Of four species of whales common to Prince William Sound, the killer whale is the only toothed whale and feeds primarily on marine mammals and fish (Calkins 1986). Killer whales are abundant and present year-round, but the migratory pattern in and out of the Sound probably varies among pods (Dahlheim and Matkin 1994). Of more than 14 pods identified in Prince William Sound, 8 are regularly found there (Matkin et al. 1994).

Four baleen whales occur seasonally in Prince William Sound. Fin, humpback, and gray whales are the largest species to visit the Sound and are migratory. Minke whales are small migratory whales that occur there year-round (Calkins 1986). Fin and humpback whales are listed as endangered under the ESA and depleted under the MMPA. Gray whales migrate to and from the Bering and Chukchi Seas and occur in the Sound in late spring and early fall (Calkins 1986). (A more detailed description of the gray whale is provided in Section 3.22.2.2.) Minke whales summer in the Gulf of Alaska and mostly are seen closer to shore to waters 650 ft deep (Consiglieri and Braham 1982). Minke whales generally feed on krill and fish (Tamura et al. 1998).

Dall's and harbor porpoises both are abundant and widespread in Prince William Sound. The Dall's porpoise is the more common species (Calkins 1986; Harvey and Dahlheim 1994). Both species feed on fish and crustaceans (Calkins 1986). Dall's porpoises occur on the continental shelf and slope and prefer straits, passes between islands, and areas of merging currents (Scheffer 1949; Cowan 1944). Harbor porpoises frequent bays, harbors, and river mouths (Calkins 1986). Both porpoises are more abundant in Prince William Sound in summer than winter (Hall 1979).

3.22.3.1 Humpback Whale

The humpback whale occurs worldwide in all ocean basins but is less common in Arctic waters (Angliss et al. 2001). Historically, the feeding range of humpback whales in the north Pacific included coastal and inland waters around the Pacific Rim from California north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk. In winter, most humpback whales are found in the temperate and tropical waters of the Northern and Southern Hemispheres. In the North Pacific, humpback whales are seasonal migrants and feed on zooplankton and small fish (Kawamura 1980). Commercial harvesting in the 20th century reduced the humpback whale population across much of its range. This species is currently listed as endangered under the ESA and depleted under the MMPA.

Humpback whales are probably the most abundant whales in Prince William Sound, and 60 to 100 individuals feed there during the summer (von Ziegesar et al. 1994). These whales are considered to be part of the Central North Pacific humpback whale stock, which spends winter and spring near the Hawaiian Islands (Angliss et al. 2001). This stock consists of feeding aggregations along the northern Pacific Rim from British Columbia to the far eastern coasts of Russia.

In a 3-year study of humpback whales in Prince William Sound, von Ziegesar (1994) found whales primarily in Knight Island Passage, the southern end of Chenega Island, and the entrances of Icy and Whale Bays. These areas are all in the southwestern portion of Prince William Sound and away from the action area (Port Valdez). These observations are consistent with those of Hall (1979). Humpback whale distributions within Prince William Sound appeared to be determined by abundance of prey and perhaps other factors rather than being habitual (von Ziegesar 1994). Records of humpback whales in Port Valdez are not available, and use of Port Valdez by humpback whales may be limited or not occur because of its distance from known occupied areas and the open waters of the Gulf Alaska and because it is at the end of an arm of the Sound.

The overall population estimate for the Central North Pacific stock is about 4,000 individuals, and there is some indication that the population may be increasing (Angliss et al. 2001). Although subsistence hunters in Alaska have not been reported to take humpback whales, an average of 3.5 humpback whales are estimated to be killed annually incidental to commercial fisheries activities (Angliss et al. 2001). Mortality resulting from collisions with ships unrelated to commercial fisheries is estimated to average 0.8 per year (Angliss et al. 2001).

3.22.3.2 Fin Whale

The fin whale occurs in all ocean basins of the world, but it is not common in tropical waters or polar seas with ice. In the North Pacific, fin whales are found from above the Arctic Circle to lower latitudes of approximately 20°N (Angliss et al. 2001). During summer, fin whales occur along the Pacific coast of North America from the Bering Sea to as far south as central Baja California. Their migratory status is unclear, but fin whales have been found during the winter in the area of the Hawaiian Islands and off the California coast (Angliss et al. 2001). Commercial harvesting of fin whales in the 1940s through 1960s greatly reduced the worldwide population and led to listing the species as endangered under the ESA and depleted under the MMPA. Fin whales feed on krill, other crustaceans, and various species of small fish (Nowak 1991).

Fin whales occur in deep water portions of Prince William Sound for a few days each year from April to June during their summer migration to their Bering Sea feeding grounds (Hall 1979). Their distribution in Prince William Sound appears to be limited to the area near the Hinchinbrook Entrance. Although fin whales are transient in Prince William Sound, they are normally relatively abundant and visible (Hall

1979). These whales are considered part of the Northeast Pacific stock, which is distributed along the North Pacific Rim from British Columbia to the far eastern coasts of Russia.

Reliable estimates of the size of the Northeast Pacific stock are not available, but approximately 15,000 individuals have been estimated for the entire North Pacific (Angliss et al. 2001). Subsistence hunters in Alaska have not been reported to take fin whales, and few fin whales have been reported killed incidental to commercial fisheries or other activities (estimated average of 0.6 per year) (Angliss et al. 2001).

3.22.3.3 Steller Sea Lion

Steller sea lions occur along the North Pacific Rim from northern Japan to California, with a center of abundance in the Gulf of Alaska (Angliss et al. 2001). The species is not known to migrate, but individuals disperse widely outside of the breeding season (late May to early June). Two stocks — eastern and western — are recognized in U.S. waters. Rookeries of the eastern stock occur in southeast Alaska, while those of the western stock range from Prince William Sound through the Aleutian Islands (Kruse et al. 2001).

The two stocks have shown very different population trends, with the eastern stock increasing at a rate of 5.9% annually from 1979 to 1997 (Kruse et al. 2001). Over a similar time span, the western stock has declined precipitously (90% at some sites). The western stock of the Steller sea lion is listed as endangered under the ESA and depleted under the MMPA. Although the eastern stock is listed as threatened, its population is at the highest level of recorded abundance, and delisting may be warranted (Kruse et al. 2001). Subsistence hunting results in an annual take of 353 Steller sea lions from the western stock (Angliss et al. 2001).

Male and female Steller sea lions congregate on rookeries from May through July. Older males (at least 9 years of age) defend territories on rookeries to attract females. A single pup is born during mid-May to mid-July, with the peak in mid-June. Steller sea lions consume a wide range of food items, including fish, squid, octopus, and crustaceans (Hoover 1988). Haulout areas are rocky shorelines, which are used by sea lions for resting. Designated critical habitat for the Steller sea lion includes three haulout areas (Perry Island, Point Eleanor, and the Needle) in Prince William Sound. None of the critical habitat areas for the Steller sea lion occur in Port Valdez, where the Valdez Marine Terminal is located. No Steller sea lion rookeries occur within Prince William Sound.

The minimum population size of the western U.S. stock of Steller sea lion is estimated to be 34,600 animals (Angliss et al. 2001). There are an estimated 3,500 to 4,000 Steller sea lions in and near Prince William Sound (Merrick et al. 1991). From 1986 to 1989 an estimated population decline of 63% occurred in the area from the central Gulf of Alaska, including Prince William Sound, to the central Aleutian Islands (NMFS 1992). At Sugarloaf Island near the Sound the decline from 1956-1957 to 1990 was from 11,963 to between 1,319 and 1,513 animals, or 87 to 89% (Merrick et al. 1991).

The observed population decline resulted first in an emergency listing of the Steller sea lion and then in a reclassification of the western stock of the Steller sea lion from threatened to endangered. The decline continues and there is no indication that it has slowed (Angliss et al. 2001). A team of scientists and stakeholders was convened to review the status of the Steller sea lion in Alaska and possible causes for its decline. The primary cause of the original decline (1970s to 1980s) is thought to have been low survival and birth rates because of undernutrition (Kruse et al. 2001). The cause of undernutrition is not known, but possible explanations include (1) competition for prey with large-scale commercial fisheries; (2) changes in prey abundance, composition, and distribution resulting from climatic change; and (3) ecosystem-level changes resulting from the commercial harvest of predators such as whales and certain fishes (Kruse et al. 2001). The team concluded that declines in the 1990s could not be attributed to humans. They identified two management goals for restoration of the sea lion population: (1) prevent human disturbance of sea lions on land, and

(2) preclude adverse impacts to the composition, density, spatial distribution, and size distribution of prey populations. To achieve these goals, the team recommended establishment of no-approach zones around rookeries and haulout areas and experimental establishment of no-fishing zones (Kruse et al. 2001).

The effect of the Exxon Valdez oil spill on the Steller sea lion is not fully understood. There were a number of indications that sea lions had been exposed to oil from the spill, including (1) observations of sea lions swimming in and near oil slicks, (2) oil observed near numerous haulout sites, (3) fouling of rookeries at Seal Rocks and Sugarloaf Island, and (4) the presence of hydrocarbon metabolites in sea lion tissues (Calkins et al. 1994). However, Calkins et al. (1994) concluded that a population-level effect could not be demonstrated. They found that after the spill, the predicted number of pups and total sea lions on rookeries and haulouts were not significantly different from the actual counts (i.e., the observed numbers were not lower than expected on the basis of long-term trends). They hypothesized that the effects on Steller sea lion may have been less than for other species (e.g., harbor seals and sea otters) because oil did not persist on sea lion rookeries and haulouts since they are located in areas of steep slopes and high surf activity.

3.22.3.4 Harbor Seal

Harbor seals occur in coastal and estuarine waters off Baja California, north along the western coast of the United States, British Columbia, and southeast Alaska, west through the Gulf of Alaska and Aleutian Islands and in the southeastern Bering Sea (Angliss et al. 2001). They haul out on rocks, reefs, beaches, and drifting glacial ice. They are generally nonmigratory. In Alaska, three stocks are recognized — the southeast Alaska, Gulf of Alaska, and Bering Sea stocks (Angliss et al. 2001). The harbor seal is not listed as depleted under the MMPA or as threatened or endangered under the ESA.

Harbor seals are abundant year-round in Prince William Sound, and seals move into and out of the Sound regularly. Although seals use haulouts throughout the year, the highest numbers of seals occur on haulouts during pupping (mainly May-June) and molting (mainly August-September). The largest concentrations of seals occur at haulouts around the perimeter of the Sound, including the Copper River Delta and the mainland glacial fjords of the Sound's northern and western portions. Harbor seals eat a variety of foods, including fish, crustaceans, squid, and octopus (Calkins 1986; Hoover 1988).

The number of harbor seals in the Gulf of Alaska decreased steadily from the mid-1970s to the 1990s (Angliss et al. 2001). In Prince William Sound, harbor seal numbers declined by 57% from 1984 to 1992. This decline began before the 1989 Exxon Valdez oil spill, was greatest in the year of the spill, and may have been less pronounced afterward. Surveys indicate that the long-term decline of harbor seal numbers in Prince William Sound has not yet ended (Angliss et al. 2001). The current population of the Gulf of Alaska stock is estimated at about 29,200 seals. Subsistence harvest of seals from the Gulf of Alaska stock is common and results in an annual take of 791 seals (Angliss et al. 2001).

In 1989, an estimated 302 seals were "missing" from haulouts that were oiled by the Exxon Valdez oil spill, and 14 dead seals (including 11 newborn pups) were recovered in the Sound following the spill (Williams et al. 1994). That estimate was based primarily on statistical analyses of counts from surveys done during August-September 1988-1992. The missing seals were presumed to have died from the spill (Frost et al. 1994). Indeed, many seals were exposed to the oil (Lowry et al. 1994) and to the massive influx of people and equipment involved in cleanup. Haulouts were oiled, treated, inspected, and studied. Seals were coated with oil, incorporated volatile hydrocarbon compounds into their tissues, and metabolized them, as shown by biochemical indicators (Frost et al. 1994).

The survey-based impact study of Frost et al. (1994) was based on assumptions that molting seals have 100% fidelity to sampled haulouts and that cleanup and other human activities did not displace seals. A review of that study by Hoover-Miller et al. (2001) indicates that the single-year reduction in seals at oiled haulouts could not be used as an estimator of spill-caused mortality. Hoover-Miller et al. (2001)

concluded that fewer seals probably died as a result of the spill, and that the effects of the spill were limited and transitory and were overshadowed by the overall continuing decline in the harbor seal population.

3.22.3.5 Sea Otter

In North America, sea otters occur from the Aleutian Islands to California, with much of the world's population occurring in Alaskan waters (Angliss et al. 2001). They are distributed in Alaska from the Aleutian Islands to southeast Alaska, but there are certain portions of the Aleutian Islands, Kodiak Archipelago, northern Gulf of Alaska, and southeastern Alaska where they are relatively uncommon.

Sea otters occupy shallow coastal areas (less than 180 ft deep) (Kenyon 1969). They are gregarious, but adult males defend territories within female-dominated areas. Groups of more than 1,000 individuals have been observed (USFWS 1994b). Reproductive activity can occur throughout the year, but pupping tends to be concentrated in late spring and early summer. Females usually give birth to a single pup annually. In Prince William Sound, sea otters feed on a variety of bivalves, crustaceans, and other invertebrates in the nearshore area (Calkins 1978; Garshelis 1983; Doroff and Bodkin 1994; Johnson and Garshelis 1995).

Those otters that occur in Alaska are currently managed as a single stock, but multiple stocks may exist (Angliss et al. 2001). Alaskan sea otters are members of a northern sea otter subspecies. Within this subspecies, the USFWS considers the Aleutian population to be a distinct population segment, which it currently considers a candidate for listing under the ESA (66 FR 54808). The Center for Biological Diversity recently petitioned the USFWS to add the Aleutian population of sea otters to the ESA list of endangered species and to list the Alaska stock of the sea otter as depleted under the MMPA (Center for Biological Diversity 2000).

Calkins and Schneider (1985) estimated the 1976 Alaskan sea otter population at 100,000 to 150,000 individuals. The current population is estimated to be in that range, with a minimum population of 100,000 (Angliss et al. 2001). In 1994, the number in Prince William Sound was estimated at 14,352 (Angliss et al. 2001). The Alaska sea otter population generally has grown and expanded since commercial harvesting stopped in 1911. Subsistence harvest continues in Prince William Sound and other portions of southcentral Alaska; the mean annual subsistence take was 297 otters from 1996-2000 (USFWS 2002). Population growth in Prince William Sound was disrupted by the earthquake in 1964 and the Exxon Valdez oil spill in 1989 (Estes 1991; Johnson and Garshelis 1995; Garshelis and Johnson 2001).

Activities associated with oil and gas exploration, development, and transportation can adversely affect sea otters and their habitat (Angliss et al. 2001). It is estimated that approximately 2,650 sea otters were killed in Prince William Sound as a result of the Exxon Valdez oil spill; 3,905 otters were estimated to have been killed as a result of the spill in Alaska as a whole (Angliss et al. 2001). By 1993, chronic effects to sea otters may have been subsiding, and recovery of the affected population appeared to be underway (Angliss et al. 2001). The overall population in western Prince William Sound has increased over the 1990s (Monson et al. 2000), and various indicators suggest the sea otter population in spill-affected areas was recovering a few years after the spill (Johnson and Garshelis 1995). The Exxon Valdez Trustee Council (2002a) considers the sea otter population to still be recovering from effects of the oil spill, because the number of otters in heavily oiled bays of the Western Sound has not returned to prespill numbers. Concerns continue over demographic effects from the initial exposure to the oil spill and over the toxicological effects of residual oil several years after the spill (Monson et al. 2000; Dean et al. 2000) in areas that were heavily oiled.

3.23 Economics

Although the TAPS can be physically identified as a separate part of the oil production and transportation system for North Slope oil, such a distinction is not easily made from an economic standpoint. Oil production, pipeline operation, and marine transportation all function as interconnected elements of the North Slope oil production and delivery system, and the economic impacts of each element are not easily separated. The system as a whole provides benefits to the economies of the state and the nation and fiscal benefits to state and local governments.

Given the relative importance of the North Slope oil production and transportation system to the Alaskan economy, the economic and fiscal benefits of the TAPS are experienced throughout the state. This description of the economic affected environment therefore focuses on describing existing economic and fiscal conditions in the state as a whole, with less emphasis placed on the pipeline corridor region through which the TAPS transports oil from the North Slope oil fields to the Valdez Marine Terminal.

The following description of the affected economic environment for the TAPS is intended to establish the appropriate baseline conditions for analyzing the impacts of (1) renewing the Federal Grant for the ROW for 30 years (proposed action alternative), (2) the time-dependent alternative (less-than-30-year renewal alternative), and (3) the nonrenewal alternative (no-action alternative) and for analyzing cumulative impacts. For the national economy, this section describes trends in the contribution of North Slope oil to domestic oil production, reduced foreign oil dependency, the balance of trade, federal tax revenues, and the marine transportation sector. For the state economy, this section describes of the state, trends in population, gross state product, employment, personal incomes, and state and local government revenues and expenditures over the current Federal Grant period, 1978–2003. For the pipeline corridor region, which consists of the six boroughs and census areas in which the TAPS is located as well as Anchorage (Map 3.23-1), this section describes trends in population, employment, and personal income. Since movements in each of these indicators of economic activity in the state follow closely the fortunes of the oil industry in the state, the next section provides a brief description of trends in North Slope oil production and world oil prices.

3.23.1 North Slope Oil Production and World Oil Prices

Oil production in Alaska is dominated by production from the North Slope fields. Minor production also occurs in Cook Inlet, which averaged 2.5% of total Alaska oil production between 1990 and 2000 (Alaska Department of Revenue 2002). Production from the North Slope oil fields and the transportation of crude to Valdez through the TAPS began in 1977, with a peak of 2.038 million bbl/d in 1988. Production has subsequently declined, with average daily production currently at 1.045 million bbl/d, 51% of its 1988 peak level (Table 3.23-1). After peaking in early 1981 at $70/bbl in 2000 dollars ($37/bbl in 1981 dollars), oil prices have fluctuated, reaching an all-time low of $13/bbl (in 2000 dollars) in 1998 ($12/bbl in 1998 dollars), 18% of the 1981 peak level (Table 3.23-1) (DOE 2001a). Prices have rebounded slightly since 1998 and currently stand at $27/bbl (October 2002).

3.23.2 National Economic Issues

Oil production from the North Slope fields has made a significant contribution to the national economy through its contribution to producing domestic oil, reducing dependency on foreign oil, and generating substantial tax revenues and royalties for the federal government. In addition, North Slope oil has benefited specific sectors of the economy, notably marine tanker transportation, since the vast majority of Alaskan oil is delivered to U.S. West Coast ports for refining and distribution.

TABLE 3.23-1 Trends in North Slope Oil Production and World Crude Prices

Year	North Slope Production (million bbl/d)	Oil Prices ($/bbl)	Oil Prices (2000 $/bbl)
1980	1.522	34	71
1985	1.782	27	43
1990	1.793	22	29
1995	1.523	17	19
2000	1.045	28	28
2001	0.991	22	21

Sources: DOE (2001b,c); Alaska Department of Revenue (2001a).

3.23.2.1 Domestic Oil Production and National Energy Security

The United States was able to satisfy domestic demand for oil from domestic supplies until 1950, when the country became a net oil importer. Dependency on foreign oil has continued to grow, and the country now imports more than 60% of domestic demand from other countries (DOE 2001c). Dependency on oil from outside the United States can create significant foreign policy issues if the countries supplying oil are politically and/or economically unstable. Without the production of North Slope oil, the nation's dependency on foreign oil would be even greater.

North Slope production has regularly constituted more than 15% of U.S. domestic crude production. Throughout the late 1980s, the fields contributed more than 20%, peaking at approximately 25% in 1988 (DOE 2001c).

3.23.2.2 Balance of Trade

Dependency on foreign oil also has implications for the nation's balance of trade with the rest of the world, and North Slope oil has reduced the U.S. balance of trade deficit in each year of North Slope production. Trade deficits contribute to federal government budget deficits and can lead to domestic economic problems if they are sufficiently large to require additional government borrowing, which could mean less money available for investment, higher interest rates, slower economic growth, and higher unemployment. As a result of North Slope production, the deficit in crude oil has been reduced by an average of 21% over the period 1977–2001, reducing the overall trade deficit by an average of 12%, with approximately $446 billion (in 2000 dollars) saved on the overall U.S. oil bill over this period (DOE 2001c). In addition, when the cost of domestic production is less than the price of imported oil, there are also cost savings to U.S. consumers and to the federal government.

3.23.2.3 Federal Tax Revenues

The federal government obtains revenues from North Slope production through corporate income taxes paid by the TAPS pipeline owners and oil producers, and through federal royalties on oil developments. In addition, windfall profits taxes were levied on oil producers between 1980 and 1988. It has been estimated that North Slope and the TAPS contributed almost $64 billion (2000 dollars) to federal government revenues over the period 1977–1998, an average of almost $2.9 billion (2000 dollars) annually (ECA 1999).

3.23.2.4 Marine Transportation

North Slope oil production provides benefits to U.S. companies transporting the oil from Alaska to the West Coast. Under the stipulations of the Jones Act of 1920, all shipping between U.S. ports must use ships built and registered in the United States and employ U.S. seamen.

Transport of North Slope oil has provided a steady source of employment directly for seamen and indirectly for shipbuilding workers since 1977. In 1999, there were about 100 U.S.-flagged tankers. In 1993, 32 tankers were used on a full-time basis for North Slope oil transportation from Valdez to West Coast ports (DOE 1994). In 1988, the year of maximum TAPS throughput, tankers transporting North Slope oil employed an estimated 2,600 seamen (DOE 1994). More than 50 tankers were built during the 1970s and 1980s to transport North Slope oil (GAO 1999). Construction of each tanker required approximately 1,000 U.S. shipyard workers, with additional jobs created at U.S. ship repair and overhaul facilities (GAO 1999). While the number of tankers required for North Slope oil has been steadily declining with falling North Slope oil production, double-hulled tankers are gradually replacing the older single-hulled tankers for North Slope transportation, providing more U.S. shipyard employment (GAO 1999).

3.23.3 State Economic Issues

3.23.3.1 Population

More than half (51.2%) of Alaskan residents (626,932 in 2000) live in the urban areas of Anchorage (population 260,283 in 2000), Juneau (30,711), and Fairbanks (30,224). In 2000, 113,145 people resided in the pipeline corridor region, including 82,840 people living in the Fairbanks North Star Census Area, 10,195 residing in the Valdez Cordova Census Area, and 7,385 in the North Slope Borough (Table 3.23-2).

Population in the state has grown rapidly since the early 1960s, particularly during the 1970s with the development of the North Slope oil fields and the construction of the TAPS, and during the 1980s in conjunction with oil production and expenditures in the state. Growth rates have varied somewhat over the period 1970-2000, with annual growth averaging 2.9% during the 1970s, and 3.2% during the 1980s. Growth in the state slowed during the 1990s, reaching a relatively modest annual average rate of 1.3% (Table 3.23-2).

A key component to Alaskan population growth has been the migration that has occurred in association with the various phases of oil industry-related economic development in the state over the last 30 years. Compared with the average natural increase in population in the state since 1970 of 1.7%, growth due to net migration, primarily in the civilian population, has been significant. Net in-migration constituted 88% of total population growth in the state in 1975 during the peak year of the construction of the TAPS. This growth was followed by a substantial net out-migration of population between 1978 and 1980 following completion of the pipeline. A similar cycle in net in-migration occurred in the early 1980s as production from the North Slope began to impact the state economy as a whole, with 74% of the growth in population resulting from in-migration in 1982. This period of growth was followed by net out-migration of population in the mid and late 1980s; out-migration also occurred in the late 1990s.

3.23.3.2 Gross State Product

Gross state product (GSP), or the sum of value added in the production of all goods and services in the state in a year, is a general measure of the level of economic activity in the state. GSP can be presented in terms of current or constant dollars, with constant dollars used to take into account general inflation in the economy and fluctuations in natural resource prices when comparing GSP values over time. Table 3.23-3 summarizes changes in Alaska GSP over the period 1970–1998, together with changes in GSP over the same period in key industries, in terms of 2000 dollars.

TABLE 3.23-2 Alaska Population Statistics, 1970–2000

1970	1980	Growth Rate,[a] 1970–1980 (%)	1990	Growth Rate,[a] 1980–1990 (%)	2000	Growth Rate,[a] 1990–2000 (%)
302,583	401,851	2.9	550,043	3.2	626,932	1.3

[a] Annual average rate.

Sources: U.S. Bureau of the Census (1994, 2001f).

TABLE 3.23-3 Alaska Gross State Product by Industry (millions of 2000 dollars)

Industry	1970	1980	Growth Rate[a] (%), 1970–1980	1990	Growth Rate[a] (%), 1980–1990	1998	Growth Rate[a] (%), 1990–1998
Alaska	7,985	22,361	10.8	24,752	1.0	22,652	-0.9
Oil and Gas	823	6,999	23.9	7,490	0.7	4,397	-5.2
Mining	48	40	-1.8	216	18.3	718	12.8
Seafood	319	695	8.1	791	1.3	979	2.2
Forest Products	266	365	3.2	539	4.0	236	-7.9
Construction	604	846	3.4	884	0.4	1,120	2.4
Manufacturing	48	109	8.5	130	1.8	172	2.
Transportation	503	573	1.3	656	1.4	837	2.
Air Cargo	1	1	0.0	56	49.3	172	11.7
Public Utilities	118	252	7.9	527	7.7	583	1.0
Trade	562	1,083	6.8	1,734	4.8	2,155	2.2
Finance	461	1,238	10.4	1,519	2.1	1,777	1.6
Services	478	1,198	9.6	1,972	5.1	2,529	2.5
Tourism	56	205	13.8	450	8.2	676	4.2
Federal Civilian	1,276	1,703	2.9	1,831	0.7	1,587	-1.4
State and Local Government	967	1,885	6.9	2,628	3.4	2,779	0.6
Military	1,481	1,498	0.1	1,922	2.5	1,267	-4.1

[a] Annual average rate.

Source: Goldsmith (1999); U.S. Department of Labor (2001).

GSP growth in Alaska sharply declined over the period 1970-1998, with an average annual growth rate of 10.8% during the 1970s giving way to a much smaller average rate of 1.0% during the 1980s, followed by negative average annual growth during the 1990s (Table 3.23-3). Changes in the Alaskan economy as a whole reflect declining growth and contraction in the petroleum sector, with growth rates falling from an annual average of almost 11% during the 1970s to 1.0% during the 1980s. The oil and gas sector declined during the 1990s, reflecting falling world oil prices and declining oil production in the state. The relative contribution of the petroleum sector to GSP has also declined, falling from about 31% of GSP in 1980 and 1990 to less than 20% in 1998, while still remaining the largest contributor to GSP in the state.

The fortunes of the oil and gas industry in the 1980s and 1990s were offset to a certain extent by rapid growth in other basic sectors (see Appendix A, Section A.8) in the state's economy that are not related to oil production, notably mining, air cargo, and tourism. Air cargo grew at annual rate of more than 29% over the period, mining at 15.5% and tourism at 6.1%. Solid annual average growth rates were also experienced in the 1990s by the manufacturing

(2.8%), transportation (2.5%), construction (2.4%), and seafood (2.2%) sectors of the economy. Forest products, a significant source of growth in 1980s with an average growth rate of 4%, suffered a major decline during the 1990s. Despite the decline in the petroleum sector, the contribution of the key growth sectors in the basic nonpetroleum economy in the state — air cargo, mining, and tourism — to GSP in 1998 was still fairly small at 6.9%. The nonbasic sectors (see Appendix A, Section A.8) trade; finance; services; federal, state, and local government; and the military each contributed more to GSP than air cargo, mining, and tourism. These nonbasic sectors also showed moderate growth in the 1990s.

3.23.3.3 Employment and Unemployment

3.23.3.3.1 Employment by Industry. Total employment in Alaska increased markedly over the period 1970–1998, growing at an average annual rate of 4.7% during the 1970s and at 3.0% during the 1980s. Growth in recent years has slowed somewhat, with annual growth rates during the 1990s averaging only slightly more than 1% (Table 3.23-4). Although the number of employees in mining, which includes oil and gas, increased rapidly during the 1970s (8.4%) and 1980s (5.5%), other parts of the economy still have more employees than the oil and gas sector. A number of these sectors experienced relatively high rates of growth during the 1970s and 1980s. Services (19%), trade (16%), and state and local government (17%) each currently have a significantly larger share of total employment in the state than does oil and gas, with tourism, mining, and air cargo growing substantially over much of the period 1970-1998.

Employment statistics significantly understate the importance of the oil and gas industry in the state. A large number of additional jobs are created in other sectors of the Alaska economy, notably construction, transportation, wholesaling and business services, through the effect of large oil and gas industry procurement and capital spending in these sectors (Goldsmith 1997). Employment in many of the remaining sectors of the economy is also closely related to the oil and gas industry itself, notably transportation, or on the overall level of economic activity resulting from the large-scale development of oil and gas, notably federal civilian and state and local government, and public utilities.

3.23.3.3.2 Unemployment. Over the last 30 years, unemployment rates in Alaska have been higher than the national rates, with higher than average rates occurring during the 1980s during the first years of North Slope oil production and TAPS operation (Table 3.23-5). The average unemployment rate for Alaska fell during the 1990s, but with the national rate also falling, rates in Alaska remained higher than in the nation as a whole. The current unemployment rate in Alaska, 5.8%, is slightly higher than the national rate of 5.7%.

It is likely that unemployment data underestimate the number of people who would like to work because the unemployment rate includes only persons registering for unemployment benefits. In many Alaskan communities, the number of employment opportunities is limited, meaning that some people may no longer be actively searching for employment.

3.23.3.4 Personal Income

Over the period 1970–1999, real personal income in the state (adjusted for the effects of inflation) more than doubled (Table 3.23-6), with an average annual growth rate of 4%. Growth was particularly rapid (6.1%) during the 1970s with the construction of the TAPS. Over the same period, per capita income increased from $19,250 to $29,111 per person, an annual average increase of 1.4%. In the latter part of this period, however, growth rates in total incomes slowed from an annual rate of 4.2% during the 1980s to 1.3% during the 1990s. Growth in per capita incomes also slowed, from an average annual rate of 1.0% in the 1980s to an average rate of 0.1% in the 1990s, primarily as a result of the shift in the Alaskan economy away from higher-paying oil industry employment to lower-paying trade and service industry jobs (Goldsmith 1997).

TABLE 3.23-4 Total Employment in Alaska by Industry[a]

Industry	1970	1980	Growth Rate[b] (%), 1970–1980	1990	Growth Rate[b] (%), 1980–1990	1998	Growth Rate[b] (%), 1990–1998
Alaska	133,400	211,360	4.7	283,580	3.0	317,350	1.1
Mining (incl. Oil and Gas)	2,990	6,690	8.4	11,480	5.5	10,450	-0.9
Seafood	120	220	6.2	460	7.7	350	-2.7
Forest Products	0	660	NA[c]	1,320	7.2	1,450	0.9
Construction	6,890	10,640	4.4	10,500	-0.1	13,430	2.5
Manufacturing	7,840	13,980	6.0	17,180	2.1	14,390	-1.8
Transportation	6,130	10,180	5.2	12,790	2.3	15,550	2.0
Air Cargo	400	600	4.1	900	4.1	2,000	8.3
Communications	1,850	4,380	9.0	3,350	-2.6	4,320	2.6
Public Utilities	820	1,360	5.2	2,390	5.8	2,560	0.7
Trade	14,760	27,070	6.3	41,770	4.4	50,500	1.9
Finance	3,100	7,650	9.5	9,170	1.8	11,330	2.1
Services	10,830	27,380	9.7	45,630	5.2	60,950	2.9
Tourism	1,530	5,800	14.3	10,470	6.1	15,230	3.8
Federal Civilian	17,110	17,720	0.4	18,730	0.6	17,180	-0.9
State and Local	18,440	36,290	7.0	51,000	3.5	54,230	0.6
Military	31,430	22,000	-3.5	23,130	0.5	18,020	-2.5
Proprietors	9,510	19,340	7.4	24,220	2.3	27,420	1.2
Fisheries	4,630	7,400	4.8	8,380	1.3	8,730	0.4

[a] Total civilian and military employment, including proprietors' primary source of employment.

