# Fishes of
# Kusawa Territorial Park

*Photo: J. Meikle*

**prepared for**

**YUKON DEPARTMENT OF ENVIRONMENT**

**by**

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## 1.0 INTRODUCTION

The vast majority of the drainages within the confines of the proposed Kusawa Territorial Park in southern Yukon form part of the upper Yukon River basin. The Yukon River basin covers an area of approximately 850,000 $km^2$ that spans significant portions of the jurisdictions of Alaska and the Yukon Territory. The park is approximately 3,065 $km^2$ in area and its southern limit shares the border with British Columbia. The most dominant feature in the park is Kusawa Lake whose large surface area makes it the 6$^{th}$ largest lake in the southern Yukon. Some of the principle drainages include the Kusawa River, Primrose River, and Takhini River. The vast majority of the surface waters in the park eventually discharge into the Yukon River. A very small portion of the park is within the Alsek River basin. On the parks western boundary is the Kluhini River that flows north and eventually west into Fredrick Lake. The Kluhini River discharges into the Dezadeash River, a major tributary of the Alsek River Basin.

The park is located in boreal cordillera ecoregion in southern Yukon. The typical mean annual temperature for the area is approximately -2°C with a summer mean of 10°C and a winter mean of -15°C. The region is generally dry being influenced by a rain shadow effect by the coastal mountains to the west. Mean annual precipitation for the region is thought to be in the range of 400-700 mm. The landscape is subject to periodic forest fires and the vegetation consists primarily of lodgepole pine on plateaus, with white and black spruce, and willow in the lowland and riparian areas.

The purpose of this paper was to review and summarize known information concerning fish and fish habitat in streams and lakes associated with the Kusawa Territorial Park. Included, is a summary of the fish species known to occur in the area and brief description of their life history and ecology. The contents of this paper and bibliography are to assist Yukon Parks with their task in the preparation of a management plan for the park.

## 2.0 LITERATURE REVIEW

The contractor met with Yukon Environment representatives in Whitehorse and gleaned all relevant field studies and reports for information that was available. Compiled information included unpublished documents contained in lake files at the Yukon Department of Environment or through the Department of Fisheries and Oceans FISS database. Written and summarized information in the form of reports for the most part were project specific and completed by other government agencies or in some rare cases non-government organisations. Projects that sampled streams and lakes in the park were largely associated with fish baseline inventories. Harvest surveys were specific to recreational fishing during the summer use period. With the exceptions of Kusawa Lake and the Takhini River, there was little information found concerning the many other streams and lakes in the study area. Specific information with respect to fish distribution, spawning locations, movements or ecology in the many streams and lakes throughout the park is largely lacking.

The information contained in this document is not intended to replace any Traditional or local knowledge that will certainly arise in the future. Instead, this document is intended to simply be an overview of information that has been recorded largely by governments and hopefully of use to supplement locally collected information from First Nation or knowledgeable residents of the Yukon.

## 3.0 RESOURCE DESCRIPTION

A total of 28 freshwater and anadromous (migrating up rivers from the sea to breed in freshwater) fish species are known to occur in the Yukon Territory. In comparison, this review identified 11 freshwater and 1 anadromous species to inhabit Kusawa Territorial Park (Table 1). The most common species that have been reported are Arctic grayling, lake or humpback whitefish, round whitefish and lake trout. Lake trout and Arctic grayling are the most sought after species by recreational anglers in the park. Over 90 percent of recreational anglers originate from Whitehorse (Yukon Environment unpublished).

### 3.2 Kusawa Lake

Kusawa Lake represents the largest lake in the park occupying a surface area of ~ 142 $km^2$. The origins of this lake basin stem back to the Cordilleran ice sheet that covered the southern Yukon and lasted from about 50,000 to 10,000 years ago. With the glacial retreat, Kusawa Lake formed part of glacial Lake Champagne and formed part of the Alsek River basin (Lindsey et al 1981). The connection to the Alsek River basin was broken as glacial Lake Champagne receded, becoming a headwater lake associated with the upper Yukon River basin.

The morphology of the Kusawa Lake is characterized as a relatively deep, glacially scoured U-shaped basin with very few islands. It is relatively narrow having a widest width of 2.7 km but is about 57 km in length. The north end of Kusawa Lake is assessable by a seasonal road that connects to the Alaska Highway. An YTG Territorial campground and boat launch is located on the lake at the road terminus. The maximum depth of Kusawa Lake has been reported to be 140 meters with an average depth of 54 meters. There are a modest number of bays and the lack of shoreline development reflects a lower potential of shallow water or littoral development. Shallow water littoral regions are generally the most productive aquatic habitats in a lake. Lakes without shallow water areas are generally less productive and yield less fish than lakes with more extensive shallow water regions. A simple way of comparing productive capacity from lake to lake is by first determining the mean depth of the basin and obtaining some very basic water chemistry. The resulting ratio of these parameters is known as the morphoedaphic (MEI) index. A relatively high MEI value for a lake generally reflects a greater productive capacity which is of great interest to fisheries managers. Kusawa Lake has a MEI of 0.74 which is one of the lowest determined for any lake in the Yukon reflecting very low productivity.

