5.0 ECOSYSTEMS

Due to the paucity of specific information available on the Beluga region, field investigations were undertaken in 1980 and 1981 to begin developing adequate baseline data. The major thrust of the field program was directed toward determining the presence or absence of fish in the numerous small creeks and tributaries of the region. Additional field observations of terrestrial and avian species were undertaken and are continuing.

An understanding of the resources of the general area requires that the study area extend well beyond the boundaries of the specific proposed project, so the field program encompasses an area extending from the Beluga River south to the Chakachatna River. The field program initially was designed to concentrate on the entire project area, and then as the season progressed more effort was placed on those areas that would have the most potential for impacts from the project, e.g. the mine areas and the transportation corridor. The field parties often were accompanied by one or more persons from state or federal resource agencies.

This chapter represents the synthesis of information derived from the existing literature, numerous conversations and meetings with agency personnel, and the preliminary results of the on-going field programs. No attempt has been made to narrow this synthesis to specific project-related activities due to the incompleteness of the field investigations. However, a general overview of the resources of the area is now possible and coupled with the continuing fall-winter observations will provide the basis for more detailed future programs.

This general area is far from pristine. Years of oil and gas exploration programs as well as logging activities and exploration related to the determination of coal reserves have resulted in numerous examples of surface disturbance.

FRESHWATER AQUATIC ECOLOGY

Existing Habitats

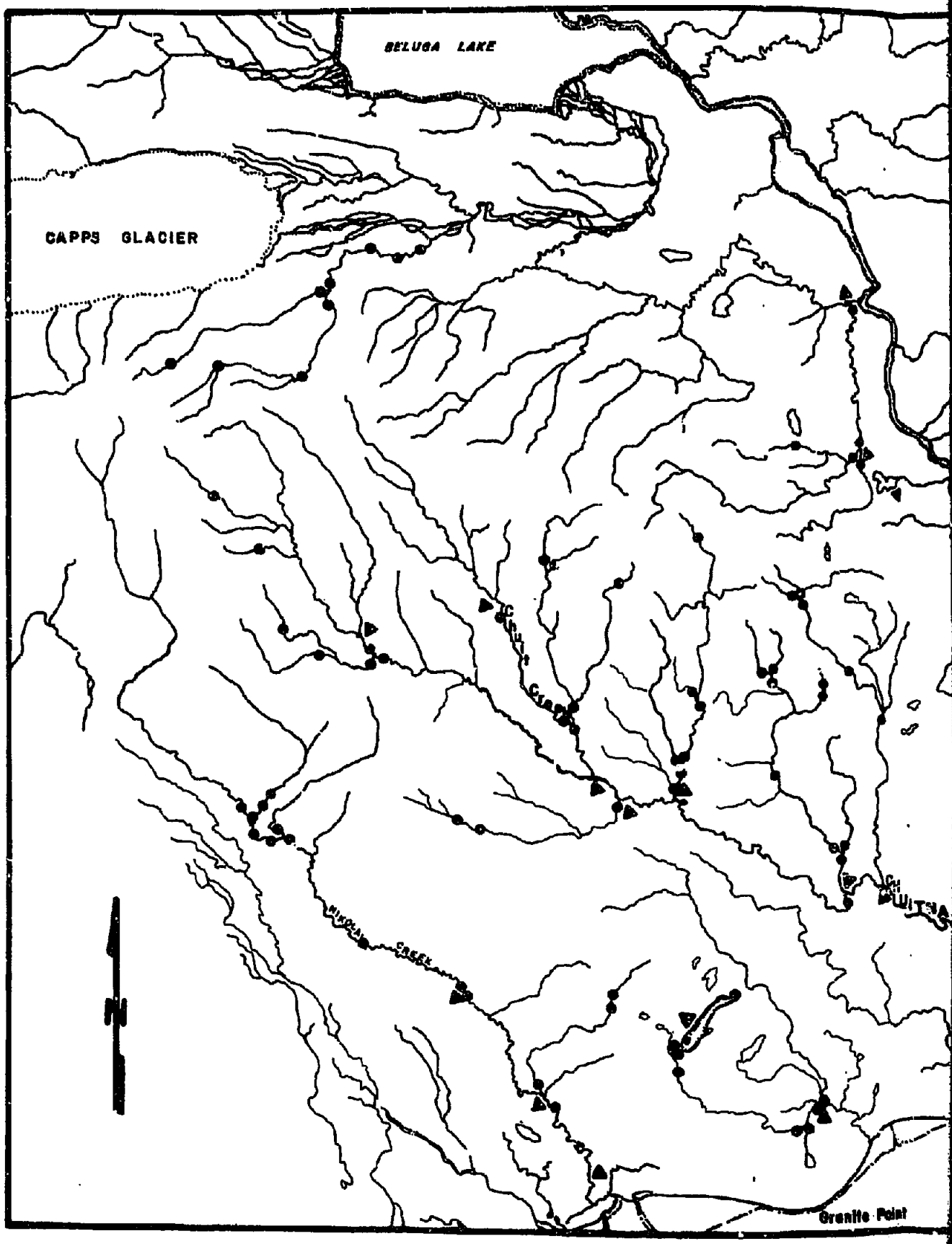
° Habitat Characterization

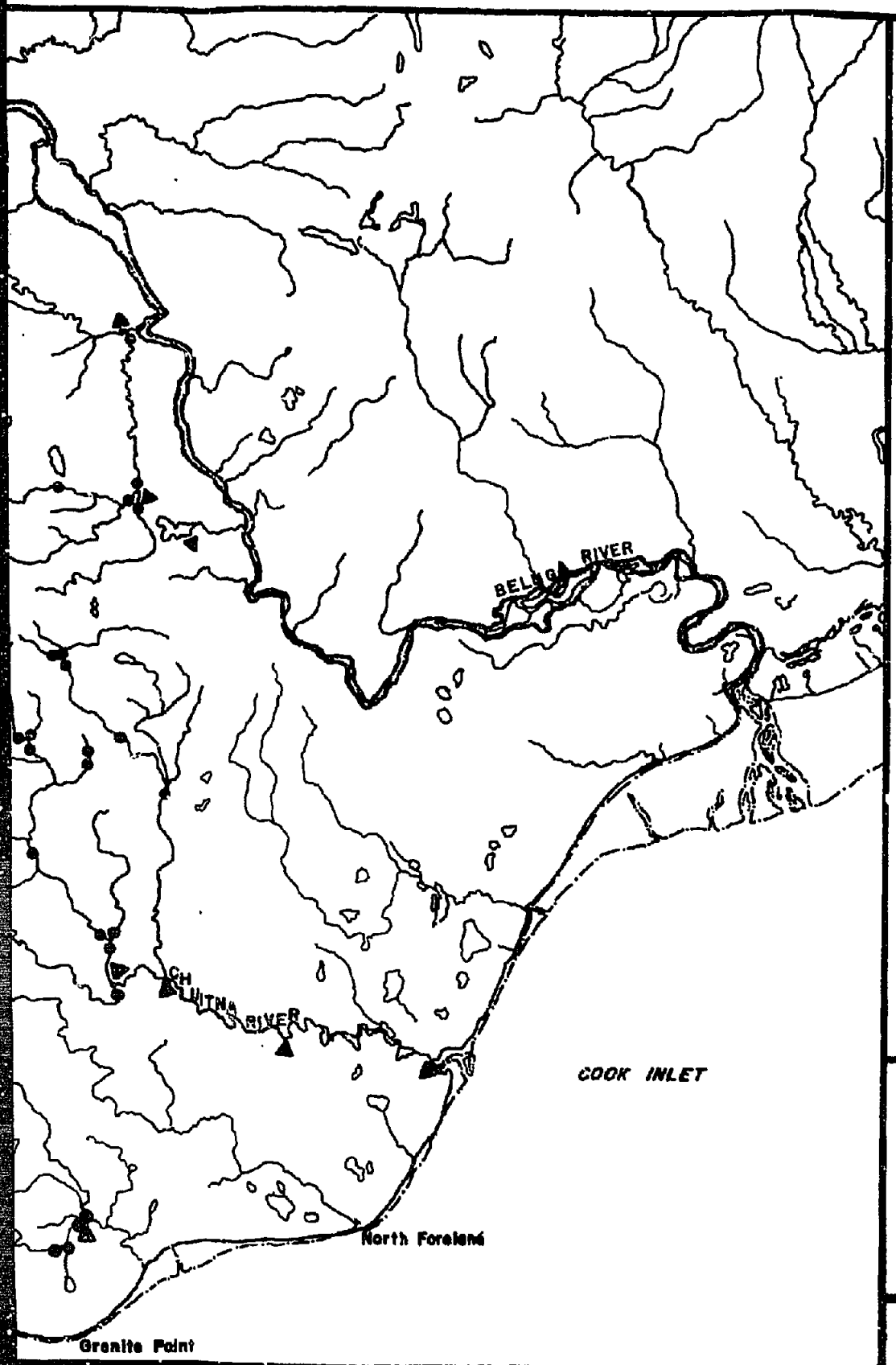
This section provides brief descriptions which characterize the general nature of the stream reaches in each drainage area where staff gauges and/or fish traps were located or where general field observations were made. General locations are shown in Figure 5.1. In many cases, these observations are limited to or pertain only to a single field excursion. This characterization of habitat is an on-going program.

BELUGA DRAINAGE

Beluga River: This glacial fed river begins at Beluga Lake, a 7-mile-long, 3-mile-wide lake located east of the toe of the Triumvirate Glacier and northeast of Capps Glacier. Both glaciers originate on the slopes of Mount Torbert. From Beluga Lake, elevation 246 feet, the river flows easterly nearly five miles before entering Lower Beluga Lake (elevation 243 feet), a narrow 3/4-mile wide lake nearly 2½ miles long. From this lower lake, the Beluga continues its easterly flow across the broad lowlands another 22 miles to Cook Inlet cutting banks into the glacial tills ranging from 10 to 150 feet or more in depth. The system supports runs of king, silver, sockeye and pink salmon. Dolly Varden also are present, and lake trout are found in Beluga Lake.

Headwaters of Scarp Creek: This stream reach has a relatively flat gradient meandering channel. The substrate is predominantly cobbles and gravel with some sand, and the stream channel is basically rectangular with vertical banks. Tall grass overhangs stream banks and covers the floodplain. Stream top widths aver-


BELUGA LAKE
CAPPS GLACIER
Granite Point



LEGEND

- ● LOCATION SAMPLED BY TRAPPING (AT LEAST ONE PERIOD) 1981 FIELD PROGRAM
- ▲ LOCATION SAMPLED BY ANGLING (AT LEAST ONE PERIOD) 1981 FIELD PROGRAM

GENERAL LOCATION SAMPLED BY TRAPPING AND BY ANGLING (MAY-AUG '81)

FIGURE 5.1

aged from 2 to 3 feet, with average depth 0.7 to 1 foot. Juvenile Dolly Varden and threespine sticklebacks were collected (1981).

Upper Scarp Creek: This reach is meandering with a moderate gradient. Riffles comprise approximately 30% of the stream, runs 30%, and pools 40%. The channel is generally rectangular. Stream top widths averaged 20 to 30 feet. Water depth in riffles was about 0.5 feet, runs 1 foot, and pools ranged from 2 to 4 feet. A discharge of 38 cfs was recorded on June 4, and flow probably ranges from 25 to 150 cfs during the ice-free season.

The substrate is gravel and small cobbles. Water is slightly peat stained. Stream bank materials are primarily silty sand, and banks are vertical and frequently undercut. Juvenile coho salmon, Dolly Varden, and rainbow trout were collected. Chinook and coho salmon fry were collected in this reach, as were adult rainbow trout (1981). Benthos collected included snails, midges, and blackfly, caddisfly, and mayfly larvae.

Mouth of Scarp Creek: The stream in the lower reach is a moderate gradient meandering run. Few riffles and pools were evident in the vicinity of the staff gauge. The stream channel is generally rectangular but is parabolic at bends where the stream is cutting into steep banks 30 to 50 feet high. Stream banks are composed of silty sands and clay. The bank is slumping at several locations in the lower two miles. An active cut exposing clay deposits is coloring the water in the lower 1½ miles of the stream. Stream top widths were approximately 30 feet and depths averaged 1.5 to 2 feet. A discharge of 47 cfs was measured on June 4, and flow probably ranges from 30 to 350 cfs during the ice-free season.

The substrate is predominantly gravel and is 100% embedded in sand and silt. Much of the gravel was loose, indicating it was

recently deposited. The floodplain is covered with alder and willow to water's edge. Some log debris was present along stream margins. Juvenile Dolly Varden, rainbow trout, and chinook salmon were collected (1981).

Wobnair Creek: This stream has a relatively flat gradient and sharp meanders near its mouth. Substrate is gravels and small cobbles. The banks are vertical with some undercutting and are composed of silts and sand. Predominant vegetation is willow and tall grass. Runs comprise 60% of the stream and pools 40%. The channel is generally rectangular. Stream top widths averaged from 7 to 10 feet with depths of 1 to 2 feet. A discharge of 5 cfs was measured on June 4, and flow probably ranges from less than 5 to 35 cfs during the ice-free season. Juvenile Dolly Varden and rainbow trout, coho and chinook salmon fry, and threespine sticklebacks were collected.

Headwaters Wobnair Creek: The headwaters of Wobnair above the beaver activity is a flat gradient meandering stream with gravel and cobble substrate. The floodplain and valley are relatively narrow. Stream top widths averaged 2 feet with depths to 1 foot. No discharge was measured, but flows are unlikely to exceed 5 cfs. Tall grass overhangs the bank and scattered spruce covers the floodplain. No fish were found here.

Below the highest set of beaver ponds the creek has a moderate to flat gradient. Substrate is basically gravel with some isolated boulders. This channel is generally rectangular with vertical banks, and this reach is predominantly a run with few pools. Pools were generally associated with remnants of old beaver dams. Several sets of active dams are present downstream. Stream top widths averaged from 5 feet, and average depth was 0.5 to 1 foot. Juvenile Dolly Varden and coho salmon were collected (1981). Stream flow probably ranges from 1 to 15 cfs during the ice-free season.

Chichantna River: This is a relatively large glacial stream with its source in Capps Glacier. The river, nearly 12 miles long with moderate to steep gradients, enters Beluga Lake over a broad silty delta.

Capps Creek: Capps Creek and its principal tributary, North Capps Creek, have their headwaters on a plateau at about 2,000-feet elevation, south of the Capps Glacier and just northwest of the upper headwaters of the Chuitna River. The creek flows northeast into the Chichantna River, joining it about three to four miles below Capps Glacier.

Both the south and north forks have their far upper headwaters covered by lapilli tuff and volcanic breccia, which contribute a small amount of volcanic sediment to the river's alluvium. The streams also pick up sediment from the Quaternary deposits, which contribute boulders, gravel, and silt to the system.

Both streams quickly become incised into the middle member of the Tertiary Kenai Formation which contributes clay, silt, sand, gravel, boulders, and coal lumps to the system. Each stream runs through about three miles of this formation.

Capps Creek and North Capps Creek then enter a deposit formed by landsliding and slumping of the middle member of the Kenai Formation and the Quaternary deposits that cover it, including sand dune deposits. These deposits contribute a variety of sediments to the river's alluvium, including clay, silt, fine sand, gravel, boulders, and coal lumps. Both streams run through this slump deposit for about three miles, with North Capps Creek joining Capps Creek about a mile before the end of the deposit.