[b] Annual average rate.

[c] NA = not applicable.

Source: Goldsmith (2000).

TABLE 3.23-5 Unemployment Rates (%)

Entity	Average, 1971–1980	Average, 1981–1990	Average, 1991–2000	Current[a]
Alaska	8.8	9.4	7.5	5.7
United States	6.4	7.1	5.6	5.6

[a] Rates for August 2002.

Sources: Goldsmith (2000); Bureau of Labor Statistics (2002).

A significant and growing portion of personal income in Alaska has come from income transfers made by the state to individuals. These transfers are payments for retirement and disability benefits, income maintenance, unemployment benefits, and public assistance. The contribution of these payments has grown from less than 6% of personal income in 1970 to almost 18% in 1997. Annual growth in the contribution of these payments was particularly rapid during the 1980s.

Another growing portion of income for many Alaskan families (particularly large, low-income families) is the Alaska Permanent Fund Dividend, an annual per capita payment from a savings account established in 1976 (see text box). Dividends were first paid in 1982 and, adjusting for inflation, grew at an annual average rate of almost 11% over the period 1983–1990, and at a rate of 4.5% during the 1990s. The annual payment has become a growing portion of per capita personal income in the state during the 1990s, increasing from 4.2% of per capita income in 1990 to 6.2% in 1999 (Table 3.23-6).

3.23.3.5 State and Local Government Revenues and Expenditures

3.23.3.5.1 State Revenues. The fiscal health of Alaska is closely tied to the fortunes of the oil industry in the state, although that dependence is declining. Revenues for the state general fund are generated from various taxes collected from the oil industry, including a severance tax based on the value of oil produced; property taxes; income taxes; and royalties, bonuses, and lease payments based on the value of oil production on state land. The balance of general fund revenues comes from corporate income taxes, fees, and licenses. Currently no state income tax or sales tax is levied in Alaska.

General purpose expenditures by state government have tended to exceed revenues collected from the various sources available, meaning that the state has had to draw on cash surpluses accumulated from oil revenues in earlier years (TAPS Owners 2001a). As revenues from oil production fell with declining

Alaska Permanent Fund

The Alaska Permanent Fund was established in 1976 as a means of converting depletable North Slope oil resources into sustainable financial assets — assets that could be managed in such a way as to insulate Alaskans from fluctuations in natural resource production. A portion of annual royalties paid to the state from oil production on state land are put into the Permanent Fund, and then those revenues are invested in the stock market. While the fund principal is constitutionally protected from being spent, a portion of the earnings from the fund is used for the Permanent Fund Dividend, an annual per capita payment made to eligible state residents, with the balance of earnings reinvested in the Fund. Although it has not been necessary to date, earnings from the fund could also be used to offset annual shortfalls in the state budget.

TABLE 3.23-6 State Personal Income and Alaska Permanent Fund Dividend

Category	1970	1980	Growth Rate[a] (%), 1970–1980	1990	Growth Rate[a] (%), 1980–1990	1999	Growth Rate[a] (%), 1990–1999
Total (2000 $ million)	5,856	10,593	6.1	15,988	4.2	18,035	1.3
Per capita (2000 $)	19,250	26,133	3.1	28,906	1.0	29,111	0.1
Transfer payments (2000 $ million)	324	835	9.9	2,217	10.3	3,053	4.7
Transfer payments per capita (2000 $)	1,071	2,079	6.9	4,030	6.8	5,011	2.7
Transfer payments share of personal income (%)	5.6	8.0	3.6	13.9	5.8	17.9	3.6
Permanent Fund Dividend (2000 $)	NA[b]	1,549[c]	NA	1,212	10.9[d]	1,800	4.5
Permanent Fund Dividend share of per capita personal income (%)	NA	3.1[e]	NA	4.2	3.9	6.2	4.4

[a] Annual average rate.

[b] NA = not applicable.

[c] Dividend payments were first made in 1982 with an appropriation by the state legislature. Subsequent dividend payments have been based on Permanent Fund Dividend earnings.

[d] Growth rate for the years 1983–1990.

[e] 1983 data.

Sources: U.S. Department of Commerce (2001); Alaska Permanent Fund Corporation (2001); U.S. Department of Labor (2001).

production and lower world oil prices, the state established the Constitutional Budget Reserve Fund (CBRF) in 1991 to cover year-to-year deficits. The CBRF consists of settlements from oil and gas tax and royalty disputes.

Oil and gas revenues have fallen at an average annual rate of -2.9% over the period 1980–2000, reflecting the overall decline in oil production and TAPS throughput. Falling revenues have meant that the contribution of the oil and gas industry to state tax revenues has fallen from 82 to 34% over this period (Table 3.23-7). Nonetheless, petroleum revenues still remain a significant source of income for the state. Helping to offset the loss of oil and gas revenues to the state has been the contribution of earnings from the investment of oil revenues. These investment earnings have grown at an average of almost 15% each year since 1980 and have become more important than oil revenues to the state budget. Also offsetting the loss of oil revenues has been the growth in federal grants to Alaska, which increased at an annual average rate of 3.1% between 1980 and 2000, and nonoil revenues, which increased at an annual rate of 2.2% over the same period. Overall, the state budget grew at an annual rate of 1.4% between 1980 and 2000.

TABLE 3.23-7 State Government Revenues (millions of 2000 dollars)

Item	1980	1990	2000	Growth Rate[a] (%), 1980–2000
Oil revenues				
Severance taxes	894	1,274	703	-1.2
Property taxes	298	114	45	-9.0
Corporate income taxes	966	149	163	-8.5
Royalties (including bonuses, rents, and settlements)	1,592	767	732	-2.5
Constitutional Budget Reserve (CBR) revenues	NA[b]	NA	448	1.2[c]
Royalties to the Permanent Fund	608	340	307	-3.4
Total oil revenues	4,359	2,645	2,397	-2.9
Earnings from investment of oil revenues	156	1,062	2,477	14.8
Nonoil revenues (excluding federal grants)	263	275	409	2.2
Federal grants	667	793	1,217	3.1
Total state revenues	5,314	6,161	6,984	1.4
Oil and gas revenue share of total state revenues	82%	43%	34%	

[a] Annual average rate.

[b] NA = not applicable; CBR was established in 1991.

[c] Data for the period 1991-2000.

Sources: Goldsmith (2000); Alaska Department of Revenue (2001a).

3.23.3.5.2 Local Revenues. A significant portion of revenues generated locally comes from property taxes, and revenues from oil company property play a major role in property tax revenues in a small number of communities (see Section 3.23.4.4). In 1996, as an example, nearly 40% of property taxes in the state were levied on real assets owned by the petroleum sector (Table 3.23-8). In all Alaskan communities, the oil and gas industry plays an important part in the funding of local government services and programs through the role of state transfers to local communities, a large portion of which came from state oil revenues. In 1996, almost 35% of local government revenues came in the form of transfers from the state, primarily in the form of direct state funding of local education programs, and the federal government. Annual average growth in state transfers, especially in state funding of education, was fairly high between 1980 and 1996, but state funding of local programs fell in the 1990s. Federal funding has remained constant, and overall local revenues have grown slightly over the period at 1.8%.

TABLE 3.23-8 Local Government Revenues (millions of 2000 dollars except where noted)

Item	1980	1990	1996	Growth Rate[a] (%), 1980–1996
Property taxes	337	663	668	3.5
Petroleum	118	316	267	4.2
Nonpetroleum	219	347	401	3.1
Petroleum percentage of total	34.9	47.7	39.9	
Other taxes	83	122	167	3.6
State transfers	524	1,036	842	2.4
For education	395	812	805	3.6
Federal transfers	93	115	115	1.1
Charges and miscellaneous revenues	472	770	663	1.7
Total general revenues	1,509	2,802	2,447	2.4

[a] Annual average rate.

Sources: Goldsmith (2000); Alaska Department of Revenue (2001a).

3.23.3.5.3 State Expenditures. Including debt service, capital programs, and transfers, state expenditures grew at an average rate of 1.9% over the period 1980–2000, although overall expenditures fell in the 1990s. Expenditures per capita have fallen significantly since 1990 and are currently lower than they were in 1980, as population growth in the state has outpaced the ability of the state to fund expenditure programs. Nevertheless, state expenditures per capita still are currently the highest in the nation, primarily because the harsh climate, low population density, and the inaccessibility of many communities make the services provided by state agencies very costly. The largest component of state government expenditures is social services, which grew at an average rate of 11.0% between 1980 and 2000 and now constitutes 45% of overall state expenditures (Table 3.23-9). Expenditures in other areas, such as public safety, have grown fairly rapidly, while state funding of other areas, such as transportation and environment and housing, have fallen.

3.23.3.5.4 Local Expenditures. Local expenditures have shown moderate growth over the period 1980–2000 at 2.0%, reflecting the relatively slow growth in the state budget at 2.4% (Table 3.23-10). Expenditures since 1990 have not kept pace with population growth in the state, however, with per capita expenditures falling slightly from 1990 levels by 1996. Almost a third of local government expenditures in 1996 were for education programs.

3.23.3.6 Public Services

In 2000, more than 23,000 full-time employees were working for the state (Table 3.23-11). Almost half of state employees were in general government, and more than a third were employed in education. The current student/teacher ratio is 16.7 in Alaska schools compared with 16.0 for the United States as a whole (U.S. Department of Education 2002). Alaskan per capita education expenditures of

TABLE 3.23-9 State Government Expenditures (millions of 2000 dollars except where noted)

Item	1980	1990	2000	Growth Rate[a] (%), 1980–2000
General government	200	301	204	0.1
Education	648	664	877	1.5
Social services	293	1,096	2,363	11.0
Transportation	402	637	156	-4.6
Public safety	105	220	468	7.8
Environment and housing	243	309	170	-1.8
Capital outlay and debt service	667	1,139	585	-0.7
Subtotal	2,556	4,367	4,823	3.2
Transfers	660	1,247	417	-2.3
Total state expenditures	3,588	5,964	5,240	1.9
Expenditures per capita ($)	8,928	10,843	8,358	-0.3

[a] Annual average rate.

Sources: Goldsmith (2000); Alaska Department of Revenue (2001b).

TABLE 3.23-10 Local Government Expenditures (millions of 2000 dollars except where noted)

Item	1980	1990	1996	Growth Rate[a] (%), 1980–1996
Education	0	849	857	0.1[b]
Other expenditures	0	922	898	-0.3[b]
Capital outlay and debt service	600	682	618	0.2
Utility expenditures	203	322	NA[c]	2.3[d]
Total expenditures	1,816	2,786	2,682	2.0
Expenditures per capita ($)	4,518	5,065	4,433	-0.1

[a] Annual average rate.

[b] Rates for 1990–1996.

[c] NA = not applicable.

[d] Rate for 1980–1990.

Sources: Goldsmith (2000); Alaska Department of Revenue (2001b).

TABLE 3.23-11 State Public Service Employment Data, 2000

Category	Number of Employees
Public safety	397
Transportation	726
General government	11,341
Firefighters[a]	1,100
Teachers[b]	8,869
Judicial and legislative	976
Total	23,409

a Does not include volunteers.

b Includes elementary and secondary schools in both Regional Educational Attendance Areas (REAAs) and in cities and boroughs.

Source: Alaska Department of Revenue (2001b).

$2,554 in 1996 were appreciably higher than in any other U.S. state and far exceeded the national average of $1,504 (U.S. Department of Education 2002), reflecting the costs associated with maintaining educational services among often extremely widely geographically dispersed communities.

3.23.4 Alaska Regional Economic Issues

3.23.4.1 Population

In the pipeline corridor, annual average population growth has mirrored growth rates in the state as a whole (Table 3.23-12). Growth in the pipeline region has been most significant in the Fairbanks North Star Borough, in the North Slope Borough, and in Anchorage, particularly during the 1980s. The Valdez Cordova Census Area experienced moderate growth during the 1970s. During the 1990s, growth slowed in each part of the corridor region, with the Yukon-Koyukuk Census Area losing population during that period.

3.23.4.2 Employment and Unemployment

3.23.4.2.1 Employment by Industry. A large portion (47%) of employment in Alaska is concentrated in Anchorage, with 128,295 wage and salary employees in 1999 (Alaska Department of Labor and Workforce Development 2001). Elsewhere, in the pipeline corridor, employment is concentrated in the Fairbanks North Star Borough, with much smaller employment totals in the North Slope Borough and in the Valdez Cordova Census Area (Table 3.23-13).

Employment in the oil and gas sector is concentrated in Anchorage and in the North Slope Borough, with smaller numbers of employees in the Fairbanks North Star Borough. Employment in Anchorage and Fairbanks is dominated by trade, services, and public sector jobs (local, state and federal government), with a smaller number of jobs in the transportation and construction sectors. In the North Slope Borough, the oil and gas industry accounts for almost 40% of all direct employment. (Many employees in the oil and gas sector are not residents of the North Slope Borough; the vast majority of state and local government positions and a large number of construction jobs in the borough depend on oil revenues.) In the remainder of the corridor area, employment is concentrated in the Valdez Cordova Census Area, where state and local government, services, and, to a lesser extent, transportation employment at the Valdez Marine Terminal are the major activities.

3.23.4.2.2 Unemployment. A marked variation in unemployment rates exists in the pipeline corridor region. During the 1990s, unemployment was particularly high in the Yukon-Koyukuk Census Area, with relatively high rates also in the Southeast Fairbanks Census Area (Table 3.23-14). The current rates in each part of the region, with the exception of the North Slope Borough, are lower than average rates for the period 1991–2000.

TABLE 3.23-12 Pipeline Corridor Region Population

Entity	1970	1980	Growth Rate[a] (%), 1970–1980	1990	Growth Rate[a] (%), 1980–1990	2000	Growth Rate[a] (%), 1990–2000
Pipeline corridor region total	192,030	254,510	2.9	334,380	2.8	373,428	1.1
Anchorage	126,385	174,431	3.3	226,338	2.6	260,283	1.4
Fairbanks North Star Borough	45,864	53,983	1.6	77,720	3.7	82,840	0.6
North Slope Borough	3,451	4,199	2.0	5,979	3.6	7,385	2.1
Southeast Fairbanks Census Area	4,308	5,676	2.8	5,913	0.4	6,174	0.4
Valdez Cordova Census Area	4,977	8,348	5.3	9,952	1.8	10,195	0.2
Yukon-Koyukuk Census Area	7,045	7,873	1.1	8,478	0.7	6,551	-2.5

[a] Annual average rate.

Sources: U.S. Bureau of the Census (1994, 2001f).

It is likely that unemployment data underestimate the number of people who would like to work, particularly in more isolated Alaska Native communities, because the unemployment rate includes only persons registering for unemployment benefits. In many Alaskan communities, the number of employment opportunities is limited, meaning that some people may no longer be actively searching for employment.

3.23.4.3 Personal Income

Real personal incomes (adjusted for inflation) in the pipeline corridor are concentrated in Anchorage and in the Fairbanks North Star Borough, both of which have seen fairly rapid personal income growth, especially during the 1970s and 1980s (Table 3.23-15). Real per capita incomes in Anchorage grew moderately during the 1980s and have only grown relatively slowly during the 1990s. In the Fairbanks-North Star Borough real per capita incomes fell during the 1980s and only grew slowly during the 1990s.

Elsewhere in the pipeline corridor region, total personal incomes grew at a moderate pace during the 1980s. Growth continued during the 1990s in the North Slope Borough and in Southeast Fairbanks, but declined in Valdez Cordova and Yukon-Koyukuk. With the exception of the Southeast Fairbanks Census Area and Valdez Cordova during the 1980s, per capita incomes have stagnated, or fallen, as has been the case in the North Slope Borough, particularly during the 1980s.

Total incomes in the Yukon-Koyukuk and Southeast Fairbanks Census Areas are the lowest in the pipeline corridor region. Data for

TABLE 3.23-13 Pipeline Corridor Region Employment[a] by Industry, 1999

Industry	Anchorage	Fairbanks North Star	North Slope	Southeast Fairbanks	Valdez-Cordova	Yukon-Koyukuk
Total	128,295	32,538	7,439	1,660	4,632	1,998
Oil and Gas	3,392	428	2,922	0	0	0
Mining	123	393	0	0	0	26
Agriculture	681	116	0	0	5	2
Seafood	0	0	0	0	81	0
Forest Products	10	0	0	0	1	0
Construction	7,081	1,757	624	44	156	79
Manufacturing	2,160	604	8	23	518	15
Transportation	7,427	1,769	178	94	648	44
Air Transportation (incl. Air Cargo)	5,872	913	119	33	48	26
Public Utilities	1,006	388	108	105	177	26
Trade	30,873	6,586	474	351	599	188
Finance	6,829	1,085	172	16	182	44
Services	35,427	8,094	846	319	1,048	368
Federal Government	9,850	3,277	24	309	125	95
State and Local Government	17,432	7,086	1,966	358	1,027	1,084

[a] Nonagricultural wage and salary employment, excluding proprietors and active duty military employment.

Source: Alaska Department of Labor and Workforce Development (2001).

these areas most closely reflect trends in personal incomes in Alaska Native villages, with a large number of small Alaska Native communities in both areas. In 1999, per capita incomes in Yukon-Koyukuk were only 57% of those in Anchorage, and in Southeast Fairbanks were only 67% of those in Anchorage.

The Permanent Fund Dividend makes a larger contribution to personal incomes in the Fairbanks-North Star Borough and in the Southeast Fairbanks and Yukon-Koyukuk Census Areas than it does in the state as a whole. Almost 7% of per capita income in the pipeline corridor region as a whole comes from the annual payment.

3.23.4.4 Local Government Revenues and Expenditures

3.23.4.4.1 Revenues. Five local jurisdictions in the pipeline corridor collect local taxes, primarily in the form of property taxes and sales taxes. These jurisdictions are Anchorage,

TABLE 3.23-14 Pipeline Corridor Region Unemployment Rates[a]

Area	Average Rate (%), 1991–2000	Current Rate[b] (%)
Anchorage	5.5	4.4
Fairbanks North Star	7.7	4.7
North Slope	5.4	12.5
Southeast Fairbanks	12.3	8.3
Valdez Cordova	9.8	6.6
Yukon-Koyukuk	16.0	13.7

[a] Rates include only those individuals registering for unemployment benefits. In some communities in each area, unemployment rates may be higher than the average for the area or borough as a whole.

[b] Rates for August 2002.

Source: Bureau of Labor Statistics (2002).

North Slope Borough, City of Valdez, Fairbanks North Star Borough, and Fairbanks.

With only a small number of communities and little local manufacturing not related to natural resource production, the North Slope Borough and the City of Valdez rely heavily on the oil and gas industry as a source of local revenues, primarily through property taxes. In the North Slope Borough, 98% of property tax revenues, and 66% of all local revenues, come from the oil and gas sector (Table 3.23-16). In the City of Valdez, 78% of property taxes, and 63% of total revenues, come from oil and gas. Both areas are relatively independent of federal and state transfers, with 76% of expenditures in the North Slope Borough and 75% in the City of Valdez coming from local sources. Both jurisdictions also have a Permanent Fund for oil revenues, providing an additional source of locally generated funds (TAPS Owners 2001a).

In contrast, Fairbanks and Fairbanks North Star Borough, with comparatively little oil and gas property to tax, receive only 30 and 40% of their revenue from local sources respectively, with the remainder coming from state assistance. State assistance is mainly in the form of transfers, revenue sharing of locally generated taxes, assistance for specific programs (such as primary and secondary education), and general aid (TAPS Owners 2001a). In Anchorage, relatively little revenue comes directly from oil and gas, meaning that state assistance constitutes a significant share of total revenues.

3.23.4.4.2 Expenditures. The character of expenditures by the five local jurisdictions in the pipeline corridor region collecting taxes varies considerably. Excluding debt service and capital projects, 91% of expenditures in Fairbanks North Star are on education and social services, with 76% of the budget spent on education alone (Table 3.23-17). In the North Slope Borough, expenditures on general government are a more significant component of total expenditures, with education and social services together constituting 71% of the budget (with education making up 26% of expenditures). A major variation exists between total per capita expenditures in the North Slope Borough and elsewhere in the pipeline corridor region. Excluding capital expenditures, more than $25,000 is spent per person by local government in the North Slope Borough, compared with $2,700 in Anchorage, $2,539 in Fairbanks North Star, $2,325 in Valdez, and $873 in Fairbanks.

3.23.4.5 Education

The level of education provision in the four pipeline corridor areas generally reflects the level of overall expenditure per capita in each area. The student/teacher ratio in the North Slope Borough is relatively low at 10.2, compared with slightly higher ratios for Fairbanks, Fairbanks North Star, Valdez, and Anchorage (Table 3.23-18).

3.23.5 Village Economies

Personal incomes in Alaska Native villages are lower than those in the state as a whole, and unemployment, especially in smaller villages, is high, particularly during the winter when there is little alternative market-based activity. Because of the key role of subsistence in many village economies, economic data that are collected for

TABLE 3.23-15 Pipeline Corridor Region Personal Income

Entity	1970	1980	Growth Rate (%) 1970–1980	1990	Growth Rate[a] (%), 1980–1990	1999	Growth Rate[a] (%), 1990–1999
Pipeline Corridor Total							
Total (2000 $ million)	3,727	7.031	6.6	10,340	3.9	11,858	1.5
Per capita (2000 $)	20,678	25,214	2.0	26,643	0.6	26,927	0.1
Permanent Fund Dividend share of per capita personal income (%)	–[b]	5.6[c]	–	4.6	-2.5	6.7	4.4
Anchorage							
Total (2000 $ million)	2,856	5,012	5.8	7,597	4.2	8,864	1.7
Per capita (2000 $)	22,404	28,510	2.4	33,380	1.6	34,383	0.3
Permanent Fund Dividend share of per capita personal income (%)	–	4.8[c]	–	3.6	-3.5	5.2	4.1
Fairbanks North Star Borough							
Total (2000 $ million)	870	1,398	4.9	1,971	3.5	2,237	1.4
Per capita (2000 $)	18,952	25,627	3.1	25,231	-0.2	26,521	0.6
Permanent Fund Dividend share of per capita personal income (%)	–	5.4[c]	–	4.8	-1.4	6.8	3.9
North Slope Borough							
Total (2000 $ million)	0	145	–	186	2.5	209	1.3
Per capita (2000 $)	0	34,186	–	30,689	-1.1	29,514	-0.4
Permanent Fund Dividend share of per capita personal income (%)	–	4.0[c]	–	4.0	0.0	6.1	4.9
Southeast Fairbanks Census Area							
Total (2000 $ million)	0	97	–	126	2.6	134	0.7
Per capita (2000 $)	0	16,890	–	21,822	2.6	23,010	0.6
Permanent Fund Dividend share of per capita personal income (%)	–	8.3[c]	–	5.6	-4.9	7.8	3.9
Valdez Cordova Census Area							
Total (2000 $ million)	0	231	–	305	2.8	294	-0.4
Per capita (2000 $)	0	27,192	–	30,390	1.1	28,686	-0.6
Permanent Fund Dividend share of per capita personal income (%)	–	5.5[c]	–	4.0	-4.0	6.3	5.2

TABLE 3.23-15 (Cont.)

Entity	1970	1980	Growth Rate (%) 1970–1980	1990	Growth Rate[a] (%), 1980–1990	1999	Growth Rate[a] (%), 1990–1999
Yukon-Koyukuk Census Area							
Total (2000 $ million)	0	148	–	155	0.5	120	-2.8
Per capita (2000 $)	0	18,878	–	18,348	-0.3	19,448	0.6
Permanent Fund Dividend share of per capita personal income (%)	NA[c]	7.9[d]	NA	6.6	-2.1	9.3	3.8

[a] Annual average rate.

[b] – = data not recorded for 1970, so growth rate cannot be determined.

[c] NA = not applicable; Permanent Fund was created after 1970.

[d] 1982 data.

Sources: U.S. Department of Commerce (2001); Alaska Permanent Fund Corporation (2001).

TABLE 3.23-16 Pipeline Corridor Region Local Government Tax Revenues, 2000 (millions of dollars except where noted)

Item	Anchorage	Fairbanks	Fairbanks North Star	North Slope	City of Valdez
Property tax	290.1	11.2	63.3	201.2	18.8
Oil and gas share[a] (%)	1	30	8	98	78
Other revenues	222.7	4.0	18.5	52.2	7.9
Total local revenues	512.8	15.2	81.8	253.4	26.7
Oil and gas share[a] (%)	0	25	7	66	63
Federal, state, and other revenues	314.7	2.2	123.5	41.7	7.9
Total operating revenues	827.5	17.4	205.3	331.3	34.6
Capital projects	11.4	9.0	7.4	36.2	1.0
Total revenues	838.9	26.4	212.7	331.3	35.6
Local share (%)	61	58	38	76	75

[a] Based on 1998 data.

Sources: ADCED (2001a); TAPS Owners (2001a).

TABLE 3.23-17 Pipeline Corridor Region Local Government Expenditures, 2000 (millions of dollars except where noted)

Item[a]	Anchorage	Fairbanks	Fairbanks North Star	North Slope	City of Valdez
General government	33.3	2.8	11.0	38.0	1.8
Public safety	97.3	9.9	4.1	15.8	2.2
Public services	212.6	9.3	26.6	81.2	10.1
Education	359.5	0	129.0	47.6	9.6
Debt service	73.0	0.6	14.3	147.0	1.9
Total operating expenditures	775.7	22.6	185.0	329.6	25.6
Capital projects	161.7	3.8	25.3	141.0	9.0
Total expenditures	937.4	26.4	210.3	470.6	34.6
Expenditures per capita ($)	3,601	873	2,539	63,724	3,394

[a] Depreciation and internal service funds, such as trust accounts, are not included.

Source: ADCED (2001a).

TABLE 3.23-18 Pipeline Corridor Region Local Education Data, 1999

Item	Anchorage	Fairbanks	Fairbanks North Star	North Slope	City of Valdez
Teachers (number)	2,723	932	932	182	55
Student/teacher ratio	17.6	17.1	17.1	10.2	14.7
Percent Alaska Native (%)	12.6	13.4	13.4	81.3	15.7

Source: ADCED (2001a).

these communities may not fully represent their economic well being. For example, many transactions between individuals involving the exchange of subsistence products that would otherwise provide income if they took place in the marketplace are not reflected in personal income statistics. Similarly, unemployment data may not reflect the extent to which additional economic activity may be required if subsistence activities provide a sufficient alternative to participation in the marketplace. In addition, the large differences in prices between urban and rural Alaska may exaggerate the corresponding differences in economic well being, depending on the extent to which local community members in rural areas have to participate in the local market economy for key consumer items, such as food, clothing and energy, and the extent to which these items can be obtained through participation in subsistence activities. Because of these considerations, the analysis did not estimate the impacts of renewal and nonrenewal for areas and villages below the level of the census area or borough.

3.23.6 Subsistence

Subsistence fishing and hunting are an important part of the economies of rural Alaskan communities, providing food, clothing, and employment. While the subsistence harvest of wild food (fish, terrestrial and marine mammals, birds, shellfish) only represents 2% of the fish and game harvested annually in Alaska (commercial fishing represents 97% and sport fishing and hunting 1%), that harvest contains about 35% of the caloric requirements of the rural population (ADF&G 2000a). In some areas of Alaska, notably the interior and western areas, subsistence products provide more than 50% of the daily requirement. Approximately 2% of the daily requirement of the urban population is met through subsistence activities.

Although it is difficult to establish the relative economic importance of subsistence harvests because the consumption and exchange of subsistence products do not occur in the marketplace, estimates of their importance have been made on the basis of the dollar value of replacing subsistence products in the market. Using a replacement value of $3 per pound, the replacement value of subsistence harvests in rural Alaska has been estimated by the ADF&G (2000a) to be $131 million annually; at $5 per pound the replacement value of these products would be $219 million. In Alaska as a whole, the replacement value of subsistence products is estimated to be between $160 million and $267 million (ADF&G 2000a).

3.23.7 Alaska Native Corporations

A substantial portion of Alaskan land is owned by Alaska Native corporations, set up under the 1971 Alaska Native Claims Settlement Act (ANCSA) (see Section 3.25). Under ANCSA, Alaska Natives were given $462.5.million and 2% of the value of federal and state leasable mineral revenues (Ervin 1976). Regional and village corporations have been organized, with 13 regional corporations administering per capita cash payments from the settlement and subsurface land rights, and 168 village/urban corporations receiving surface rights. These corporations undertake a variety of economic development activities, in particular the development and sale of natural resources (including mining, forestry, timber and fisheries) and tourism. Investments in real estate and private companies also provide benefits to corporation members. A significant number of Alaska Natives are shareholders in at least one of these corporations. A number of corporations provide contracting services to the TAPS. Over the period 1996–2001, for example, out of total TAPS contracting expenditures of $1.9 billion, $0.759 billion (39%) was awarded to Alaska Native corporations (TAPS Owners 2002b).

In addition to their economic role, Alaska Native corporations also play important cultural and social roles in the daily lives of Alaska Natives, providing shareholders with homesites and benefits for elders, promoting traditional tribal culture, and managing cultural resources.

3.24 Subsistence

3.24.1 Introduction

In Alaska, the term subsistence refers to "the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption" (Federal Subsistence Board 1999). Subsistence activities can involve hunting, fishing, trapping, and collecting. Uses of resources acquired through subsistence include food, clothing, transportation, construction, art, crafts, exchange, and customary trade.

> **Subsistence**
>
> *Subsistence* is the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption (Federal Subsistence Board 1999).
>
> Subsistence resources are used for food, clothing, transportation, construction, art, crafts, exchange, and customary trade. The roles of subsistence include the following:
>
> - Economic: Provides necessary resources.
> - Sociocultural: Important component of Alaska Native and rural non-Native sociocultural systems.
> - Ceremonial: Subsistence and subsistence resources often play an important role in Alaska Native ceremonial activities.
>
> Although the State of Alaska does not limit subsistence to rural residents, the federal government does; this document uses the rural criterion.

Subsistence is extremely important in many rural Alaskan communities because of three key roles that it plays. One is economic — that is, it provides a means of obtaining important resources particularly food. Resources acquired through subsistence activities are used to meet a range of demands that are both central for survival and, in many parts of Alaska, either difficult to obtain by other means or quite costly in monetary terms (MMS 1988; Wolfe and Bosworth 1994; Wolfe and Walker 1987). Coupled with the high cost of many commodities in rural Alaska is a general tendency for high unemployment, increasing the importance of subsistence as an economic activity.

Although the economic role of subsistence in many rural localities is undeniably important, one must remember that in Alaska it is not the sole function of this activity. Moreover, rural communities rely on both subsistence production as well as goods and services obtained through the monetized, national economy. The term "mixed, subsistence-based economy" is often used to describe the economic systems of these localities.

A second role of subsistence is sociocultural. The sociocultural function of subsistence is particularly important to Alaska Native groups, for whom subsistence provides a crucial link between modern sociocultural systems and their roots, and for whom the acquisition and exchange of subsistence resources helps knit together cohesive societal units (Berger 1985; Worl 1982; see also Beetus and Beetus 1992; Brower and Opie 1997; Schmitz 1992; Solomon 1986). The act of harvesting subsistence resources in many cases requires cooperation by several individuals, particularly during times of resource abundance, such as salmon runs and caribou migrations. The shared labor of producing and processing subsistence foods creates and maintains enduring bonds within kin groups, between men and women, and between elders, adults, and younger people.