Lake trout, lake whitefish and round whitefish are the most common species in Kusawa Lake based on past gillnet assessments by management agencies (Yukon Environment unpublished). In the most recent fish survey in 2006, the largest captured lake trout was ~80 cm in fork length and ~6.3 kg.

Lake trout are a highly sought species by recreational anglers in Kusawa Lake. Their high relative abundance in the lake results in good angler success with the capture of hundreds each year. During the spring they can be found in shallow water habitat. The species becomes more difficult to catch during mid summer after they migrate to the deeper portions of these lakes to avoid warmer water temperatures. Lake trout that are harvested by anglers are generally small, with the majority that are harvested rarely getting above 60 cm in length and 2 kg in weight. About half of all the lake trout that are caught are released by anglers.

Generally, whitefish are rarely captured or sought after by recreational anglers due to their bottom feeding nature. The most common species in Kusawa Lake are lake and round whitefish based on the most recent fish surveys. Other whitefish types that have been infrequently captured in the lake are least cisco and broad whitefish.

Other reported fish species in Kusawa Lake include Arctic grayling, northern pike, burbot, longnose sucker and chinook salmon. Arctic grayling are not common in the lake but tend to prefer habitat associated with the lakes outlet and the many inlets and alluvial fans associated with small drainages that enter the lake. Shallow weedy bay areas are limited on Kusawa Lake which is the preferred habitat of northern pike and is reflected in their rarity throughout the lake. Arctic grayling and northern pike are infrequently caught by recreational anglers and harvests of these species are thought to be low. Chinook salmon and longnose sucker are almost always documented with the outlet of Kusawa Lake. Burbot abundance and their distribution throughout the lake remain largely unknown.

Kusawa Lake has been a focus of study for organochlorine (OC's) contaminants. These types of contaminants are thought to have originated from southern parts of the continent where they were once used and transported north in a process known as long-range air transport. Since 1993 Kusawa Lake has been monitored for these types of contaminants. Lake trout and burbot are annually monitored. There is strong evidence that these contaminants are

declining in lake trout in Kusawa Lake (Ryan et al 2005). Conversely, no consistent trends were observed in OC concentrations for burbot.

### 3.3 Primrose Watershed

The Primrose watershed contains several lakes, ponds and wetlands of varying size and represents the largest sub-drainage in the park. The three principle lakes are Johns Lake, Primrose Lake and Rose Lake. Only Primrose and Rose lakes have received some attention by management agencies, primarily establishing the occurrence of two known species; Arctic grayling and lake trout. In the most recent fish survey Yukon Environment reported lake trout were relatively abundant in Rose Lake in 2002. It is believed that obstructions in the form of velocity barriers and/or waterfalls in the Primrose River Canyon likely have prevented the colonization of other species in these lakes.

The basin morphology of both Primrose and Rose lakes are like other lakes in the park, being long and relatively narrow in shape. Rose Lake appears to have a more complex shoreline, with many more islands and marshes. The profusion of islands, marshes, ponds and sand bars at the inlets to each of these lakes are features presumably created from the deposition of glacial sediment. Glacial meltwater originating from the upper reaches of the drainage make surface waters in both lakes appear turbid.

The drop in elevation of the Primrose River between Rose Lake and Kusawa Lake is estimated to be about 212 m. The high gradient makes this section of river attractive for hydro development. The Primrose River has been identified as a potential 20 to 30 MW hydro site by Yukon Energy (Yukon Energy 2006). The remote nature of the site would involve substantial generation capital and planning costs, prior to a decision to proceed with construction.

### 3.4 Takhini River

The relatively short section of the Takhini River that begins at the outlet of Kusawa Lake is perhaps the most productive fish habitat in the park. Relatively well documented and assessable, there is significant amount of spawning habitat for anadromous chinook in this section of river. The size of the spawning

population varies from year to year, however it is believed these fish contribute significantly to the diversity of stocks that represent the upper Yukon River basin. The population is considered distinct genetically from other populations surveyed in the Yukon River (Beacham et al 1989). The chinook spawning window in the Takhini is roughly between August 15 and September 15. There are no other known spawning locations in the park. Reports of chum salmon utilizing spawning habitat in the Takhini River remain unconfirmed.

The lower section of the Takhini River is also known to be utilized by 11 species of freshwater fish. While broad whitefish have not been confirmed in the river they have been captured and identified in Kusawa Lake by Yukon Environment staff and are also likely part of the Takhini River fish assemblage. Both broad whitefish and inconnu are capable of long migrations. Many of the species in the river likely utilize habitat in Kusawa Lake for some of their life history. Little information is available with respect to movements of fish between the outlet of Kusawa Lake and the Takhini River.

Specific information pertaining to the upper reaches of the Takhini River, upstream of the inlet into Kusawa Lake, was not located. Sections of the river both upstream and downstream of Takhini Lake are dominated by a profusion of islands, side channels, ponds and sand bars that dominate the stream. These features are the result of deposition of glacial sediment originating in the headwaters of this stream. Glacial meltwater originating from the upper reaches of the drainage make surface waters in Takhini Lake appear turbid.