The canyons at the confluence of Capps Creek and North Capps Creek are narrow and steep with sidewalls about 150 feet high at a slope of approximately 45°. Many local slides occur on the can-

yon walls, involving the Tertiary and Quaternary sediments of the sidewalls. Overlying sand dunes as much as 20 feet thick were noted here. Many sites of slides were noted to also be the sites of water seeps from the canyon walls, which may have been the slide-triggering mechanism.

Capps Creek then enters a region of Quaternary and Recent glaciofluvial deposits of sand, gravel, and boulders, continuing for about three miles to the Chichantna River.

Capps Creek at Junction with North Capps Creek: Substrates are composed of very coarse boulder and cobble alluvium, with some sand and gravel. Fines appear to be predominantly sand of eolian origin (from nearby sand dunes that overlie the Tertiary sediments). Boulders are as much as 6 feet in diameter, many composed of granite. Stream gradient is moderately steep, with many riffles. Logjams found above the normal fall water stages indicate probable occasional flooding.

South Fork Capps Creek: Stream gradients are moderate to very steep. Steep gradients were characterized by almost continual waterfalls, cascades, or steep riffles; moderate gradients were described as intermittent cascades or riffles with some pools; and low gradients were characterized as entirely slow runs or very few riffles among slow runs. Streambed materials within the water course consist primarily of granite boulders and large pieces of coal, with gravels and sands filling the interstices. These streams consist almost entirely of riffles and rapids, but a few pool areas can be found at the outside of stream bends and among boulders at low flows.

Several high-water marks were observed 10 to 15 feet above the water surface elevation of November.

Both Capps and North Capps creeks are already incised in narrow, steep-walled canyons. Vegetation is primarily grass and devil's club with an alder brush overstory. Mass wasting is a common natural process within these canyons.

Although no major barriers to fish migration were observed along either stream, steep gradients may preclude passage and use by many species.

Capps Creek (vicinity of USGS gauge): The gradient is gentle throughout this stream segment. The stream meanders at a moderate velocity throughout a glacial outwash type floodplain. Stream bank vegetation consists principally of a low alder and willow overstory with a tall grass understory. Some scattered large birch and cottonwood trees occur adjacent to the stream, and some moss-covered cobble and gravel banks with occasional spruce trees can also be seen. Overhanging alder shrubs and grassy banks occur along the lower several miles of Capps Creek.

The predominant substrate material is much smaller than that found in the upper reaches of Capps Creek. Substrate is principally cobbles and large gravels about 50% embedded in small gravels and sand. Some scattered coal pieces occur throughout the stream course, and some of the finer to medium-size gravel substrate is cemented with a heavy clay deposition.

High-water marks are evident 3 to 5 feet above the November 6 water surface elevation.

The stream is characterized as approximately 60% riffle, 40% pool in this section. Interspersed are numerous sandy gravel bars, with many silty clay deposits.

A juvenile Dolly Varden was observed (1980) in a backwater area along the left bank of the stream. Benthos, consisting primarily

of caddisfly larvae, was observed beneath 8- to 10-inch cobbles. No aquatic vegetation was observed.

Apparent signs of animal use included bear, fox, and otter tracks. Beaver sign is extensive throughout this area as evidenced by active lodges, newly created dams, and freshly cut shrubbery.

CHUITNA DRAINAGE

Chuitna River: The upper Chuitna River and its principal tributary, Wolverine Fork, both head in a plateau at about the 2,000 feet elevation south of Capps Glacier. The river system flows southeastward into Cook Inlet. The streams initially course through Quaternary deposits overlying the plateau area, consisting of a discontinuous cover of glacial debris. Erosion of this cover contributes sediments consisting of gravel, silt, and some boulders to the streams.

Several of the upper, western tributaries to the Chuitna River have their far upper headwaters in an area covered by dark gray lapilli tuff and volcanic breccia. Alluvial sediments of this origin are found in small quantities throughout the Chuitna River.

The streams soon become incised into Tertiary sediments that underlie the area. Near their headwaters, the streams cut through the middle member of the Kenai Formation, consisting of a non-marine sequence of gray and light yellow claystone, siltstone, sandstone, and conglomerate, interbedded with sub-bituminous coal, and occasional layers of calcareous cemented siltstone. These sediments are poorly indurated and easily eroded, contributing clay, silt, sand, gravel, boulders, and coal lumps to the streams.

Within a few miles, the streams cross into the lower member of the Kenai Formation, consisting of light gray to light yellow pebbly

sandstones and conglomerates. These sediments are also poorly indurated and easily broken down, contributing sand, gravel, and boulders to the streams. Both streams reenter Quaternary sediments for a few miles, then Wolverine Fork joins the Chuitna River in this section.

About six to seven miles downstream, the Chuitna River crosses the Castle Mountain Fault, reentering the middle member of the Kenai Formation and remaining in it for the next 15 to 16 miles. The Chuitna River is joined by Chuit Creek after running about four to five miles through this section. The canyon walls of the river in this section contain many large and small landslides and slump deposits, composed of the overlying Quaternary sediments, including sand dunes deposits, and the middle member of the Kenai Formation. These continually contribute clay, silt, sand, gravel, boulders, and coal lumps to the Chuitna River alluvium.

Many upper tributaries to the Chuitna River are blocked by waterfalls formed on coal seams, which appear to be the hardest strata in the area. These waterfalls may serve as barriers to fish migration.

The Chuitna River canyon at its confluence with Wolverine Fork is narrow and sidewall slopes average 35° to 40°. The walls are about 150 feet high and are composed of Tertiary conglomerate of a friable nature, consisting of sand, gravel, cobbles, and boulders up to several feet in diameter. Many slide deposits are found along the valley walls, composed of these Tertiary sediments and a shallow Quaternary cover.

At the confluence with Chuit Creek, the canyon of the Chuitna River is relatively broad, with walls about 150 feet high, and sidewalls of 35° to 40°. The walls here are composed of sandstone, claystone, and sub-bituminous coal, with the sandstone layer being somewhat conglomeratic in places, and including some

discontinuous layers of well-indurated sandstone and concretions. Local slides, abundant in the area, are composed of these sediments. Water seeps are also common, often in conjunction with slides.

The lower four to five miles of the Chuitna River cuts through Quaternary sediments consisting of unconsolidated glacial outwash, sand and gravel. Slides are less common here. The canyon walls in the vicinity of the USGS gauging station are 60 to 70 feet high; sidewall slopes average about 25° to 30°. The valley then broadens and becomes gentler until reaching the Chuitna River delta about two miles northeast of the Village of Tyonek.

Chuitna River just Below Wolverine Fork: Substrates are composed of sand, gravel, cobbles, and boulders as much as 10 to 15 feet in diameter. Most boulders are composed of Tertiary sandstone, but some are granite. The sandstone boulders are fairly well indurated and contain some wood and coal fossils. The stream gradient is moderate.

Lower Chuitna River (USGS gauge): Substrates are composed of sand, gravel, cobbles, and boulders as much as 2 to 3 feet in diameter. A large portion of the cobbles falls in the 6- to 10-inch range. Fines consist predominantly of medium sand. The stream gradient is low.

Lone Creek at Upper Forks: This stream reach has a moderate gradient with a cobble/gravel substrate. The stream channel is rectangular with vertical to undercut banks. Tall grasses are the predominant vegetation and overhang the banks. The tributary to Lone Creek has a steeper gradient 100 feet upstream from the mouth, and the substrate is predominantly cobbles.

Lone Creek's top widths averaged 5 to 7 feet, with depths ranging from 0.5 to 1.5 feet in this reach. It was comprised of 75% pool/

run and 25% riffle. No discharge was measured in this reach. Juvenile Dolly Varden and coho salmon were collected; Dolly Varden fry were also observed in this reach.

Upper Lone Creek: This reach has a meandering channel with a moderate to flat gradient. Stream banks are nearly vertical, with some slumping into the stream channel. Stream top widths averaged from 20 to 25 feet with an average depth of 1 to 1.5 feet. A discharge of 13 cfs was measured on June 4, and flow probably ranges from 5 to 200 cfs during the ice-free season.

The substrate is predominantly gravel and small cobbles partially embedded in sand. Banks are covered primarily by alder and willow with a grass understory. Several side channels and cutoff meanders are present in this reach, as well as log debris in pools and along margins.

This stream reach supports a rich benthic community, and the stream bottom is covered with green filamentous algae. Juvenile Dolly Varden and coho salmon, and rainbow trout and chinook salmon fry were collected (1981). A beaver dam upstream of the staff gauge supports juvenile Dolly Varden and coho salmon. Adult Arctic lamprey were observed in this area (1981). A surber sample was collected over large gravel and included water mites, midges, and larval forms of mayflies, caddisflies, stoneflies, and danceflies.

Lower Middle Creek: Lower Middle Creek has a moderate gradient and basically a riffle/run sequence. It consists of approximately 20% pool, 50% run, and 30% riffle. The channel in this portion of the stream is basically triangular. The average stream top width was 30 feet, with average depths ranging from 0.4 to 0.7 feet. Discharge was not measured at this site.

Substrate is composed mainly of cobbles and boulders with small, isolated gravel and sand deposits probably associated with road construction. Riparian vegetation consists of cottonwood trees with an understory of alder and willow. Some log debris was present in the pools. Juvenile Dolly Varden, coho salmon, and chinook salmon, and pink and coho salmon fry were collected in this reach (1981).

A moderate to steep gradient tributary (Culvert Creek) enters Middle Creek in this reach. Dolly Varden and coho salmon juveniles were collected downstream of the culvert (1981).

Middle Creek (near the BHW Chuitna lease boundary): This stream reach is characterized by a moderate to flat gradient and a very meandering channel. It consists of approximately 50% pool, 30% riffle, and 20% run. The channel was rectangular and the stream width averaged 10 to 15 feet in riffle areas and 15 to 20 feet in pool areas. Average depth in riffles was 0.3 to 0.6 feet, and pools averaged from 1.5 to 2 feet. A discharge of 1 cfs was measured on June 3.

Gravel and sand were the predominant substrate material. The nearly vertical banks are composed of silts and sands, and were undercut on bends. Stream banks are covered with tall grasses and a little log debris was present in the stream channel. Juvenile Dolly Varden, rainbow trout, and chinook and coho salmon were collected in this reach; an adult Arctic lamprey was also collected (1981).

Upper Middle Creek: This reach has a moderate gradient with approximately 30% pool, 20% riffle, and 50% run. This channel is basically rectangular with average top widths of 10 to 15 feet. Water depth of runs and pools averaged from 0.5 to 1 foot and 1 to 2 feet, respectively. A discharge of 4.2 cfs was measured on June 3.

The substrate consists of gravels and cobbles embedded in silts and sands. There are large deposits of silt and sand in pool areas. Stream banks are nearly vertical with undercutting on bends and are composed of silt and sands. Tall grasses and an occasional willow cover the banks. Juvenile Dolly Varden and coho salmon were collected in this reach (1981).

Strip Creek: Strip Creek is a flat gradient tributary of Middle Creek. The stream is an incised meandering run. Pools are present in meander bends but probably comprise only 15% of the stream. Few riffles were noted. The top width of this small stream averaged 3 feet, and the average depth was 1 foot. A discharge of 1.5 cfs was measured on July 3, and flow probably ranges from 1 to 25 cfs during the ice-free season. This system is probably influenced by groundwater.

The substrate is primarily silts and sands. Stream banks are composed of similar materials and were nearly vertical to undercut, with tall grasses covering them. Juvenile Dolly Varden, coho salmon, and coastrange sculpins were collected in this creek (1981).

Brush Creek: Brush Creek is a moderate gradient stream which combines with Strip Creek to form Middle Creek. It is composed of 30% pool, 20% run, and 50% riffle. The channel is generally rectangular with near vertical banks. Stream top widths averaged from 7 to 10 feet. Water depth in the pool areas was generally 1 to 1.5 feet and in riffle areas was from 0.2 to 0.7 feet. Much of this stream probably freezes solid during the winter. A discharge of 2.5 cfs was measured in June and flow probably ranges from 1 to 50 cfs during the ice-free season.

Substrate is primarily cobbles and boulders. Stream bank material is a glacial till which supports a dense growth of alders. Juvenile Dolly Varden, coho salmon, and coastrange sculpins were collected here (1981).

Chuit Creek: Chuit Creek has its headwaters on a plateau at about 2,000 feet elevation south of the Capps Glacier, about three miles east of the headwaters of the Chuitna River. The stream flows southeastward about 10 miles to its confluence with the Chuitna River. The stream initially flows through Quaternary glacial deposits of gravel, silt, and boulders. The stream shortly becomes incised into the middle member of the Tertiary Kenai Formation, consisting of poorly indurated claystone, siltstone, and conglomerate, interbedded with sub-bituminous coal and occasional layers of cemented siltstone. These sediments contribute clay, silt, sand, gravel, boulders, and coal lumps to the stream.

Within less than a mile the stream crosses into the lower member of the Kenai Formation, consisting of pebbly sandstones and conglomerates. These contribute sand, gravel, and boulders to the river. About six miles downstream, Chuit Creek crosses the Castle Mountain Fault and reenters the middle member of the Kenai Formation, remaining in it for about five more miles until its confluence with the Chuitna River.

Chuit Creek canyon, within the Chuitna coal lease area, is a relatively gentle canyon with sidewalls about 150 feet high and averaging about 30°. Landslides occur here, but appear to be fewer than along the Chuitna River. Just north of the lease area, the sediments in the sidewalls consist of poorly indurated gravelly sand, with cobbles up to 5 inches in diameter. Near the confluence with the Chuitna River, the sidewalls are composed of poorly indurated sandstone, with some lenses of well indurated sandstone and occasional concretions. They grade downward into claystone, which overlies thick, platy sub-bituminous coal.

Chuit Creek (just above Chuitna lease area): Substrate is sand, gravel, and cobbles as much as 10 inches in diameter. Gradient is moderate and very few boulders are evident.

Chuit Creek (near junction of Chuitna River): Substrate is sand, gravel, cobbles, and many boulders, as much as 1 to 2 feet in diameter. Stream gradient is moderate.

Chuit Creek Area: Chuit Creek stream gradients are moderate (primarily riffles with occasional pools or runs) as this creek meanders through a relatively wide canyon. Riparian vegetation is predominantly low willow thickets and grass at the higher elevations. Spruce, birch, and cottonwood trees occur in the floodplain near the mouth of Chuit Creek. The stream is primarily riffles and runs with some (approximately 10%) pool areas. Several beaver ponds occur in the floodplain. The substrate materials are principally gravels and small cobbles in the upper reaches grading toward large cobbles and isolated boulders near the mouth. No barriers to fish migration are evident along this stream.

East Fork of Chuit Creek: This stream is relatively straight and has a moderately steep gradient. It consists primarily of riffle/run/rapid sequences with less than 5% pools. The channel is basically triangular with an average stream top width of 35 to 40 feet. Average water depths were 1.5 to 2 feet. A discharge of 78 cfs was measured below the confluence of Camp Creek in June. Stream flow probably ranges from 20 to 300 cfs during the ice-free season.