In many communities, a small number of families (or households) in a village ultimately harvest the vast majority of subsistence resources (Magdanz and Utermohle 1998). A survey of selected communities in the mid-1980s showed that about 30% of households generated about 70% of the total community subsistence production (Wolfe 1987). These resources are distributed widely to other households throughout a community, establishing or further defining the relations of mutual aid and obligation among components of a society, as well as providing increased security in a very challenging natural setting (ADF&G 1990).

A third role of subsistence is ceremonial. Once again, this function is particularly important in Alaska Native groups, for whom subsistence activities and resources incorporate a set of religious and spiritual beliefs about proper relations between humans and the spirits of the natural world. Subsistence foods are often central components of important indigenous ceremonial events. Examples of such ceremonies include the messenger feasts of the Nunamiut and potlatches of the various Athabascan groups. The first, firmly rooted in tradition, serves to establish relationships between Nunamiut communities through sharing food at large ceremonies (Spencer 1984). Potlatches are multiday feasts to commemorate an important day (including Christmas), as well as the memory of a recently deceased member of a community (see Clark 1981; Simeone 1995). In such ceremonial events subsistence resources play a central role, representing at once the generosity of the spirits of the natural world, and the spiritual maturity of the hunter who has found favor with these spirits and who expresses appreciation for these gifts by sharing freely with others.

This section contains the main discussion of the subsistence affected environment in this EIS. However, other portions of the document also contain information relevant to this topic. A more detailed presentation and discussion of subsistence data appears in Appendix D. Certain sociocultural and ceremonial aspects of subsistence also are discussed in Section 3.25, primarily providing evidence for the continuing ties of modern subsistence activities to traditional sociocultural systems. Human health issues associated with the consumption of foods harvested through subsistence activities are discussed in Section 3.17, and environmental justice issues associated with subsistence are examined in Section 3.29.

Subsistence in Alaska is a complex topic. Some of this complexity is due to factors related to the act of subsistence itself, including (1) the large array of subsistence resource types available and the intricate cycle of seasonal availability in discrete portions of the traditional use area, (2) the flow of subsistence resources through (primarily) Native sociocultural systems via several exchange mechanisms, (3) the mixture of modern technology and traditional ecological knowledge enabling highly efficient subsistence harvests, (4) the wide range of uses for subsistence resources, and (5) the tendency for different cultural groups to use different resources in different parts of the state. Much of the complexity associated with subsistence, however, also stems from the current laws surrounding subsistence, particularly the legal division between subsistence on federal lands and subsistence on state lands. Alaska became a state in 1959, adopting a constitution that reserved fish and wildlife resources for “common use” by Alaskans. The first Fish and Game Code following statehood recognized subsistence fishing, although this was not limited to rural residents, and there was no statutory definition of subsistence hunting (Kelso 1987). In 1978, Alaska lawmakers enacted legislation that recognized and protected subsistence uses of both fish and game, in part to comply with anticipated federal legislation. As implemented in regulations adopted by the Alaska Joint Boards of Fisheries and Game, the state statute required that individuals engaged in subsistence activities be rural residents, and it gave subsistence uses of any resource priority over other uses (AS 16.05.940).

In 1980, Congress passed the Alaska National Interest Lands Conservation Act (ANILCA), in which Title VIII established a rural definition of subsistence, a priority for subsistence over other uses, and a requirement for local participation in subsistence management decisions through advisory bodies. The state subsistence program was determined to meet the requirements of the federal statute, and so the state was authorized to implement a unified subsistence management program on federal as well as state and private lands.

However, in December 1989, the Alaska Supreme Court ruled that the rural residency provision of the subsistence law violated the state’s constitution, removing the ability of state agencies to enforce a rural preference. Federal law (Title VIII of ANILCA, 16 USC §3111 et seq.) provided for direct implementation of the federal statutes on federal public lands in the event that the state could no longer comply with the federal standards. Thus, subsistence in Alaska has been defined in several different ways over the past 25 years, and it currently is treated differently on state and federal public lands (and certain navigable waters). In an attempt to avoid some of this confusion, this FEIS uses the current federal definition of subsistence and its central requirement of rural residency, although some urban residents also benefit from harvesting wild resources for uses consistent with subsistence.

Subsistence involves a large number of people, with more than 123,000 persons eligible in 1999 on the basis of rural residency (Wolfe 2000). Harvest patterns and amounts vary considerably by location and resource availability, although for the entire state, the most important subsistence food by weight is fish (about 60%), followed by land mammals (20%), marine mammals (14%), birds (2%), shellfish (2%), and plants (2%). Commercial fishing far outstrips subsistence and recreational harvests, accounting for about 97% of the total fish and game harvest during the 1990s by weight, compared with 2% taken for subsistence by rural residents and 1% taken through recreational hunting and fishing (Wolfe 2000; see also ADF&G 2001a). This figure aggregates all fish and wildlife harvests, which are dominated by the large commercial fisheries. A similar figure on wildlife alone would show that a far higher percentage of wildlife, particularly moose and caribou, is taken for subsistence purposes. Harvest ticket data for moose taken from 1983 through 2000 indicate that rural residents harvested 39%, while urban residents took 58% (residency for the remaining 3% was unknown) (Office of Subsistence Management 2002).

Subsistence harvest techniques frequently involve a combination of traditional techniques, traditional ecological knowledge, and modern technology. For example, people often will arrange their activities to exploit a particular resource at a particular place and time, as they have done for generations, although harvesting may involve modern firearms and mechanized transportation. Subsistence harvests tend to be part of a "mixed, subsistence-based economy" that also involves varying amounts of wage labor — with the subsistence resources, combined with cash, providing the means of survival.

3.24.2 Community Harvest Patterns

The examination of subsistence in this EIS focuses on the topic from primarily a community perspective, organized within four broad geographical zones. These geographic zones share a common ecology, and some common patterns result for communities within each zone. The decision to examine subsistence at the level of individual communities was based in part on data availability. The ADF&G, which collects the most detailed information on subsistence, compiles and presents this information at the level of individual communities (Fall 1990). However, focusing on particular

The Evolution of Subsistence Regulation in Alaska

Prior to 1978, there was no statutory distinction between subsistence and other fish and game harvests did not exist. Local managers exercised some discretion to recognize local needs and traditions. In 1978, legislation and regulations enacted by the State of Alaska (AS 16.05.940) identified subsistence as an activity undertaken by *rural* residents, with subsistence given priority over commercial and sport harvests. In 1980, the Alaska National Interest Lands Conservation Act similarly identified subsistence as an activity undertaken by *rural* residents, with priority over other harvests. However, in December 1989, the Supreme Court of the State of Alaska ruled that the rural preference violates the state constitution, prohibiting the state from using rural residency for subsistence eligibility. Therefore, from December 1989 until the present, the State of Alaska regulations apply to state and private lands, and federal regulations (maintaining the rural eligibility requirement and subsistence priority) apply to federal lands.

places also has an important analytical correlate: a community-specific examination makes it possible to focus this subsistence analysis on a geographic region that is proximal to the TAPS and, thus, potentially affected by it. Moreover, because subsistence resources and harvest patterns can vary dramatically between different locations in rural Alaska, a community-specific perspective emerges as the most useful when examining the complex issues surrounding subsistence. The communities of interest include the homes of the 21 federally recognized tribes identified by the BLM as those that would be potentially directly affected by renewing the TAPS ROW (see BLM 2001a). This EIS also examines subsistence in five other rural communities in proximity to the TAPS — a subset of the 23 largely non-Native communities defined elsewhere in the FEIS (see Section 3.29) for which subsistence data exist. Eleven of the 23 communities defined by geographic proximity to the TAPS (College, Ester, Fairbanks, Fox, Harding Lake, Moose Creek, North Pole, Pleasant Valley, Salcha, Two Rivers, and Valdez) would have been excluded from this analysis anyway because of their location in nonrural portions of Alaska as defined by the Federal Subsistence Board (Office of Subsistence Management 2001). The remaining seven (Big Delta, Coldfoot, Copperville, Deadhorse, Delta Junction, Livengood, and Prudhoe Bay) never have been the subject of systematic subsistence studies. In all, then, the evaluation of potential impacts on subsistence in this document considers all communities of interest that are eligible for subsistence because of rural locations for which reliable subsistence data exist (i.e., the 26 communities that are discussed in this section).

Brief descriptions of community harvest patterns and any subsistence concerns that residents or researchers have identified are provided in the following subsections. Apart from the incomplete coverage of all rural communities, the information examined is, in many cases, several years old and likely suffers from inaccuracies such as underreporting. Moreover, subsistence is by its very nature a collection of flexible and strategic behaviors that vary both seasonally and between years in response to fluctuations in resource availability. Such variability over time requires caution when examining quantitative characterizations of subsistence activities and particularly in relying on harvest patterns for a *representative year* (identified for many communities by researchers at ADF&G). Similarly, maps of geographic patterns or traditional use areas are typically based on the past 10 to 20 years and provide a relatively accurate depiction of contemporary harvest patterns. However, these use areas are not fixed and could see adjustments as people respond to the inherent variability in the timing, location, and abundance of subsistence resources (see Nelson 1992). Information from interviews and testimonies on subsistence concerns (a form of traditional ecological knowledge) is offered both to help fill gaps in more conventional data and because subsistence practitioners tend to develop intimate understandings of the resources they pursue.

The data presented in this EIS are drawn from historic ethnographies, over two dozen intensive community studies conducted primarily by the ADF&G Division of Subsistence, and on-going data series from subsistence fishing harvest calendars and permits, sport fishing surveys, and wildlife harvest tickets. This is the best available data on subsistence at the community level and provides reliable documentation of the array of important subsistence resources, the levels of participation in various types of subsistence harvest, harvest levels, and traditional use areas. These data typically describe a baseline pattern in the mid- to late 1980s, with a limited number of cases in which update studies were conducted during the 1990s. Although some trend information is available from permit and ticket data, these data are limited. As a result, one must be cautious in using them to extrapolate and predict patterns for the early 21st century. Additional information on these communities appears elsewhere in this EIS. Sociocultural characteristics of the main communities of the 21 directly affected federally recognized tribes and 23 other communities in proximity of the TAPS are addressed in Section 3.25 (see Tables 3.25-1 and 3.25-3), and selected demographic characteristics for all 44 settlements are addressed in Section 3.29 (see Table 3.29-1). Subsistence and community harvest patterns are discussed in greater detail in Appendix D, while subsistence impacts under

ANILCA Section 810 are discussed in Appendix E.

The EIS arranges the following brief overviews of community subsistence patterns in four geographic groupings of communities: North Slope, Yukon River Drainage, Copper River Basin, and Prince William Sound and Lower Cook Inlet. This approach groups communities with similar ecological, sociocultural, and (hence) subsistence characteristics in an attempt to provide an improved understanding of subsistence in the vicinity of the TAPS.

3.24.2.1 North Slope

In this document, the term “North Slope” refers to that portion of north-central Alaska north of the Brooks Range. Alaska Natives in this region comprise two Iñupiat sociocultural systems, the Nunamiut and the Tareumiut (see Section 3.25). The Tareumiut live along the north coast of Alaska. Although they use terrestrial resources, it is their use of marine resources — notably whales — that one often associates with Tareumiut subsistence. The Nunamiut live inland from the coast in the Brooks Range. Subsistence harvests in this region are generally among the highest in the state (ADF&G 2000a), with Nuiqsut residents taking more than 740 lb per person in 1993 (Table 3.25-1). Nunamiut adaptation relied heavily on caribou for subsistence, supplemented by a number of other (primarily) terrestrial resources, and trade for sea mammal products with the coastal Tareumiut.

Subsistence harvests for North Slope coastal communities involve relatively equal reliance on large land mammals (mainly caribou), marine mammals, and fish, as displayed in Figure 3.24-1 for an example community. These resources are harvested at different times of the year, in some cases requiring temporary relocation or aggregation of residents from a particular community (Figure 3.24-2).

This EIS discusses one village representative of both of the above sociocultural (and subsistence) systems: Anaktuvuk Pass, a Nunamiut settlement, and Nuiqsut, a (largely) Tareumiut village. In addition to the brief descriptions of subsistence in both of those communities presented in the following paragraphs, further details are provided in Appendix D.

3.24.2.1.1 Anaktuvuk Pass. Located in the central Brooks Range approximately 49 mi west of the TAPS, the community of Anaktuvuk Pass is the last remaining settlement of the Nunamiut (Interior North Alaska Eskimo) (see Map 3.24-1) (Alaska Department of Community and Economic Development [ADCED] 2001b). As discussed in greater detail in Section 3.25.1.1.6, Anaktuvuk Pass was resettled in the late 1940s following abandonment earlier in the century. By 2000, its population had risen to 282, the majority Native (mostly Nunamiut – see Tables 3.25-1 and 3.29-1). In part because of geographic isolation and economic pressures, and in part because of cultural reasons, subsistence remains important in this community. Seasonal wage employment (e.g., trapping, handicraft production) plays a role in the mixed economy of Anaktuvuk Pass, supplementing the resources acquired through subsistence activities (including those received in sharing and trade) (see North Slope Borough 1999).

Subsistence hunting and fishing involves a large number of species throughout the year (Spearman et al. 1979) However, caribou are traditionally the dominant resource and the only resource reported in the ADF&G survey data (Table 3.24-1). Hunting other land mammals, large and small, and fishing help supplement caribou hunting (ADCED 2001b). Data from 1993 (the representative year) indicate that 43% of the households in Anaktuvuk Pass hunted caribou for subsistence (Table 3.24-2), and that caribou alone provides more than 200 lb of food per capita. If quantitative data were available for other species, higher rates of participation and harvest levels would result — consistent with the wider range of resources documented by research on subsistence with a broader focus conducted in Anaktuvuk Pass during the 1970s (Spearman et al. 1979). Subsistence harvest surveys for 3 years in the early 1990s indicate fluctuating caribou harvests, ranging from fewer than 220 lb per capita to nearly 250 lb (Figure 3.24-3).

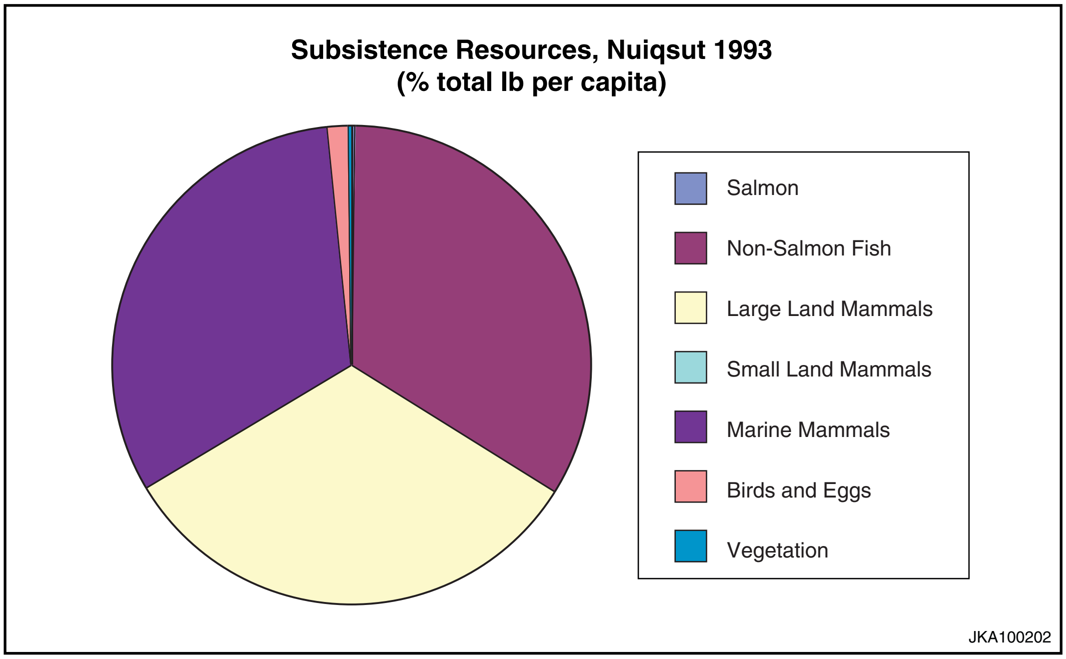

FIGURE 3.24-1 Example Combination of Subsistence Resources on the North Slope (Nuiqsut) (Source: ADF&G 2001b)

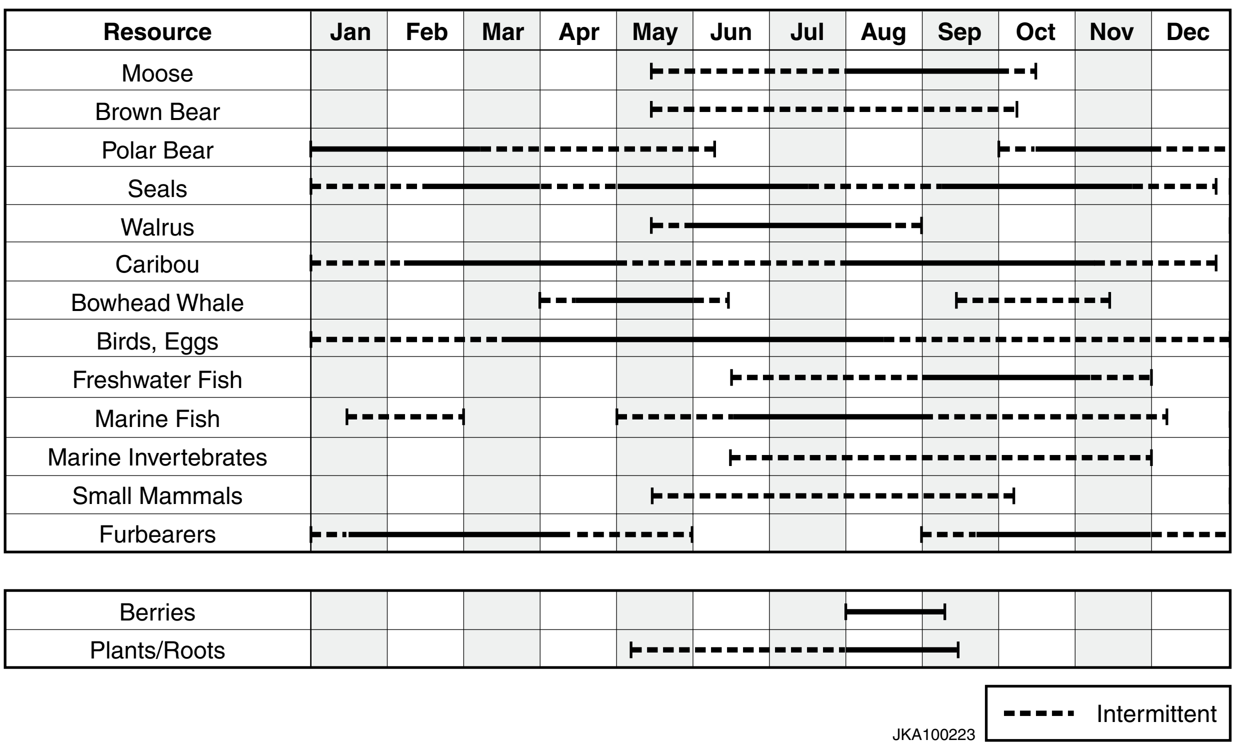

FIGURE 3.24-2 Example of the Seasonality of the Subsistence Harvest on the North Slope (Barrow) (Source: Wolfe et al. 1986)

TABLE 3.24-1 Subsistence Resource Pounds Harvested per Capita in Directly Affected and Other Selected Rural Communities, Selected Recorded Year

TABLE 3.24-1 Subsistence Resource Pounds Harvested per Capita in Directly Affected and Other Selected Rural Communities, Selected Recorded Year[a]

Subsistence Resource	Alatna[b]	Allakaket[c]	Anaktuvuk Pass	Chenega Bay	Chitina	Copper Center	Cordova	Evansville	Gakona	Glennallen	Gulkana	Hughes	Kenny Lake	Manley Hot Spgs	Minto	Nanwalek	Nuiqsut	Paxson	Port Graham	Rampart	Stevens Village[b]	Tanana	Tatitlek	Tazlina	Tonsina
Reference year	'98	'82	'93	'93	'82	'87	'97	'82	'87	'87	'87	'82	'87	ND[d]	'84	'97	'93	'87	'97	'93	'84	'87	'97	'87	'87
All Resources	153	906	219	275	191	174	179	260	95	99	153	1,492	136	ND	1,015	254	742	289	253	ND	1,139[e]	2,157[f]	406	107	156
Marine mammal	-[g]	-	-	35	-	-	4	-	-	-	-	-	-	-	-	24	236	-	9	-	-	-	165	-	-
Polar bear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
Porpoise	-	-	-	0	-	-	0	-	-	-	-	-	-	-	-	0	-	-	0	-	-	-	4	-	-
Seal	-	-	-	25	-	-	0	-	-	-	-	-	-	-	-	18	23	-	9	-	-	-	116	-	-
Sea otter	-	-	-	0	-	-	4	-	-	-	-	-	-	-	-	0	-	-	0	-	-	-	0	-	-
Steller sea lion	-	-	-	10	-	-	0	-	-	-	-	-	-	-	-	6	-	-	0	-	-	-	46	-	-
Walrus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
Whale	-	-	-	0	-	-	0	-	-	-	-	-	-	-	-	0	213	-	0	-	-	-	0	-	-
Large land mammal	153	118	-	18	43	58	52	134	48	43	45	212	47	-	90	12	242	139	1	-	73	141	46	42	74
Bison	-	-	-	-	0	0	0	-	0	0	0	-	0	-	-	-	-	14	-	-	-	-	-	3	0
Black bear	-	9	-	1	0	0	1	6	0	0	1	11	5	-	15	4	-	0	1	-	19	11	0	1	3
Brown bear	-	-	-	0	0	0	1	3	0	0	0	0	0	-	-	0	2	0	0	-	0	3	0	1	0
Caribou	53	5	219	2	6	26	1	28	22	18	15	0	17	-	-	0	228	33	0	-	-	11	0	15	33
Dall sheep	-	2	-	0	0	2	0	3	3	1	0	0	0	-	-	0	0	8	0	-	-	-	0	0	2
Deer	-	-	-	15	0	0	25	-	0	0	0	-	2	-	-	0	-	0	0	-	-	-	41	0	0
Elk	-	-	-	0	-	-	2	-	-	-	-	-	-	-	-	0	-	-	0	-	-	-	0	-	-
Goat	-	-	-	0	0	1	1	-	0	0	0	-	0	-	-	0	-	0	0	-	-	-	5	0	0
Moose	100	102	-	0	37	28	21	96	22	23	30	201	23	-	76	8	12	84	0	-	54	116	0	23	37
Muskox	-	-	-	-	-	0	-	-	0	0	0	-	0	-	-	-	0	0	-	-	-	-	-	0	0
Small land mammal	-	24	-	0	9	1	2	9	1	1	8	16	1	-	31	0	0	25	0	-	21	39	0	2	1
Beaver	-	0	-	0	0	0	0	2	0	0	2	11	0	-	22	0	-	22	0	-	2	33	0	0	0
Coyote	-	-	-	0	0	0	0	0	0	0	0	-	0	-	-	0	-	0	0	-	-	-	0	0	0
Fox	-	15	-	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0
Hare	-	9	-	0	7	0	2	7	1	1	2	6	1	-	6	0	-	1	0	-	5	5	0	1	1
Land otter	-	-	-	0	0	0	0	0	0	0	0	0	0	-	0	0	-	0	0	-	0	0	0	0	0
Lynx	-	-	-	0	2	0	0	0	0	0	0	0	0	-	0	0	-	0	0	-	3	0	0	0	0
Marmot	-	-	-	-	0	0	0	-	0	0	0	-	0	-	-	0	0	0	0	-	-	-	0	0	0
Marten	-	-	-	0	0	0	0	0	0	0	0	0	0	-	0	0	-	0	0	-	0	0	0	0	0
Mink	-	-	-	0	0	0	0	-	0	0	0	-	0	-	0	0	0	0	0	-	0	0	0	0	0
Muskrat	-	-	-	0	0	0	0	0	0	0	4	0	0	-	2	0	-	0	0	-	11	0	0	0	0
Porcupine	-	-	-	0	0	0	0	-	0	0	0	-	0	-	1	0	-	2	0	-	0	0	0	1	0
Squirrel	-	-	-	0	0	0	0	-	0	0	0	-	0	-	-	0	0	0	0	-	-	-	0	0	0
Weasel	-	-	-	0	0	0	0	-	0	0	0	-	0	-	0	0	0	0	0	-	-	-	0	0	0
Wolf	-	-	-	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0
Wolverine	-	-	-	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0

TABLE 3.24-1 (Cont.)

Subsistence Resource	Alatna[b]	Allakaket[c]	Anaktuvuk Pass	Chenega Bay	Chitina	Copper Center	Cordova	Evansville	Gakona	Glennallen	Gulkana	Hughes	Kenny Lake	Manley Hot Spgs	Minto	Nanwalek	Nuiqsut	Paxson	Port Graham	Rampart	Stevens Village[b]	Tanana	Tatitlek	Tazlina	Tonsina
Fish	-	732	-	198	124	110	105	107	41	54	95	1,234	83	-	860	199	251	107	220	-	1,023	1,958	159	56	73
Salmon	-	554	-	109	116	104	63	66	29	41	86	1,162	67	-	687	158	3	45	144	-	922	1,600	93	38	65
Non-salmon	-	177	-	89	8	7	43	42	12	13	19	72	16	-	174	42	248	63	76	-	102	358	66	18	8
Marine invert.	-	-	-	14	-	-	6	-	0	0	0	-	0	-	-	9	-	0	13	-	-	-	19	1	1
Bird and egg	-	25	-	1	2	1	2	2	2	0	1	24	2	-	26	4	12	15	1	-	20	16	10	1	2
Crane	-	-	-	0	-	0	0	-	0	0	0	-	0	-	-	0		3	1	-	1	0	1	0	0
Duck	-	9	-	1	1	0	1	1	0	0	1	9	0	-	11	2	3	7	0	-	7	3	4	0	0
Goose	-	14	-	0	0	0	0	1	0	0	0	14	0	-	13	0	6	0	0	-	9	7	1	0	0
Seabird and loon	-	-	-	0	-	-	0	-	-	0	-	-	-	-	-	0	-	-	0	-	-	-	0	-	-
Shorebird	-	-	-	0	-	-	0	-	-	0	-	-	-	-	-	0	-	-	0	-	-	-	0	-	-
Swan	-	-	-	-	-	0	0	-	0	0	0	-	0	-	-	0	0	0	0			-	0		0
Upland bird	-	1	-	0	1	1	1	0	2	0	0	1	2	-	2	0	2	5	0	-	2	6	0	1	2
Bird egg	-	-	-	-	-	-	0	-	-	0	-	-	0	-	-	1	-	0	0	-	-	-	5	-	0

[a] When data were available for more than one year, figures shown are those for "representative year" (if designed).

[b] No representative year designated.

[c] Data presented represent "Allakaket/Alatna." Data may not equal sums for major categories, due to rounding error.

[d] "ND" = no data available.

[e] More than half of the fish harvested was used to feed sled dogs.

[f] As much as 75% of the chum and coho harvested was used to feed sled dogs.

[g] A dash indicates no data presented, which could mean that they were not applicable, applicable but zero, or not collected; "0" indicates that zero was reported.

Source: ADF&G (2001b).

TABLE 3.24-2 Percent Households in Directly Affected and Other Selected Rural Communities Participating in Subsistence Harvest, Selected Recorded Year[a]

Subsistence Resource	Alatna[b]	Allakaket[c,d]	Anaktuvuk Pass	Chenega Bay	Chitina	Copper Center	Cordova	Evansville[d]	Gakona	Glennallen	Gulkana	Hughes[d]	Kenny Lake	Manley Hot Spgs	Minto	Nanwalek	Nuiqsut	Paxson	Port Graham	Rampart	Stevens Village[b]	Tanana	Tatitlek	Tazlina	Tonsina
Reference year	'98	'82	'93	'93	'82	'87	'97	'82	'87	'87	'87	'82	'87	ND[e]	'84	'97	'93	'87	'97	ND	'84	'87	'97	'87	'87
All Resources	70	NA	43	96	87	100	90	NA	86	92	90	NA	100	ND	96	100	90	93	98	ND	100	92	88	69	92
Marine mammal	-[f]	-	-	44	-	-	5	-	-	-	-	-	-	-	-	35	37	-	27	-	-	-	50	-	-
Polar bear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		2	-	-	-	-	-	-	-	-
Porpoise				0	-	-	0	-	-	-	-	-	-	-	-	0	-	-	0	-	-	-	13	-	-
Seal	-	-	-	9	-	-	4	-	-	-	-	-	-	-	-	7	-	-	11	-	-	-	19	-	-
Sea otter	-	-	-	39	-	-	4	-	-	-	-	-	-	-	-	35	36	-	21	-	-	-	50	-	-
Steller sea lion	-	-	-	26	-	-	0	-	-	-	-	-	-	-	-	7	-	-	0	-	-	-	19	-	-
Walrus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
Whale	-	-	-	0	-	-	0	-	-	-	-	-	-	-	-	0	5	-	0	-	-	-	0	-	-
Large land mammal	70	-	-	48	13	52	47	-	62	39	35	-	61	-	53	14	74	50	5	-	47	54	63	29	69
Bison	-	-	-	-	0	0	0	-	0	0	0	-	0	-	-	-	-	7	-	-	-	-	-	2	0
Black bear	0	37	-	9	0	0	5	5	0	3	5	53	11	-	20	14	-	0	5	-	40	14	0	4	4
Brown bear	-	0	-	0	0	0	2	0	1	0	0	0	0	-	-	0	8	0	0	-	7	2	0	1	1
Caribou	60	6	43	4	9	48	1	5	45	33	30	0	37	-	-	0	74	43	0	-	-	12	0	22	64
Dall sheep	-	11	-	0	0	5	1	5	16	2	0	0	0	-	-	0	0	29	0	-	-	-	0	2	11
Deer	-	-	-	48	0	0	41	-	0	1	0	-	11	-	-	0	-	0	0	-	-	-	63	0	2
Elk	-	-	-	0	-	-	2	-	-	-	-	-	-	-	-	0	-	-	0	-	-	-	0	-	-
Goat	-	-	-	0	0	5	4	-	0	0	0	-	0	-	-	0	-	0	0	-	-	-	19	0	1
Moose	30	77	-	0	13	19	11	35	14	14	20	79	17	-	40	7	10	43	0	-	20	35	0	14	25
Muskox	-	-	-	-	-	0	-	-	0	0	0	-	0	-	-	-	0	0	-	-	-	-	0	0	0
Small land mammal	-	-	-	13	52	27	27	-	46	8	50	-	28	-	84	7	42	57	7	-	73	41	13	23	40
Beaver	-	66	-	0	0	1	3	0	3	2	10	63	2	-	36	0	-	36	0	-	13	13	0	1	10
Coyote	-	-	-	0	13	1	3	0	10	1	5	-	13	-	-	0	-	14	0	-	-	-	0	6	1
Fox	-	34	-	0	0	6	0	0	20	1	5	53	8	-	22	0	26	29	0	-	30	12	0	7	6
Hare	-	80	-	0	48	7	22	0	26	6	30	90	19	-	60	0	-	29	0	-	57	33	0	15	23
Land otter	-	6	-	9	0	0	4	0	1	0	5	11	0	-	11	3	-	21	0	-	3	3	0	2	2
Lynx	-	54	-	0	9	0	0	30	0	0	5	53	0	-	7	0	-	0	0	-	27	9	13	0	0
Marmot	-	-	-	-	0	0	0	-	0	0	0	-	0	-	-	0	0	0	0	-	-	-	0	0	1
Marten	-	80	-	0	13	5	5	25	29	3	10	84	8	-	47	0	-	36	0	-	47	21	0	4	8
Mink	-	-	-	0	13	0	4	-	10	0	5	-	5	-	13	0	0	7	0	-	10	6	0	1	2
Muskrat	-	31	-	0	0	0	2	15	9	1	10	42	0	-	40	0	-	14	0	-	53	5	0	1	1
Porcupine	-	-	-	4	-	19	1	-	0	0	20	-	0	-	18	3	-	14	0	-	10	4	0	10	11
Squirrel	0	0	-	-	0	1	2	-	7	0	0	-	2	-	-	3	16	0	7	-	-	-	0	2	0
Weasel	-	-	-	0	4	6	2	-	13	2	5	-	8	-	9	7	3	14	2	-	-	-	0	1	2
Wolf	-	6	-	0	4	0	0	0	3	0	5	0	3	-	2	0	11	7	0	-	0	4	0	2	4
Wolverine	-	11	-	0	4	0	1	15	1	0	5	21	3	-	-	0	16	0	0	-	3	3	0	0	1

TABLE 3.24-2 (Cont.)