### 3.4 Other Lakes and Drainages

The Jo-Jo Creek drainage basin is a relatively small watershed that flows south and discharges into the central portion of Kusawa Lake. The watershed is dominated by Jo-Jo Lake, whose morphology is similar to that of all other lakes in the park, being relatively long and narrow. This moderately sized lake (639 ha) has a maximum depth of 63 m and averages 30.6 m in depth. Jo-Jo Lake has a very low MEI of 1.01 reflecting its low productivity and modest amounts of shallow water littoral habitat. The shoreline has few bays and the lake has no

islands. The most productive areas are likely associated with the outlet and inlet regions of the lake. Jo-Jo Lake has been the focus of few studies. Archibald (1977) assessed the effects of planktivorous fish predation, lake morphology and lake productivity on the limnetic zooplankton on this lake. In 2006, Yukon Environment reported the occurrence of Arctic grayling and lake trout in the lake, with the latter being relatively abundant. It is believed that obstructions in the form of velocity barriers and/or waterfalls in Jo-Jo Creek likely have prevented the colonization of other species in this lake.

The short section of the Kluhini River at the extreme western border of the park is located in the Alsek drainage basin. This Alsek basin is known to contain unique species of fish that are not found in the Yukon River basin. The most notable are kokanee salmon, a species that have been documented in Frederick Lake just west the park. Only two populations of kokanee are known to occur in the Yukon. Kokanee are known to utilize both shorelines of lakes and creeks for spawning habitat. Fry typically rear in lakes. No information could be located concerning fish utilization for the section of the Kluhini River that is located in the park.

## 4.0 MANAGEMENT AUTHORITY, REGULATIONS AND MONITORING

Kusawa Territorial Park is within the Traditional Territories of the Champagne and Aishihik First Nation, Carcross Tagish First Nation and the Kwanlin Dun First Nation. As such, people of First Nation ancestry from these First Nations have the right to harvest fish for subsistence within any lake or stream in each respective Traditional Territory. Fish harvests by other residents and non-residents of the Yukon is monitored and managed by the Government of Yukon, Department of Environment. The department administers the issuance of all recreational angling licenses and permits associated with fish harvest. The *Yukon Territory Fishery Regulations* are made under the authority of the *Fisheries Act* and control all fishing activity in that territory. Fisheries and Oceans Canada is the lead management agency for the management and

protection of fish habitat in the Yukon Territory. The overall management of salmon is the responsibility of Fisheries and Oceans Canada.

Recreational angling catch limits for some game species were reduced in Jo-Jo Lake in 1994. Barbless hooks became mandatory with licensed catch and possession limits reduced to 2 lake trout, 4 Arctic grayling and 4 northern pike. In addition, a slot size regulation was imposed that required the release of slot sized for these species on designated *Conservation Waters*. It is believed by the Department of Environment that trophy sized lake trout in small lakes like Jo-Jo Lake are especially vulnerable due to their slow growth and rarity. Freshwater fish catch limits for all other lakes and streams in the park have remained unchanged since the early 1990s and are subject to general catch and possession limits as outlined in the *Yukon Territory Fishing Regulations*. Salmon fishing has been prohibited since the late 1980s in the Takhini River from August 20 to September 15. During this period, recreational anglers pursuing other freshwater fish in the Takhini River are permitted to use artificial flies only.

Yukon Environment monitors the harvests of fish in these lakes through periodic surveys. These surveys, also known as creel census, are a statistical method of estimating angler effort and fish harvest from a series of boat counts and angler interviews. The method involves interviewing anglers and examining their catch after a days fishing, or under certain circumstances, while they were still fishing. Surveyors are usually stationed at boat launches at a lake or stream and are equipped with interview forms and fish sampling kits. Sampling of the fish allows the determination of the species, average size, sex and state of sexual maturity of harvested fish. Harvest surveys are nearly always performed in the summer or open water periods when recreational angling activity is the greatest. Collected information over many years provides valuable information as to trends in harvests, catch rate and angling practises. The most recent harvest surveys conducted on Kusawa Lake occurred in 2001 by Environment Yukon.

Lake trout abundance is also estimated through a technique known as a small mesh (CPUE) survey. These surveys employ the use of gillnets in a non-

destructive manner. The technique requires the survey to be conducted in the spring, usually before surface waters reach 13°C, when lake trout are typically found in shallow water habitat just after ice-out. The use of small mesh gillnets for short periods (1 hour) allow the capture of lake trout through mesh entanglement of teeth and nose bones, while avoiding the more damaging gilling action of larger mesh sizes. Theoretically, if lake trout are abundant in a waterbody, then catches should be correspondingly high in comparison to other surveyed lakes where abundance is known to be low. Yukon Environment has been developing a Yukon wide database since the early 1990's. The most recent CPUE survey by Yukon Environment of Jo-Jo Lake was in 2000, Kusawa Lake in 1993 and Rose Lake in 2000.

## 5.0 SPECIES ECOLOGY AND NATURAL HISTORY

Fish communities in the Yukon vary over the landscape as a result of many factors. One of the most significant is the glacial history which likely accounts for much of the variation in species between watersheds we see today. A good discussion by Lindsey *et al* (1981) was one of the first to document the differences in fish communities between the Yukon's largest watersheds of the Alsek, Liard, Peel and Yukon River basins.