The substrate is predominantly large cobbles and boulders. Alder and willow thickets grow to the water's edge, with some cottonwoods scattered throughout the narrow floodplain. No log debris was observed in the channel. Juvenile Dolly Varden were collected in the vicinity of the staff gauges (1981).

Camp Creek: This stream has a steep gradient and consists primarily of riffles/rapids. The channel is primarily triangular with an average top width of 10 feet. Depths averaged 0.5 to 1 foot.

A discharge of 12 cfs was measured in June and flow probably ranges from 5 to 30 cfs during the ice-free season.

The substrate is predominantly large cobbles and boulders. Alders and willows cover the stream banks and overhang the stream. No log debris was observed in the channel. Juvenile Dolly Varden and rainbow trout were collected (1981).

Frank Creek: This stream reach (elevation 16,000 feet) has a moderate gradiant with 30% pool, 30% riffle and 40% run. Top width averaged 10 to 12 feet with average depths of 0.8 feet in pools, 0.3 feet in riffles and 0.5 feet in runs. Substrate is composed of small to medium gravels. The stream channel is rectangular with nearly vertical banks approximately 3 to 4 feet high. The stream banks were composed of sand and silt and supported willows and tall grasses. Some mass wasting was evident farther downstream where the stream cuts into a high bluff. One of the few beaver dams present was located upstream. The floodplain is covered with grasses and has several large marshy areas. High-water marks were apparent 6.5 feet above the stream bottom.

Upper Chuitna River (above Wolverine Fork): The stream gradient in this area is moderate, with a substrate consisting predominantly of large cobbles and boulders with a gravel-sand base. Considerably more sand- and silt-size particles occur in the Chuitna River above the confluence with Wolverine Fork.

The water courses in this area wind through distinct canyons where vegetation consists of grassy or muskeg meadows or patchy low willow and alder areas. Some active landslide areas are visible on the Chuitna above the confluence with Wolverine Fork, but the streams are clear and contain little sediment.

No barriers to fish migration are evident in this area. The substrate material appeared suitable for spawning by salmonids.

NIKOLAI DRAINAGE

Nikolai Creek: Nikolai Creek has its headwaters on the plateau south of Capps Glacier, in a small lake about 2¼ miles south of the glacier, and about a mile west of the upper headwaters of Capps Creek and the Chuitna River. The creek flows off the plateau in a narrow valley and then crosses a small, flat area before plunging into a canyon cut through the Nikolai escarpment. The canyon is cut into Quaternary glacial debris consisting of gravel, silt, and boulders.

The creek then follows a course southeastward along the foot of the Nikolai escarpment for about 18 miles to empty into Trading Bay. Near the logging road crossing, slightly more than a mile west of Stedatna Creek, the creek is cutting only a few feet into Quaternary and Recent glaciofluvial sediments of sand and gravel. At the bridge, the creek banks are about 2 feet high, and composed principally of sand. Substrate is silt, sand, gravel, and small cobbles as much as 3 inches in diameter. Stream gradient is low. Stream banks at this point consist of find sand.

Nikolai Creek (vicinity of logging road bridge): The gradient of Nikolai Creek is very slight. The river meanders extensively through a muskeg floodplain, and banks are alternately characterized by thick muddy banks or grass-covered clayey banks. Clumps of alder and some individual spruce trees are scattered along the stream course. Substrate is principally clayey sand in the low-energy deposition areas; in other areas with higher velocities, considerably larger materials, specifically small to medium cobbles, are predominant. Considerable quantities of branches and twigs are found lying on or embedded in the clayey banks along the stream. Beaver sign is extensive in this area, as evidenced by the newly cut willow branches. Some man-made pollution enters this stream in the form of suspended silts and clays, as well as log debris, from upstream logging operations.

Stedatna Creek: Stedatna Creek begins in a muskeg flat about two miles northwest of Congahbuna Lake and flows southwest to its confluence with Nikolai Creek. The creek flows over the Nikolai escarpment, cutting a canyon about 50 feet deep into Quaternary deposits in the escarpment, consisting of gravelly sand with boulders up to 8 feet in diameter. Substrate is sand, gravel, cobbles, and boulders as much as 6 feet in diameter.

The stream gradient just above the logging road is moderate, and large boulders and cobbles are scattered throughout the stream course. Although this stream reach had been channelized in association with construction of the logging road, some grass lines the banks. Most of the riparian shrubbery and trees have been removed. The substrate is a heterogeneous mix ranging from sands through large boulders. Habitats upstream and downstream consist principally of a meandering stream cascading over cobbles and boulders. The stream passes through a cottonwood/birch/spruce forest with an alder and grass understory. This segment is approximately 20% pool, 80% riffle. No suitable salmonid spawning sites are apparent in the area.

Steep cascades downstream from the logging road crossing, as well as the culverts beneath the road, may create definite fish migration barriers. However, an adult rainbow trout was captured upstream from the culvert in 1981.

Pit Creek: This stream has clear water and the lower quarter mile has a moderate gradient with approximately 10% pools, 20% riffles, and 70% runs. The channel is rectangular with very steep banks. Few scour holes or undercut banks are apparent. Stream top widths averaged from 10 to 12 feet with an average depth of 1 foot. A discharge of 13 cfs was measured on June 1, and flow probably ranges from 10 to 50 cfs during the ice-free season.

The substrate is predominantly gravels and cobbles embedded in silts and sands. The substrate is tightly packed and has the appearance of being cemented together. Tall grass overhangs the banks and scattered alders and cottonwoods cover the floodplain. Dolly Varden and coho salmon juveniles and chinook salmon fry were collected in this reach (1981).

Upstream of River Mile 0.25 the gradient steepens and the stream is predominantly riffles. The substrate contains larger material, including large cobbles and boulders. A surber sample collected over large cobbles included water mites, midges, and larval forms of mayflies, caddiesflies, stoneflies, blackflies, snipeflies, and false craneflies.

Jo's Creek: This stream has clear water and the lower half mile has a moderate to flat gradient with 40% pools, 50% runs, and 10% riffles. The channel is rectangular with almost vertical banks. Several scour holes are present along the banks. Stream top widths averaged from 15 to 20 feet with an average depth of 1.5 feet. A discharge of 30 cfs was measured on June 1, and flow probably ranges from 5 to 60 cfs during the ice-free season.

The substrate is predominantly gravels and small cobbles with some fines. The substrate appeared cleaner and was composed of smaller particle sizes than those present in Pitt Creek. Tall grass overhangs the stream banks, and scattered alders and cottonwoods cover the floodplain. Little log debris was present in the stream. Juvenile Dolly Varden and coho salmon and Dolly Varden fry were collected (1981). A surber sample collected over small cobbles included larval forms of mayflies, stoneflies, caddiesflies, craneflies, and false craneflies.

Above River Mile 0.5 the gradient steepens and the stream becomes riffle/run/rapids. Substrate particle sizes increase to large cobbles and boulders.

CONGAHBUNA

Congahbuna Creek: Congahbuna Creek is a small creek that begins in Congahbuna Lake and flows southeast and north to its confluence with Old Tyonek Creek about one to two miles above Beshta Bay. The creek runs principally through a region of peaty soils and muskegs, underlain by Quaternary sands and gravels. The substrate near the stream junction is silty fine sand, but upstream a few hundred yards the substrate is gravelly. The stream gradient is low. At the junction of Congahbuna Creek and Old Tyonek Creek, the substrate is sand, gravel, and some cobbles as large as 2 inches in diameter. The stream gradient is low. Stream bank materials at this site consist of silt and fine sand.

Muskrat Creek: Muskrat Creek is a small creek that begins in a small lake just north of Granite Point and flows north for slightly more than a mile to its confluence with Congahbuna Creek. Its course is predominantly across muskeg flats underlain by Quaternary sand and gravel. The substrate is silty fine sand with organic material and is stained red. The stream gradient is low (almost imperceptible).

Both Muskrat Creek and Congahbuna Creek meander slowly through a muskeg bog. Stream bank vegetation is principally tall grass, which overhangs the stream providing extensive cover. Muskrat Creek, which originates in a small lake about three-quarters of a mile to the south is a tea-colored stream with a bottom comprised of organic silty-sand material. The entire course of this tributary appears to be one long slow run, with no true riffles or pools. However, the uppermost section of this stream near the lake from which it originates was not observed. Congahbuna Creek is also tea-colored and is characterized by a long slow run, and an organic silty-sand substrate. Submerged

grass is also visible. Downstream from the confluence with Muskrat Creek, Congahbuna Creek develops a series of riffles and pools in a near 50:50 ratio.

Old Tyonek Creek: Old Tyonek Creek begins in a small lake, about two miles southeast of the confluence of Chuit Creek and the Chuitna River, and runs about nine miles to Cook Inlet, emptying into the sea at Beshta Bay. The creek's entire course is through Quaternary glaciofluvial deposits of sand, gravel, and boulders. The creek valley is relatively flat with low banks 6 to 10 feet in height. Substrate is sand, gravel, and cobbles as much as 3 inches in diameter. The stream gradient is low.

Tall grass extensively overhangs the stream banks. Small patches of willow and alder thickets with scattered birch, cottonwood, and spruce trees provide the primary overstory. The substrate type is a medium to fine gravel embedded in sand. Isolated patches of armored substrate are present. Flooding is evidenced by a water mark about 5 to 8 feet above the water surface. Stream banks are deeply undercut, and some sloughing of bank materials was observed. With the slight gradient present throughout the stretch below Congahbuna Creek, the river exhibits a ratio of about 60% run/pool to 40% riffle providing excellent spawning habitat.

- Fishes

A comprehensive survey of the seasonal use, distribution and abundance of fish in the Beluga region has not been performed. Four species of Pacific salmon are known to inhabit the Chuitna River system and the mainstream of the Chuitna is an important king salmon spawning stream. The occurrence of the fifth species, the sockeye, is questionable though it may be found near the mouth of the Chuitna. Figure 5.2 displays a preliminary overview of the species distribution and spawning areas. The

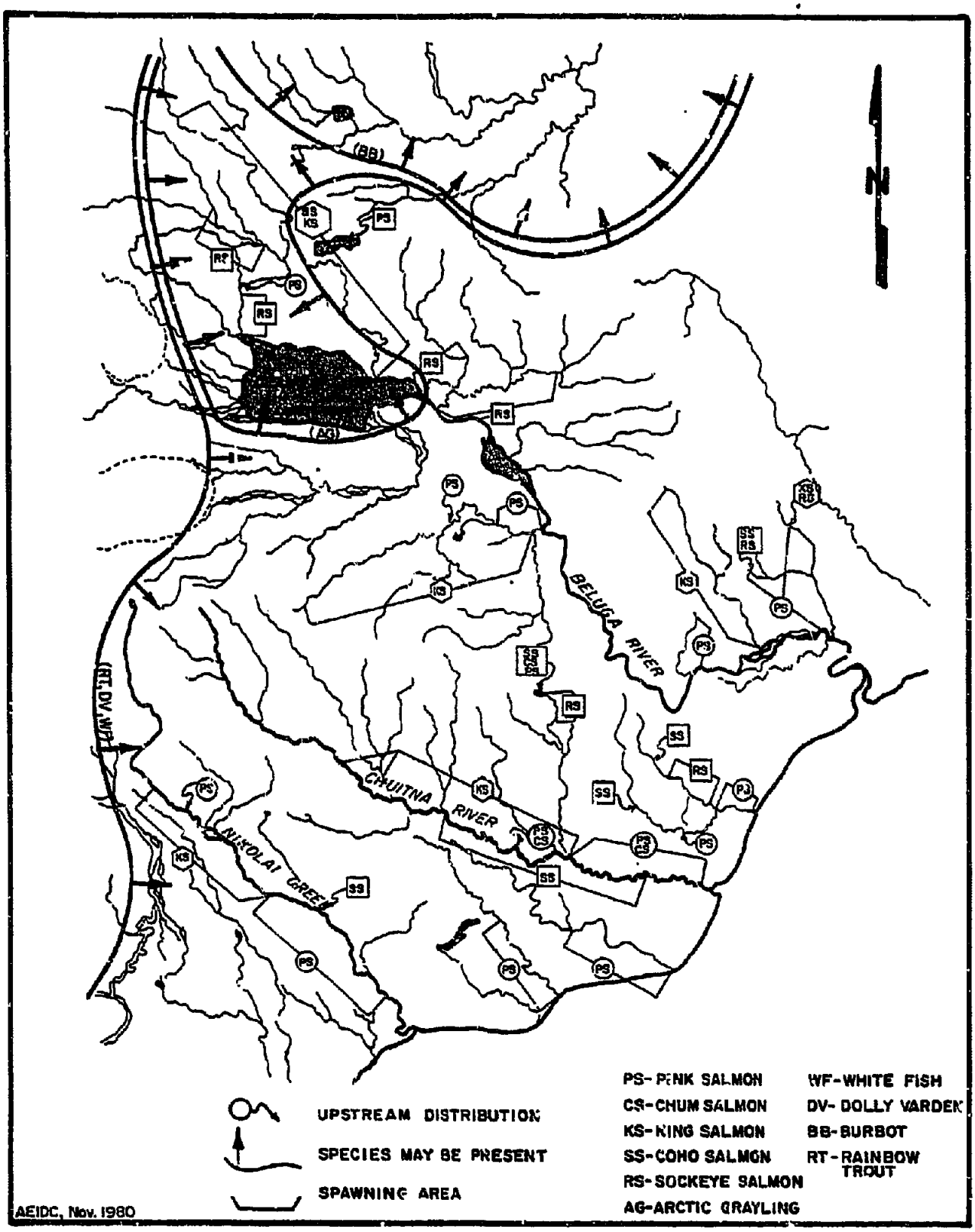


FIGURE 5.2 SPECIES DISTRIBUTION AND SPAWNING AREAS

completion of the 1981 field program will provide further insight into both distribution and habitat utilization.

Chuit Creek is a known king salmon spawning area, and both pink and chum salmon spawn in the Chuitna from Lone Creek to the mouth of the river. Estimates of the abundance of the annual return to the Chuitna system are:

Pinks	100,000 even years
Chums	20,000 odd years
Coho	few
Kings	5,000
Rainbow Trout	?
Dolly Varden	?

Nikolai Creek provides spawning for king, coho, and pink salmon and pink salmon also spawn in Old Tyonek Creek. Nikolai Creek is known for its rainbow trout and Congahbuna Lake supports a resident rainbow population.

The various Pacific salmon of Cook Inlet are discussed in some detail later in this section under Marine Species, and Table 5.1 provides a summary of selected life history data.

Table 5.2 illustrates the type of data being obtained from the 1981 field program relative to determining the presence or absence of species. Emphasis during this period was to determine the presence or absence of juveniles and observe the return of adult fish to the system. No outmigration or preemergent work was accomplished in 1981.

Table 5.3 is a checklist of the probable freshwater species of the Beluga region (not all species have been confirmed by this program).