Subsistence Resource	Alatna[b]	Allakaket[c,d]	Anaktuvuk Pass	Chenega Bay	Chitina	Copper Center	Cordova	Evansville[d]	Gakona	Glennallen	Gulkana	Hughes[d]	Kenny Lake	Manley Hot Spgs	Minto	Nanwalek	Nuiqsut	Paxson	Port Graham	Rampart	Stevens Village[b]	Tanana	Tatitlek	Tazlina	Tonsina
Fish	-	-	-	78	65	78	75	-	70	71	90	-	89	-	89	100	81	79	91	-	83	77	75	63	83
Salmon	-	60	-	70	48	68	66	24	58	60	60	68	57	-	78	100	36	43	86	-	73	67	69	38	64
Non-salmon	-	71	-	57	57	58	59	62	58	42	70	84	83	-	73	90	79	79	64	-	80	64	63	15	67
Marine invert.	-	-	-	74	-	0	29	-	10	1	0	-	0	-	-	79	-	0	75	-	-	-	63	12	2
Bird and egg	-	-	-	44	39	34	30	-	52	21	20	-	44	-	84	45	76	71	25	-	90	86	69	40	43
Crane	-	-	-	0	-	5	2	-	0	0	0	-	0	-	-	3	-	14	0	-	13	3	19	2	0
Duck	-	80	-	26	9	6	23	15	9	3	10	79	5	-	82	31	39	43	21	-	70	37	44	7	10
Goose	-	77	-	9	0	5	6	10	0	0	5	74	0	-	64	0	73	14		-	73	45	31	2	1.4
Seabird and loon	-	-	-	0	-	-	0	-	-	-	-	-	-	-	-	14	-	-		-	-	-	0	-	-
Shorebird	-	-	-	0	-	-	3	-	-	-	-	-	-	-	-	0	-	-		-	-	-	0	-	-
Swan	-	-	-	-	-	0	0	-	0	0	0	-	0	-	-	0	8	0		-	-	-	0	0	0
Upland bird	-	46	-	26	39	34	23	25	52	19	20	68	44	-	73	17	45	71		-	77	77	13	38	42
Bird egg	-	-	-	-	-	-	2	-	-	0	-	-	0	-	-	31	-	0		-	-	-	56	-	0

[a] When data were available for more than one year, figures shown are those for "representative year" (if designated).

[b] No representative year designated.

[c] Data presented represent "Allakaket/Alatna."

[d] In cases were original data did not include household participation figures for the categories shown in this table but include figures for subcategories, the largest figure in a subcategory was used to show household participation.

[e] ND = no data available.

[f] A dash indicates no data presented, which could mean that they were not applicable but zero, or not collected; "0" indicates that zero was reported.

TABLE 3.24-1 (Cont.)

Click here to view Table 3.24-1, page 2

TABLE 3.24-2 Percent Households in Directly Affected and Other Selected Rural Communities Participating in Subsistence Harvest, Selected Recorded Year

Click here to view Table 3.24-2, page 1

TABLE 3.24-2 (Cont.)

Click here to view Table 3.24-2, page 2

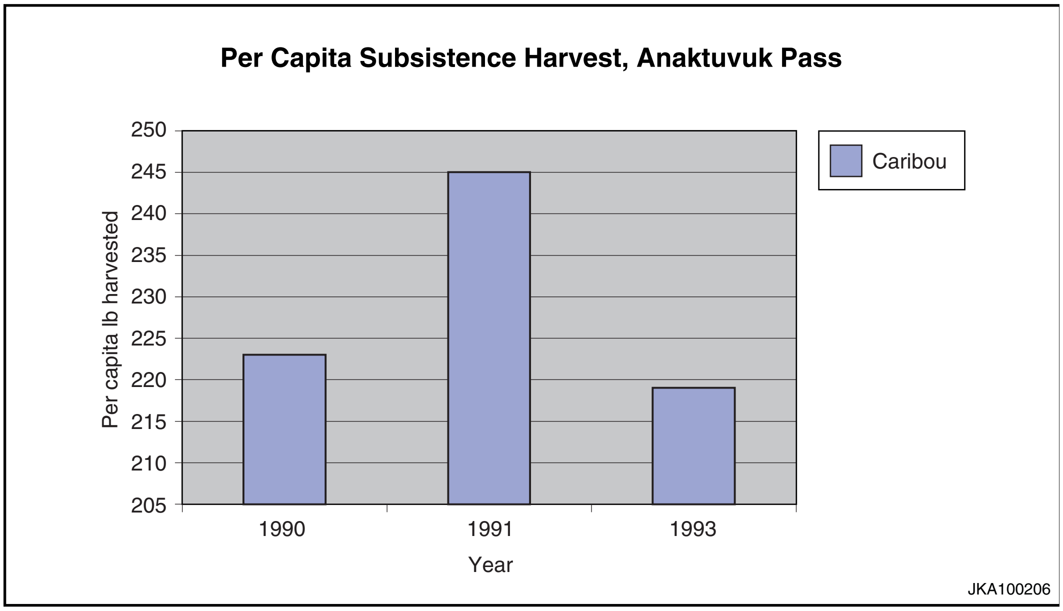

FIGURE 3.24-3 Variability in Anaktuvuk Pass Caribou Harvest Over Time (Source: ADF&G 2001b)

The subsistence use area for Anaktuvuk Pass extends generally east to west along the central Brooks Range. The area used for caribou hunting is particularly extensive. On the eastern boundary, the subsistence use area for Anaktuvuk Pass overlaps with a section of the TAPS (see Map 3.24-1).

Subsistence concerns of local residents identified during the early 1990s revolved around the lack of caribou migration through the pass in 1989 because of nonlocal subsistence and sport hunting (ADF&G 2001b). Concerns also included the increased difficulty in subsistence hunting within Gates of the Arctic NPP because of regulations on this activity in the park itself (Mekiana 1992).

3.24.2.1.2 Nuiqsut. Nuiqsut is an incorporated community on the western bank of the Nechelik Channel of the Colville River Delta, about 57 mi west of the TAPS (see Map 3.24-1) (ADCED 2001b). Originally the location of a Native village called Itquilippaa, the old community was abandoned in the 1940s and resettled in 1973 by 27 Tareumiut families from Barrow who originally had lived in the area (Galginaitis 1990). The population of Nuiqsut was 433 in 2000, more than 88% of whom were Natives (mostly Tareumiut) (see Tables 3.25-1 and 3.29-1).

Although some wage employment is available in nearby oil fields and with North Slope Borough and state governments, subsistence remains extremely important to the residents of Nuiqsut for economic, sociocultural, and ceremonial reasons (North Slope Borough 1999). Subsistence harvests are large in Nuiqsut at 742 lb per person annually. The composition of the total harvest is relatively balanced among marine mammals (notably whales), large land mammals (especially caribou), and fish (notably whitefish), with each of these resource categories contributing more than 230 pounds per capita to the Nuiqsut economy during the reference year of 1993 (see Table 3.24-1) (see also Galginaitis 1990). Hunting large land mammals and fishing involved 74% and 81%, respectively, of the Nuiqsut households in 1993 (see Table 3.24-2). Even larger percentages of households gave or received these (and other) resources, providing evidence of the considerable exchange that continues in the community (ADF&G 2001b).

Evidence for earlier periods suggests that similar harvest patterns, in the sense of species mix and level of importance, occurred over time in Nuiqsut, although detailed quantitative data are lacking (Libbey et al. 1979; North Slope Borough Planning Commission and Commission on History and Culture 1979; see also ADF&G 1986a). Subsistence data from 1994-1995, the year following the representative year presented in Tables 3.24-1 and 3.24-2, indicate similar breadth in subsistence species and in their emphasis, with caribou being particularly important (Brower and Opie 1997). Subsistence harvest surveys for 1985 and 1993 reveal considerable variability, the per capita harvest in the latter year much higher than in the former with a particular distinction in marine mammal harvest (Figure 3.24-4). The primary cause of this difference is the failure of whaling in 1985. Local hunters attributed this to disturbance of whales by seismic exploration activities, which drove the migrating animals farther offshore (Pedersen et al. 2000).

The Nuiqsut subsistence use area encompasses a large, generally circular area, extending north to the Beaufort Sea coast and south to the foothills of the Brooks Range. A portion of the use area, focused on caribou hunting, reaches into the Brooks Range to Anaktuvuk Pass. Part of the Nuiqsut subsistence harvest area overlaps with a section of the TAPS in the vicinity of Prudhoe Bay and Deadhorse (see Map 3.24-1).

Subsistence concerns identified by local residents during 1985 and 1993 included habitat destruction resulting from increasing oil and gas development, growing competition for subsistence resources because of larger populations and improved access by nonlocal hunters, and oil exploration activities noted above (ADF&G 2001b; Pedersen et al. 2000). Subsistence problems identified in 1995–1996 included aircraft scaring caribou, musk oxen affecting caribou movements, absence of caribou, lack of access to key equipment (such as a working snowmachine) to enable hunting, and the possibility that modern activities may be poisoning game (Brower and Opie 1997). Subsistence concerns expressed by Nuiqsut residents during public scoping for this EIS included vehicles on the Dalton Highway disturbing wildlife; a general decline in caribou population near Nuiqsut (no reason given); altered caribou migration patterns because of TAPS infrastructure and operation, as well as other oil-related infrastructure and activities; bowhunter wounding of caribou near the TAPS; modifications of subsistence harvest schedules, in part because of spill response training and in part because of oil and gas development activities; spills in the Sagavanirktok River headwaters that have reduced fish populations; and spills and other impacts related to the oil

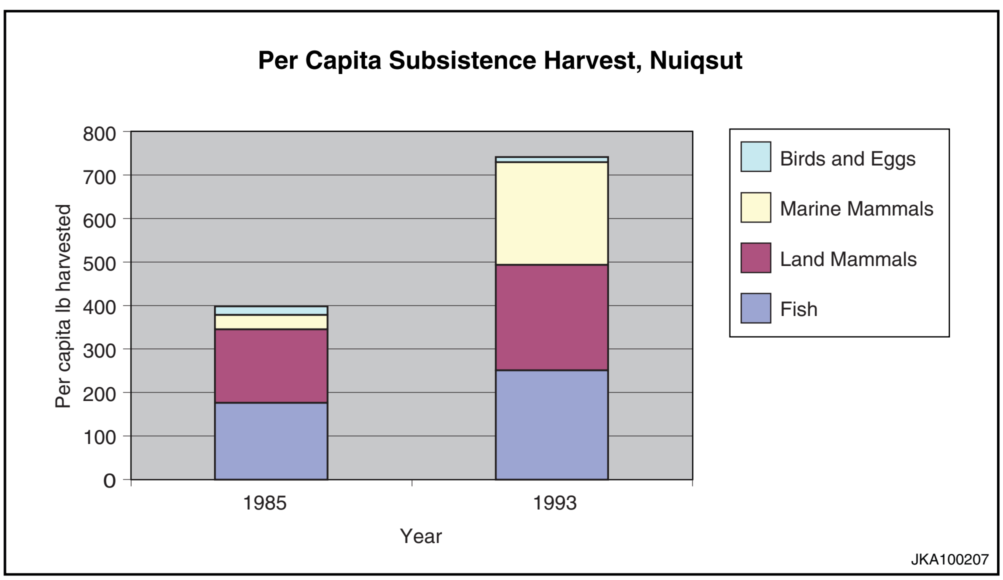

FIGURE 3.24-4 Variability in Nuiqsut Subsistence Harvest Over Time (Source: ADF&G 2001b)

industry that have altered the taste and general quality of fish.

3.24.2.2 Yukon River Drainage

The Yukon River Drainage comprises a broad expanse of the interior Alaska Plateau between the Brooks Range and the Alaska Range drained by the Yukon River and its tributaries. The Alaska Native sociocultural systems of this region comprise several Athabascan peoples, including Gwich'in, Koyukon, and Tanana (see Section 3.25.1). Adaptive strategies of these peoples, as well as rural non-Native sociocultural systems, emphasize combinations of terrestrial mammals and both anadromous and resident fish (supplemented by other resources in smaller amounts, as available). Salmon harvests represent a particularly large portion of total subsistence foods in this region. Harvesting these resources during both traditional and modern times often involves carefully timed, short-term relocations to places where certain resources are abundant. Figure 3.24-5 shows the main subsistence resources harvested in the Yukon River Drainage for an example community from this region — in terms of per capita pounds of salmon combined with lesser amounts of other types of fish and large land mammals. The timing of resource harvests indicates the importance of certain months for key resources (Figure 3.24-6). Per capita harvest levels in the Interior are very high, second in the state only to western Alaskan villages (ADF&G 2000a). Among the Interior villages examined in this EIS, harvests range from about 900 to 1,200 lb per capita, with the exception of much lower levels for Evansville (see Table 3.24-1). For the upper Yukon River villages, the high values include a significant amount of fish harvested for sled dog food, estimated at 62% of the harvest for chum and coho salmon (Andersen 1992).

This EIS discusses 10 communities that lie in the Yukon River Drainage: Alatna, Allakaket, Evansville, Hughes, Manley Hot Springs, Minto, Rampart, Stevens Village, Tanana, and Wiseman. As the data presented reveal, subsistence varies among these localities, although it plays an important economic, sociocultural, and (except for Wiseman) ceremonial role in each. The EIS groups these communities primarily because the salmon upon which all to a degree rely spend part of their lives in the ocean west of Alaska — subjecting them to different impacts than salmon associated with waters south of Alaska. In addition to the brief descriptions of subsistence in these communities presented in the following paragraphs, further details may be found in Appendix D.

3.24.2.2.1 Alatna. Alatna is a small village on the northern bank of the Koyukuk River about 56 mi west of the TAPS (Map 3.24-1) (ADCED 2001b). The population of Alatna in 2000 was 35, and although the village is located in a part of Alaska inhabited predominantly by Athabascan peoples, most of the Alatna inhabitants in 2000 were Kobuk River Iñupiat, a reflection of the long history of trading relations between the Iñupiat of the Kobuk River region and the Koyukon Athabascans (see Tables 3.25-1 and 3.29-1).

Subsistence is important to this small community, serving as the main economic activity (supplemented by a small amount of seasonal wage labor), as well as playing key cultural roles. Subsistence activities involve harvesting a variety of land mammals, birds, and fish that contribute a considerable amount of food and other resources (Marcotte and Haynes 1984; see Table 3.24-1). Note that data on Alatna subsistence activities in the referenced table also appear in the Allakaket column, because information on these two neighboring communities has often been joined in projects collecting subsistence data . Most recent available data for Alatna combined with Allakaket indicate that a large percentage of the village households were involved with subsistence in 1982 (see Table 3.24-2, Allakaket column). For example, 70% of households harvested moose, 80% of households harvested small mammal species of marten and hare, while 66% of households harvested beaver, and at least 70% of households harvested fish and 80% took waterfowl. A more limited survey in the late 1990s, indicated that 70% percent of households harvested large mammals, such as caribou or moose, while 100% of households used these species, indicating that sharing enables all households to have access to these important

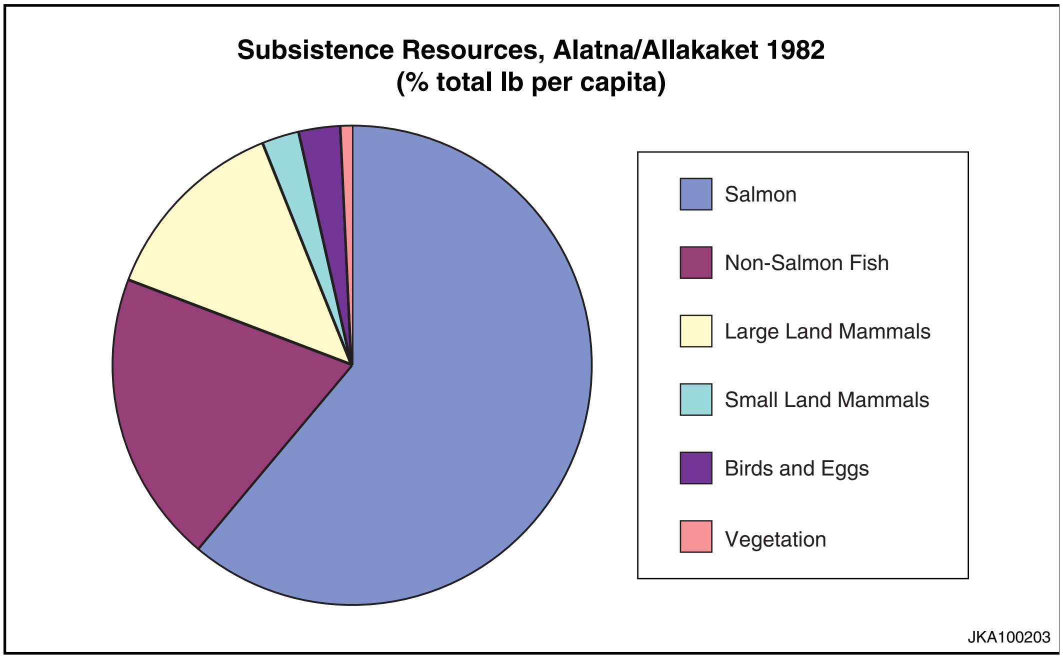

FIGURE 3.24-5 Example Combination of Subsistence Resources in the Yukon River Drainage (Alatna/Allakaket) (Source: ADF&G 2001b)

resources (ADF&G 2001b). Subsistence harvest surveys for Alatna and neighboring Allakaket in the early 1980s indicate declining subsistence harvests, with much of the decrease accounted for by reduced salmon harvest (Figure 3.24-7). Subsistence levels for large mammals during the 1980s and late 1990s, in contrast, do not reveal a clear trend, with per capita pounds harvested for two of the three years in the late 1990s higher than their early 1980s counterparts (Figure 3.24-8).

The subsistence use area for Alatna is a large zone running along the Koyukuk River near the village, extending east along the Kanuti River, and northwest up the Alatna River and associated uplands. The zone includes an area in the Brooks Range, northwest of the community. Although the subsistence use area for Alatna does not intersect the TAPS, it does include part of the Koyukuk River downstream from the pipeline (see Map 3.24-1).

Concerns identified during the late 1990s by local residents included both competition from nonlocal hunters and declining numbers of moose and caribou; the latter problem was blamed on hunting competition and predation by wolves (ADF&G 2001b).

3.24.2.2.2 Allakaket. Allakaket is located on the southern bank of the Koyukuk River about 55 mi west of the TAPS (see Map 3.24-1) (ADCED 2001b). The village population in 2000 was 97, with most of the inhabitants Alaska Natives (primarily Koyukon Athabascans) (see Tables 3.25-1 and 3.29-1).

Subsistence is important in Allakaket, with both land mammals and fish harvested in large amounts (Marcotte and Haynes 1984; see Table 3.24-1; see also Brannian and Gnath 1988). Data from 1982, the year specified by the ADF&G as being representative of subsistence activities in Allakaket, indicate a very large per capita harvest at 906 lb, and very high rates of household participation (see Table 3.24-2). As in Alatna, in the early 1980s, 70% of households took large mammals, especially moose, 80% of households harvest small mammals, 66% of households took furbearers, at least 70% of households harvested fish, and 80% took waterfowl. By the late 1990s, data only on subsistence harvests of large land mammals

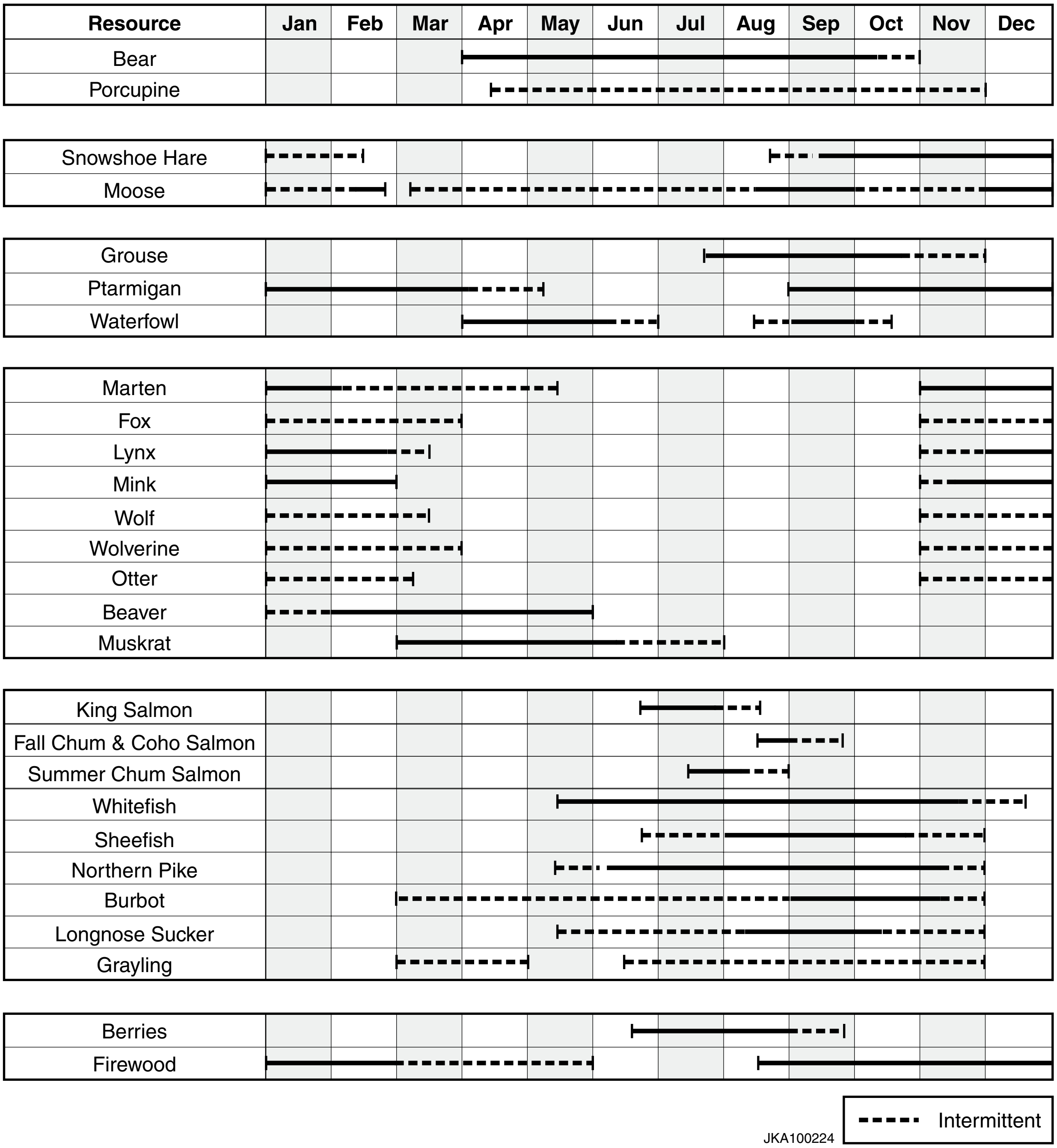

FIGURE 3.24-6 Example of the Seasonality of the Subsistence Harvest in the Yukon River Drainage (Stevens Village) (Source: Sumida 1988)

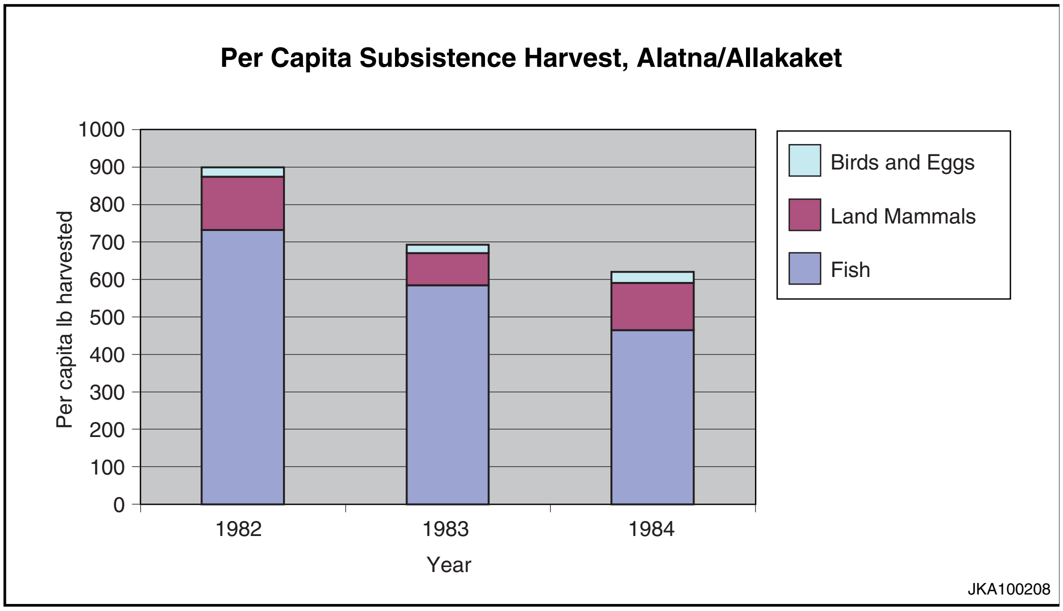

FIGURE 3.24-7 Variability in Alatna/Allakaket Subsistence Harvest Over Time (Source: ADF&G 2001b)

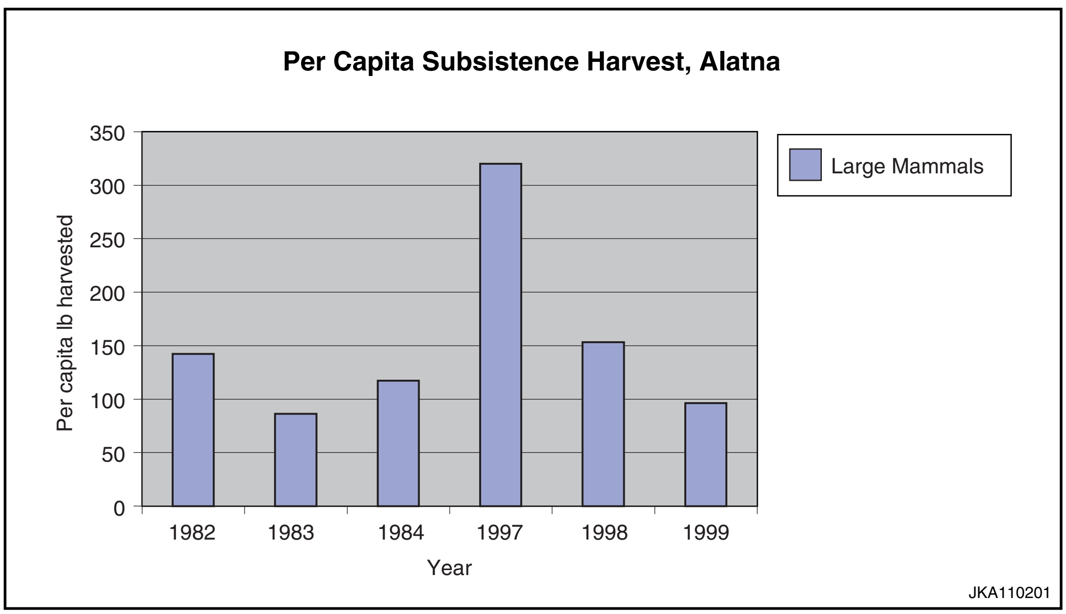

FIGURE 3.24-8 Variability in Alatna Subsistence Harvest of Large Mammals Over Time (Source: ADF&G 2001b)

indicate that nearly all households who successfully hunt these species give them to other households (ADF&G 2001b). Thus, although only slightly more than half the community households harvest these resources, all households use them. This is evidence of continuing social interaction through subsistence activities. Subsistence harvest surveys for Allakaket and neighboring Alatna in the early 1980s indicate declining subsistence harvests, with much of the decrease accounted for by reduced salmon harvest (see Figure 3.24-7). Harvest data for large animals for subsistence during the early 1980s and late 1990s indicate fairly constant harvest levels, with some reduced harvests for the early 1980s (Figure 3.24-9).

The subsistence use area for Allakaket is a large zone running along the Koyukuk River near the village, extending east along the Kanuti River, and northwest up the Alatna River and association uplands. The zone include an area in the Brooks Range, northwest of the community. Although the subsistence use area for Allakaket does not intersect the TAPS, it does include part of the Koyukuk River downstream from the pipeline (see Map 3.24-1).

Subsistence concerns identified during the late 1990s included both competition from nonlocal hunters and declining numbers of moose and caribou; the latter problem was blamed on hunting competition and predation by wolves (ADF&G 2001b). Subsistence concerns expressed by Allakaket residents during public scoping for this EIS included TAPS impacts on caribou migration patterns (both the presence of the pipeline and vehicle movement along the Dalton Highway causing them not to come near Allakaket as they did in the past); competition from nonlocal hunters and fishermen (including TAPS employees); airboats disrupting fish spawning grounds; and tourism disrupting the subsistence process (interrupting harvest activities). In the recent past, residents also expressed concerns that the influx of outsiders has led to the imposition of new rules and regulations that unnecessarily constrain subsistence activities (Beetus and Beetus 1992), and (again) that declines in local caribou since the 1970s are due to changing migration patterns caused by the TAPS (Moses 1993).

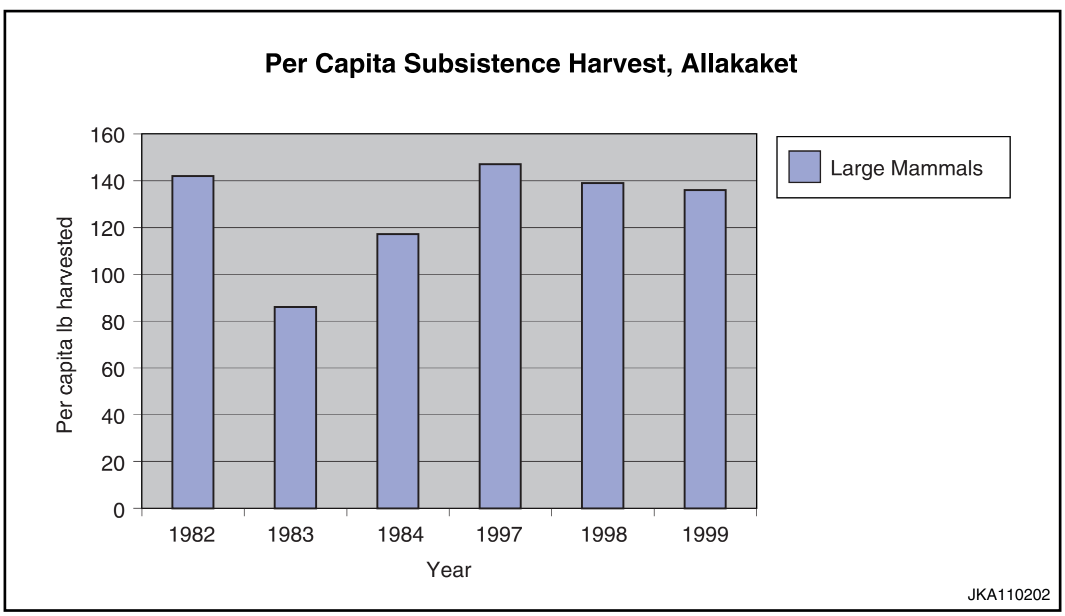

FIGURE 3.24-9 Variability in Allakaket Subsistence Harvest of Large Mammals Over Time (Source: ADF&G 2001b)

3.24.2.2.3 Evansville. Evansville is an interior village about 180 air mi northwest of Fairbanks and 22 mi west of the TAPS (see Map 3.24-1) (ADCED 2001b). In 2000, the decennial census recorded 28 people in Evansville, half of them Native (Athabascan and Iñupiat) (see Tables 3.25-1 and 3.29-1). In contrast to most rural communities in Alaska, many Evansville residents are employed in wage-producing jobs — the majority associated with air transportation, visitor services, and government.