Generally, each fish species tend to prefer specific habitat types. Some species prefer the still water habitat in lakes, ponds or wetlands while others prefer moving water in rivers and creeks. Several species including slimy sculpin and Arctic grayling are ubiquitous and can be found in both lake and stream environments. Landscape features such as waterfalls, canyons and gradient can also have a great influence on the distribution of stream dwelling species. For lake dwelling species an adequate depth is needed for overwintering. The 8 freshwater species known to inhabit the park are widely distributed in Yukon, Alaska and throughout Canada and northern USA. Chinook salmon, the only anadromous species in the park, is common throughout the Yukon River Basin, Alaska, coastal stream of British Columbia, Washington and Oregon. Combined, these species inhabit a wide variety of habitat types in lakes to rivers that vary in

greatly in size, morphology and depth. Their status nationally and in the Yukon is for the most part secure. The following is a brief description of life history of each species that are known to inhabit the freshwater environs of Kusawa Territorial Park.

### 5.1 Arctic Grayling

Inhabits open water of clear, cold medium to large rivers and lakes, entering rocky creeks to spawn during the spring. Juvenile Arctic grayling are typically found in schools in moderate numbers feeding on zooplankton with a gradual shift to immature insects. Adults can be territorial and feed mainly on surface insects but can also consume fishes, fish eggs, lemmings, and planktonic crustaceans. Utilized fresh and can be fried, broiled, boiled, and baked.

### 5.2 Burbot

Burbot are the only member of the cod family which lives in freshwater. Nocturnal by nature they inhabit deep lakes and large rivers with slow-moving current. They tend to seek shelter under rocks, in crevices on the river banks, among roots of trees and dense vegetation. Movements into shallower water during summer nights are related to feeding. Burbot are known to aggregate for spawning late winter to early spring. Smaller individuals feed on insect larvae, snails and other invertebrates with a changing preference for fishes in larger individuals. Because of its nocturnal habits and its slow movements, this fish is not very much appreciated by recreational anglers although popular in the Yukon.

### 5.3 Chinook Salmon

Chinook salmon adults return to natal streams from the ocean to spawn. Fry migrate to the ocean after spending anywhere from 3 months to 3 years in fresh water but usually 2 years in the Yukon. Food in streams is mainly terrestrial insects and small crustaceans; in the ocean, major food items include fishes, crustaceans, and other invertebrates. Young are preyed upon by fishes and birds such as mergansers and kingfishers. Adults are prey of large mammals and large birds. Highly regarded game fish whose flesh is usually red,

but some are white. Highly valuable commercial species that is marketed fresh, smoked, frozen, and canned. Eaten steamed, fried, broiled, boiled, and baked.

### 5.4 Inconnu

Inconnu can be found in coastal waters near mouths of rivers, but usually found in large rivers or lakes. Adults feed mostly on small fishes with young eating aquatic insect larvae and planktonic crustaceans. This species spawns in the late fall in flowing water usually associated with large rivers. During spawning migration, it feeds little if at all. Inconnu are consumed as food where they occur, having flesh that is white, sweet and slightly oily.

### 5.5 Lake Trout

Found in shallow and deep waters of northern lakes and streams and is restricted to relatively deep lakes in the southern part of its range. Lake trout are usually a solitary wanderer, the extent of their movements apparently limited by the size of the lake and individual. Although lake trout generally feed on a variety of organisms such as crustaceans, insects, fishes (with a preference for ciscoes), and small mammals, some populations feed on plankton throughout their lives. Lake trout spawn are known to spawn in the fall months of September and October. They are highly susceptible to pollution, especially from insecticides. Utilized as a food fish, its flesh is usually of a yellow or creamy color but may be anything from white to orange. Lake trout are a valuable game fish and are highly prised.

### 5.6 Northern Pike

Northern pike occurs in clear vegetated lakes, quiet pools and backwaters of creeks and small to large rivers. Usually solitary and highly territorial adults feed mainly on fishes, but at times feed heavily on frogs and sometimes small mammals and young birds. Known to be also cannibalistic as juveniles, eggs and young are preyed upon by fishes, aquatic insect larvae, birds, and other aquatic mammals. The species is not known to undertake long migrations. Northern pike spawn in the spring in shallow heavily vegetated areas of lakes and rivers.

It is a valuable game fish and an excellent food fish that can be eaten pan-fried, broiled, and baked.

### 5.7 Slimy Sculpin

Slimy sculpin inhabits rocky riffles of cold streams and rocky areas of lakes. They are known to use shallow water habitat to spawn in the early spring. Slimy sculpin are known to excavate a nest cavity. Males guard the nest after adhesive eggs are deposited in the nest. They feed mostly on aquatic insect larvae and nymphs but also on crustaceans, small fishes, and plant materials.

### 5.7 Whitefishes

Lake or humpback whitefish, broad whitefish, round whitefish and least cisco are all part of the whitefish family. Lake whitefish and least cisco are primarily lake dwellers. Round and broad whitefish have more of a preference for streams and rivers, but both can be readily be found in lakes. All spawn during the fall and early winter. Lake whitefish and least cisco utilize shallow-water spawning habitat of lakes. Round and broad whitefish are known to use gravel beds in streams and rivers. Adult lake, broad and round whitefish feed mainly on aquatic insect larvae, snails, clams and amphipods, but also other fishes and fish eggs, including their own. Least ciscoes are known to be planktonic feeders of crustaceans and surface insects. Lake whitefish are valued for their roe and all can be eaten steamed, fried, broiled, boiled, and baked.