Table 5.1

LIFE HISTORY DATA FOR FIVE SPECIES OF PACIFIC SALMON*

	Chinook (King)	Pink	Sockeye (Red)	Coho (Silver)	Chum (Dog)
Freshwater habitat	Large Rivers	Short Streams	Short Streams & Lakes	Short Streams & Lakes	Short & Long Streams
Length of time young stay in fresh water	3 to 12 mos.	1 day or less	1 to 3 yrs.	1 to 2 yrs.	Less than 1 mo.
Length of ocean life	1 to 5 yrs.	1-3/3 yrs.	½ to 4 yrs.	1 to 2 yrs.	½ to 4 yrs.
Year of life at maturity (years)	2 to 8	2	3 to 7	2 to 4	2 to 5
Average length at maturity (inches)	36	20	25	24	25
Range of length at maturity (inches)	16 to 60	14 to 30	15 to 33	17 to 36	17 to 38
Average weight at maturity (pounds)	22	4	6	10	9
Range of weight at maturity (pounds)	2½ to 125	2 to 9	1½ to 10	3 to 30	3 to 45
Principal spawning months	Aug - Sept	July - Sept	July - Sept	Sept - Dec	Sept - Nov
Fecundity (number of eggs)	5,000	2,000	4,000	3,500	3,000
Principal spawning habitats	Sands & gravels (coarse)	Silts & small gravel	Fine to large gravels	Fine to coarse gravels (5 cm)	Fine gravels (2.5 cm)
Principal rearing habitat	Cool, clear streams	Estuarine	Lakes & ponds	Pools in streams	Streams

* Exceptions to these general descriptions occur frequently.

Table 5.2

SELECTED FISH TRAPPING DATA
NIKOLAI DRAINAGE (JUNE 1981)

Location	Date	Species Captured	
Nikolai Creek	6/6	Adult Chinook Salmon	(8)*
	6/2	Juvenile Chinook Salmon	(4)
	6/2	Juvenile Coho Salmon	(24)
	6/2	Coho Salmon Fry	(2)
	6/6	Adult Rainbow Trout	(10)*
	6/2	Juvenile Rainbow Trout	(2)
	6/2	Juvenile Dolly Varden	(25)
	6/2	Coastrange Sculpin	(13)
	6/2	Threespine Stickleback	(1)
Jo's Creek	6/2	Chinook Salmon Fry	(1)
	6/2	Juvenile Coho Salmon	(2)
	6/2	Juvenile Dolly Varden	(3)
	6/2	Coastrange Sculpin	(2)
Pitt Creek	6/2	Chinook Salmon Fry	(2)
	6/2	Juvenile Coho Salmon	(2)
	6/2	Juvenile Dolly Varden	(3)
Stedatna Creek	6/2	Juvenile Chinook Salmon	(1)
	6/2	Juvenile Coho Salmon	(4)
	6/2	Juvenile Dolly Varden	(4)

*by angler (hook & line)

Table 5.3

CHECKLIST OF THE FRESHWATER FISH OF BELUGA AREA*

Pacific Lamprey	Entosphenus tridentatus
Arctic Lamprey	Lampetra japonica
Green Sturgen	Acipenser medirostris
Pacific Herring	Clupea harengus pallasi
American Shad	Aloza sapidissima
Pygmy Whitefish	Prosopium coulteri
Round Whitefish	P. cylindraceum
Rainbow Trout	Salmo gairdneri
Lake Trout	Salvelinus namaycush
Dolly Varden	S. malma
Sockeye Salmon (red or blue back)	Oncorhynchus nerka
Coho Salmon (silver)	O. kisutch
King Salmon (chinook)	O. tshawytscha
Chum Salmon (dog)	O. keta
Pink Salmon (humpy)	O. gorbuscha
Arctic Grayling	Thymallus arcticus
Pond Smelt	Hypomesus olidus
Surf Smelt	H. pretiosus
Eulachon (hooligan)	Thaleichthys pacificus
Longnose Sucker	Catostomus catostomus
Burbot	Lota lota
Saffron Cod	Eleginus gracilis
Threespine Stickleback	Gasterosteus aculeatus
Ninespine Stickleback	Pungitius pungitius
Slimy Sculpin	Cottus cognatus
Coastrange Sculpin	C. aleuticus
Pacific Staghorn Sculpin	Clinocottus acuticeps
Starry Flounder	Platichthys stellatus

* Including anadromous species and the marine species of brackish estuaries.

Figure 5.2 shows the location of all reaches sampled by trapping and angling during the period May to early August 1981. In addition, aerial observations were made on numerous streams at various times during the field season (Table 5.4 is an example) and all of the streams within the study area, with the exception of those in the Bishop Creek System, have been examined in part both from the air and the ground. Figure 5.3 shows those areas where adult king salmon wre observed in July and August 1981.

- Invertebrates

  Only preliminary studies of the benthic invertebrate community have been undertaken by the USGS and only general sampling of these communities is part of the 1981 field program. Table 5.5 illustrates the results from basket samples taken at two stations of the Chuitna River by the USGS.

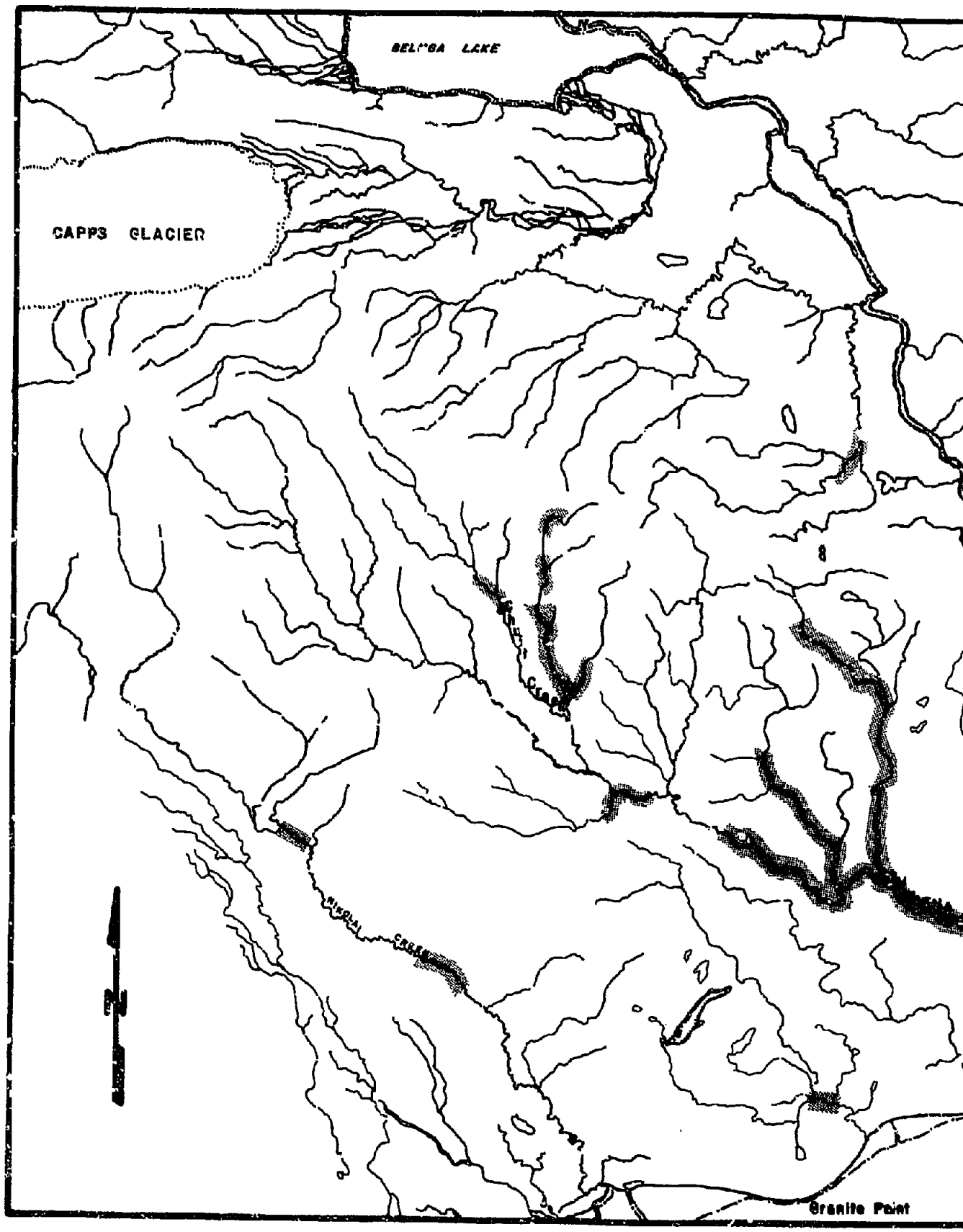
TERRESTRIAL ECOLOGY

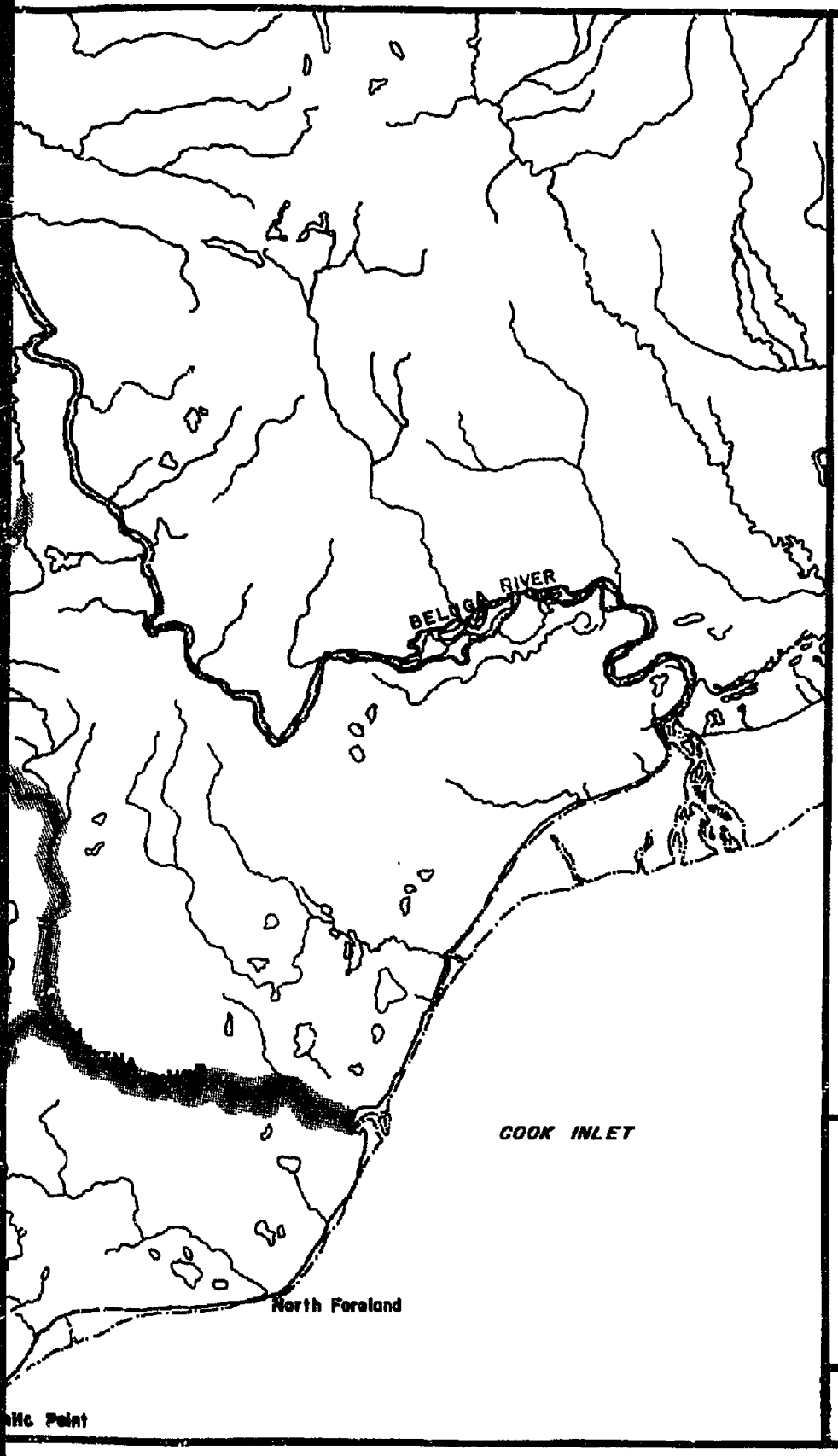
Existing Vegetation

A generalized vegetation map adapted from the map, "Major Ecosystems of Alaska" prepared by the Federal-State Land Use Planning Commission in 1973, is shown in Figure 5.4. Terrestrial vegetation in the region includes four general vegetative types:

- upland spruce - hardwood forest
- high brush
- wet tundra
- alpine tundra

The upland spruce - hardwood forest is a fairly dense, mixed forest of white spruce, paper birch, quaking aspen, black cottonwood and balsam poplar occupying major portions of the benchland in the re-


BELUGA LAKE
CAPPS GLACIER
Granite Point



LEGEND

AERIAL OBSERVATIONS OF ADULT KING SALMON

AREAS WHERE ADULT KING SALMON WERE OBSERVED

(JULY-AUGUST, '81)

FIGURE 5.3

Table 5.4

CHINOOK SALMON AERIAL SURVEY
August 3, 1981*

LOCATION	NUMBER
Chuitna River below mouth of Lone Creek	71
Lone Creek	207
Middle Creek	26
Cole Creek	2
Frank Creek	2
East Fork of Chuit Creek	32
Nikolai Creek above Jo's Creek	0
Jo's Creek	0
Pitt Creek	0
Camp Creek	3

* By helicopter; observers JB, JT and RD.

Table 5.5

BENTHIC INVERTEBRATE COMMUNITY

Analysis of Basket Samples
Chuitna River Near Tyonek

	10/18/77	3/29/78	Sampling Dates
	#50	#60	Station Number
INSECTS			
Ephemeroptera nymphs (May Flies)			
Baetis sp	--	--	
Ephemerella doddsi	--	--	
Ephemerella inermis	2	--	
Ephemerella sp	--	1	
Plecoptera nymphs (Stone Flies)			
Capnia sp	--	--	
Hastaperla brevis	--	6	
Isoperla ebria	--	2	
Isoperla sp	--	6	
Pteronarcella badia	--	--	
Taenionema nigripenne	--	--	
Taenionema sp	--	3	
Zapada cintipes	2	6	
Zapada frigida	--	3	
Trichoptera larva (Caddis Flies)			
Apatania sp	--	--	
Arctopsyche ladogensis	--	2	
Brachycentrus sp	1	4	
Ecclisocyla sp	--	--	
Glossosoma sp	--	--	
Homophylax sp	--	--	
Molanna sp	--	1/1P	
Onocosmoecus sp	4	7	
Psychoglypha subborealis	--	--	
Rhyacophila sp	--	--	
Diptera larva (True Flies)			
Tipulidae larva (Crane Flies)			
Dicranota sp	--	1	
Hexatoma sp	--	--	
Limnophila sp	--	--	
Ormosia sp	--	--	

Table 5.5
(Continued)
BENTHIC INVERTEBRATE COMMUNITY

	10/18/77 #50	3/29/78 #60	Sampling Dates / Station Number
Simuliidae larva (Black Flies)			
Prosimulium sp	3	1	
Similium sp --	--		
Chironomidae larva (midges)			
Arcto or Conchapelopia sp	--	--	
Brillia sp	--	--	
Cladotanytarsus sp	--	--	
Conchapelopis sp	--	--	
Cricotopus sp 3	--	--	
Diamesa sp 1	1	1	
Diamesa sp 2	--	--	
Eukiefferiella sp	7	17	
Micropsectra sp	3	--	
Orthocladius sp	1	--	
Polypedilum sp	--	--	
Potthastia sp	--	--	
Procladius sp	--	2	
Rheotanytarsus sp	--	--	
Tanytarsus sp	--	5	
Trissocladius sp	--	--	
Thienemanniella sp	--	6	
Ceratopogonidae larva (Biting Midges)			
Palpomyia sp	--	--	
Empididae larva (Dance Flies)	--	--	
Psychodidae larva (Moth Flies)			
Pericoma sp	1	2	
MISCELLANEOUS ORGANISMS			
Acari (Water Mites)			
Limnesia sp	--	--	
Sperchon sp 1	--	--	
Total Number of Organisms	25	80	
Total Number of Taxa	10	19	
Number of Taxa - Insects Only	10	19	
Total Number of Insects	25	80	
Diversity Index - Insects Only	3.00	3.79	
Pooled: Total Number of Insects	105		
Diversity Index - Insects Only	3.92		

F Indicates pupa stage.