Many Evansville residents continue to practice subsistence hunting, fishing, and trapping, along side the economic alternatives of wage employment. The level of participation and the amount harvested in 1982 vary widely by subsistence resource (Marcotte and Haynes 1984; see Tables 3.24-1 and 3.24-2), with moderate rates of household participation in most forms of harvest, but high production in moose, salmon, and other fish. The annual per capita level of harvest was 260 lb. Subsistence data collected on large land mammals in the late 1990s indicate that the exchange of subsistence resources helps ensure that individuals who do not harvest these animals still have access to them while reaffirming social networks (ADF&G 2001b). Subsistence harvest surveys for Evansville (and neighboring Bettles) in the early 1980s indicate declining subsistence harvests, with much of the decrease accounted for by reduced fish harvest (Figure 3.24-10). Subsistence harvest data for large mammals in the early 1980s and late 1990s also indicate a general trend towards decline over time (Figure 3.24-11).

The subsistence use area for Evansville, (shared with neighboring Bettles) extends along the Koyukuk River and associated lowlands from Alatna/Allakaket up into the Brooks Range to the north. The zone extends east-west along the lower reaches of the Brooks Range, including the John River and other river headwater valleys. Part of the subsistence area for Evansville overlaps with a sector of the TAPS to the east (see Map 3.24-1). In addition, the use area for this community includes part of the Koyukuk River downstream from the pipeline.

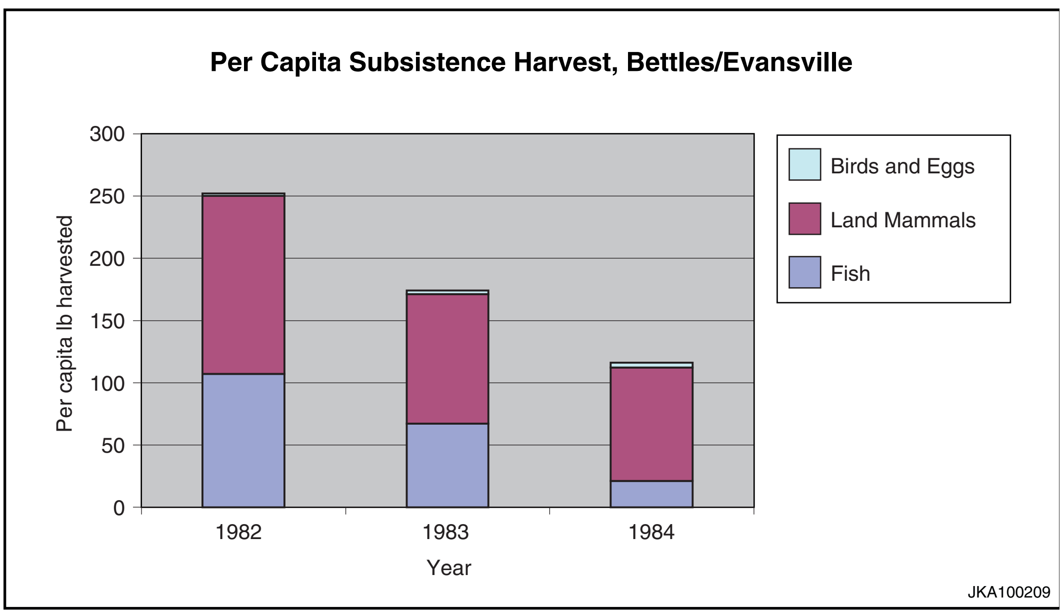

FIGURE 3.24-10 Variability in Evansville/Bettles Subsistence Harvest Over Time (Source: ADF&G 2001b)

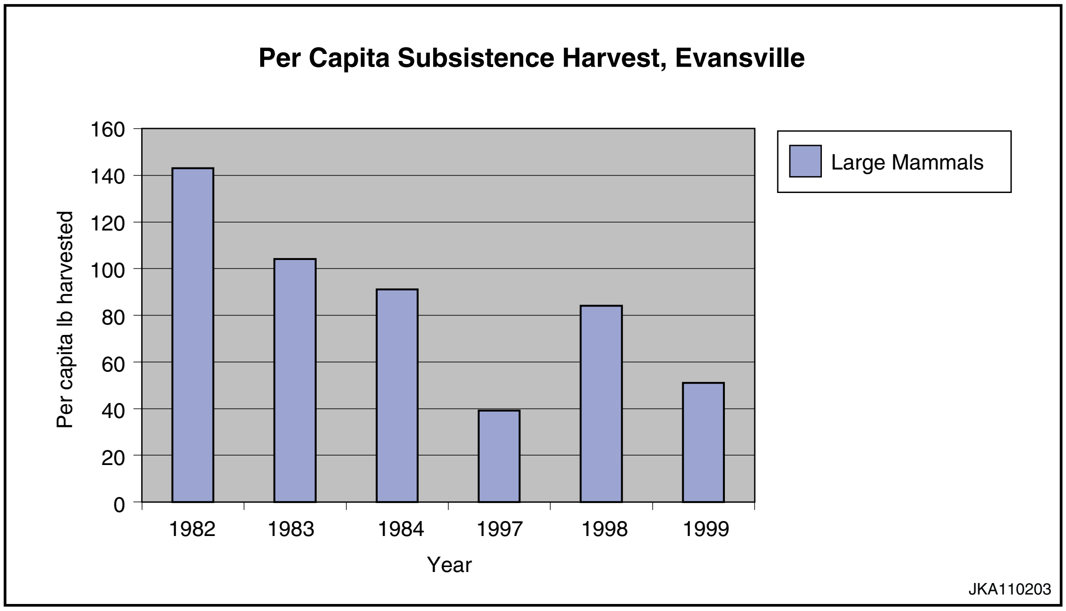

FIGURE 3.24-11 Variability in Evansville Subsistence Harvest of Large Mammals Over Time (Source: ADF&G 2001b)

Subsistence concerns identified by local residents during the early 1980s included increased competition for subsistence resources due to improved access and restrictions on nonsubsistence hunting in Gates of the Arctic NPP, sporadic caribou migration (no reason proposed), and low moose populations (in 1987, again with no reasons proposed) (ADF&G 2001b; Holly 1992).

3.24.2.2.4 Hughes. Hughes is located on a tall bluff on the eastern bank of the Koyukuk River, roughly 210 air mi northwest of Fairbanks and about 105 mi west of the TAPS (see Map 3.24-1) (ADCED 2001b). In 2000, the population of Hughes was 78, the vast majority of whom were Native (primarily Koyukon Athabascans) (see Tables 3.25-1 and 3.29-1).

Subsistence involves much of the population of Hughes. A detailed community survey in 1982 recorded average per capita harvest of 1,492 lb. Subsistence remained important to Hughes residents into the 1990s based on more limited data from annual harvest tickets and subsistence salmon surveys. Residents of Hughes harvested a broad range of land mammals, birds, and fish in the reference year of 1982, although moose and salmon by far dominated the weight harvested (Marcotte and Haynes 1984; see Table 3.24-1; see also Brannian and Gnath 1988). Several subsistence resources, including moose and salmon, were harvested by more than 60% of the community households (see Table 3.24-2). The limited data available on exchange indicate that many households also received subsistence resources, preserving a key sociocultural function of subsistence while extending access to key resources (ADF&G 2001b). Because ADF&G did not collect subsistence harvest data for multiple years, evidence on harvest variability over time is unavailable.

The subsistence use area for Hughes extends for more than 100 mi along the Koyukuk River valley, including upland zones to both the north and the south. Although the subsistence area for Hughes does not intersect the TAPS, it does include part of the Koyukuk River downstream from the pipeline (see Map 3.24-1).

Subsistence concerns identified by local residents during the early1980s included increased competition for subsistence resources resulting from improved access for nonlocal hunters and fishermen, sporadic caribou migration (no reason proposed), and low moose populations (in 1987, again with no reasons proposed) (ADF&G 2001b).

3.24.2.2.5 Manley Hot Springs. Manley Hot Springs is a small community located on Hot Springs Slough about 5 mi north of the Tanana River at the end of the Elliott Highway and 65 mi west of the TAPS (see Map 3.24-1) (ADCED 2001b). The Manley Hot Springs population in 2000 was 72, the majority of whom were non-Native (see Tables 3.25-1 and 3.29-1).

The economy of Manley Hot Springs is diverse, including employment in small businesses, government, and commercial fishing. Alongside the availability of these other economic options, subsistence remains important in this small village. Gardening, hunting, and fishing play important roles in providing food, with salmon and moose particularly important (see Betts 1997, Brannian and Gnath 1988). Specific data on harvest levels, participation rates, and subsistence concerns are unavailable from the ADF&G for this community. However, subsistence data collected recently for an environmental assessment of road construction indicate a range of subsistence resources similar to that found in nearby Alaska Native villages, such as Rampart and Stevens Village, except for a virtual absence of caribou from subsistence because of the lack of that resource locally (Betts 1997).

The subsistence use area for Manley Hot Springs extends along a large portion of the Tanana River, with significant upland zones both north and south of the river. The use area does not intersect the TAPS; it does, however, include parts of the Tanana and Yukon Rivers and associated drainages as close as 6.5 mi downstream from the pipeline (see Map 3.24-1).

Subsistence concerns primarily consist of competition from nonlocal hunters (Betts 1997). Additional concerns expressed during public scoping included competition from nonlocal hunters made possible by increased access.

3.24.2.2.6 Minto. Minto is located on the western bank of the Tolovana River, about 47 mi south of the TAPS and about 130 mi northwest of Fairbanks (see Map 3.24-1) (ADCED 2001b). In 2000, Minto contained 258 people, nearly 92% of whom were Native (mainly Tanana Athabascan) (see Tables 3.25-1 and 3.29-1). The village economy of Minto is mixed. Wage employment is predominantly seasonal, although some is year-round. Subsistence remains important for economic, sociocultural, and ceremonial reasons, involving most of the village population (Andrews 1988; see Table 3.24-1).

Minto residents harvest a wide array of resources, with particularly high reliance on fish (notably salmon, but also pike and grayling) as documented in the reference year of 1984. Large land mammals, particularly moose, also were important. The annual per capita harvest for Minto residents was 1,015 lb in 1984. Nearly all Minto households were involved in subsistence activities, with nearly 90% of all households fishing (often traveling to fish camps during the summer) and over 80% of households participating in large land mammal, small land mammal, and bird harvests (see Table 3.24-2). Because ADF&G did not collect subsistence harvest data for multiple years, evidence on harvest variability over time is unavailable.

The subsistence use area for Minto extends throughout the Minto Flats, along a large portion of the Tanana River, and into a large upland zone generally north of the village. Part of the subsistence area for Minto intersects the TAPS, while other sections include part of the Tanana River and associated drainages downstream from the pipeline (see Map 3.24-1) (Andrews 1988).

Subsistence concerns identified by local residents in 1984 included habitat destruction resulting from mining; excessive constraints of certain hunting regulations; competition for moose, waterfowl, furbearers, and pike (exacerbated by low populations of moose and pike) from nonlocal hunters and fishermen; and disruption of fish and game by airboats used by nonlocal hunters and fishermen (ADF&G 2001b; Betts 1997). Subsistence concerns expressed by Minto residents during public scoping included competition by nonlocal hunters.

3.24.2.2.7 Rampart. Rampart is located on the southern bank of the Yukon River, about 75 mi upstream from its intersection with the Tanana River and 33 mi south-southwest of the TAPS (see Map 3.24-1) (ADCED 2001b). In 2000, the population of Rampart was 45, with most of its inhabitants Koyukon Athabascans (see Tables 3.25-1 and 3.29-1). Subsistence is extremely important in this small village. In addition to its sociocultural and ceremonial roles, subsistence fuels much of the economy in this geographically isolated community, supplemented by a small amount of primarily seasonal wage labor (including a small amount of commercial fishing).

Rampart residents harvest particularly large quantities of fish, mainly salmon and whitefish, and large game, particularly moose and caribou (Brannian and Gnath 1988). Limited harvest data are available from the ADF&G (see Table D-12 in Appendix D), but these data do not include information on per capita harvest levels or participation in subsistence activities comparable to that presented in Tables 3.24-1 and 3.24-2 for other communities. Subsistence data collected recently for an environmental assessment of road construction indicate a range of subsistence resources similar to that in nearby Stevens Village, although an analysis of available information suggested a decline in subsistence over the past few decades (Betts 1997).

The subsistence use area for Rampart runs along the Yukon River from near the confluence with the Tanana River to a point upstream of the TAPS. It includes upland zones generally south of the Yukon River, near the village. The subsistence use area for Rampart intersects the TAPS and includes several miles of the Yukon River and associated drainages downstream from the pipeline (see Map 3.24-1).

Subsistence concerns include predation of game and competition from nonlocal hunters and commercial fishing (Betts 1997).

3.24.2.2.8 Stevens Village. Stevens Village is located on the northern bank of the Yukon River, upstream from where it crosses the Dalton Highway and about 20 mi north of the TAPS (see Map 3.24-1) (ADCED 2001b). The Stevens Village population in 2000 was 87, most of whom were Koyukon Athabascans (see Tables 3.25-1 and 3.29-1). A few Stevens Village residents participate in a small amount of primarily seasonal wage labor in the village. In contrast, the majority of residents in Stevens Village participate in subsistence activities as a means of providing necessary resources for economic, sociocultural, and ceremonial purposes.

Stevens Village residents rely on a broad range of subsistence resources, together yielding a per capita harvest of 1,139 lb in 1984 (Sumida 1988) (see Table 3.24-1). Available data indicate that a large percentage of the village population harvested subsistence resources in the mid-1980s (Table 3.24-2), with over 80% of households involved in subsistence fishing, 90% in bird harvest, and 73% in small land mammal and furbearer harvests. A smaller portion of households, 46%, participated in large land mammal hunting, but harvesting households shared foods with others, providing wider access to these resources and helping to define and maintain exchange networks (ADF&G 2001b). In 1984, the most representative year for which detailed harvest data exist, fishing (notably for salmon) was particularly important, with per capita harvest more than one-half ton. Note that more than half of the fish harvested was used to feed sled dogs (Sumida 1988). Hunting small and large game also contributed to subsistence. Because ADF&G did not collect subsistence harvest data for multiple years, evidence on harvest variability over time is unavailable.

The Stevens Village subsistence use area encompasses the western portion of the Yukon Flats, from approximately the point where the Dalton Highway crosses the Yukon River, up to the village of Beaver, a distance of well over 100 river miles. The use area ranges north of the Yukon, especially in the Dall River area, and south of the Yukon into the drainages of Waldron and Rogers Creeks. Part of the subsistence harvest area for Stevens Village overlaps with a section of the TAPS (see Map 3.24-1) (Sumida 1988).

Subsistence concerns identified by local residents during 1984 included habitat destruction associated with the TAPS, competition for resources by nonlocal residents, particularly in the Dall River area, and low moose populations (with no reason proposed) (Sumida 1988; ADF&G 2001b).

3.24.2.2.9 Tanana. The village of Tanana is about 2 mi west of the junction of the Tanana and Yukon Rivers in Interior Alaska, approximately 83 mi southwest of the TAPS (Map 3.24-1) (ADCED 2001b). In 2000, the decennial census recorded 308 inhabitants in this community, the majority of whom were Alaska Natives (primarily Athabascan) (see Tables 3.25-1 and 3.29-1). The economy of Tanana is mixed. Several wage labor positions exist, both full-time (with the city, village council, or school district) and seasonal (fire fighting, construction, and commercial fishing) jobs.

Subsistence remains important in Tanana dominated by salmon fishing, but also including fishing for other species, hunting large and small land animals, and hunting and collecting birds and eggs (see Table 3.24-1; see also Betts 1997). Tanana residents harvested 2,157 lb per capita in 1987. Data from the most representative harvest year (1987) indicate that more than 91% of the households participated in subsistence harvests, with salmon fishing again registering the highest harvest rate (Case and Halpin 1990) (see Table 3.24-2). Subsistence fishing has been exceptionally productive in this community, amounting to nearly 2,000 lb per capita, although as much as 75% of the chum and coho salmon taken is used for dog food. Exchange patterns for subsistence resources incorporate the remaining households that do not harvest resources themselves, in the process helping to redefine patterns of social interaction (ADF&G 2001b). For example, in 1987 just over a third of households harvested moose, but all households report using this resource. Data collected on large mammal harvests in Tanana during the late 1990s indicate a substantial decline in per capita pounds harvested between 1997 and 1999 (Figure 3.24-12), although it is uncertain if this is representative of a longer-term trend.

The subsistence use area for Tanana consists of a long section of the Yukon River, roughly centered at its confluence with the Tanana River, and extending up this important tributary to Manley Hot Springs. South of the Yukon River, the Nowitna River drainage also constitutes an important portion of the Tanana

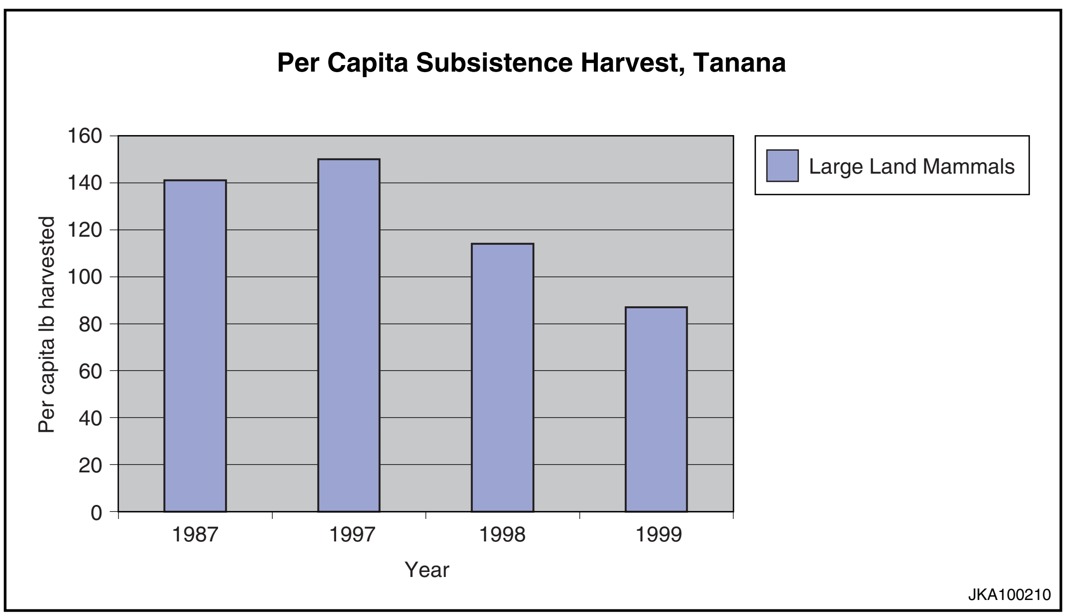

FIGURE 3.24-12 Variability in Tanana Subsistence Harvest of Large Mammals Over Time (Source: ADF&G 2001b)

use area. Although the subsistence use area for Tanana does not intersect the TAPS, it does include part of the Yukon and Tanana Rivers downstream from the pipeline (see Map 3.24-1).

Subsistence concerns identified by local residents during the late 1980s and late 1990s included habitat destruction caused by mining; competition from nonlocal fishermen, hunters, and trappers for salmon, moose, and fur-bearing animals; low moose population because of hunting competition and high wolf predation; and varying seasonal availability of caribou (ADF&G 2001b; Betts 1997). Additional concerns expressed during public scoping included competition from nonlocal hunters (especially for caribou) made possible through increased access.

3.24.2.2.10 Wiseman. Wiseman is a small community located a few miles west of the Dalton Highway and about 1 mi west of the TAPS. In 2000, the population of Wiseman was only 21 persons, 19% of whom were Alaska Native (see Table 3.29-1). Although a few sources of wage labor exist — primarily in providing road services on the Dalton Highway, mining, government employment, and commercial fishing — subsistence plays an important role in the economy of this small community (Johnson 1992; Reakoff 1992; Scott 1998).

During the 1990s, most households participated in subsistence, with hunting and fishing providing key resources according to the study by Scott (1998). Because the information obtained in that study employed different methods than those used by the ADF&G, results are not strictly comparable and thus are not included in Tables 3.24-1 and 3.24-2.

Available data indicate that the subsistence use area used by Wiseman residents intersects the TAPS (Scott 1998). Part of this area includes a length of the middle fork of the Koyukon River and its tributaries, exploited primarily for fishing. It also includes a broad portion of the southern Brooks Range in the vicinity of Wiseman, extending east to incorporate a large portion of the TAPS ROW.

Subsistence-related concerns expressed by Wiseman residents included competition by nonlocal hunters (especially) and fishermen whose access has been facilitated by the opening of the Dalton Highway, constraints placed on subsistence activities by government management agencies, and declining resource levels (Scott 1998).

3.24.2.3 Copper River Basin

The Copper River Basin refers to that portion of the Alaskan interior plateau that is drained by the Copper River and its tributaries. The region includes Alaska Native villages as well as rural communities that are inhabited largely by non-Natives (see Section 3.25). The Alaska Natives who inhabited this region at the time of Euro-American contact were Ahtna Athabascans, the people whose sociocultural presence continues to dominate much of the region. Subsistence in the Copper River Basin emphasizes a combination of fish (particularly salmon) and land mammals (with caribou and moose often the most important in terms of amount harvested). Other resources, including non-salmon fish, birds and their eggs, and marine invertebrates from the mouth of the Copper River also play a role in Copper River Basin community subsistence, although in much lesser amounts than the other categories.
Figure 3.24-13 shows the main subsistence resources harvested in the Copper River Basin for an example community from this region. The data reveal that salmon and large land mammals contribute the vast majority of pounds per capita harvested. The timing of resource harvests indicates the importance of summer and early fall for much of the volume of subsistence resources harvested, with other parts of the year providing important supplemental resources (Figure 3.24-14). Harvest levels in the Copper River Basin communities generally are 25% to 33% those for Interior and Arctic villages (ADF&G 2000a). Among the villages examined in this EIS, reported values range from about 100 to 200 lb per capita, the harvest for Paxson higher at 289 lb per person (see Table 3.24-1).

The EIS discusses subsistence in nine Copper River Basin communities: Chitina, Copper Center, Glennallen, Gakona, Gulkana, Kenny Lake, Paxson, Tazlina, and Tonsina. With

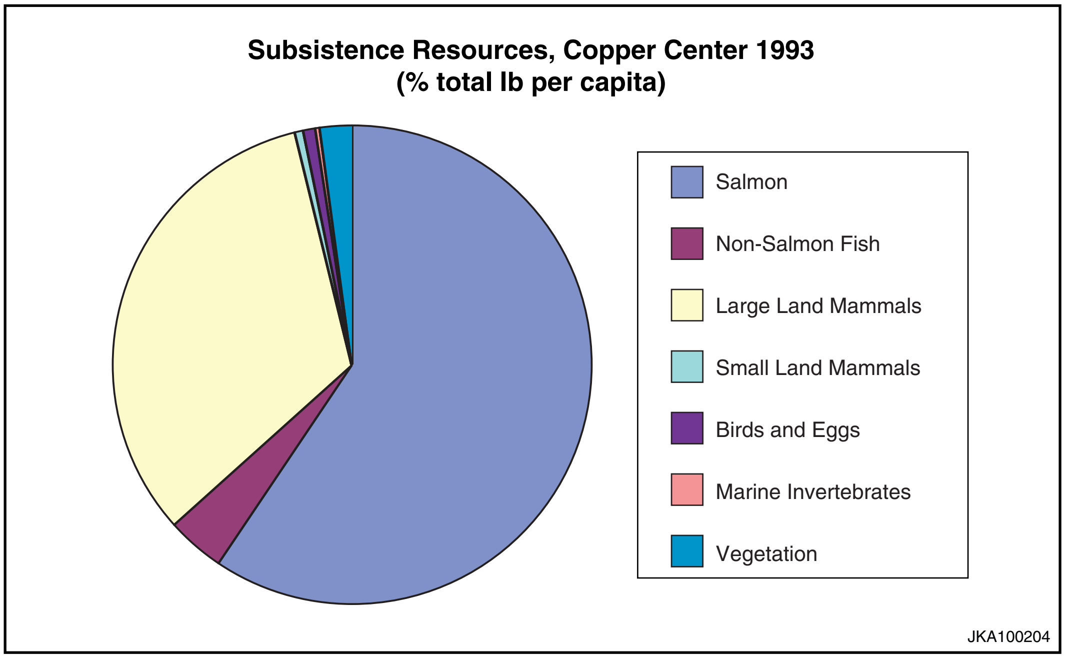

FIGURE 3.24-13 Example Combination of Subsistence Resources in the Copper River Basin (Copper Center) (Source: ADF&G 2001b)

the exceptions of Glennallen, Kenny Lake, and Paxson, federally recognized Tribal governments are important local institutions. Although residents of these communities generally pursue subsistence through harvesting terrestrial and riverine resources found elsewhere in interior Alaska, they rely heavily on salmon runs in the Copper River and its tributaries. These salmon spend much of their lives in the ocean waters south of Alaska, subjecting them to different conditions than their western Alaska counterparts. As a consequence, subsistence in this region also is subject to the population cycles and management of these salmon runs. In addition to the brief descriptions of subsistence in these nine communities presented in the following paragraphs, further details are provided in Appendix D.

3.24.2.3.1 Chitina. Chitina is located about 21 mi east of the TAPS on the western bank of the Copper River at its confluence with the Chitina River (see Map 3.24-1) (ADCED 2001b). The population of Chitina was 123 in 2000, with most of its inhabitants Ahtna Athabascan (see Tables 3.25-1 and 3.29-1). The village economy is mixed, with both year-round and seasonal wage employment along with subsistence activities.

Subsistence remains important in Chitina, with an average per capita harvest of 191 lb in 1982 (McMillan and Cuccarese 1988) (see Table 3.24-2). Large percentages of village households harvest a range of resources, while considerable exchange of these resources provides access to food resources for more of the community and reaffirms patterns of social interaction and obligation (ADF&G 2001b). Fishing played a particularly important role in Chitina subsistence through the late 1980s, with salmon the dominant resource by weight (see Table 3.24-1). Subsistence harvest data from 1982 and 1987 indicate a large increase in per capita pounds harvested in the latter year, primarily accounted for by an increase in salmon harvest (Figure 3.24-15).

The subsistence use area for Chitina residents is centered at the confluence of the Copper River and the Chitina River, were the village is located. It extends up the Copper River to the vicinity of Kenny Lake, and down the Richardson Highway to nearly Thompson Pass. Rugged uplands in the Wrangell-St. Elias

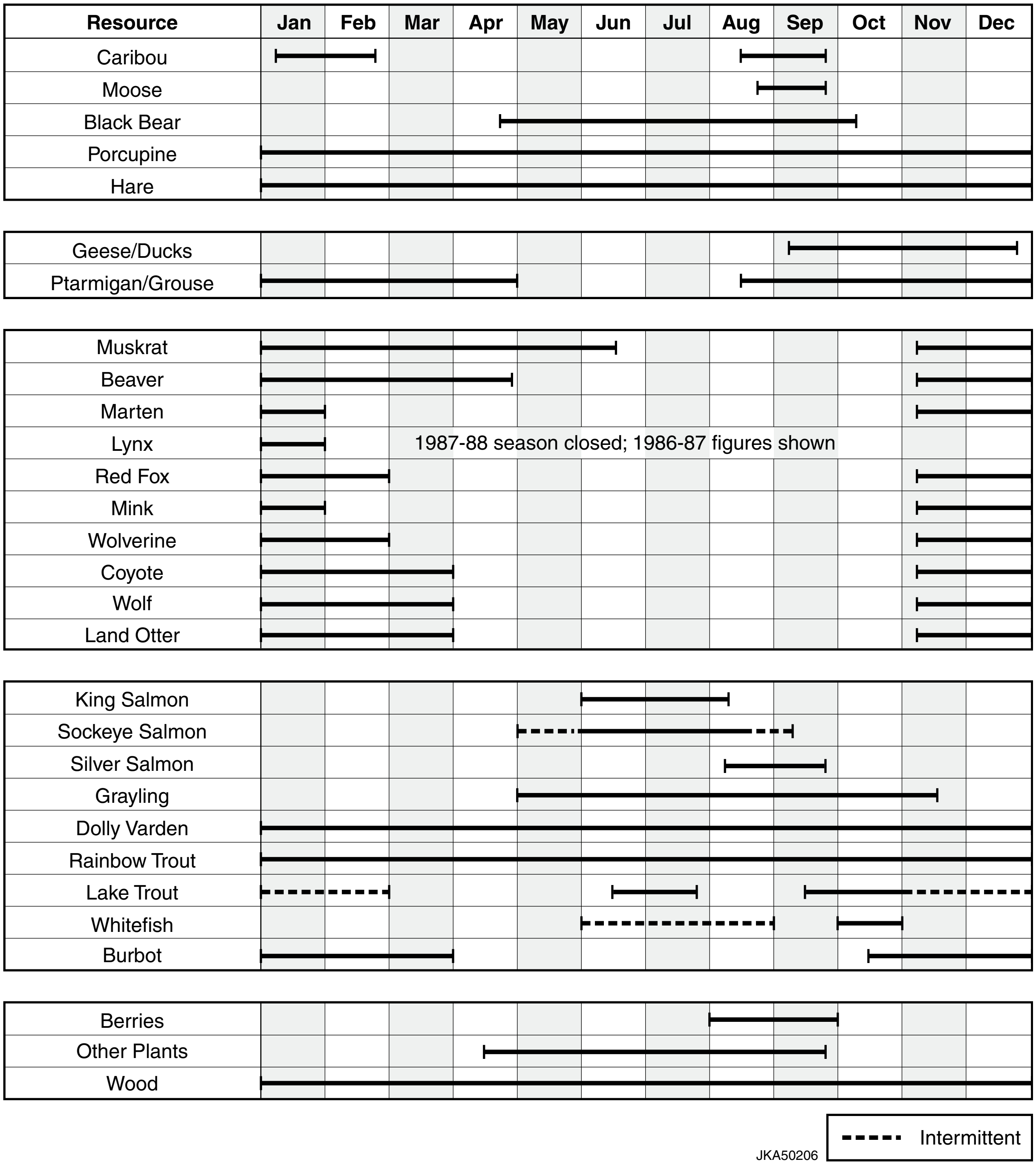

FIGURE 3.24-14 Example of the Seasonality of the Subsistence Harvest in the Copper River Basin (Source: National Park Service 1995)

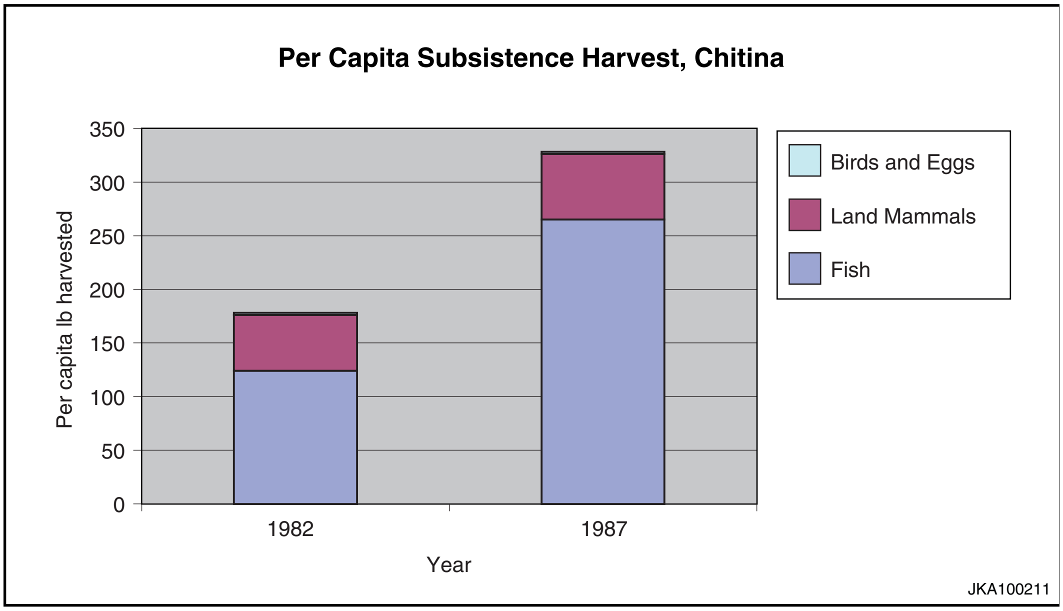

FIGURE 3.24-15 Variability in Chitina Subsistence Harvest Over Time (Source: ADF&G 2001b)

Mountains to the north and the Chugach Mountains to the south of the Chitina River are included in this use area. Part of the subsistence use area for Chitina overlaps with a section of the TAPS (see Map 3.24-1). In addition, the use area for this community includes part of the Copper River downstream from the pipeline.