## 6.0 DATA GAPS

Overall, few detailed inventories specific to fish have been conducted in the many remote tributaries, ponds, wetlands and lakes in the Kusawa Territorial Park. The focus of study has been primarily on Kusawa Lake that is road assessable and receives high recreational use. Almost all of the study efforts have been during the summer months. The most recent surveys by the Yukon Department of Environment have established harvest estimates and relative abundance of lake trout. Descriptions of seasonal movement patterns of fish as well as specific locations of spawning, rearing and overwintering habitat for the

dominant species is lacking. A good data base of historical flow in the Takhini River is available through Water Survey of Canada (2008). Data bases are available for both the Kusawa Lake outlet and the Takhini River near its confluence with the Yukon River just north of Whitehorse, Yukon.

Perhaps the most obvious data gaps are associated with the few larger more remote lakes in Kusawa Territorial Park that have never been surveyed for fish. These include Johns Lake, Primrose Lake, Takhini Lake and the smaller lakes associated with the upper Kluhini River. The upper Kluhini River is especially interesting, not only is it part of another drainage basin but is suspected of containing spawning habitat of one of only two known Yukon spawning populations of kokanee salmon. Should any of these lakes or streams be surveyed, non-destructive sampling techniques should be employed as well as a general characterization of water quality and lake basin bathymetry should be considered. While a bathymetry map for Jo-Jo Lake is available for photocopy, consideration should be given for the development of a digital copy for public availability through the Yukon Environment website.

The extensive stream and river network throughout Kusawa Territorial Park remains largely un-surveyed. Stream survey techniques used by the BC Ministry of Environment could easily be adopted to assess any of the several watersheds in the park. Watershed assessments in other jurisdictions are usually associated with land use interests requiring some level of planning and the collection of stream resource information. Considering the remote nature of the park and current lack of development interest within the park boundaries, watershed assessments are likely cost prohibitive.

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**Table 1 Known presence of fish species of Kusawa Territorial Park.**

| FAMILY AND SCIENTIFIC NAME | COMMON NAME |
|---|---|
| CYPRINIDAE | |
| *Couesius plumbeus* | lake chub |
| CASTOMIDAE | |
| *Catostomus catostomus* | longnose sucker |
| ESOCIDAE | |
| *Esox lucius* | northern pike |
| SALMONIDAE | |
| *Oncorhynchus tshawytscha* | chinook salmon |
| *Salvelinus namaycush* | lake trout or lake char |
| *Coregonus clupeaformis* | lake or humpback whitefish |
| *Coregonus nasus* | broad whitefish |
| *Coregonus sardinella* | least cisco |
| *Prosopium cylindraceum* | round whitefish |
| *Thymallus arcticus* | Arctic grayling |
| *Stenodus leucichthys nelma* | inconnu |
| GADIDAE | |
| *Lota lota* | burbot, lingcod, loche |
| *Cottus cognatus* | slimy sculpin |