FIGURE 5.4 | **GENERAL VEGETATION MAP**

gion extending from sea level to more than 1,000 feet in elevation. Black spruce generally occupies areas of poor drainage; pure stands of white spurce and mixed stands of cottonwood and poplar often occur along stream courses. Successional stages following fire are birch on the east- and west-facing slopes with aspen following willow on south-facing slopes. Either of these stages provides good browse for moose. Some Sitka spruce occur as far north as the southern slopes of Mt. Susitna and some small stands are found near Tyonek. Sitka spruce hybridize with white spruce making identification difficult. Some mountain hemlock is also found in the vicinity of Tyonek. The endemic spruce beetle, Dendroctonus rufipennis, has destroyed thousands of acres of forest in the Beluga region. Principal species include:

White spruce	Picea glauca
Black spruce	Picea mariana
Quaking aspen	Populus tremuloides
Paper birch	Betula papyrifera
Black cottonwood	Populus balsamifera trichocarpa
Balsam popular	Populus balsamifera balsamifera
Willow	Salix
Alder	Alnus
Rose	Rosa
High-bush cranberry	Viburnum edule
Lingenberry	Vaccinium vitis-idaea minus
Raspberry	Rubus
Currant	Ribes

The dominant species in the high brush vegetative type range from dense willows to dense alder. This type occupies a wide variety of soil types and often occurs as pure thickets in coastal lowlands and floodplains. Occasional trees including aspen, birch, and spruce may be present but are generally widely scattered. Principal species include:

Sitka alder	Alnus crispa sinuata
Green alder	Alnus crispa
Thinleaf alder	Alnus incana tenuifolia
Devil's club	Echinopanax horridum
Willow	Salix
Currant	Ribes
Blueberry	Vaccinium
Raspberry	Rubus
Soapberry	Shepherdia canadenus
Lingenberry	Vaccinium vitis-idaea minus
Spirea	Spirea beauverdiana
Thimbleberry	Rubus parviflorus
Salmonberry	Rubus spectabilis
Dogwood	Cornus

The wet tundra vegetative type is generally a mat of vegetation occurring along tidal flats and other flat areas near sea level. This vegetative mat is dominated by sedges and cottongrass with scattered woody and herbaceous plants occurring on drier sites above the water table. Principal species include:

Sedges	Carex
Cottongrass	Eriophorum
Lyme grass	Elymus arenarius
Pendant grass	Arctophila fulva
Bur reed	Sparganium
Mare's tail	Hippuris
Rushes	Juncus
Willow	Salix
Dwarf birch	Betula nana exilis
Labrador tea	Ledum palustre groenlandicum
Cinquefoil	Potentilla fruticosa
Lingenberry	Vaccinium vitis-idaea minus
Bog cranberry	Oxycocus microcarpus

Alpine tundra is generally found at the higher elevations and is comprised primarily of low mat plants, both shrubby and herbaceous. Principal species include:

Resin birch	Betula glandulosa
Dwarf birch	Betula nana exilis
Arctic willow	Salix arctica
Crowberry	Empetrum nigrum
Labrador tea	Ledum palustre groenlandicum
Mountain heather	Phyllodoce
Rhododendron	Rohododendron lapponicum
Dwarf blueberry	Vaccinium caespitosum
Alpine blueberry	Vaccinium uliginosum alpinum
Alpine bearberry	Arctostaphylos alpina
Mountain avens	Dryas
Moss campion	Silene acaulis
Arctic sandwort	Minuartia arctica
Cassiope	Cassiope
Alpine azalea	Loisaluria procumbens
Sedges	Juncus
Lichens	
Mosses	

A more detailed vegetation map of the region is currently being prepared by the U.S. Forest Service Laboratory of the Pacific Northwest Experiment Station as part of the Susitna Basin Project. It is anticipated that this map will be available in 1982. The classification system being utilized is unique for the project and is based on Viereck and Dyrness's 1980 "A Preliminary Classification System for Vegetation of Alaska". A modified vegetation map based primarily on the laboratory's preliminary photo-mapping is shown in Figure 5.5. This system classifies existing, not potential, vegetation and begins with four formations for terrestrial vegetation - forest, tundra, shrub, and herbaceous vegetation.

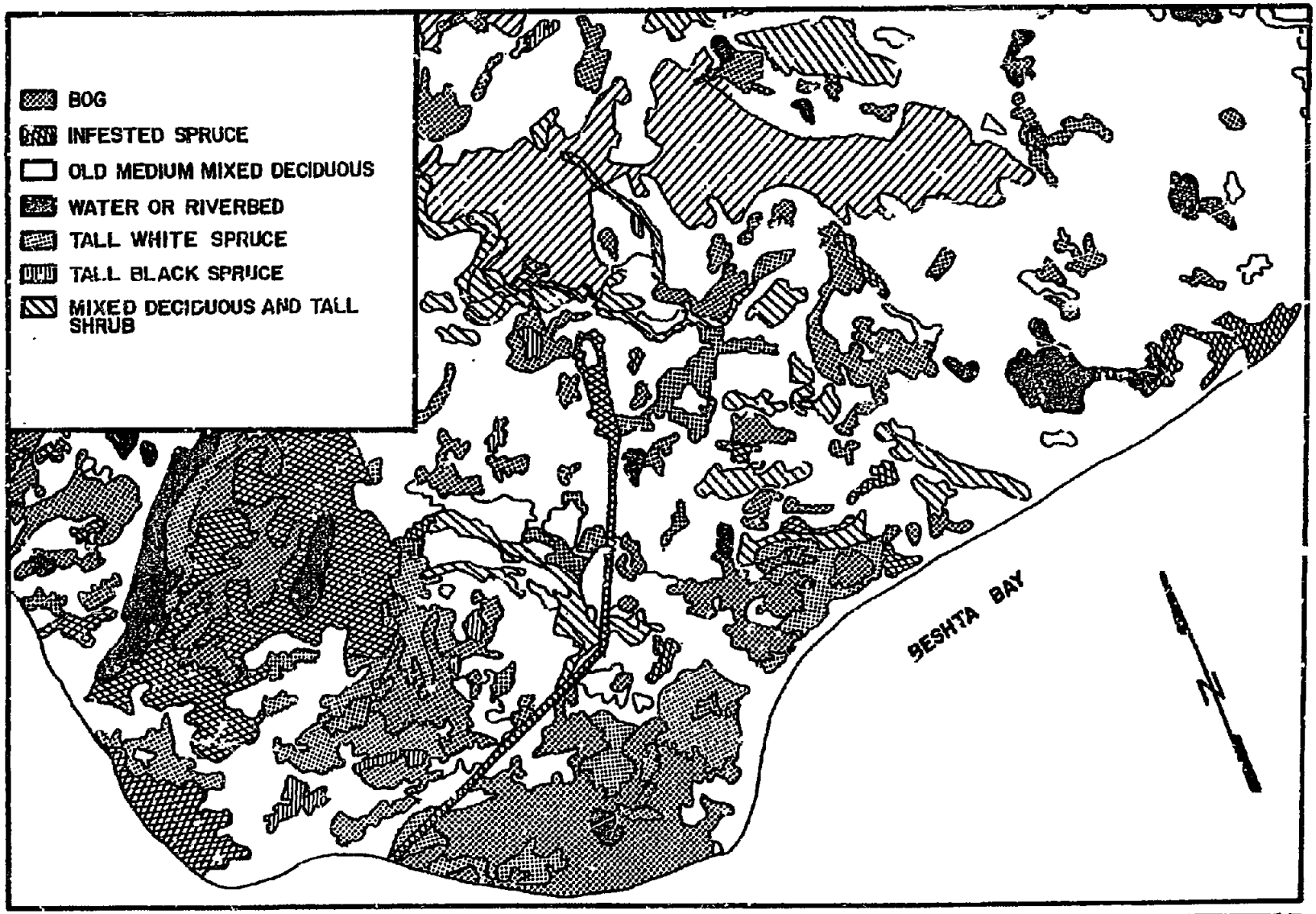


FIGURE 5.5 PRELIMINARY PHOTO INTERPRETATION VEGETATION MAP

Based on Murray's 1980 list of "Threatened and Endangered Plants of Alaska", only one species, the pale poppy Papaver alboroseum which is often found in alpine tundra, is known to occur in the region.

The plant communities described above will ultimately be related to successional stages and such regulating factors as altitude, soil and groundwater conditions, wildlife, and man's activities, as part of a continuing characterization of terrestrial habitats. Much of the necessary baseline data will result from the 1981 field activities of the SCS. It is anticipated that surficial soils data and ground-truth confirmation of photo vegetation types will be available in 1982.

Wetlands

Wetlands constitute a large portion of the general area. The COE (Regulatory Program, July 19, 1977, Part 323, Section 323.2) provides the following definition:

> c) The term "wetlands" means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

The U.S. Fish and Wildlife Service has mapped portions of western Cook Inlet at a scale of one inch to the mile as part of the National Wetlands Inventory. This inventory has been curtailed by budgetary constraints and it is not known when such information for the general project area will become available.

The COE has made a preliminary wetlands determination in the Beluga area and that determination is shown in Figure 5.6.

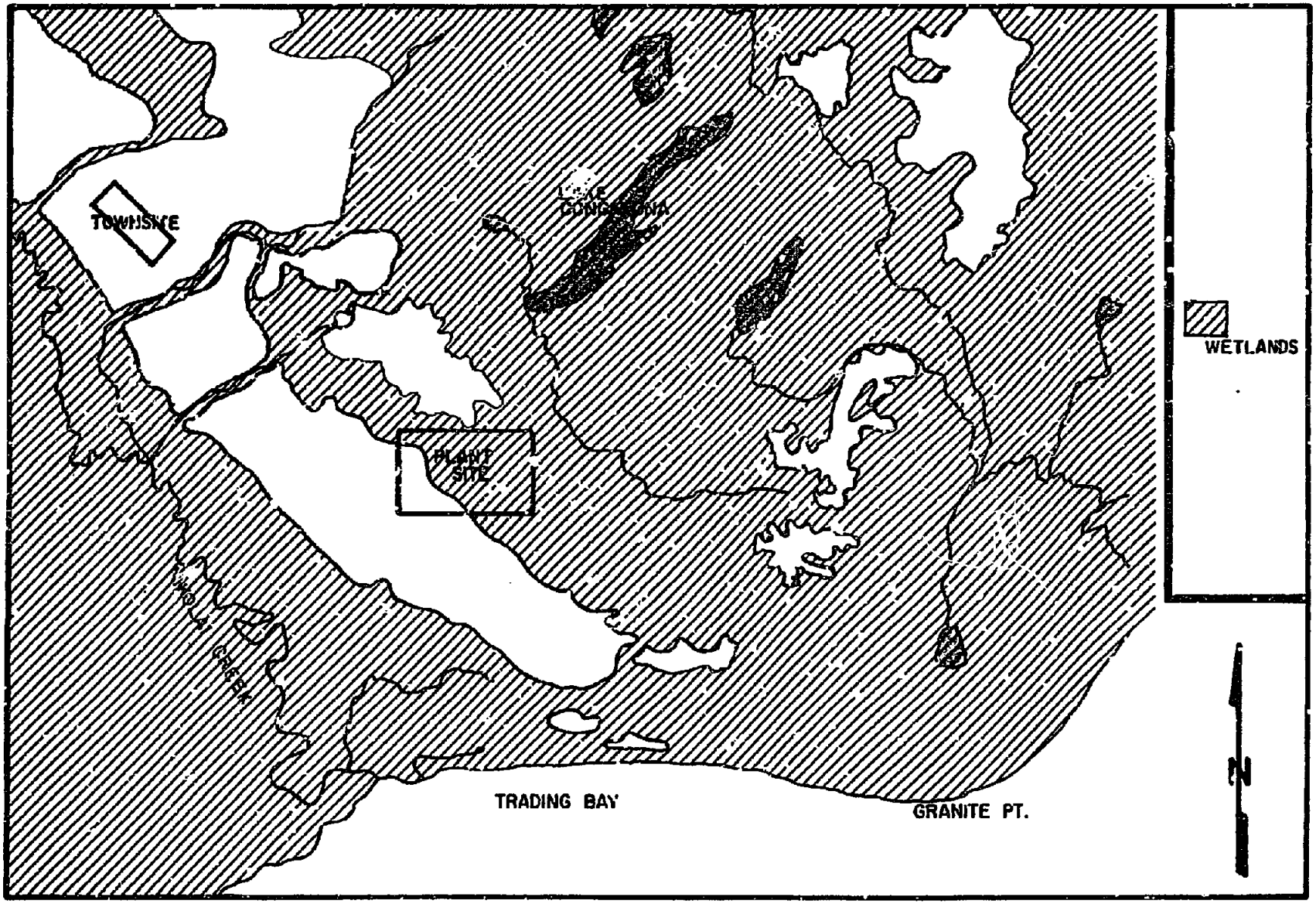


FIGURE 5.6 PRELIMINARY DETERMINATION OF WETLANDS

The above wetland classifications or determinations will not of themselves portray wetland resources in sufficient detail to assess environmental impacts of site specific activities. Different types of wetlands vary in value, extent, and associated use by wildlife and this will be assessed on a site specific basis.

Existing Mammal Populations

The brown bear (Ursus arctos), the black bear (Ursus americanus), and the moose (Alces alces) are the principal species of large mammals found within the general project area. All three species can be considered common and widespread throughout the area. Moose are often locally abundant; most bears are transient using the area on a seasonal basis. Seasonal concentrations of moose are shown in Figure 5.7; known seasonal feeding areas along salmon streams for bears are shown in Figure 5.8 as are primary denning areas. Other denning areas most likely occur within the region, as do other feeding areas along streams supporting seasonal runs of Pacific salmon. The wolf (Canis lupus) is not common within this area but has been observed in the Trading Bay State Game Refuge. Three wolves were also observed in the Capps area in August 1981 above the headwaters of Wolverine Fork.

Brown bears reach minimum breeding age at 4½ to 6½ years of age; most males reach sexual maturity at 4 to 6 years (average 5½). The bears mate in May or June and cubs are born the following February or March. Denning in the study area probably begins in November, with younger and pregnant female bears denning earlier. Most bears remain in their dens until May, although they may emerge for brief periods if disturbed or during stretches of mild weather. The cubs remain with the sow for two years and are then abandoned in the third year before the sow breeds again. Litters of cubs and yearlings contain, on the average, slightly more than two cubs. A postnatal mortality differential between cubs and yearlings makes this "average" somewhat questionable.