Subsistence concerns identified by local residents during the 1980s included hunting and fishing bag limits (particularly for caribou and salmon) as well as both the potential increased competition for resources and habitat destruction resulting from development in the area (ADF&G 2001b).

3.24.2.3.2 Copper Center. Copper Center lies on the western bank of the Copper River at its confluence with the Klutina River, about 0.6 mi east of the pipeline (see Map 3.24-1) (ADCED 2001b). Slightly fewer than half of its 2000 population of 362 were Alaska Natives (mainly Ahtna Athabascan) (see Tables 3.25-1 and 3.29-1). Proximity to Glennallen, the TAPS, and the Richardson Highway provides a range of economic options, including wage employment in local businesses, such as those associated with the highway and tourism, the Copper River Native Association (a regional Tribal consortium), and the National Park Service.

Over 75% of Copper Center households participate in subsistence harvest activities, particularly subsistence fishing. Salmon, caribou, and moose provide the largest amounts of harvested meat by weight, together contributing an average per capita harvest of 174 lb in 1987 (McMillan and Cuccarese 1988) (see Tables 3.24-1 and 3.24-2; see also Simeone and Fall 1996). Sharing of subsistence food is widespread, as indicated by the example that just under 20% of households harvested moose, but 53% of households reported utilizing moose for food. Such exchange ensures that virtually all households have access to the resources obtained (ADF&G 2001b). Subsistence harvest data from the 1982 and 1987 indicate an increase in per capita pounds harvested in the latter year, a consequence of increased salmon and (especially) large mammal harvests (Figure 3.24-16).

The Copper Center use area runs generally along the Richardson Highway, north and south of the village, and extends through a wide zone to the west of the road. Many extensions along river valleys into the Wrangell-St. Elias Mountains are also included. Part of the

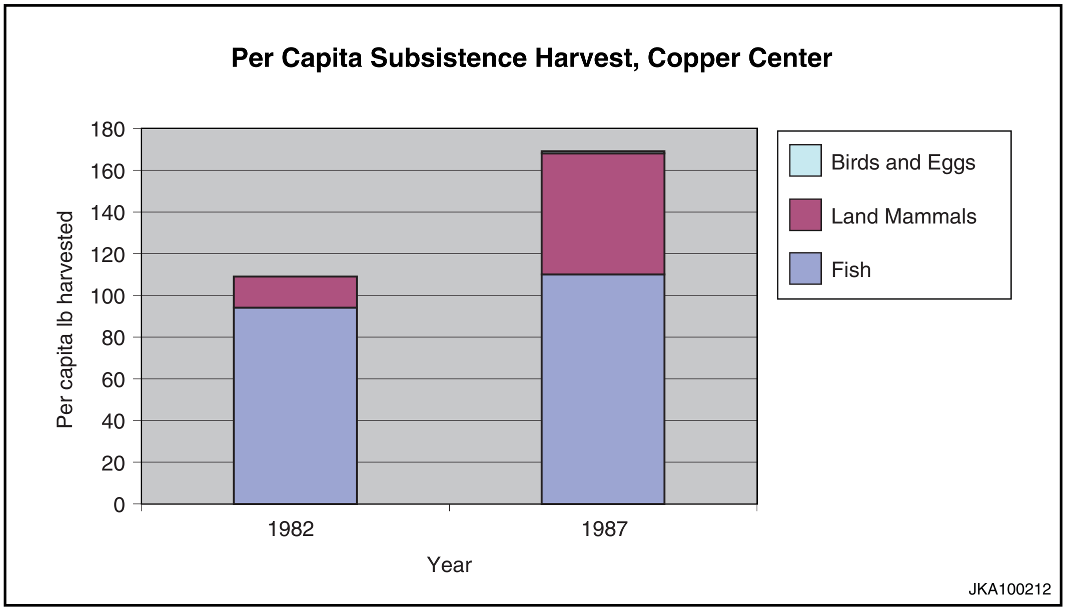

FIGURE 3.24-16 Variability in Copper Center Subsistence Harvest Over Time (Source: ADF&G 2001b)

subsistence use area for Copper Center overlaps with a section of the TAPS (see Map 3.24-1). In addition, the use area for this community includes part of the Copper River downstream from the pipeline.

Subsistence concerns identified by local residents during the 1980s included hunting and fishing bag limits (particularly on caribou and salmon), as well as both the potential increased competition for resources and the habitat destruction resulting from non-TAPS-related development in the area (ADF&G 2001b). By the late 1990s, the Nelchina caribou herd was at low population levels, so that harvest restrictions and allocational conflicts were severe. Increased nonlocal participation in moose hunting and the Chitina dip net fisheries also frustrated local subsistence users.

3.24.2.3.3 Gakona. Gakona is a small community at the confluence of the Copper and Gakona Rivers, at mile 2 of the Tok Cutoff to the Glenn Highway and about 6 mi east of the TAPS (see Map 3.24-1) (ADCED 2001b). The Gakona population in 2000 was 215, about 13% of whom were Native (mainly Ahtna Athabascan) (see Tables 3.25-1 and 3.29-1). The economy of Gakona relies largely on local businesses and seasonal tourist travelers.

Many residents participate in subsistence activities; caribou, moose, and salmon contribute similar amounts in terms of weight (McMillan and Cuccarese 1988; Stratton and Georgette 1984) (see Table 3.24-1; see also Simeone and Fall 1996). The average per capita harvest was 95 lb in 1987. Available data indicate that as many as 70% of the community residents harvested fish for subsistence in 1987 (see Table 3.24-2). Widespread sharing provided nearly all households in the village with access to subsistence resources, in the process helping to maintain patterns of social interaction (ADF&G 2001b). Subsistence harvest data from 1983 and 1987 indicate a substantial decrease in per capita pounds harvest in the latter year, primarily accounted for by a large decline in salmon harvest (Figure 3.24-17).

The Gakona subsistence use area is generally located north of the village and includes significant zones both east and west of the Richardson Highway, along with additional areas located in the Wrangell Mountains north of Chitina and in the Chugach Mountains west of Tonsina. Part of the subsistence use area for Gakona overlaps with a section of the TAPS

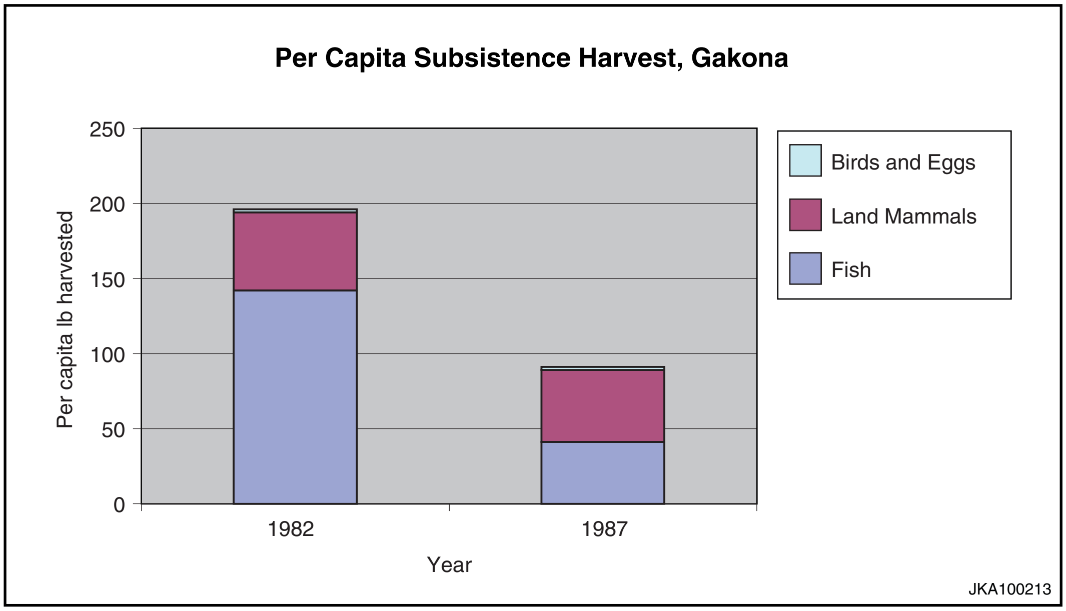

FIGURE 3.24-17 Variability in Gakona Subsistence Harvest Over Time (Source: ADF&G 2001b)

(see Map 3.24-1). In addition, the use area for this community includes part of the Copper River downstream from the pipeline.

Subsistence concerns identified by local residents during the 1980s included hunting and fishing bag limits (particularly on caribou and salmon), as well as both the potential increased competition for resources and habitat destruction resulting from non-TAPS-related development in the area (ADF&G 2001b).

3.24.2.3.4 Glennallen. Glennallen is a small community on the Glenn Highway near its intersection with the Richardson Highway, about 3.5 mi west of the TAPS (see Map 3.24-1) (ADCED 2001b). Glennallen's population in 2000 was 554, 5.1% of whom were Native (primarily Athabascan) (see Table 3.29-1). Largely because of its location near the intersection of two highways and its proximity to Wrangell-St. Elias NPP, residents of Glennallen have more economic options than most rural Alaskans. Wage labor provides most of the livelihood in Glennallen, primarily through working for local businesses or government agencies.

Subsistence, nevertheless, remains an important activity in Glennallen, with an average per capita harvest of 99 lb in 1987. Hunting (notably for moose and caribou) and fishing (particularly for grayling and salmon) provided most of the meat obtained through noncommercial means in the representative year of 1987 (see Table 3.24-1) (McMillan and Cuccarese 1988; Simeone and Fall 1996). About 71% of the households fished in 1987 (see Table 3.24-2). Exchange patterns made fish and other subsistence resources available to all households while helping to redefine social networks (ADF&G 2001b). Subsistence harvest data from 1983 and 1987 indicate an increase in per capita pounds harvested in the latter year, the growth due to increased harvests of salmon and land mammals (Figure 3.24-18).

The Glennallen subsistence use area is particularly large, reflecting the tendency of newer residents to travel along area highways to access the hunting range. Part of the subsistence use area for Glennallen overlaps with a section of the TAPS (see Map 3.24-1). In addition, the use area for this community includes part of the Copper River downstream from the pipeline.

Subsistence concerns identified by local residents in 1987 included habitat destruction and potentially increased competition for

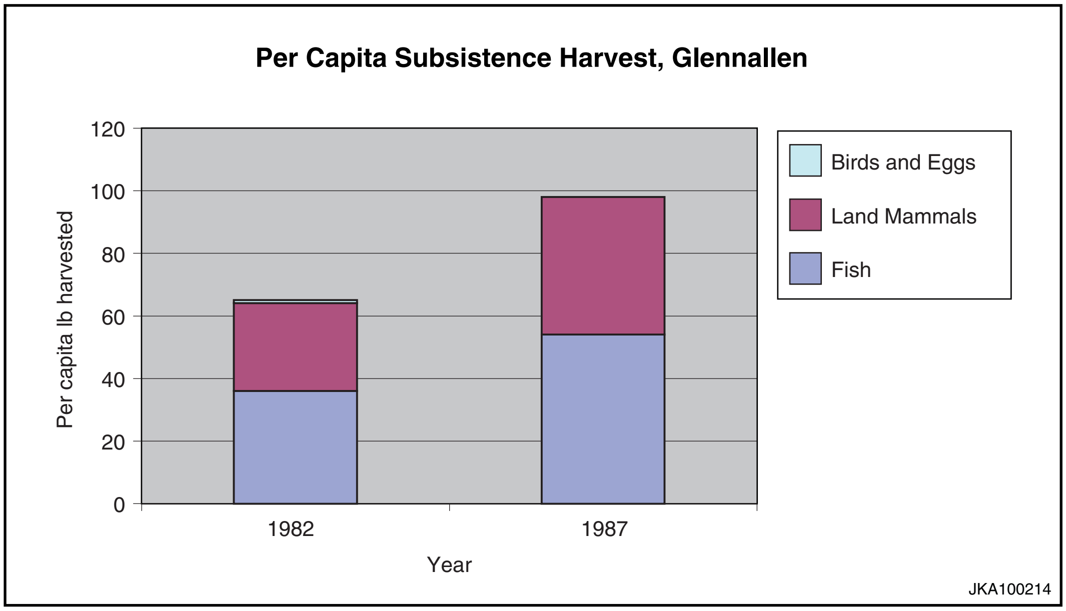

FIGURE 3.24-18 Variability in Glennallen Subsistence Harvest Over Time (Source: ADF&G 2001b)

subsistence resources because of non-TAPS-related development in the area (ADF&G 2001b).

3.24.2.3.5 Gulkana. Gulkana lies on the eastern bank of the Gulkana River where it joins the Copper River, approximately 3 mi east of the TAPS (Map 3.24-1) (ADCED 2001b). The population of Gulkana in 2000 was 88, about 72% of whom were Alaska Natives (primarily Ahtna Athabascan — see Tables 3.25-1 and 3.29-1).

The village economy of Gulkana is mixed, with subsistence hunting, fishing, gathering, and trapping providing key resources along with limited year-round and seasonal wage employment. Gulkana residents harvested an average 153 lb per capita in 1987 (McMillan and Cuccarese 1988; see Table 3.24-1; see also Simeone and Fall 1996). Fishing, particularly for salmon, contributes the greatest amount of subsistence resources by weight. Similarly, the largest percentages of households harvested fish compared with other subsistence activities, although hunting of land mammals also involved relatively large percentages of village residents (see Table 3.24-2). The exchange of subsistence resources helped to ensure that nearly all households in the village had access to these materials, while reestablishing patterns of giving and receiving (ADF&G 2001b).

The Gulkana subsistence use area is concentrated to the north and west of the village, but extends south along the Richardson Highway to Thompson Pass and to the northwest along the upper Copper River toward Nabesna. A discontinuous portion of this use area is also found in the Wrangell-St. Elias Mountains north of Chitina. Part of the subsistence use area for Gulkana overlaps with a section of the TAPS (see Map 3.24-1). In addition, the use area for this community includes part of the Copper River downstream from the pipeline. Subsistence harvest data from 1983 and 1987 indicate an increase in per capita pounds harvested in the latter year, primarily accounted for by larger amounts of salmon and land mammals (Figure 3.24-19).

Subsistence concerns identified by local residents during the 1980s included hunting and fishing bag limits (particularly on caribou and salmon), as well as both the potential increased competition for subsistence resources and habitat destruction resulting from non-TAPS-related development in the area (ADF&G 2001b).

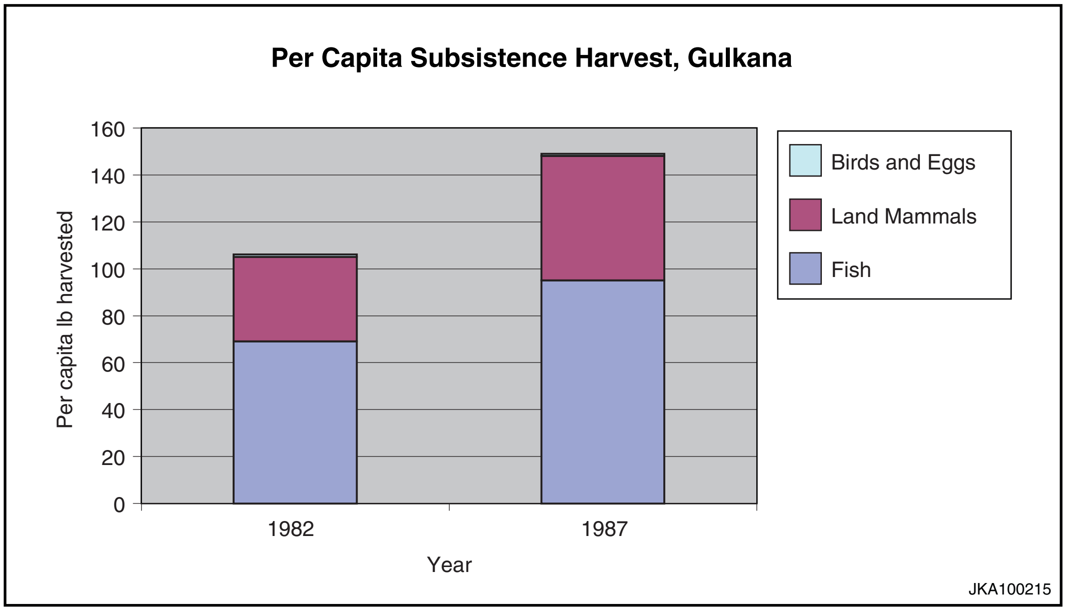

FIGURE 3.24-19 Variability in Gulkana Subsistence Harvest Over Time (Source: ADF&G 2001b)

3.24.2.3.6 Kenny Lake. Kenny Lake is a small community located about 7 mi east of the TAPS in the central Copper River Basin (ADCED 2001b) (see Map 3.24-1). The total population of Kenny Lake was 410 in 2000, with slightly more than 10% of the residents Alaska Natives (see Table 3.29-1). Although the area in and around Kenny Lake was inhabited for centuries by Athabascans, the community itself was founded in the 1960s by people homesteading agricultural land.

The economy of Kenny Lake is mixed, although wage labor is the main economic activity, with the majority of employment in commercial agriculture and small businesses . Subsistence, primarily hunting and fishing, also is conducted by residents of the community, producing an average per capita harvest of 136 lb in 1987. During 1987, the year designated by ADF&G as representative, subsistence contributed more than 130 edible pounds per person (McMillan and Cuccarese 1988) (see Table 3.24-1). Salmon accounted for nearly 83 edible pounds per person, with most of the remainder coming from moose and caribou. ADF&G survey data indicate that all households in Kenny Lake harvested at least one subsistence resource in 1987 (see Table 3.24-2). Despite this high rate of participation in harvesting, exchange of subsistence resources also occurred in this small community, reaffirming patterns of social interaction (ADF&G 2001b). Subsistence harvest data from 1983 and 1987 indicate a large increase in per capita pounds harvested in the latter year, accounted for by increased large mammal and (especially) salmon harvests (Figure 3.24-20).

The Kenny Lake subsistence use area encompasses a wide zone to the west and east, generally south of the village, including both the Copper River and the Chitina River basins. Extensions along the Richardson and Glenn Highways are also important. Part of the subsistence use area for Kenny Lake overlaps with the TAPS (see Map 3.24-1). In addition, the use area for this community includes part of the Copper River downstream from the pipeline.

Subsistence concerns identified by local residents during the late 1980s included both potential increased competition for subsistence resources and possible habitat destruction resulting from non-TAPS-related development in the area (ADF&G 2001b).

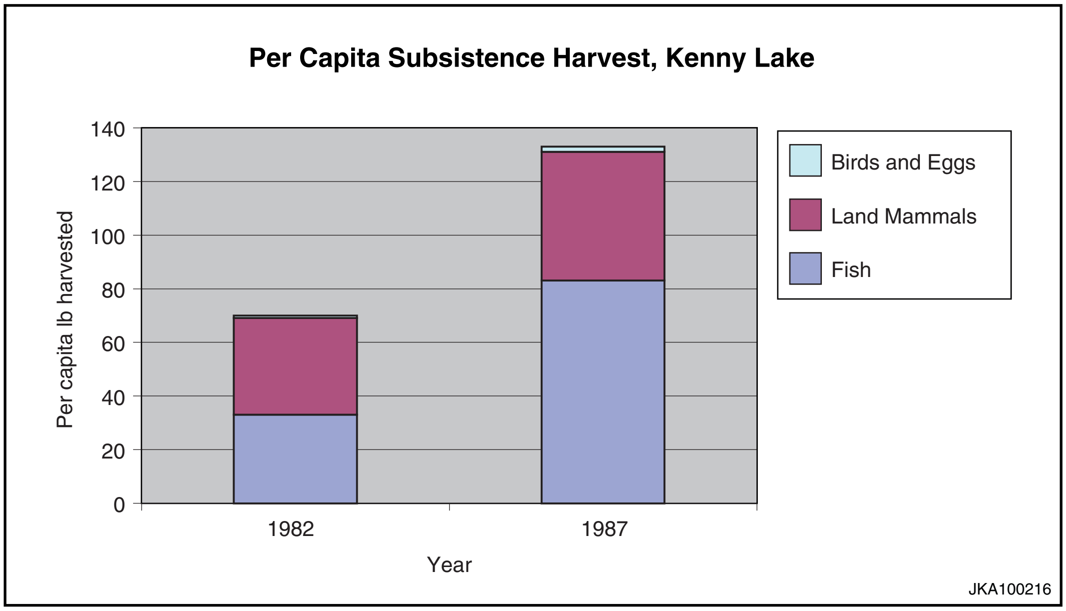

FIGURE 3.24-20 Variability in Kenny Lake Subsistence Harvest Over Time (Source: ADF&G 2001b)

3.24.2.3.7 Paxson. Paxson is located about 4 mi west of the TAPS in the Copper River Basin, at the intersection of the Richardson and Denali Highways (ADCED 2001b) (see Map 3.24-1). Paxson's total population was 43 in 2000, with no residents either Native or of any other minority (see Table 3.29-1). Paxson began in the early 1900s as a small roadhouse in the vicinity of the modern community.

Although the economy of Paxson is mixed, wage labor is the dominant component as residents take advantage of their proximity to two major highways to work in small local businesses that provide services to travelers, or for the government (primarily in highway maintenance). Nevertheless, subsistence activities provide considerable resources to community residents, in excess of 280 edible pounds per person in 1987 (McMillan and Cuccarese 1988) (see Table 3.24-1). Nearly every household harvested subsistence resources in the late 1980s. Despite higher participation in fishing that year, the largest amount of resources was contributed by land mammals, mainly moose and caribou (see Table 3.24-2). Although evidence exists for the exchange of subsistence resources, the receipt of resources did not generally increase the percentage of households using these resources (ADF&G 2001b).

The Paxson subsistence use area covers a wide area centered on the village, including the and extending west along the Denali Highway, and south. Part of this area for Paxson overlaps with a section of the TAPS (see Map 3.24-1).

Subsistence concerns identified by local residents during the late 1980s included both potential increased competition for resources and possible habitat destruction from non-TAPS-related development in the area (ADF&G 2001b).

3.24.2.3.8 Tazlina. Tazlina is a small community located along the Richardson Highway on the Tazlina River near its juncture with the Copper River, about 2 mi northeast of the TAPS (see Map 3.24-1) (ADCED 2001b). Its population in 2000 was 149, about a quarter of whom were Native (primarily Ahtna Athabascan) (see Tables 3.25-1 and 3.29-1).

Largely because of its location on a major highway and its proximity to a large community (Glennallen), residents of Tazlina have more economic options than most rural Alaskans.

Wage labor, primarily for local businesses or government agencies, provides most of the livelihood in Tazlina. Nevertheless, subsistence continues as an important activity for many village residents. Hunting (notably for moose and caribou) and fishing (particularly for grayling and salmon) provide most of the meat obtained through noncommercial means (McMillan and Cuccarese 1988) (see Table 3.24-1; see also Simeone and Fall 1996). In 1987, the representative year for Tazlina, per capita harvests for all resources reached 107 lb. About 63% of the households harvested fish, while 29% took large land mammals (mostly moose and caribou), 23% took small mammals and furbearers, and 40% took birds, mostly grouse and ptarmigan (see Table 3.24-2). Considerable exchange of subsistence resources also occurred in 1987, providing access to these resources for households that do not harvest them, as well as further defining distribution networks. For example, although 63% of households fished, 94% of households were able to use this food source because of sharing (ADF&G 2001b).

The Tazlina subsistence use area is particularly large, reflecting the tendency of residents to travel along area highways to access the hunting range. Part of the subsistence use area for Tazlina overlaps with a section of the TAPS (see Map 3.24-1). In addition, the use area for this community includes part of the Copper River downstream from the pipeline.

Subsistence concerns identified by local residents in 1987 included habitat destruction by non-TAPS-related development and potentially increased competition for subsistence resources resulting from non-TAPS-related development in the area (ADF&G 2001b).

3.24.2.3.9 Tonsina. Tonsina is a small settlement in the central Copper Basin, located about 2 mi east of the TAPS in the vicinity of PS 12 (ADCED 2001b; see Map 3.24-1). The total population of Tonsina in 2000 was 92, about 10% of whom were Alaska Natives (mainly Ahtna Athabascan) (see Tables 3.25-1 and 3.29-1). In 1902, the U.S. Army established a telegraph station at the location of the modern community. The majority of growth experienced in Tonsina, however, has been related to construction and continued operation of the TAPS.

Most adults in Tonsina work for wages, with employment at PS 12 and work on road maintenance crews providing much of their income. Nearly all households also harvested some sort of subsistence resource in 1987, the representative year for the community, testimony to the continuing importance of this activity (McMillan and Cuccarese 1988) (see Table 3.24-2). Rates of household participation in subsistence are high, with 83% of households fishing, 70% hunting for large land mammals, primarily caribou and moose; and about 40% taking small land mammal, furbearers, and birds (mostly grouse and ptarmigan). Tonsina residents harvested 156 lb of subsistence resources per capita in 1987. About half of the per capita subsistence harvest by weight was fish, primarily salmon, with most of the remainder being caribou and moose (see Table 3.24-1). Exchange of subsistence resources also occurred, with moose and salmon shared most widely. This sharing provides some households who did not harvest resources themselves access to those resources as well as further defining exchange networks (ADF&G 2001b). Subsistence harvest data from 1983 and 1987 indicate a substantial increase in per capita pounds harvested in the latter year, primarily accounted for by a larger harvest of land mammals (Figure 3.24-21).

The Tonsina subsistence use area extends through a large portion of the Copper Basin from Paxson to Thompson Pass, into the Chugach Mountains south of the community, and through much of the Chitina River valley. Part of the subsistence harvest area for Tonsina overlaps with a section of the TAPS (see Map 3.24-1). In addition, the use area for this community includes part of the Copper River downstream from the pipeline. Subsistence concerns identified by local residents during the late 1980s included both the potential increased competition for subsistence resources and possible habitat destruction from non-TAPS-related development in the area (ADF&G 2001b).

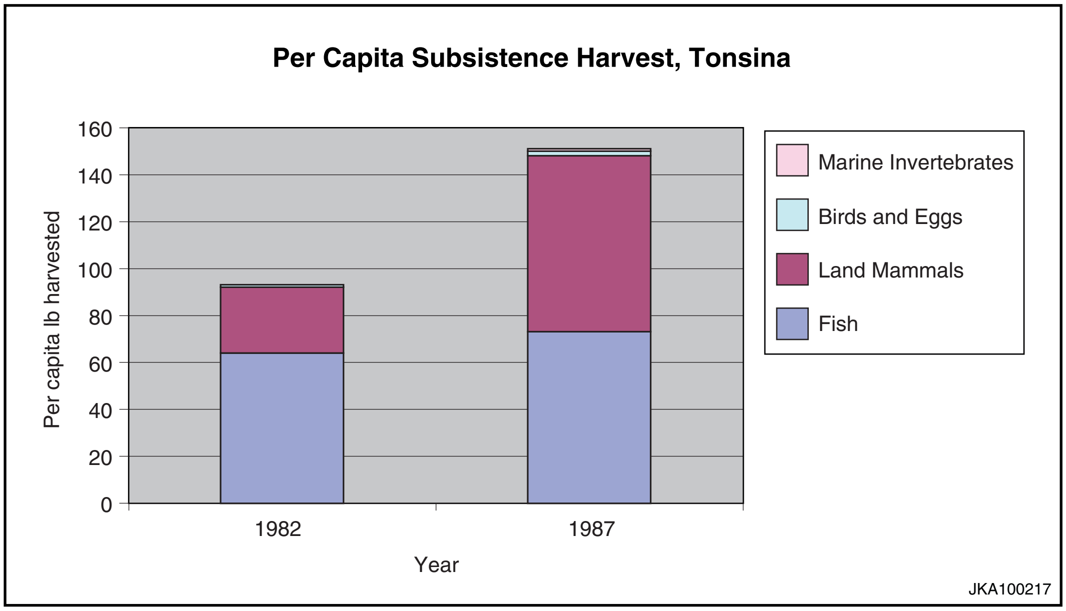

FIGURE 3.24-21 Variability in Tonsina Subsistence Harvest Over Time (Source: ADF&G 2001b)

3.24.2.4 Prince William Sound and Lower Cook Inlet

Prince William Sound is the body of water along the coast of south-central Alaska extending from Cape Puget in the west to Cape Hinchinbrook in the east (see Map 3.1-2). The lower Cook Inlet, in turn, refers in the present context to the marine setting south of Kachemak Bay, on the Kenai Peninsula's most southern reaches. The focus here is on human settlements located near the shores of both of these bodies of water — communities having traditional affiliations with Chugach Alutiiq, Eyak, and (more recently) non-Native sociocultural systems (see Section 3.25). Subsistence in these south-central Alaska coastal communities typically involves a broad range of marine, riverine, and terrestrial animals — marine mammals, marine invertebrates, fish, land mammals, and birds — many in relatively large amounts. However, resources from water environments tend to be most important in terms of total pounds harvested. Figure 3.24-22 graphically presents the relative contribution of various subsistence resources harvested in Prince William Sound in per capita pounds for an example coastal community. The data reveal a heavy reliance on fish within a subsistence strategy that includes a broad range of marine and terrestrial resources. Harvests occur throughout the year, carefully timed in a complex series of activities based on the availability of a large number of resources (Figure 3.24-23). Harvest levels in the Prince William Sound-Lower Cook Inlet region are about 25% to 33% of those in Interior and Arctic villages, and nearly double those of the Copper River Basin communities. Among the villages of interest in this EIS, reported values range from about 250 lb per capita to 400 lb per capita. The exception is Cordova, where per capita harvest for 1997 was about 180 lb per person.