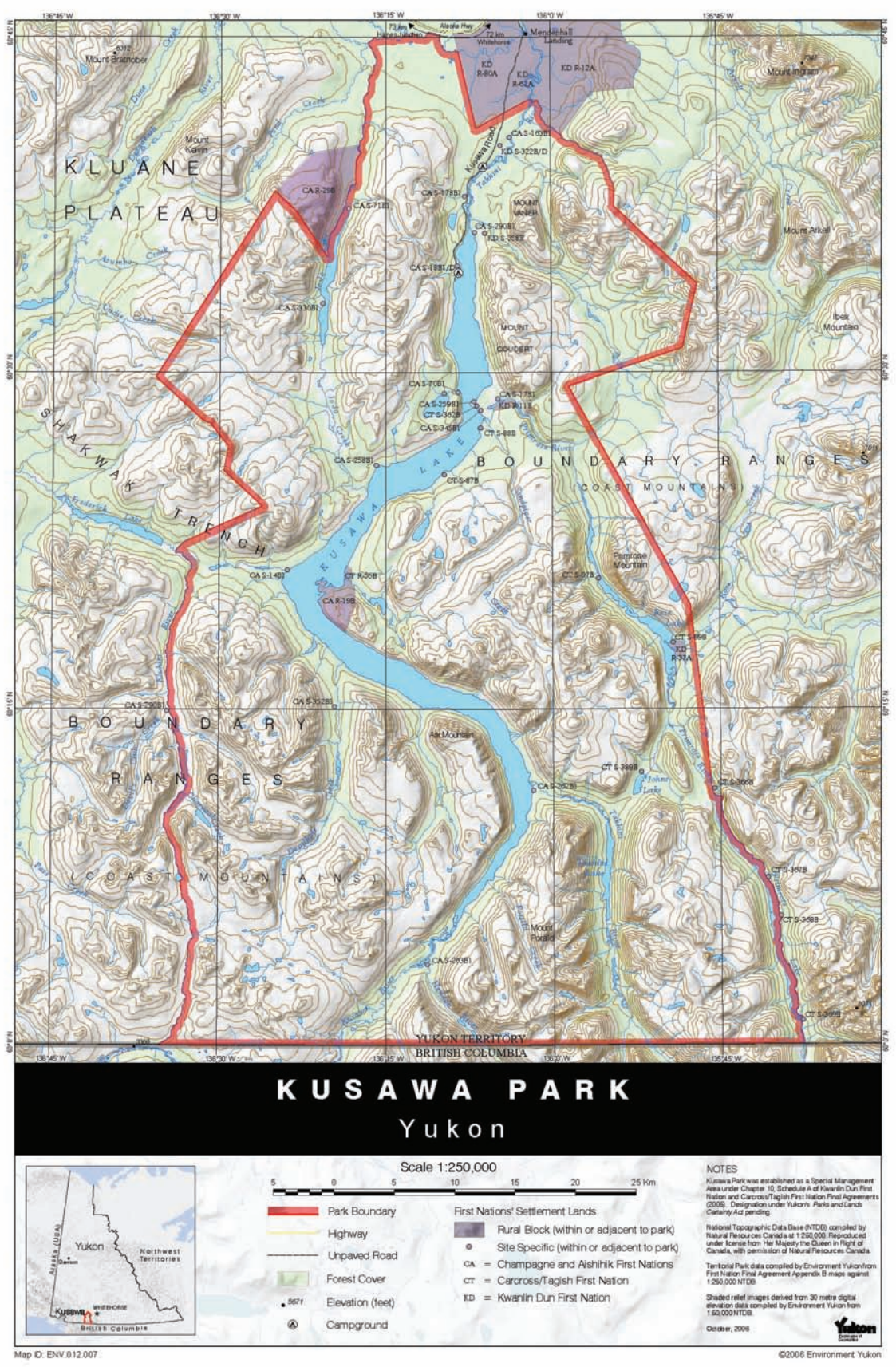



**Figure 1 Kusawa Territorial Park.**

# Appendix I

## Fish and Fish Habitat Information Summaries

# JO-JO LAKE
# Yukon Territorial Park
# Fisheries Information Summary

| | | | |
|---|---|---|---|
| **Drainage: Yukon - Takhini** | **Status: Unregulated** | **Mean Depth: 30.6 m** | **Max Depth: 63 m** |
| **Elevation: 889 m** | **Surface Area: 639 ha** | **Volume: 0.2 $km^3$** | **TDS: 31 mg/L** |
| **Species: GR, LT** | | **MEI: 1.01** | **Bathymetry Map: Yes** |

**Studies:**

| Agency (s) | Year | Study Name | Author | Source |
|---|---|---|---|---|
| DFO | 1976 | Catalogue of aquatic resources of the upper Yukon River drainage (Whitehorse area). | Brown et al | YTG/DOE library |
| Masters Thesis | 1977 | The effects of planktivorous fish predation, lake morphometry and lake productivity on the limnetic zooplankton of Yukon Lakes. | Archibald | YTG/DOE library |

**Technical Information:**

| Agency (s) | Year | Collected Information | Author | Source |
|---|---|---|---|---|
| YTG | 1992 | Lake trout MSY – 23 kg @ 10%; 34 kg @ 15 %; 46 kg @ 20% | YTG/DOE Fisheries | YTG/DOE lake and stream files |
| YTG | 2000 | Lake trout abundance survey – 3.33 / gillnet hour. | YTG/DOE Fisheries | YTG/DOE lake and stream files |
| YTG | 2006 | Lake trout abundance survey – 1.60 / gillnet hour. | YTG/DOE Fisheries | YTG/DOE lake and stream files |

**GLOSSARY OF FISH SPECIES:**
Note: Species in parentheses are not confirmed.

GR – Arctic grayling  LT – Lake trout

# KUSAWA LAKE
# Kusawa Territorial Park
# Fisheries Information Summary

| | | | |
|---|---|---|---|
| **Drainage: Yukon - Kusawa** | **Status: Unregulated** | **Mean Depth: 54 m** | **Max Depth: 140 m** |
| **Elevation: 671 m** | **Surface Area: 14,200 ha** | **Volume: 7.7 $km^3$** | **TDS: 40 mg/L** |
| **Species: BB, BW, CH, CS, GR, LNS, LT, LW, NP, RW** | | **MEI: 0.74** | **Bathymetry Map: Yes** |

**Studies:**

| Agency (s) | Year | Study Name | Author | Source |
|---|---|---|---|---|
| DFO | 1976 | Catalogue of aquatic resources of the upper Yukon River drainage (Whitehorse area). | Brown et al | YTG/DOE library |
| DFO | 1981 | Glaciation and the Physical, Chemical, and Biological Limnology of Yukon Lakes. | Lindsey et al | YTG/DOE library |
| DFO | 1984 | The Historical Overview of Fishing in the Yukon. | Seigel and McEwen | YTG/DOE library |
| University of Calgary | 1993 | Spatial variability of chlorinated bornanes (toxaphene) in fishes from Yukon Lakes. | Kidd et al | YTG/DOE library |
| Yukon River Panel | 1997 | Archival Research – Salmon in the Upper Lakes Region, Yukon Territory. | Cox | DFO Whitehorse |
| INAC | 1998 | Effects of trophic position and lipid on organochlorine concentrations in fishes from subarctic lakes in Yukon Territory | Kidd et al | DFO Whitehorse |
| DFO | 2005 | Temporal Trends of Organochlorine Contaminants in Burbot and Lake Trout from three selected Yukon Lakes. | Ryan et al | DFO Whitehorse |