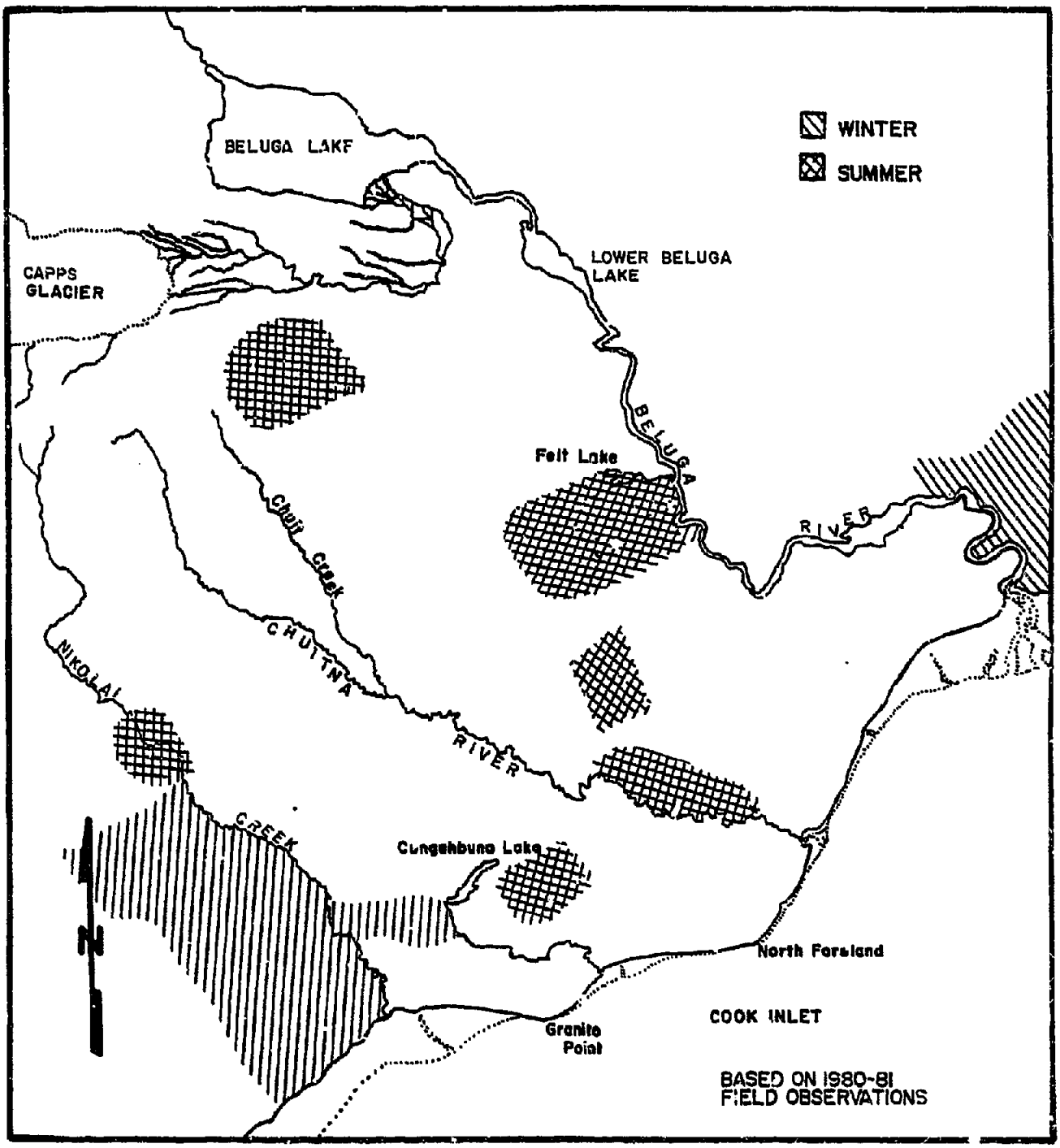
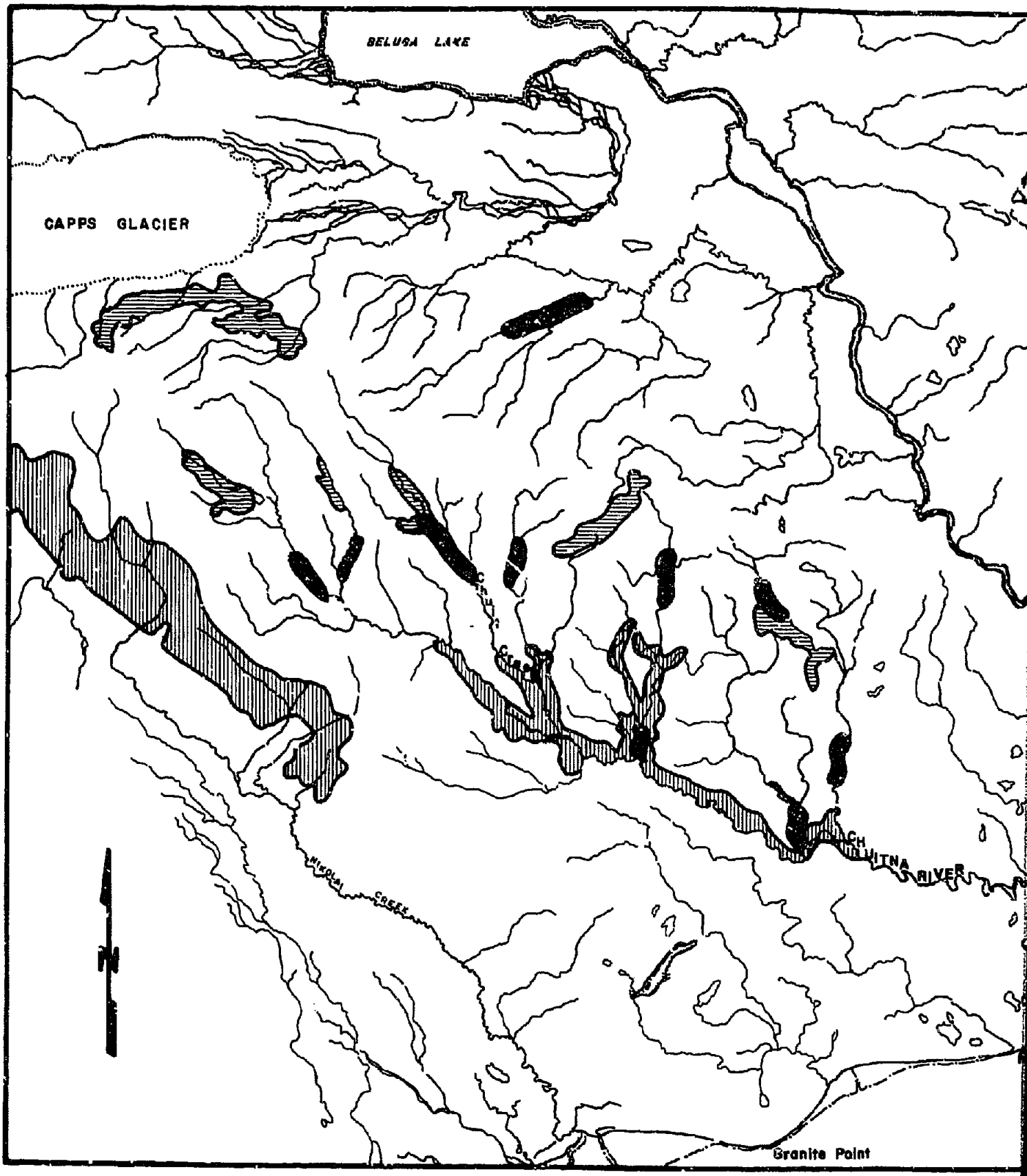
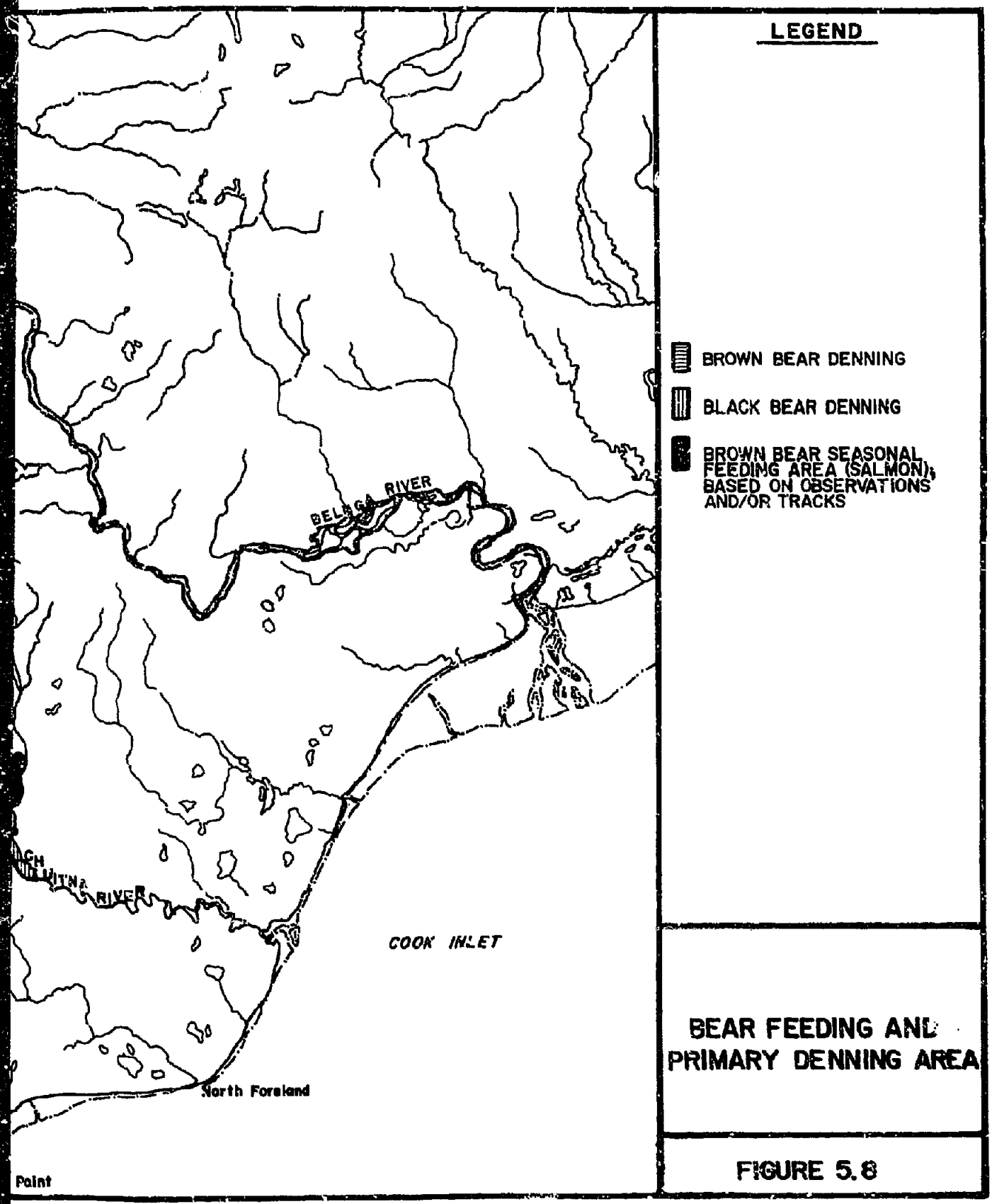


FIGURE 5.7 SEASONAL CONCENTRATION OF MOOSE


BELUGA LAKE
CAPPS GLACIER
Granite Point



BEAR FEEDING AND PRIMARY DENNING AREA

FIGURE 5.8

Brown bears usually leave their dens in May and may move to the lower elevations or even onto the beaches, feeding on animal carcasses cast up during the winter storms. More typically, the bears remain at mid-elevations for various reasons both sociological and physiological. Inland bears may opportunistically utilize "moose yards" for winter kills and prey on moose calves at the calving grounds. As spring progresses, green vegetation becomes the principal diet, and as the snow retreats, the bears follow the spring growth to higher ground. Green vegetation, with occasional small mammals, carrion, roots, and other plant materials, form the mainstay of the diet until berries and salmon become available during the summer. Soon after they reach the spawning streams, salmon become the primary component of their diet, and the bears remain near the streams throughout the summer, supplementing their diet with plants and berries. After the salmon runs are complete, brown bears feed largely on berries, roots, and green vegetation, and occasional small mammals and carrion.

° Brown Bear Denning

Brown bears prepare dens by digging into hillsides usually at an altitudinal range of 300 to 750 meters (m) (1,000 to 2,500 feet). This zone provides certain environmental conditions favorable to winter denning including moderate, ambient temperatures during cold intervals, a relatively stable snowpack that insulates the den cavity, and an interwoven complex of vegetation that supports the snowpack (drifting) and den cavity (soil binding by root systems).

Dens generally have a single entrance, a chamber, and in some cases, a connecting tunnel. They are occupied from October or November until April or May and when abandoned, thawing and erosion soon cause them to collapse. Rocky caves and natural cavities may be appropriated or modified for use and reuse as winter dens.

Denning habitat of brown bears may be delineated by subjectively evaluating the principal criteria leading to site selection: elevation and slope, soil/rock substrate, and vegetation. The best snow conditions during the denning period are generally at intermediate elevations. Higher levels above the vegetation zone (635 m or 2,000 ft plus) tend to have erratic and unstable snow conditions characterized by massive drifting, wind scouring, icing, heavy crusting and avalanches, and provide marginal denning opportunities. Sea level temperatures are above freezing later in the winter and snow cover may not be sustained at lower elevations. Temperatures at the 300 m (1,000 ft) level may average lower than at sea level and, therefore, permit the snowpack to increase in depth. Later, during spring, lower temperatures at higher elevations permit snow cover to remain longer than at lower elevations. The insulating property of snow has been recognized as an essential element of successful denning of polar and brown bears (Craighead and Craighead 1972; Lentfer and Hensel 1978, Lentfer et al. 1972). Intermediate levels also provide a warmer air stratum compared to lower and higher elevations since temperature inversions prevail during midwinter cold snaps in calm conditions. Site preference probably is also a function of slope as an incline aids in excavation--soil material can be easily deposited downhill from the den entrance. An incline also provides site drainage during thaws and spring snowmelt.

Suitable soil condition is a major criterion for den site selection. Generally of shallow depth, alpine soils are easily pulverized and lack the cohesive properties of soils found at lower elevations. At upper elevations dens supported by subsurface freezing are likely to collapse during warm periods and be abandoned prematurely. Although suitable soil conditions occur at lower elevations, site selection at this level may be precluded by colder temperatures during midwinter cold snaps, reduced insulation qualities of snow, and insufficient drainage during snowmelt.