The EIS discusses subsistence in three Prince William Sound communities — Chenega Bay, Cordova (which includes the Native Village of Eyak), and Tatitlek. It also examines subsistence in Nanwalek and Port Graham, neighboring communities on the coast of the lower Cook Inlet. These communities all share broadly common ecological locations, providing them access to both terrestrial and marine subsistence resources. As a consequence, they all harvest and use the broad range of animals and plants from both ecological settings characteristic of coastal adaptive strategies. Although the sociocultural composition of these five communities varies (see Section 3.25), and

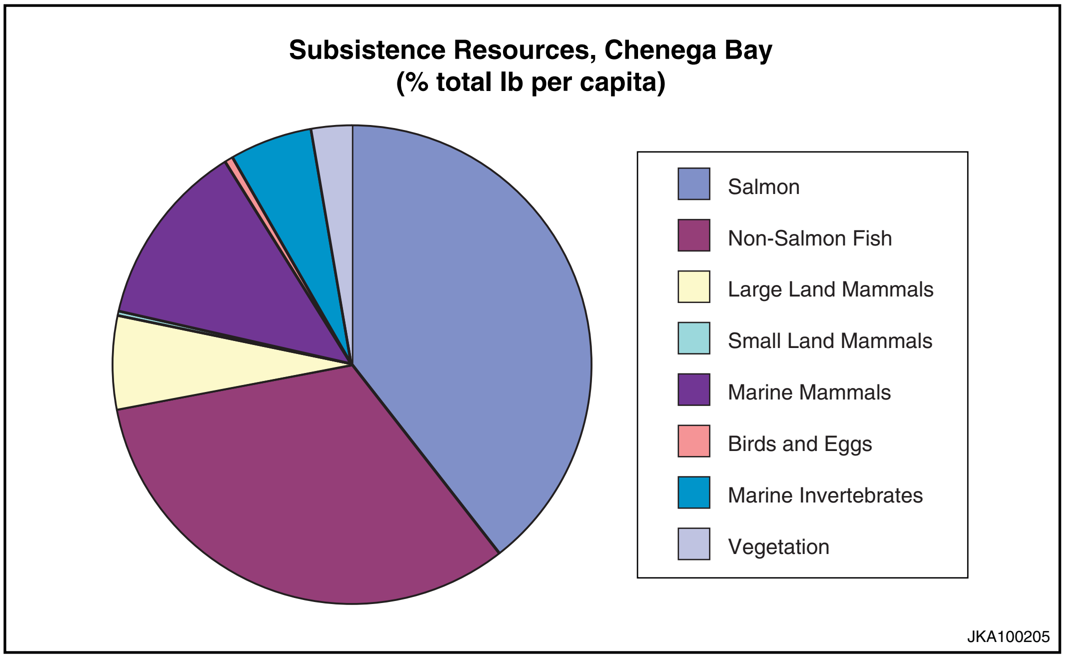

FIGURE 3.24-22 Example Combination of Subsistence Resources in Prince William Sound (Chenega Bay) (Source: ADF&G 2001b)

specifics of their geographic locations also vary, for present purposes certain shared subsistence characteristics and locations with respect to the TAPS provide justification for their grouping. In addition to the brief descriptions of subsistence in these five communities presented below, further details are provided in Appendix D.

3.24.2.4.1 Chenega Bay. Chenega Bay is a small, unincorporated community located on Evans Island in Prince William Sound, about 85 mi southwest of the Valdez Marine Terminal (see Map 3.24-1) (ADCED 2001b). The original village of Chenega, a Chugach Alutiiq settlement, was destroyed by the 1964 earthquake, and the current location was settled in 1984. The 2000 census recorded 86 people in Chenega Bay, nearly 74% of them Alaska Native or Native American (see Tables 3.25-1 and 3.29-1). The Chenega Bay economy is mixed, combining commercial fishing, small-scale oyster farming, and subsistence (Tomrdle and Miraglia 1993).

The residents of this small community harvest a wide range of land and marine mammals, fish, birds, and marine invertebrates for subsistence purposes (Fall and Utermohle1999; Stratton and Chisum 1986) (see Table 3.24-1). Chenega Bay residents harvested 275 lb of subsistence resources per capita in 1993. Harvest participation rates vary by resource category, with nearly 80% involved in subsistence fishing in the reference year, and 40-50% of households involved in hunting marine mammals (primarily seals), land mammals (mostly deer) and birds (both waterfowl and upland species) (see Table 3.24-2). The exchange of subsistence resources involved many of the village households, expanding access to these materials while further establishing social networks and patterns of obligation (ADF&G 2001b). Figure 3.24-24 shows per capita pounds harvested for several resources in the 1980s and 1990s. Harvest data have changed over time, declining considerably in 1989 and 1990 as a consequence of the Exxon Valdez Oil Spill and followed by a resurgence in harvests to levels higher than pre-spill amounts.

The contemporary Chenega Bay subsistence use area encompasses the lands

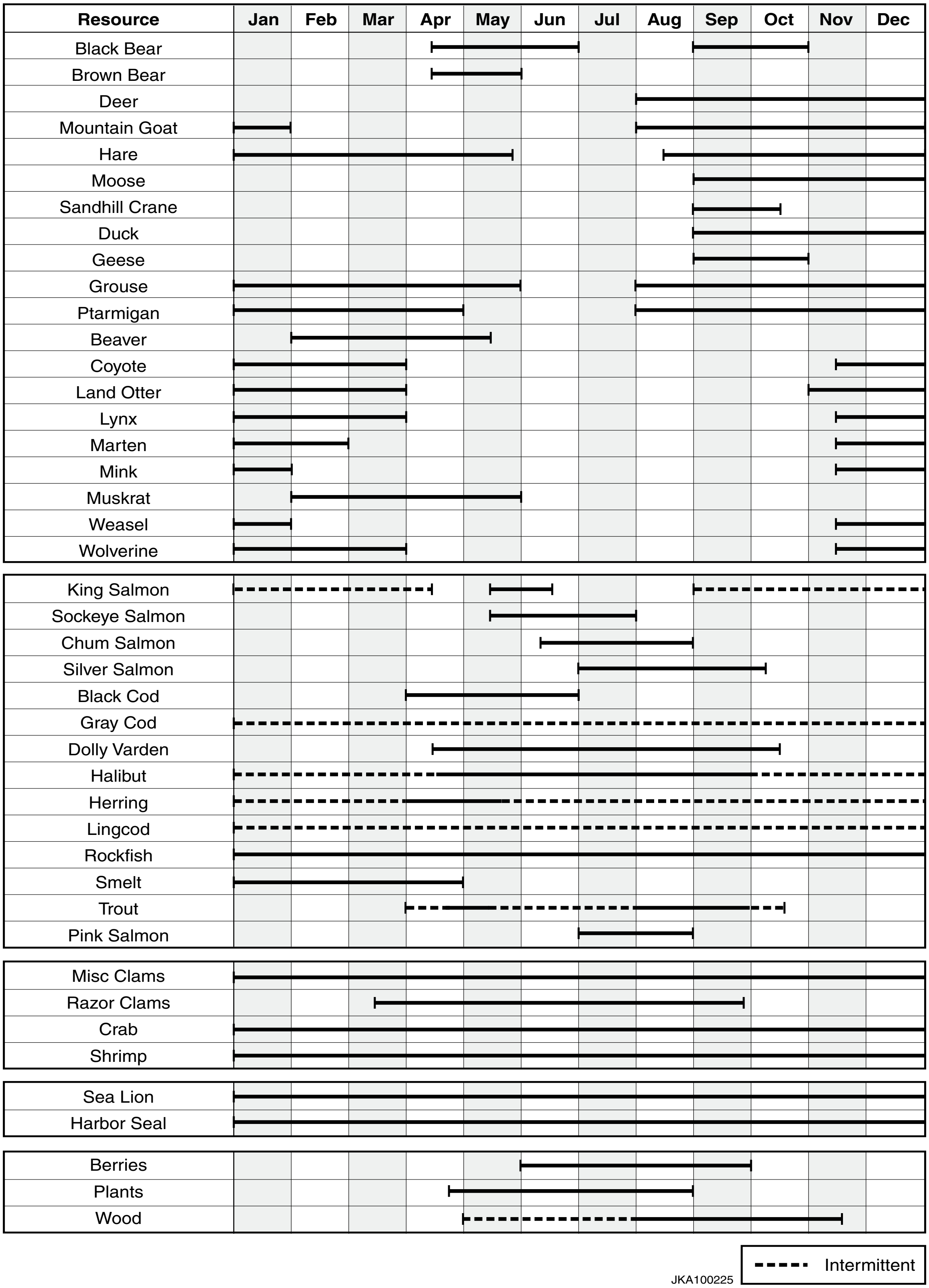

FIGURE 3.24-23 Example of the Seasonality of the Subsistence Harvest in Prince William Sound (Cordova) (Source: Stratton 1992)

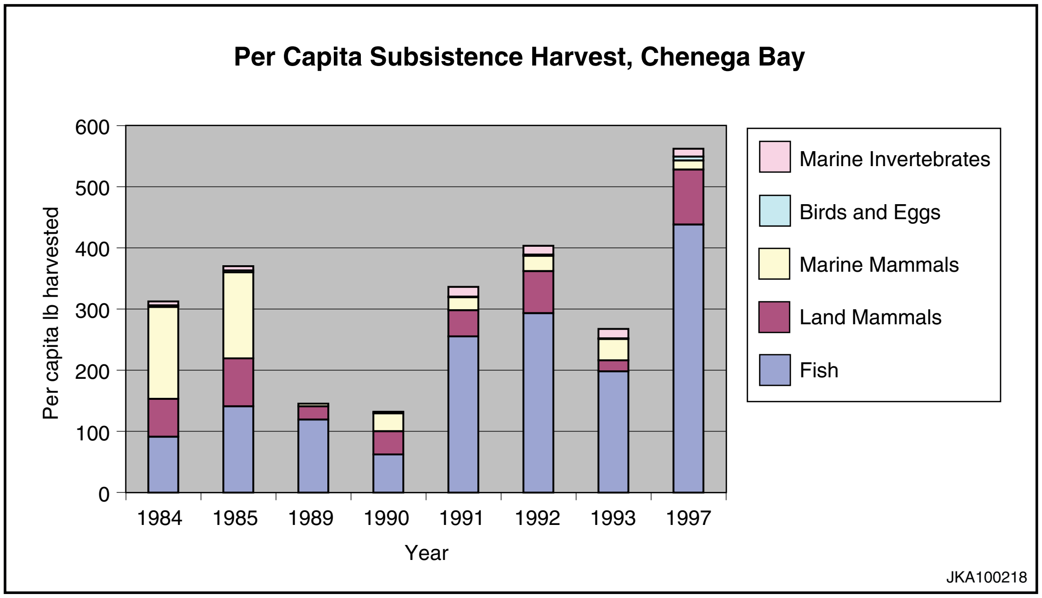

FIGURE 3.24-24 Variability in Chenega Bay Subsistence Harvest Over Time (Source: ADF&G 2001b)

and surrounding waters of Evans Island, where the village is located, nearby LaTouche Island and Elrington Island to the southeast, and Bainbridge Island to the west. A portion is also found to the north, in the vicinity of Chenega Island, the site of the historic community of Chenega, destroyed in the 1964 earthquake. Although the subsistence use area generally lies well west of the TAPS, small localities occur close to the south and west of the Valdez Marine Terminal (see Map 3.24-1) (see also Ganley and Wheeler 2000; Ganley 2001).

Due in part to the community's relatively recent settlement in its current location, subsistence concerns in the Chenega Bay area are still emerging (ADF&G 2001b). On the basis of 1984-1986 data (collected before the Exxon Valdez spill), per capita harvests appear to have declined substantially (42%) from levels in the 1960s. Reasons for the decline proposed by local residents included changing regulations and reduced resource levels (Stratton and Chisum 1986). Data collected after the Exxon Valdez spill support local concerns about subsistence impacts as a consequence of that event, indicating declines (an estimated 57% reduction in Chenega Bay) in the first year following the 1989 spill (Fall et al. 1996). Residents generally attributed this decline to actual and feared contamination of resources. Subsistence harvests rebounded in the following years, although some residents reported increased effort and costs to achieve desired harvest levels, which they attributed to scarcity of resources. Subsistence harvest participation and production showed substantial recovery into the late 1990s (Fall 1999; Fall and Utermohle1999). Persisting effects of contamination from the Exxon Valdez oil spill; shortages of seals, sea lions, clams, octopus, and some ducks; certain regulations affecting subsistence harvests of salmon; and competition for deer by nonlocal or recreational hunters all have been cited as subsistence concerns. Section 4.7.8.1 discusses subsistence levels in Chenega Bay and other communities directly affected by the Exxon Valdez spill before and after the spill.

3.24.2.4.2 Cordova (and Eyak). Cordova is a small community in the eastern part of Prince William Sound, about 35 mi south-southeast of the TAPS (see Map 3.24-1) (ADCED 2001b). The population of Cordova was 2,454 in 2000, 10.4% of whom were Alaska Natives (ethnically Eyak, Chugach Alutiiq, Tlingit, and other peoples) (see Table 3.29-1). The Native Village of Eyak is a politically separate entity representing Alaska Natives who reside in Cordova and along the Copper River Highway east of town (see Section 3.25.1.1.8). The Native Village of Eyak is one of the 21 directly affected Tribes examined in this EIS. Because Eyak Tribal members live throughout the Cordova area, not in a geographically distinct location, and because the ADF&G reports Eyak subsistence data aggregated with those from Cordova, the following discussion focuses on the latter community.

Although Cordova is relatively remote from major Alaska population centers and transportation arteries, wage labor dominates the community's economy, with most employment associated with commercial fishing or fish processing. Most residents also are involved in subsistence. Fishing for a variety of species, hunting (particularly deer, moose, and hare), and collecting marine invertebrates provide most of the meat obtained through noncommercial means in Cordova, although as with most coastal communities residents pursued a broad range of subsistence resources (see Table 3.24-1) (Fall and Utermohle1999). Cordova residents harvested approximately 179 lb of subsistence resources per capita in 1997, the representative year for Cordova. Nearly 80% of the households in Cordova fished for subsistence that year, with another 47% hunting large land mammals (see Table 3.24-2). Sharing of both fish and land mammal subsistence resources is widespread. For example, just under 50% of households harvest large land mammals, but 77% report using these foods; 75% of households harvest subsistence fish, while 94% reporting using them. Giving and receiving the resources harvested helped to make them available to households not involved in the actual harvest, at the same time reaffirming patterns of exchange and social obligation (ADF&G 2001b). Figure 3.24-25 shows per capita pounds harvested by Cordova residents for several resources during the 1980s and 1990s. Harvest data indicate a decline for several years following the Exxon Valdez Oil Spill (1989), with data for 1997 indicating what appears to be a resurgence towards pre-spill amounts.

The Cordova subsistence use area extends across Prince William Sound from near Cape Suckling in the east to Port Wells and the eastern shore of the Kenai Peninsula in the west. This area includes marine waters and upland areas along the coast and on a number of islands (see Map 3.24-1).

Subsistence concerns identified by local residents during public scoping for this EIS and during the late 1990s included both contamination and environmental damage associated with the Exxon Valdez oil spill in 1989 (Fall and Utermohle1999). Data collected after the Exxon Valdez spill indicated declines in subsistence harvests following the 1989 spill, with recovery continuing into the late 1990s (Fall 1999; Fall and Utermohle1999). Residents attributed the sharp decline to contamination and fear of contamination of resources. Although harvest levels subsequently rebounded, residents reported increased efforts and cost to obtain desired levels due to resource scarcity. Cordova residents expressed concerns during public scoping about continued contamination in the water column, persisting low herring stocks, and restrictions to areas important for crab harvests because of oil tanker lanes whose definition expanded following the events of September 11, 2001. Section 4.7.8.1 discusses subsistence levels in Cordova and other communities directly affected by the Exxon Valdez oil spill before and after the spill.

3.24.2.4.3 Nanwalek. Nanwalek is located at the southern tip of the Kenai Peninsula, approximately 252 mi southwest of the TAPS on the lower Cook Inlet (see Map 3.24-1) (ADCED 2001b). The population of Nanwalek in 2000 was 177, nearly 90% of whom were Alaska Natives (mainly Unegkurmiut Alutiiq) (see Tables 3.25-1 and 3.29-1). Some wage employment is available, mainly seasonal work at the Port Graham Cannery.

Subsistence remains extremely important to many Nanwalek residents for economic, sociocultural, and ceremonial reasons. One of the more notable characteristics of subsistence in Nanwalek is the broad range of marine and terrestrial resources harvested, with fishing for and gathering marine invertebrates especially important (see Table 3.24-1). Nanwalek residents harvested an average of 254 lb per person in 1997. All Nanwalek households harvested fish and marine invertebrates, while

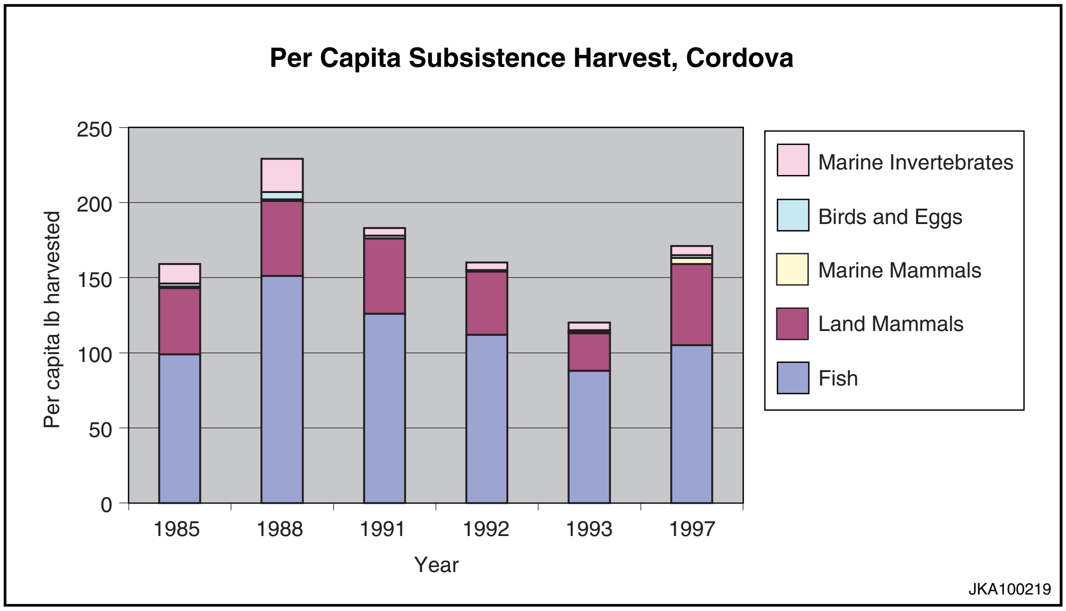

FIGURE 3.24-25 Variability in Cordova Subsistence Harvest Over Time (Source: ADF&G 2001b)

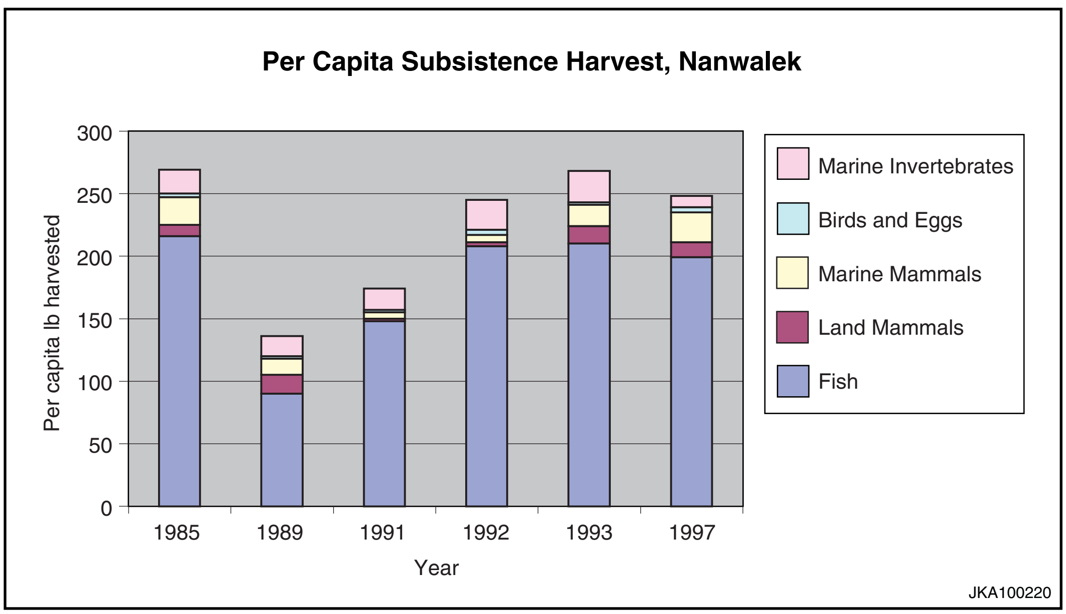

FIGURE 3.24-26 Variability in Nanwalek Subsistence Harvest Over Time (Source: ADF&G 2001b)

marine mammals involved 34% of households, land mammals about 14%, and birds and their eggs about 45% during the reference year of 1997 (see Table 3.24-2). In addition, resource exchange involved nearly all households in Nanwalek, helping to reaffirm patterns of social interaction and obligation (ADF&G 2001b). Figure 3.24-26 shows per capita pounds harvested for several resources in the 1980s and 1990s. These data indicate changing harvests over time, declining considerably in 1989 and 1991 as a consequence of the Exxon Valdez oil spill and increasing thereafter similar to levels recorded prior to the spill (Fall 1999; Fall and Utermohle 1999).

The Nanwalek subsistence use area lies on the southwesternmost tip of the Kenai Peninsula in the vicinity of the village, and also in the Fox River area at the head of Kachemak Bay to the northeast. The use area for Nanwalek lies well west of the TAPS (see Map 3.24-1) (see also Ganley 2001; Ganley and Wheeler 2000).

Subsistence concerns identified by Nanwalek residents during the late 1980s and early 1990s included persistent problems resulting from the Exxon Valdez oil spill; low populations of seals, sea lions, some waterfowl, sockeye salmon, and a number of marine invertebrates; and competition with nonresidents for black bear, moose, goats, salmon, and halibut (ADF&G 2001b). Section 4.7.8.1 discusses subsistence levels in Nanwalek and other communities directly affected by the Exxon Valdez spill before and after the spill.

3.24.2.4.4 Port Graham. Port Graham is located at the southern end of the Kenai Peninsula on the shore of Port Graham, about 223 mi southwest of the Valdez Marine Terminal (see Map 3.24-1) (ADCED 2001b). Originally a Russian settlement in the mid-19th century, in 2000 the settlement of Port Graham contained 171 people, nearly 85% of whom were Native (largely Unegkurmiut Alutiiq) (see Tables 3.25-1 and 3.29-1). The economy of Port Graham is mixed (Stanek 1985). Wage employment is available in the nearby cannery and hatchery, and 15 residents held commercial fishing licenses in 2000.

Subsistence remains an important activity in Port Graham, with a harvest level of 253 lb per person in 1997. Fishing was by far the dominant activity, accounting for 220 lb per capita that year (see Table 3.24-1). Subsistence harvests involved large percentages of Port Graham households, with more than 90% harvesting fish in the same reference year, while 27% took marine mammals, about 5% took large land mammals (black bears), and 25% took birds (see Table 3.24-2). In addition to high levels of harvesting, many households exchanged subsistence resources — providing access to those resources for those who had not obtained fish and game themselves, while reaffirming patterns of social interaction and exchange (ADF&G 2001b). Figure 3.24-27 shows per capita pounds harvested for several resources in the 1980s and 90s. Harvest data have changed over time, declining considerably in 1989 as a consequence of the Exxon Valdez oil spill but apparently recovering shortly thereafter to pre-spill levels (Fall 1999; Fall and Utermohle 1999).

The Port Graham subsistence use area lies on the southwesternmost tip of the Kenai Peninsula in the vicinity of the village, and also in the Fox River area at the head of Kachemak Bay to the northeast. The use area for Port Graham lies well west of the TAPS (see Map 3.24-1) (see also Ganley 2001; Ganley and Wheeler 2000).

Subsistence concerns identified by local residents during the late 1980s and early 1990s included persisting problems because of the Exxon Valdez oil spill; habitat destruction from logging; low populations of seals, sea lions, some waterfowl, sockeye salmon, and a number of marine invertebrates; and competition with nonresidents for black bear, moose, goats, salmon, and halibut (ADF&G 2001b). Section 4.7.8.1 discusses subsistence levels in Port Graham and other communities directly affected by the Exxon Valdez oil spill before and after the spill.

3.24.2.4.5 Tatitlek. Tatitlek is located on the shore of Prince William Sound in an area called the Tatitlek Narrows, about 17 mi southwest of the Valdez Marine Terminal (see Map 3.24-1) (ADCED 2001b). It is located on the site of a historic Alutiiq village. The 2000 census

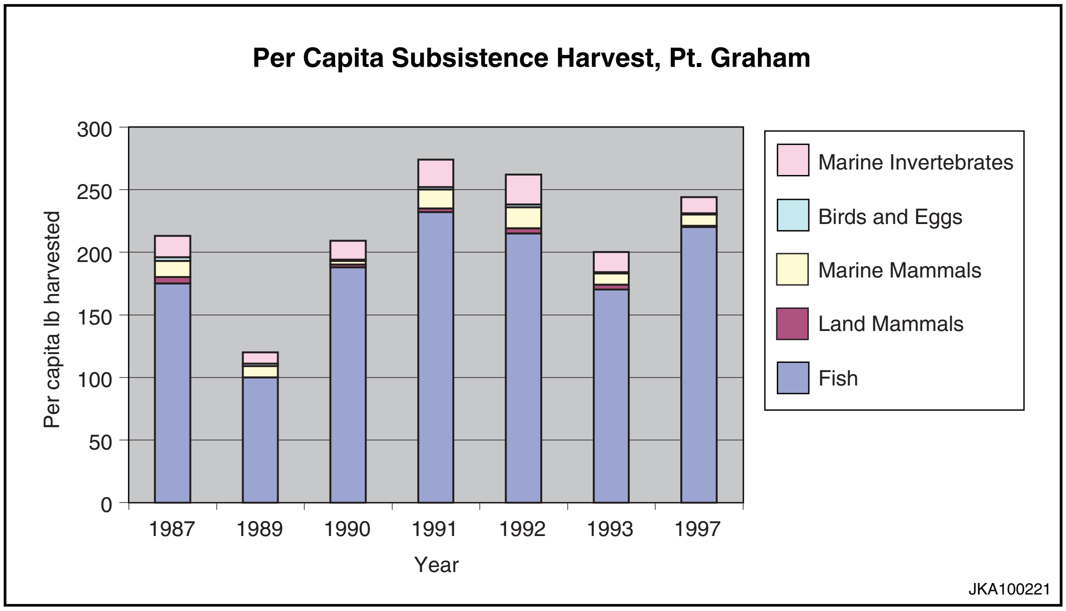

FIGURE 3.24-27 Variability in Port Graham Subsistence Harvest Over Time (Source: ADF&G 2001b)

recorded 107 people living in Tatitlek, more than 84% of whom were Alaska Natives (primarily Chugach Alutiiq) (see Tables 3.25-1 and 3.29-1). The village economy relies on both cash income and subsistence. Seasonal wage employment is available in fish processing and oyster farming, and in 2000 three residents held commercial fishing licenses.

Subsistence remains extremely important in Tatitlek, among other functions providing most of the food items and other resources used by the community. Subsistence harvest reached 406 lb per capita in 1997. As is the case in many coastal communities, a large variety of subsistence resources are exploited, including marine mammals and invertebrates, fish, large and small land mammals, and birds (Fall and Utermohle 1999) (see Table 3.24-1). This information on breadth of resources harvested is consistent with earlier research on the same community, although data for different years point to the considerable variability possible even between successive harvest years (Tomrdle and Miraglia 1993; see also Stratton 1992). Data from 1997, the representative year designated for Tatitlek, indicate that 75% of households harvest fish and marine invertebrates, 69% take birds (particularly ducks), 63% take land mammals (mostly deer), and 50% harvest marine mammals (mostly seals) (see Table 3.24-2). Sharing subsistence resources involves most households of the village. For example 50% of households take seals, but 94% of households report using this food resource; 63% of households take deer, while 94% of households use this species. Sharing provides access to resources while reaffirming patterns of exchange and social interaction (ADF&G 2001b). Figure 3.24-28 shows per capita pounds harvested for several resources in the 1980s and 1990s. Harvest data have changed over time, declining considerably in 1989 and 1990 as a consequence of the Exxon Valdez oil spill and resurging in later years (although remaining well below the exceptionally high levels recorded for 1988).

The subsistence use area for Tatitlek spreads to islands and coastal marine waters in much of eastern Prince William Sound, near the village. Although this area does not intersect the TAPS, it does include several parts of Prince William Sound in the immediate vicinity of the Valdez Marine Terminal (see Map 3.24-1) (see also Ganley 2001; Ganley and Wheeler 2000).

Subsistence concerns identified by local residents during the late 1980s through the late 1990s included persistent problems resulting

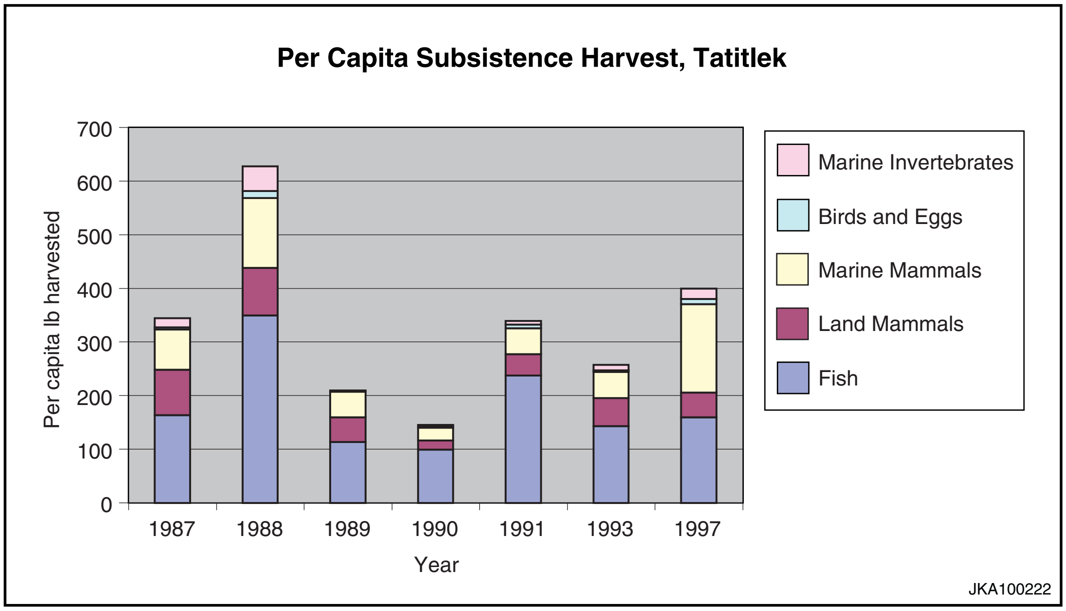

FIGURE 3.24-28 Variability in Tatitlek Subsistence Harvest Over Time (Source: ADF&G 2001b)

from the Exxon Valdez oil spill; low populations of seals, sea lions, some waterfowl, herring, sockeye salmon, a number of marine invertebrates, and deer; and competition for salmon and herring roe with nonresidents or commercial operations (ADF&G 2001b) (Stratton 1990). Studies focusing on subsistence changes following the Exxon Valdez spill indicate declines (an estimated 56% reduction in Tatitlek) in the first year following the 1989 spill (Fall et al. 1996). Residents generally attributed these rapid declines to actual and feared contamination of resources. Subsistence harvests rebounded in the following years, although some residents reported the need for increased effort and costs to achieve desired harvest levels, which they attributed to scarcity of resources. Subsistence harvest participation and production showed recovery continuing into the late 1990s (Fall 1999; Fall and Utermohle1999). Section 4.7.8.1 discusses subsistence levels in Tatitlek and other communities directly affected by the Exxon Valdez oil spill before and after the spill.