## Technical Information:

| Agency (s) | Year | Collected Information | Author | Source |
|---|---|---|---|---|
| DFO | 1968 | Lake closed to commercial fishing due to recreation and development. | Seigel and McEwen | YTG/DOE lake and stream files |
| DFO | 1981 | Monitoring of the Kiwanis Fishing derby. | DFO | YTG/DOE lake and stream files |
| DFO | 1982 | Monitoring of the Kiwanis Fishing derby. | DFO | YTG/DOE lake and stream files |
| DFO | 1983 | Monitoring of the Kiwanis Fishing derby. | DFO | YTG/DOE lake and stream files |
| DFO | 1984 | Monitoring of the Kiwanis Fishing derby. | DFO | YTG/DOE lake and stream files |
| YTG | 1990 | Summer angler harvest survey – estimated harvest of 409 lake trout. | YTG/DOE Fisheries | YTG/DOE lake and stream files |
| YTG | 1992 | Lake trout MSY – 587 kg @ 10%; 881 kg @ 15 %; 1,175 kg @ 20% | YTG/DOE Fisheries | YTG/DOE lake and stream files |
| YTG | 1993 | Lake trout abundance survey – 0.54 / gillnet hour. | YTG/DOE Fisheries | YTG/DOE lake and stream files |
| YTG | 2001 | Summer angler harvest survey – estimated harvest of 504 lake trout. | YTG/DOE Fisheries | YTG/DOE lake and stream files |
| YTG | 2006 | Lake trout abundance survey – 0.49 / gillnet hour | YTG/DOE Fisheries | YTG/DOE lake and stream files |
| YTG | 2006 | Summer angler harvest survey – data not available | YTG/DOE Fisheries | YTG/DOE lake and stream files |
| INAC | 1993,1999 and 2001 to 2007 | Lake whitefish, round whitefish, longnose sucker, burbot and lake trout chemically tested for organochlorine content. Emphasis on burbot and lake trout. | Contaminants Program | YTG/DOE lake and stream files |
| DFO and YTG | 1960 to present | Various reconnaissance type surveys of fish and fish habitat in various regions of the lake. | Various authors | YTG/DOE/DFO lake and stream files, FISS database |

## GLOSSARY OF FISH SPECIES:

Note: Species in parentheses are not confirmed.

BB –Burbot
BW – Broad whitefish
CH – Chinook salmon
CS – Least cisco
GR – Arctic grayling
LNS – Longnose sucker
LT – Lake trout
LW – Lake whitefish
NP – Northern pike
SS – Slimy sculpin

# PRIMROSE LAKE
# Yukon Territorial Park
# Fisheries Information Summary

| | | | |
|---|---|---|---|
| **Drainage: Yukon - Takhini** | **Status: Unregulated** | **Mean Depth:** | **Max Depth:** |
| **Elevation:** | **Surface Area:** | **Volume:** | **TDS:** |
| **Species: GR, LT** | | **MEI:** | **Bathymetry Map: No** |

**Studies:**

| Agency (s) | Year | Study Name | Author | Source |
|---|---|---|---|---|
| DFO | 1976 | Catalogue of aquatic resources of the upper Yukon River drainage (Whitehorse area). | Brown et al | YTG/DOE library |
| YTG | 1981 | Aquatic Resources Inventory Southern Lakes. | Davies et al | YTG/DOE library |

**Technical Information:**

| Agency (s) | Year | Collected Information | Author | Source |
|---|---|---|---|---|
| | | | | |

**GLOSSARY OF FISH SPECIES:**
Note: Species in parentheses are not confirmed.

GR – Arctic grayling LT – Lake trout

# ROSE LAKE
# Yukon Territorial Park
# Fisheries Information Summary

| | | | |
|---|---|---|---|
| **Drainage: Yukon - Takhini** | **Status: Unregulated** | **Mean Depth:** | **Max Depth:** |
| **Elevation: 883 m** | **Surface Area:** | **Volume:** | **TDS:** |
| **Species: GR, LT** | | **MEI:** | **Bathymetry Map: No** |

**Studies:**

| Agency (s) | Year | Study Name | Author | Source |
|---|---|---|---|---|
| DFO | 1976 | Catalogue of aquatic resources of the upper Yukon River drainage (Whitehorse area). | Brown et al | YTG/DOE library |
| YTG | 1981 | Aquatic Resources Inventory Southern Lakes. | Davies et al | YTG/DOE library |

**Technical Information:**

| Agency (s) | Year | Collected Information | Author | Source |
|---|---|---|---|---|
| | 1997 | Lake trout abundance survey – 2.2 / gillnet hour. | | |
| YTG | 2002 | Lake trout abundance survey – 2.3 / gillnet hour. | YTG/DOE Fisheries | YTG/DOE lake and stream files |