Den site selection appears to be related to the subalpine ecotone delineated by the upper limit of woody vegetation types, notably alder, willow, and dwarf birch. Root penetration by these and large herbaceous plants bind the soil and provide added support to the den cavity. At intermediate elevations vegetation affords concealment and enhances security. Standing vegetation also retains and stabilizes the snowpack by retarding wind erosion. Snow accumulation on semi-brushy sites seals the den entrance, inhibiting air transfer, and provides an insulative layer covering the entire den. Usable and marginal denning habitats in the Beluga area were delineated through direct aerial observation of bears, dens, and related signs, together with the site selection criteria described by Spencer and Hensel (1980). Three possible den sites were located in the upper reaches of the Wolverine Fork and the Chichantna drainages and in the Chuitna drainage. Actual occupancy of these sites was not verified by ground inspection. Distribution of tracks and bear sightings noted late in the period of den emergence indicated that denning activity is remarkably more intensive in the headwaters of the Chichantna River, and in hilly areas of North Capps Creek, and the mainstem of upper Capps Creek where the gentle relief the the plateau slopes abruptly and drainage systems form intervening gullies and steep-walled canyons. Considerable post-denning activity was noted in the upper Chuitna drainage, to a lesser degree in the upper Chuit drainage, and along the upper edge of the Nikolai escarpment. Most brown bear activity in the Beluga area is probably associated with this escarpment and steep slopes paralleling the upper Chuitna and its major tributaries where elevation exceeds 300 m (1,000 ft). At this altitude the snowpack is probably of sufficient depth, composition and duration to accommodate most of the brown bear denning occurring in the Beluga area. Canyons and tributary slopes provide good drainage and adequate shrub/herbaceous coverage are an added inducement for brown bear denning in these areas. Slopes and drainages near the Capps Glacier lack suitable soil and vegetation condition to be considered usable denning habitat. Rocky land outcroppings and

large boulders along the bottom edges of tributary canyons may provide natural den sites for brown bears, but these situations appear to be limited in number.

Much of the Beluga area, because of its elevated plateau character and lowland tree cover, is unusable or marginal denning habitat for brown bears. That portion of the plateau stretching from Nikolai escarpment to Lone Ridge north to the Capps Glacier is of such gentle grade, sparse vegetation cover and gravelly sandy soils to virtually preclude denning. Approximately 20% of the delineated brown bear habitat is situated in the North Capps Creek lease area.

- Brown Bear Movement and Activity Patterns

  The locations of established bear trails were noted on topographic maps from aerial and field observations. When there is no snow cover, such trails are prominent features on the landscape, patterns of which indicate the level and direction of movements to and from activity areas. Depending upon biological needs and habitat conditions, brown bears utilize two or more activity areas, which can be viewed merely as different portions of an all-encompassing range. Distances between activity areas also vary, since one or several drainages may be part of a year-around range of an individual bear.

  The location of principal trail systems relates to topographic obstacles and cross country distance and/or access to activity areas, particularly those associated with seasonal food gathering. In the Beluga area, topography limits movements to and from adjacent areas. The high glaciated mountains preclude movements north of the moraine plateau. The extensive lowland marsh between Nikolai and the Chakachatna drainges deter westward movement because brown bears traveling across lowland areas have a proclivity to avoid open terrain. Logging operations in and around this sector also affect movement in this area. The absence of any established trails or recent signs indicative of traveling

bears in this area supports this observation. To the east, the relatively large and fast-flowing Beluga River probably restricts brown bear movements parallel to the mountain range or Cook Inlet. The region's geomorphology limits the degree of interchange between brown bear subpopulations resident to the north side of Cook Inlet. Brown bears may, therefore, be considered in the Beluga area as a relatively discrete population with minimum interchange between adjacent subpopulations.

Feeding and socializing (breeding behaviorism) as distinct activities greatly influence the extent to which brown bears move. Individual tracks and bear sightings made during the post-denning (breeding) period indicated bears traverse the upper reaches of the plateau at an altitudinal range of 350 to 700 m (1,200 to 2,300 ft). Considerable movement activity of an exploratory nature was noted to occur along the eastward edge of the plateau in the headwaters of Bishop and Scarp creeks, and headwaters of the Chuitna and Wolverine Fork.

In the Nikolai area, a major travel route (Pit Creek) was found to connect the upper Chuitna and Nikolai drainages. The absence of any permanent bear trails across the marshy areas west of Nikolai Creek supports the supposition of limited population interchange.

- Black Bears

Black bears are generally considered open forest animals which tend to avoid both the denser forest and large open areas; this may not be typical of the southcentral portion of the range where black bears are found throughout the study area along principal stream courses. Primary denning habitat for black bears occurs along the Nikolai escarpment and forested portions of the upper Chuitna and Lone Creek drainages. It is estimated that less than 15% of the primary habitat for black bear denning occurs within the overall project area and even less in specific site locations.

Black bear usually reach maturity in their third year, although some females may not breed until they are 5 or 6 years of age. They mate in June or July and the cubs, usually two to three per litter, are born in the den in midwinter. Black bears in the study area generally emerge from their dens in May, though females with their cubs may emerge later and den earlier than others. Cubs are generally weaned by the next September after their birth, but may remain with a lactating sow for another winter.

Black bears eat a wide variety of plant and animal material. During the spring, grasses, sedges, and horsetail (Equisetum) make up the bulk of their diet. During the summer and early autumn, berries make up the larger portion of the diet. Black bears in general are less dependent on salmon runs than brown bears, but in the study area, concentrations along salmon streams indicate that salmon is an important component of the summer diet. In the fall, vegetation again becomes more important in the diet as salmon and berries become less and less available.

- Moose

Moose range throughout the study area and calve during the spring in areas of muskeg or swamps. One or two calves are the norm. Bulls and cows with calves from previous years usually summer on higher ground, and in early to mid fall move down the hills to lower elevations. Wintering grounds usually are in the lowlands and river valleys and may hold dense aggregations of moose in "moose yards". "Yarding" occurs primarily in response to heavy snow cover and difficult feeding conditions.

Moose eat a variety of vegetable matter including browse (woody plant stems, buds, leaves, bark, and twigs), lichens, fungi, grasses, and forbs (non-woody annual and perennial plants other than grasses). The percentage of each of these components in

the diet is determined for the most part by its seasonal availability. Birch, which constitutes a large percentage of the diet, does not provide sufficient nutrition to support the moose for sustained periods.

Moose reportedly eat alder and willow preferentially throughout the year, but the quantity of these plants available to the moose is usually less than sufficient to comprise the bulk of the diet. Low browse, forbs, and other plant material are essential to moose diets. Typically, vegetation on the best moose range is in the earlier seral stages (i.e., 5 to 25 years old) of plant succession. Much of the area logged in recent years is now in excellent browse condition, particularly along the Nikolai escarpment.

Aerial observation of big game is continuing as part of the ongoing 1981 field program. Table 5.6 shows the results of a 2-day observation period in early June. Table 5.7 shows the results of the 1980 moose survey conducted by ADF&G.

Seasonal distribution of bears, moose, and other mammals can only be generally described considering the limits of the past and ongoing field studies. A more comprehensive mapping effort will be required to quantify the impacts on habitat of the project. The status and discreteness of both the moose and bear populations require additional field evaluation. Predator-prey relationships for big game and other species have not been described.

- Other Mammals

Other mammals known or considered to be present within the study area are:

Red Fox	Vulpes fulva
Mink	Mustela vison
River of Land Otter	Lutra canadensis

Table 5.6

MOOSE/BEAR OBSERVATIONS (AERIAL) JUNE 1-4, 1981

Date 1981	Obs. No.	Obs.	Location	Altitude	Brown Bear	Black Bear	Adult	Sub-adult	Unidentified	Females w/cubs	Females w/Yearling	Males	Females	Females w/calves	Unidentified
6/1	-	H	Lower Chulitna	300									1		1
6/2	1A	T	Lower Capps Crk	500		1			1						
6/2	1B	H	Lower Chulitna	300										1(2)	
6/3	2H	H	Mid-Chulitna	1,000		1			1						
6/3	3H	H	Mid-Chulitna	500								1			
6/3	4H	H	Lower Chulitna	150		1			1						
6/3	5H	H	3 Mile Creek	250								1			
6/3	6H	H	East Fork Chulitna	600		1			1						
6/3	7C	H	S. Side Chichantna	300	1				1						
	8C	H	Wolv. Crk E. Side	1,500								2	1		
	9C	H	Upper Chichantna	1,000[1]											
	10C	H	Upper Chulitna	1,300		1			1						
	11C	H	Lower Chulitna	800		1			1						
	12C	H	Lower Chulitna	200										1	
	13C	H	Upper Chakachatna	1,900	3					1(2)					
	14C	H	Straight Creek	500		1		1							
	15C	H	Straight Creek	300								1	2		2
	16C	H	Upper Nikolai	2,000	1		1								
	17C	H	Upper Chult	1,600		1		1							
	18C	H	Mid-Chulitna	800		1	1								
	19C	H	Mid-Chulitna	800								1			
	20C	H	Lower Chulitna	200		1			1						
	21C	H	Upper Wolverine	1,700[1]											
	22H	H	Mid-Chulitna	375		1									
	23C	H	Nikolai Creek	900		3				1(2)					
	24C	H	East Chulitna	350		1			1						

Table 5.7

1980 MOOSE SURVEY

Area: Lone Ridge, Beluga Drainage, Chuitna Drainage

Observer: J. Didrickson, ADF&G (Palmer)

Total Moose: 151 (139 adults, 12 calves)

Age-Sex Ratios: Bulls - 33 large, 11 yearlings, 44 Total

Cows - 85 w/o calves, 8 w/calves, 2 w/2 calves, 95 Total

Period of Observation: December

Red Squirrel	Tamiasciurus hudsonicus
Lynx	Lynx canadensis
Snowshoe or Varying Hare	Lepus americanus
Flying Squirrel	Glaucomys sabrinus
Muskrat	Ondatra zibethica
Beaver	Castor canadensis
Wolverine	Gulo luscus
Porcupine	Erethizon dorsatum
Least Weasel	Mustela rixosa
Ermine or Shorttail Weasel	Mustela erminea
Mouse Weasel	Mustela nivalis
Marten	Martes americana
Coyote	Canis latrans
Ground Squirrel	Citellus undulatus
Collared Pika	Ochotna collaris
Hoary Marmot	Marmota caligata
Brown Lemming	Lemmus trimucronatus
Northern Bog Lemming	Synaptomys borealis
Red-backed Vole	Clethrionomys rutilus
Tundra Vole	Microtus oeconomus
House Mouse	Mus musculus
Meadow Jumping Mouse	Zapus hudsonius
Masked Shrew	Sorex cinereus
Dusky Shrew	Sorex obscurus
Water Shrew	Sorex palustris
Little Brown Bat	Myotis lucifugus

Population estimates for the above are not available, however the area has historically supported a relatively large harvest of furbearers, particularly beaver and wolverine. Beavers are active throughout the region and have a significant impact on the headwaters of nearly every stream within the system. An aerial count of active lodges is anticipated as part of an on-going field program to be conducted in the fall of 1981.

- General Sensitivity to Changed Conditions

Populations of large mammals change in response to natural biologic, geologic, and climatic events and in response to human activities. Pressures from human activities are generally related to economic development. Direct pressures also occur when habitats are altered or their uses are denied by segmentation or other means. Habitat may be altered or destroyed by fire, clearing, logging, road building, or other construction and resource extraction activities. Segmentation divides a habitat into tracts too small to be used effectively by a population. The noise and activity associated with development also may prevent utilization of a habitat. Many diverse habitat types within the range of a species may be occupied at least occasionally by a particular species. One or more of these types termed "critical habitats" may be of particular importance and their extent may limit the population. Critical habitats may be areas used for denning, wintering, calving, or feeding. Use of a critical habitat may vary widely from year to year depending on a variety of factors. Critical habitats for many species have been defined.

Denning areas, spring feeding areas, and salmon streams are probably the most critical habitats for brown bears. Most of the salmon streams support brown bear concentrations and may be considered critical habitat during the salmon runs. The future of the brown bear inevitably will be determined by human encroachment into bear habitat. Within the study area, brown bears probably are more vulnerable to the secondary effects of development, especially increased access by hunters and increased incidental confrontations, than to the more direct modifications of habitat associated with resource development.

Factors determining black bear mortality are well known, and hunting and other human activities generally become the major limiting factors in accessible areas. Loss of habitat to develop-

ment, loss of access to salmon streams and berry patches, harassment (both intentional and inadvertent) by outdoor recreation and transportation activities, and the incidence of nuisance bears that must be destroyed will increase as human populations and bear populations interface more frequently. Small, discrete black bear populations may be especially vulnerable to over-harvest. In the study area, where black bear populations infrequently are isolated from one another, the bears are less vulnerable to the effects of human activities. Black bears usually inhabit open woodlands, avoiding extensive open areas and the larger tracts of dense forest. Where human contact has not been encouraged, habitat preference and native wariness permit black bears to withstand considerable human pressure.

Winter mortality of moose, including deaths associated with starvation and losses to predators caused by the weakened condition of the moose and loss of mobility in deep snow, are the major factors limiting natural moose populations. Winter mortality is determined primarily by food availability, which in turn is determined by competition for the food resources and by the depth, duration, and hardness of the snow. Adverse winter conditions first affect the calves, then the cows, and finally the bulls. Mortality in extremely harsh years may be nearly 100%. Predation by bears, wolves, and human hunters also may affect populations. Accidental kills by automobiles may be important locally, and traffic mortality increases when roads and railroads are constructed through prime ranges or across migration routes. Secondary effects of development, particularly increased access for hunters, would have the greatest impact on existing moose populations.

Existing Avian Populations

Little information is available on terrestrial avian populations for the Beluga area. Ornithological records primarily reflect lists published by various observers. Year-round populations of terrestrial birds

are represented by relatively few species, including raven, chickadee, redpoll, Canada and Steller's Jay, magpie, and several woodpeckers. Species diversity and abundance increase markedly in the summer. Table 5.8 represents a list of birds which can be expected to be found in the Beluga region. The list includes year-round residents, migratory species (excluding waterfowl, shorebirds and seabirds) and accidental or occasional sightings. Known nesting sites (cranes, eagles, swans) based on 1981 field observations are shown in Figure 5.9. Included in Figure 5.9 are swan and eagle nests sighted during a June 2, 1981 flight of the Upper Cook Inlet Oil and Gas Lease Units by personnel of ADF&G.

Nesting habitat (current and potential) will be mapped eventually as part of an overall habitat mapping scheme. The relationship between project development and operation relative to adjacent refuge lands must be carefully considered particularly if the DF&G were to undertake any enhancement programs to encourage additional summer utilization of the lands.

Amphibians

The only amphibians known from the region are the rough-skinned newt, Taricha granulosa, and the wood frog, Rana sylvatica. The rough-skinned newt is a relatively large brown salamander (up to 6 inches in length) found near small ponds and lakes throughout the spruce forests near the coast. The wood frog is a small (up to 3 inches) light brown or gray frog, with a prominent dark eye mask, found in or near the shallow ponds of both the lowland forest and wet tundra. Both the rough-skinned newt and the wood frog are active during daytime (diurnal).