3.24.3 Access to Subsistence Resources

Subsistence inevitably requires access to the resources targeted for harvest. During traditional times, Alaska Natives moved through an annual seasonal round of locations to harvest resources efficiently, relocating to new areas in response to longer-term changes in resource abundance and availability. More recently, increasingly sedentary settlement by Natives and non-Natives alike has changed certain aspects of this access — such as the use of more frequent trips from a central locality. Moreover, modern transportation technology has had an important affect on geographic patterns of subsistence exploitation, often making it possible to continue harvest throughout the traditional range, and occasionally in a larger area than was traditionally used. This section briefly describes access in modern subsistence activities.

For several reasons, access to subsistence resources varies widely among communities examined in this EIS. One reason is geographic location of a particular resource. For example, the challenge of gaining access to marine subsistence resources, and the combination of knowledge, equipment, and personnel involved, differs from access to riverine resources, which, in turn, differs from access to terrestrial resources. Another reason is the geographic distribution and behavior patterns of subsistence resources. For example, access to more widely occurring terrestrial mammal resources located in specific areas, such as hares, might differ from access to terrestrial mammals that migrate and whose geographic availability is more limited, such as caribou. A third reason for differing access to subsistence resources is density. Resources such as moose and whales tend to be sparsely distributed, thus often requiring more effort and travel over greater distances than for resources available in higher density.

Modern technology has had enormous impacts on subsistence harvest activities, affecting access as well as means of harvest. During traditional times and, indeed, extending well into the 1960s in many parts of rural Alaska, pursuit of subsistence resources often required considerable effort — rowing or paddling boats in marine and riverine environments and walking or traveling by dogsled on land. In pre-contact and early contact times, indigenous peoples roamed over extremely large areas in search of subsistence resources. Sedentary settlements and mechanized travel have resulted in many changes. Boats with motors, off-road vehicles, snowmachines, and (infrequently, because of high cost) airplanes all play key roles in modern subsistence activities. Modern transportation technology in subsistence has offset some effects of sedentary settlement in modern communities. Traditional use area patterns persist, in part because traditional place names and traditional ecological knowledge about resources anchor identity and aid in hunter effectiveness. In some instances, new transportation technologies have resulted in expansion of feasible harvest areas beyond those traditionally used.

Access to marine subsistence resources now primarily involves travel by shallow-draft boats with engines when there is open water and snowmachines when ice forms. Although both means of transport have sustained, or in some cases increased, the size of geographic areas exploited, engine-powered boats have also made certain previously inaccessible places now available for subsistence activities.

Access to riverine resources often involves boats with engines, if any river travel is required, in both rivers near the coasts and interior rivers. Access to terrestrial resources usually involves travel by some type of motorized vehicle, including off-road vehicles (trucks and all-terrain vehicles) when snow depth is not a hindrance, snowmachines when sufficient snow exists, and airplanes during much of the year (although their use for subsistence activities is limited by high cost). Access to terrestrial resources can also involve travel by boat, particularly in coastal areas, and, in some cases (notably parts of the northern interior) travel by dogsleds. Similarly, access to marine and riverine resources in some settings can involve travel over land. The importance of improved transportation technology in the context of subsistence is substantial; lack of access to such technology is occasionally given as a reason for not engaging in subsistence activity (e.g., Brower and Opie 1997). Similarly, highly productive households have secure access to transportation technology and money to cover operating costs (Wolfe 1987). The impacts of transportation extend beyond traveling to harvest sites to the exchange of subsistence resources, of particular importance to Alaska Natives for economic as well as sociocultural (including ceremonial) reasons.

Travel to harvest locations tends to follow routes and involve destinations established over many generations. Although the terrestrial harvest areas depicted in Map 3.24-1 are often composed of large parcels of land, access is usually by trails linked to topographic features, such as valleys, shorelines, lakes, and geologic formations (TAPS Owners 2001a). Fishing, both in marine environments and on rivers, often focuses on places that have been used for centuries. Development that has interrupted these access routes or restricted access to desired harvest areas, such as certain localities associated with North Slope Oil development, is viewed by people pursuing subsistence as having an adverse effect on their activities (e.g., Haynes and Pedersen 1989).

Finally, access to subsistence resources involves not only travel to those resources, but also the ability to obtain them. Modern technology again plays an important role, as it has with transportation adapted to what may be centuries-old activities. For example, Alaska Native whaling crews off the northern coast of Alaska use global positioning units, which rely on signals from satellites orbiting the earth, to help relocate key areas for whales (TAPS Owners 2001a). Modern firearms, harpoons, and fishing technology, as well as implements introduced many decades ago (such as fish wheels), contribute to the act of harvesting — improving the amount harvested and, in certain situations, making harvesting possible when older technology would not.

The topic of access is important to the analysis of subsistence in this EIS, in part because of the geographic patterns of subsistence practices and the possibility that various alternatives considered in the EIS might affect these patterns. The topic of access is also important in understanding modern subsistence in Alaska, because in addition to benefits of modern technology there also are costs. Snowmachines, boats with engines, rifles, and so on all play central roles in subsistence activities in 21st century Alaska. But all require money for purchasing, maintaining, and obtaining necessary components (such as fuel and ammunition), and money is often in short supply in rural settings. Just as the use of dogsleds in the Alaska of the past required increased harvests of fish for dog food, modern technology requires sufficient cash to acquire, maintain, and operate the equipment.

3.24.4 Sport Harvests Versus Subsistence

A recurring concern regarding subsistence in Alaska is the impact of sport or recreational hunting and fishing over the past two to three decades. This issue appeared repeatedly in the summary presented above on subsistence issues at the community level (Section 3.24.2), as well as during public scoping. In the case of the TAPS, the increased access via the Dalton Highway and access roads, and the introduction of relatively large numbers of people to northern and Interior Alaska, have been seen by many as providing the foundations for competition with regard to subsistence activities.

One means of evaluating the relationship between subsistence and sport harvests is to examine data on harvest tickets compiled by the ADF&G (see Haynes 2000). These data are available for several species, with information on most available annually beginning in the early 1980s. Two characteristics of these data make them particularly useful for present purposes. First, they are compiled by location of harvest, with the maximum level of precision the uniform coding unit. Uniform coding units are geographic subdivisions of the game management units that the State of Alaska uses for wildlife management purposes. This spatial component of the data enables one to focus on harvests in particular parts of the state, such as the subsistence use areas presented in Map 3.24-1 (see also Appendix D), thereby making selected data of particular relevance for this study.

A second important characteristic of the harvest ticket data is that they record the address of the hunter filing each ticket. These data do not distinguish between subsistence and sport harvests, due in part to dual federal-state management of hunting (which define sport and subsistence harvests differently) and to the changing definition of subsistence over time, as discussed in Section 3.24.1. However, as this study relies on the federal definition of subsistence based on rural residency, it is possible to *approximate* subsistence versus sport harvests on the basis of the town where the harvesting party resided. It is important to note that this is very much an approximation. Harvests on state lands that this study records as sport harvests because of nonrural residency, for instance, may well have been subsistence harvests under state definition (which technically would have applied to a harvest on state land). However, applying the rural residency criterion enables the application of a single principle for purposes of examining the relationship between sport and subsistence harvests over time.

Before we examine the data, some brief cautionary notes are required. In general, these data are based on self-reporting — that is, submitting a harvest ticket to the ADF&G with accurate information. Underreporting and erroneous reporting always are possible problems. In an examination of similar data for a slightly different region, Haynes (2000) also noted the general concern that older data and data from rural settings tend to be less reliable than other information because of unsystematic or incomplete reporting.

The present study examines harvest ticket data for more than 600 uniform coding units that lie at least partially within the subsistence use areas shown in Map 3.24-1. Although data exist for several species, four are particularly important for sport and subsistence uses: caribou, mountain goat, moose, and Dall sheep.

As noted in Section 3.24.2, caribou is an important subsistence resource for most of the communities examined that lie in the Copper River Basin, in the Yukon River Drainage, and on the North Slope. Amidst considerable variability, harvests declined in the mid-1980s before generally recovering, showing a marked increase in the mid-1990s (Figure 3.24-29). This surge in harvests occurred immediately after opening of the Dalton Highway to public use, although this analysis did not focus solely on areas accessible from that road. Two changes are particularly marked with regard to the sport-subsistence distinction related to both absolute and relative subsistence harvests. Although the end points of the data reveal extremes, they provide a sense of trends in the data. Subsistence harvests accounted for 500 animals in 1983, nearly 37% of the total harvest; by 2001, subsistence users harvested fewer than 130 animals, slightly more than 11% of the total harvest for the uniform coding units of interest. Subsistence harvests generally have accounted for an increasingly small percentage of total Caribou harvests in the area examined. Total subsistence harvest was relatively high for many years in the middle of the time period considered, before declining back to levels seen in the mid-1980s.

Mountain goat harvest data reveal more variability, and less of a developing trend, than do the caribou data (Figure 3.24-30). An increase in combined subsistence and sport harvests in the early 1990s was followed by a slight decline in the middle of that decade. The relative importance of subsistence generally grew over time, reaching nearly half of the total harvest near the middle of the period considered before declining in the later 1990s. As with caribou, mountain goat harvest levels in the early 21st century were comparable to those seen in the early 1980s, following two periods of increase and subsequent decline.

Moose also play an important role in subsistence for many of the rural communities examined in this EIS (see Section 3.24.2). Overall moose harvest generally grew from 1983 to 1999, before declining slightly in the final two years examined. Subsistence harvests remained fairly constant over the period examined, while much of the overall harvest variability is accounted for by shifts in sport harvest levels (Figure 3.24-31). Sport harvests accounted for a larger percentage of the total from 1993 onward than they had previously.

Dall sheep harvests in the geographic area of interest increased twice over the nearly two decades examined — in the late 1980s and the late 1990s (Figure 3.24-32). Harvests once again varied considerably over time, with the 2001 harvest similar to that recorded in 1983. The subsistence share of harvests varied, but for all the years considered generally increased its relative role over time.

The approximations of subsistence and sport harvests for the uniform coding units near rural communities examined in this EIS do not reveal particularly strong trends throughout. In part this is due to variability seen to some degree in data for all four species examined. However, this conclusion is also in part due to declines in harvests over the past few years. Focusing on the period from 1983 through the late 1990s, total animals taken increased considerably for all animals examined except Dall sheep — with growth in sport harvests of caribou and moose particularly strong. Moreover, for caribou and moose, the data presented reveal increasing percentages of harvests by sport hunters compared to subsistence hunters. Such harvest trends for these most important terrestrial subsistence resources provides support for many of the concerns voiced by rural Alaskans in this area regarding growing competition. That stated, the

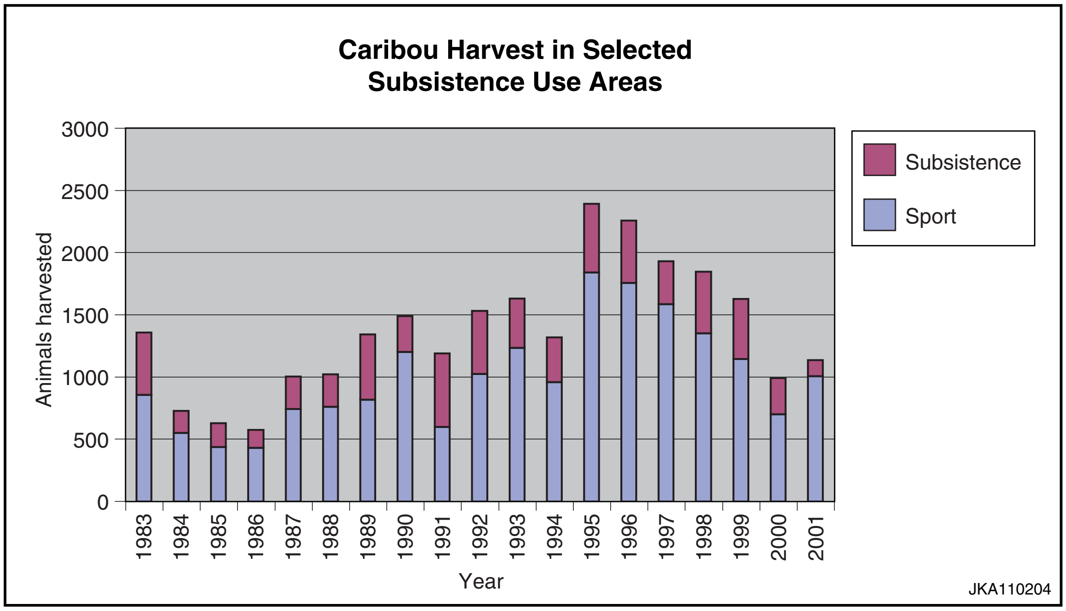

FIGURE 3.24-29 Approximated Sport and Subsistence Harvests of Caribou in Uniform Coding Units that Intersect Subsistence Use Areas of Rural Communities Examined in this EIS (Data Source: Lieb 2002)

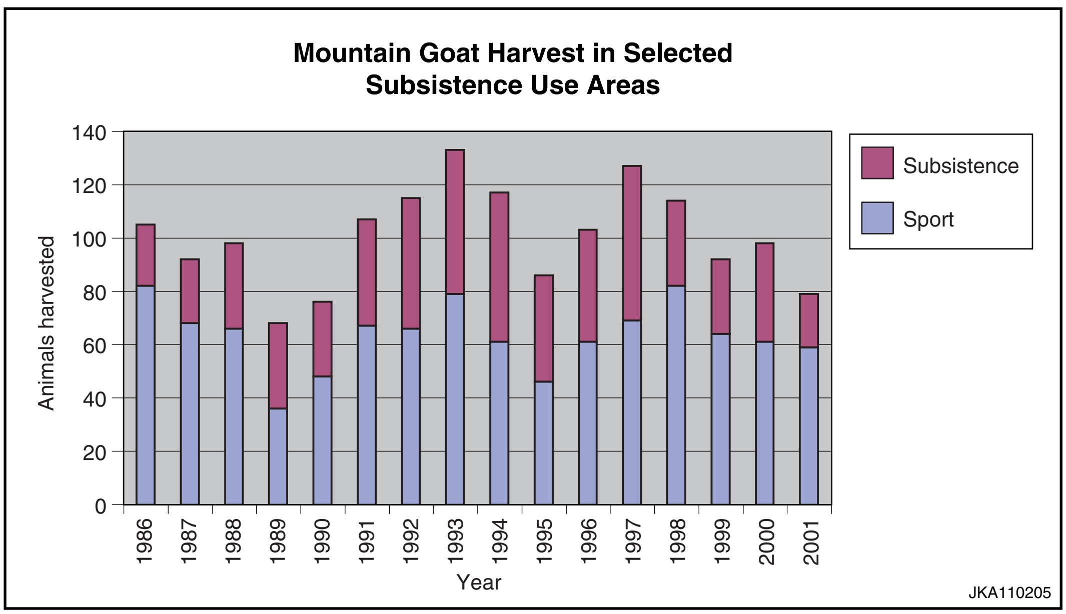

FIGURE 3.24-30 Approximated Sport and Subsistence Harvests of Mountain Goats in Uniform Coding Units that Intersect Subsistence Use Areas of Rural Communities Examined in this EIS (Data Source: Lieb 2002)

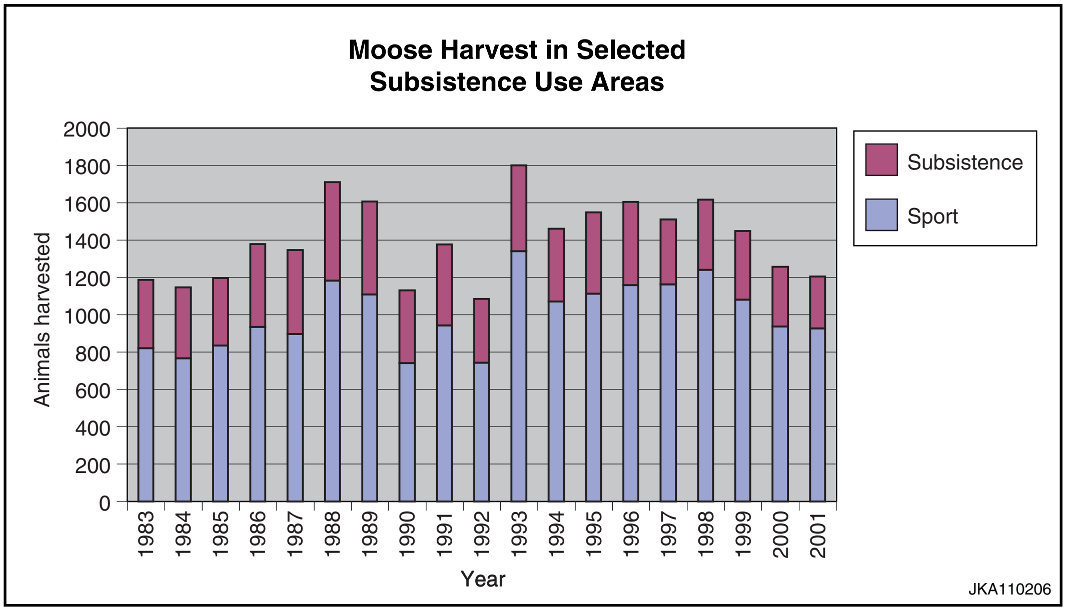

FIGURE 3.24.31 Approximated Sport and Subsistence Harvests of Moose in Uniform Coding Units that Intersect Subsistence Use Areas of Rural Communities Examined in this EIS (Data Source: Lieb, 2002)

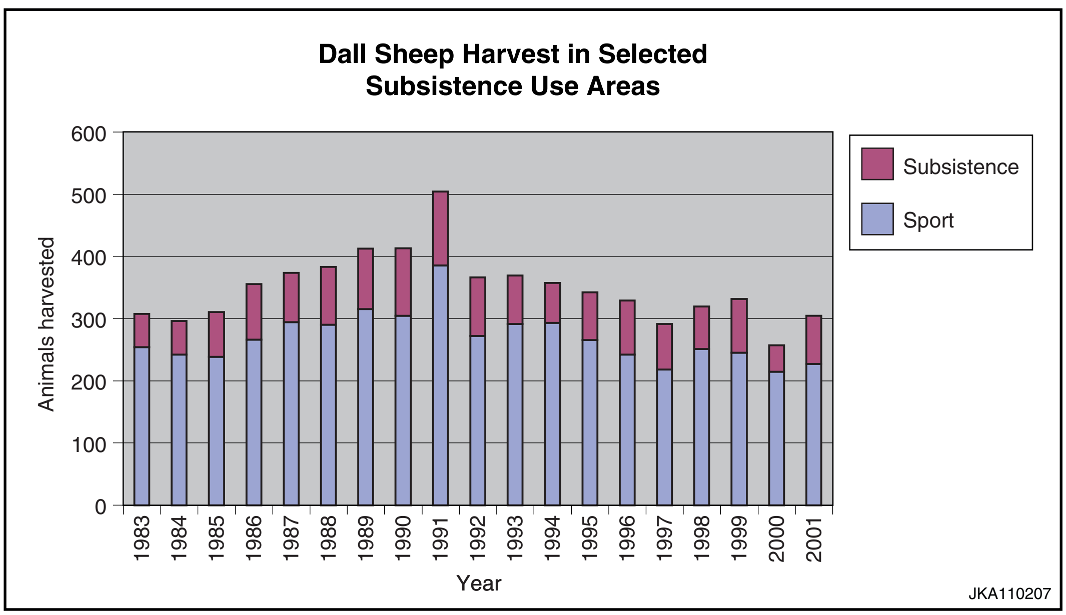

FIGURE 3.24.32 Approximated Sport and Subsistence Harvests of Dall Sheep in Uniform Coding Units that Intersect Subsistence Use Areas of Rural Communities Examined in this EIS (Data Source: Lieb, 2002)

reasons for harvest increases in general and sport harvests in particular through the late 1990s is not necessarily associated with the TAPS, but instead is likely a consequence of several other causes, including general population growth.

Subsistence fishing provides an important source of food for many rural Alaskans. Although recreational fishing is one source of competition for fishing resources, by far the greatest competition comes from commercial fishing — an estimated 97% of fish and game harvests by weight for the state (Wolfe 2000). Nevertheless, the TAPS has long been considered a *possible* source of impact on subsistence fisheries. In 1974, the ADF&G closed several rivers and streams in the Haul Road corridor to subsistence fishing (Haynes 2000). In addition to citing limited biological knowledge of fish stocks in these waterways, the agency also cited the need to protect the fish from nontraditional subsistence fisheries by people associated with the North Slope oil fields and the TAPS. Parts of this area were subsequently reopened to subsistence fishing in the mid-1980s, and the entire area was reopened in 1988.

Data on recreational fishing are available for certain sections of the northern part of the TAPS corridor beginning as early as the 1980s (Haynes 2000). Access by those engaged in recreational fishing along the corridor again appears to be important. Sport fishing was closed along the Dalton Highway corridor briefly during the late 1970s and reopened in 1981. Opening the highway to public traffic as far north as the Dietrich River in 1981 and north to Prudhoe Bay in 1994 provided new access to fishing areas in previously remote areas. Evidence published in the late 1980s indicated that for areas accessible to anglers, individual fish of interest to anglers were less numerous and smaller after construction and opening of the TAPS Haul Road (Dalton Highway) (BLM and USACE 1988). The ADF&G responded to possible impacts of increased access by restricting sport fishing bag limits (northern pike and arctic grayling) for this area and by implementing a catch-and-release-only requirement for lake trout within the Dalton Highway corridor. Data for sport fishing, both in terms of angler-days and catches, indicate a slight increase for certain indicators (within a considerable amount of variability) north of Atigun Pass from 1983 through the late 1990s (Figure 3.24-33). Data for sport fishing between Atigun Pass and the Yukon River are more limited temporally, although they indicate a general increase from 1995 through 1999 (Figure 3.24-34). Data for subsistence fishing reveal a varying reliance on fish by communities near the TAPS north of the Yukon River (ADF&G 2001a).

Data on subsistence salmon fisheries are available for individual communities over time — the years of data availability varying with the fishery involved. Figure 3.24-35 shows how subsistence salmon harvests varied over time for three of the four regions considered in this EIS: the Yukon River Drainage, Copper River Basin, and Prince William Sound-Lower Cook Inlet (presented separately in the figure). The importance of salmon to communities in the Yukon River Drainage immediately becomes obvious, although many of the chum and coho salmon harvested by rural villages in that region are used for dog food. The failure of the Yukon River salmon runs in 1990s also is clear in the graph, after particularly large harvests in the mid-1990s. Copper River Basin subsistence salmon fisheries also are highly productive, as indicated by the descriptions of those communities in Section 3.24.2.3. Management of these fisheries is challenging, particularly in light of commercial fishing pressures coupled with high demands of the Chitina dip-net fishery (see Simeone 1998). The total subsistence salmon produced by Prince William Sound and the Lower Cook Inlet are less than the other two regions. The data presented in Figure 3.24-35 is for salmon only. Other species of fish for which data are not presented are of varying importance in the subsistence of south-central Alaska communities (Fall and Utermohle 1999).

As was the case with harvests of terrestrial mammals, available evidence on subsistence fishing does not reveal particularly clear trends, largely because of variability over time. Low subsistence harvests for certain years, particularly for entire fisheries such as the Yukon River in the late 1990s, has had an important impact on the economies and sociocultural systems of the communities affected. That

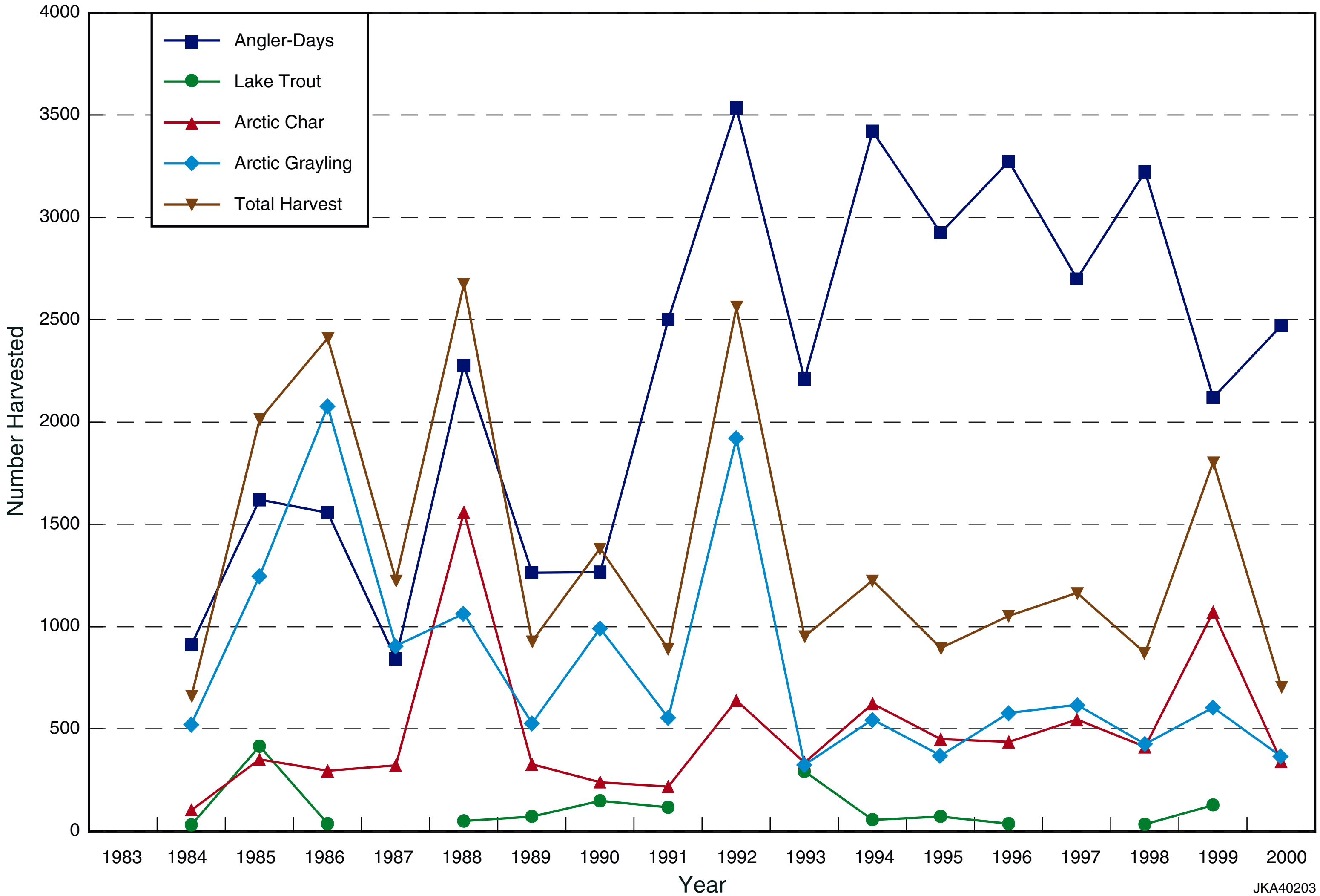

FIGURE 3.24-33 Sport Fishing Indicators North of Atigun Pass, 1983-1999 (Source: Based on ADF&G data reported in Haynes 2000)

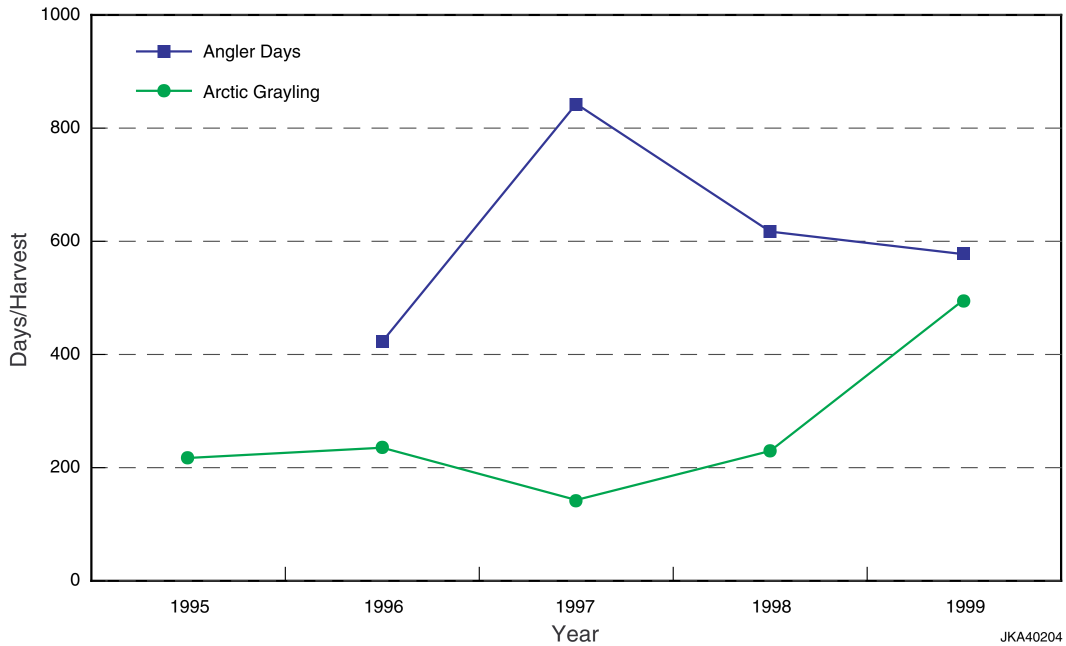

FIGURE 3.24-34 Sport Fishing Indicators between Atigun Pass and the Yukon River, 1995–1999 (Source: Based on ADF&G data reported in Haynes 2000)

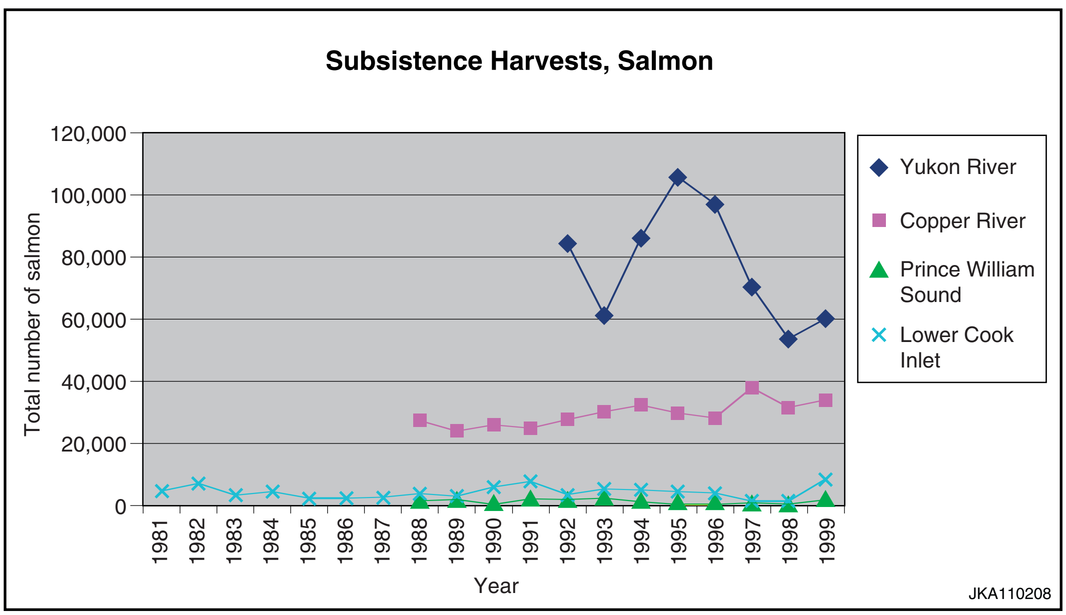

FIGURE 3.24-35 Variability in Subsistence Harvests of Salmon in Communities Examined in the EIS, Grouped by Region (Data source: ADF&G 2000c)

stated, the reasons for such fluctuations tend to involve factors other than sport fishing, with commercial fishing and environmental variables of particular concern. A review of available data on fisheries (presented in Section 4.3.16) indicates that monitoring and the subsequent establishment of regulations to manage fisheries along the TAPS ROW largely have been successful.