Table 5.8

TERRESTRIAL BIRDS

Common Name	Scientific Name	Occurrence S/S/F/W
Goshawk	Accipiter gentilis	U/U/U/U *
Sharp-shinned Hawk	Accipiter striatus	C/U/C/U *
Red-tailed Hawk	Buteo jamaicensis	R/R/R/+ *
Rough-legged Hawk	Buteo lagopus	R/+/R/+
Golden Eagle	Aquila chrysaetos	R/R/R/R *
Bald Eagle	Haliaeetus leucocephalus	C/C/C/C *
Marsh Hawk	Circus cyaneus	C/U/C/R *
Osprey	Pandion haliaetus	R/R/R/- *
Gyrfalcon	Falco rusticolus	R/R/R/R *
Peregrine Falcon	Falco peregrinus	U/R/U/R *
Merlin	Falco columbarius	R/R/R/R *
American Kestrel	Falco sparverius	R/+/R/+
Spruce Grouse	Canachites canadensis	U/U/U/U *
Willow Ptarmigan	Lagopus lagopus	U/U/U/U *
Rock Ptarmigan	Lagopus mutus	C/C/C/C *
White-tailed Ptarmigan	Lagopus leucurus	R/R/R/R *
Sandhill Crane	Grus canadensis	C/R/C/- *
Rock Dove	Columba livia	C/C/C/C *
Great Horned Owl	Bubo virginianus	C/C/C/C *
Snowy Owl	Nyctea scandiaca	R/+/R/U
Hawk Owl	Surnia ulula	U/U/U/C *

S/S/F/W = Summer, Spring, Fall, Winter

C = Common
U = Uncommon
R = Rare
+ = Casual or accidental
- = Not known to occur
* = Known or probable breeder

Table 5.8
Continued
TERRESTRIAL BIRDS

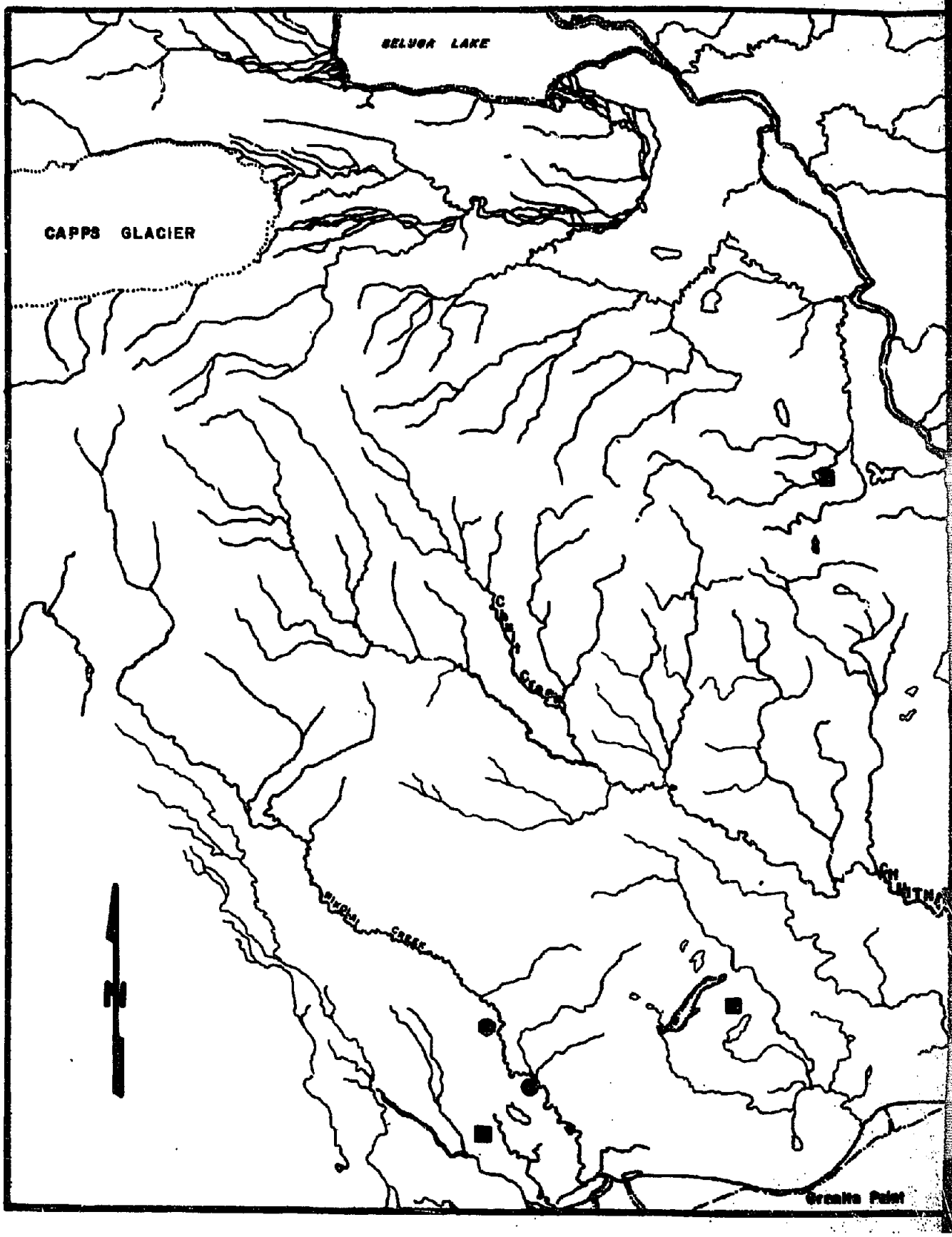
Common Name	Scientific Name	Occurrence S/S/F/W	
Great Gray Owl	Strix nebulosa	R/R/R/R	*
Short-eared Owl	Asio flammeus	C/C/C/R	*
Boreal Owl	Aegolius funereus	U/U/U/U	*
Saw-Whet Owl	Aegolius acadicus	R/R/R/R	*
Rufous Hummingbird	Selasphorus rufus	C/C/C/-	*
Belted Kingfisher	Megaceryle alcyon	U/U/U/U	*
Common Flicker	Colaptes auratus	+/R/U/-	
Yellow-bellied Sapsucker	Sphyrapicus varius	+/-/+/-	
Hairy Woodpecker	Picoides villosus	U/U/U/U	*
Downy Woodpecker	Picoides pubescens	U/U/U/U	*
Black-backed Three-toed Woodpecker	Picoides arcticus	+/-/-/-	*
Northern Three-toed Woodpecker	Picoides tridactylus	R/R/R/R	*
Eastern Kingbird	Tyrannus tyrannus	-/+/+/-	
Alder Flycatcher	Empidonax alnorum	U/U/U/-	*
Western Wood Pewee	Contopus sordidulus	-/R/R/-	*
Olive-sided Flycatcher	Nuttallornis borealis	R/R/R/-	*
Horned Lark	Eremophila alpestris	R/R/R/-	
Violet-green Swallow	Tachycineta thalassina	C/C/C/-	*
Tree Swallow	Iridoprocne bicolor	C/C/C/-	*
Bank Swallow	Riparia riparia	U/U/U/-	*
Rough-winged Swallow	Stelgidopteryx ruficollis	+/+/-/-	
Barn Swallow	Hirundo rustica	C/C/C/-	*
Cliff Swallow	Petrochelidon pyrrhonota	U/U/U/-	*
Gray Jay	Perisoreus canadensis	R/R/R/R	*
Steller's Jay	Cyanocitta stelleri	C/C/C/C	*
Black-billed Magpie	Pica pica	C/C/C/C	*

Table 5.8
Continued
TERRESTRIAL BIRDS

Common Name	Scientific Name	Occurrence S/S/F/W	
Common Raven	Corvus corax	C/C/C/C	*
Northwestern Crow	Corvus caurinus	C/C/C/C	*
Black-capped Chickadee	Parus atricapillus	U/U/U/U	*
Boreal Chickadee	Parus hudsonicus	R/R/R/R	*
Chestnut-backed Chickadee	Parus rufescens	C/C/C/C	*
Red-breasted Nuthatch	Sitta canadensis	R/R/U/R	*
Brown Creeper	Certhia familiaris	U/U/U/U	*
Dipper	Cinclus mexicanus	C/C/C/C	*
Winter Wren	Troglodytes troglodytes	U/U/U/U	*
American Robin	Turdus migratorius	C/C/C/R	*
Varied Thrush	Ixoreus naevius	C/C/C/U	*
Hermit Thrush	Catharus guttatus	C/C/C/-	*
Swainson's Thrush	Catharus ustulatus	U/U/U/-	*
Gray-cheeked Thrush	Catharus minimus	U/U/U/-	*
Wheatear	Oenanthe oenanthe	R/R/R/-	*
Townsend's Solitaire	Myadestes townsendi	R/R/R/-	*
Golden-crowned Kinglet	Regulus satrapa	U/U/U/U	*
Ruby-crowned Kinglet	Regulus calendula	C/C/C/+	*
Water Pipit	Anthus spinoletta	C/C/C/-	*
Bohemian Waxwing	Bombycilla garrulus	U/U/U/R	*
Northern Shrike	Lanius excubitor	U/U/U/U	*
Starling	Sturnus vulgaris	R/-/R/R	
Tennessee Warbler	Vermivora peregrina	+/-/-/-	
Orange-crowned Warbler	Vermivora celata	C/C/C/-	*
Yellow Warbler	Dendroica petechia	U/U/U/-	*
Yellow-rumped Warbler	Dendroica coronata	U/U/U/-	*
Townsend's Warbler	Dendroica townsendi	U/U/U/-	*
Blackpoll Warbler	Dendroica striata	R/R/R/-	*

Table 5.8
Continued
TERRESTRIAL BIRDS

Common Name	Scientific Name	Occurrence S/S/F/W	
Northern Waterthrush	Seiurus noveboracensis	R/R/R/-	*
Wilson's Warbler	Wilsonia pusilla	C/C/C/-	*
Red-winged Blackbird	Agelaius phoeniceus	R/R/R/-	*
Rusty Blackbird	Euphagus carolinus	U/R/U/R	*
Brambling	Fringilla montifringilla	-/-/+/+	
Bullfinch	Pyrrhula pyrrhula	-/-/+/+	
Pine Grosbeak	Pinicola enucleator	U/U/U/U	*
Gray-crowned Rosy Finch	Leucosticte tephrocotis	U/U/U/R	*
Hoary Redpoll	Carduelis hornemanni	R/-/-/R	
Common Redpoll	Carduelis flammea	C/U/U/C	*
Pine Siskin	Carduelis pinus	C/C/C/U	*
Red Crossbill	Loxia curvirostra	R/R/R/R	*
White-winged Crossbill	Loxia leucoptera	U/U/U/U	*
Savannah Sparrow	Passerculus sandwichensis	C/C/C/-	*
Dark-eyed Junco	Junco hyemalis	U/U/U/U	*
Tree Sparrow	Spizella arborea	U/R/U/R	*
Chipping Sparrow	Spizella passerina	+/-/+/-	
Harris' Sparrow	Zonotrichia querula	+/-/+/-	
White-crowned Sparrow	Zonotrichia leucophrys	U/R/U/R	*
Golden-crowned Sparrow	Zonotricha atricapilla	C/C/C/R	*
White-throated Sparrow	Zonotricha albicollis	-/-/+/+	
Fox Sparrow	Passerella iliaca	C/C/C/R	*
Lincoln's Sparrow	Melospiza lincolnii	C/C/C/+	*
Song Sparrow	Melospiza Melodia	C/C/C/C	*
Lapland Longspur	Calcarius lapponicus	U/R/U/+	*
Snow Bunting	Plectrophenax nivalis	U/R/U/R	*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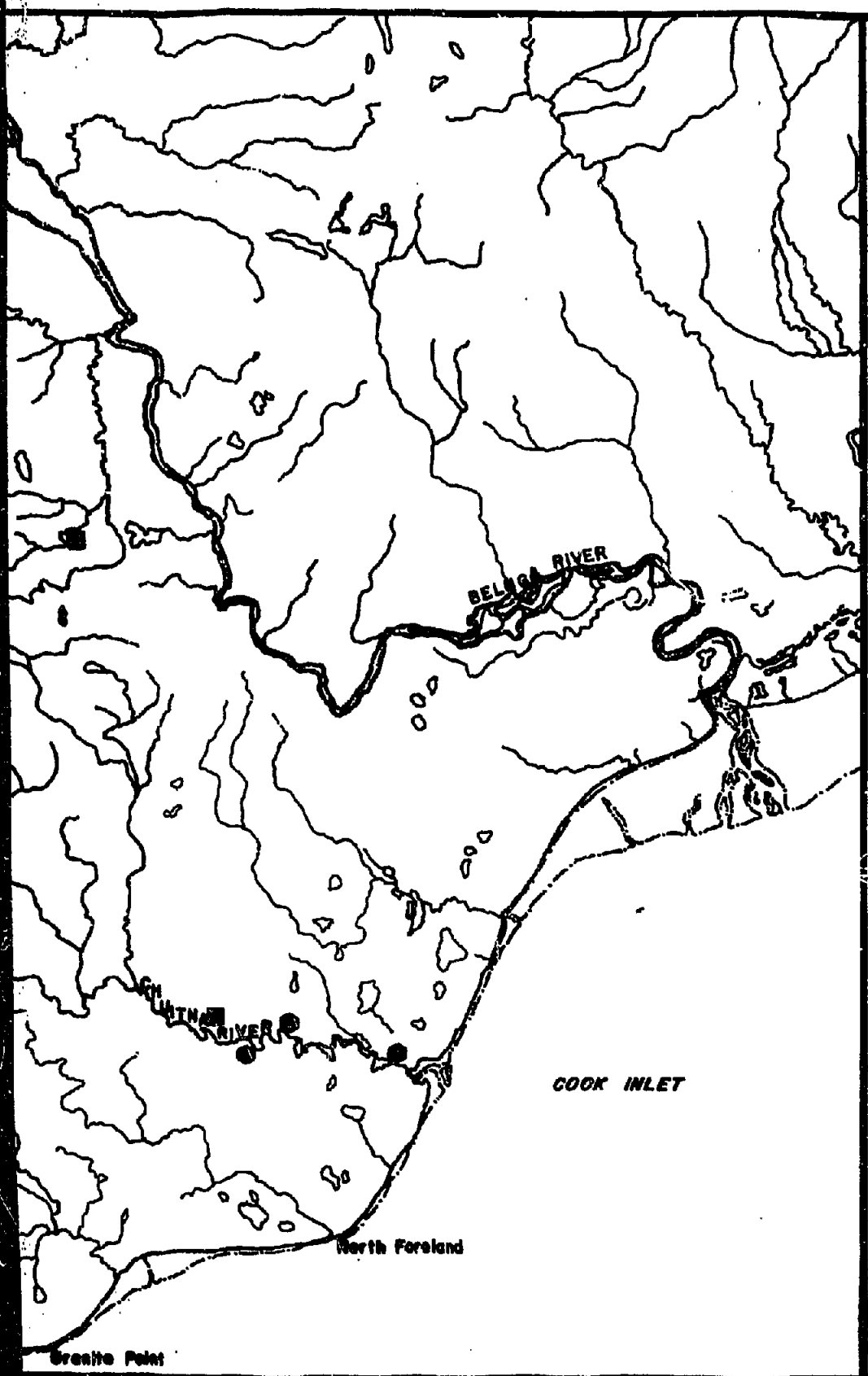
CAPPS GLACIER
Granite Point



LEGEND

- BALD EAGLE NEST
- TRUMPETER SWAN NEST
- SANDHILL CRANE NEST

KNOWN NESTING SITES (ACTIVE, 1981)

FIGURE 5.9