**GLOSSARY OF FISH SPECIES:**
Note: Species in parentheses are not confirmed.

GR – Arctic grayling  LT – Lake trout

# TAKHINI RIVER
# KDFN Freshwater Assessment

| | |
|---|---|
| **Drainage: Yukon – Takhini** | **Key developments in the watershed:**<br>• **River outlet at Kusawa Lake is within a Yukon Territorial Park**<br>• **Chinook salmon spawning location at outlet of Kusawa Lake**<br>• **Hydrometric Station located on the Takhini River**<br>• **Agricultural and urban encroachment profuse in Takhini Valley** |
| **Species: BB, (BW), CH, (CM), CS, GR, IN, LKC, LNS, LT, LW, NP, RW, SS** | |
| **Drainage Area:** | |
| **Status: Unregulated** | |

**Studies:**

| Agency (s) | Year | Study Name | Author | Source |
|---|---|---|---|---|
| US Department of Interior | 1957 | A special report on the salmon resources of the Upper Yukon River Basin (above Carmacks), Yukon Territory, Canada. | US Fish and Wildlife Service | Yukon College Library |
| DFO | 1976 | Catalogue of aquatic resources of the upper Yukon River drainage (Whitehorse area). | Brown et al | YTG/DOE library |
| Fisheries and Environment | 1977 | Potential impacts of gas pipeline construction and operation on use and value of Yukon fisheries. | Eby et al | YTG/DOE library |
| DFO | 1977 | A Collection of Fisheries Information from Waterbodies associated with Pipeline Routes in Yukon Territory from Dawson to Watson Lake. | Northern Natural Resource Services | Yukon College Library |
| Foothills Pipe Lines | 1977 | A preliminary inventory of fish resources in the Southern Yukon Territory, 1976. | Beak Consultants | YTG/EMR library |
| Foothills Pipe Lines | 1978 | Fisheries Investigations along the Klondike Highway Section of the Prospective Dempster Lateral Route, Yukon Territory – Summer and Fall, 1977. | Beak Consultants | Yukon College Library |
| Environment Canada | 1978 | Studies on the freshwater and anadromous fishes of the Yukon River within Canada. | Walker | YTG/EMR library |
| Foothills Pipe Lines | 1979 | Fishery resource investigations of waterbodies within the influence of the Alaska Gas Pipeline, alternate alignments, 1978. | Beak Consultants | Yukon College Library |

| Agency (s) | Year | Study Name | Author | Source |
|---|---|---|---|---|
| Foothills Pipe Lines | 1980 | Summary of fisheries investigations of new crossing locations, Alaska Highway Gas Pipeline, Yukon Territory, 1979. | Foothills Pipe Lines | Yukon College Library |
| Foothills Pipe Lines | 1980 | Enumeration of spawning salmon in aquatic systems along the Alaska Highway Gas Pipeline in southern Yukon Territory, 1980. | Fernet | Yukon College Library |
| YTG | 1981 | Aquatic Resources Inventory Southern Lakes. | Davies et al | YTG/DOE library |
| Foothills Pipe Lines | 1981 | Catalogue of fisheries resource information for waterbodies crossed by the Alaska Highway Gas Pipeline route in southern Yukon Territory. | Environmental Management Associates | Yukon College Library |
| Foothills Pipe Lines | 1982 | Enumeration of spawning salmon in aquatic systems along the Alaska Highway Gas Pipeline in southern Yukon Territory, 1981. | Environmental Management Associates | Yukon College Library |
| DFO | 1985 | A Summary of the Indian Food fishery in District Ten (Yukon and Northern BC), 1985. | Seigel and McKenzie | DFO Whitehorse |
| DFO | 1988 | Abundance, distribution, habitat utilization and habitat preference of juvenile chinook salmon (O. tshawytscha) in three study areas of the Upper Yukon River Basin. | Hunka et al | YTG/DOE library |
| DFO | 1989 | Age, morphology and biochemical genetic variation of Yukon River chinook salmon. | Beacham et al | DFO Whitehorse |
| DFO | 1996 | A Summary of Aboriginal catches of salmon in the Yukon/Northern BC Division, 1995. | Wilson | DFO Whitehorse |
| DFO | 1998 | Salmon in the Yukon River Basin, Canada. – A compilation of historical records and written narratives. | Cox | DFO Whitehorse |

## Technical Information:

| Agency (s) | Year | Collected Information | Author | Source |
|---|---|---|---|---|
| DFO | 1963 | 250 chinook salmon spawning at outlet of Kusawa Lake, 1963. | DFO | FISS database |
| DFO | 2000 | School fry release field trips. | Stream Keepers North Society | DFO lake and stream files, FISS database |
| Environment Canada | unknown | Data compilation of biophysical surveys (invertebrates, sediments and /or periphyton) of various Yukon streams. | Environmental Protection | FISS database |

| Agency (s) | Year | Collected Information | Author | Source |
|---|---|---|---|---|
| DFO | Various years | Counts of spawning chinook in the Takhini River at the outlet of Kusawa Lake. | DFO | FISS database |
| DFO | 1950's to present | Salmon specific harvest and spawning escapement counts. | DFO | DFO lake and stream files, FISS database |

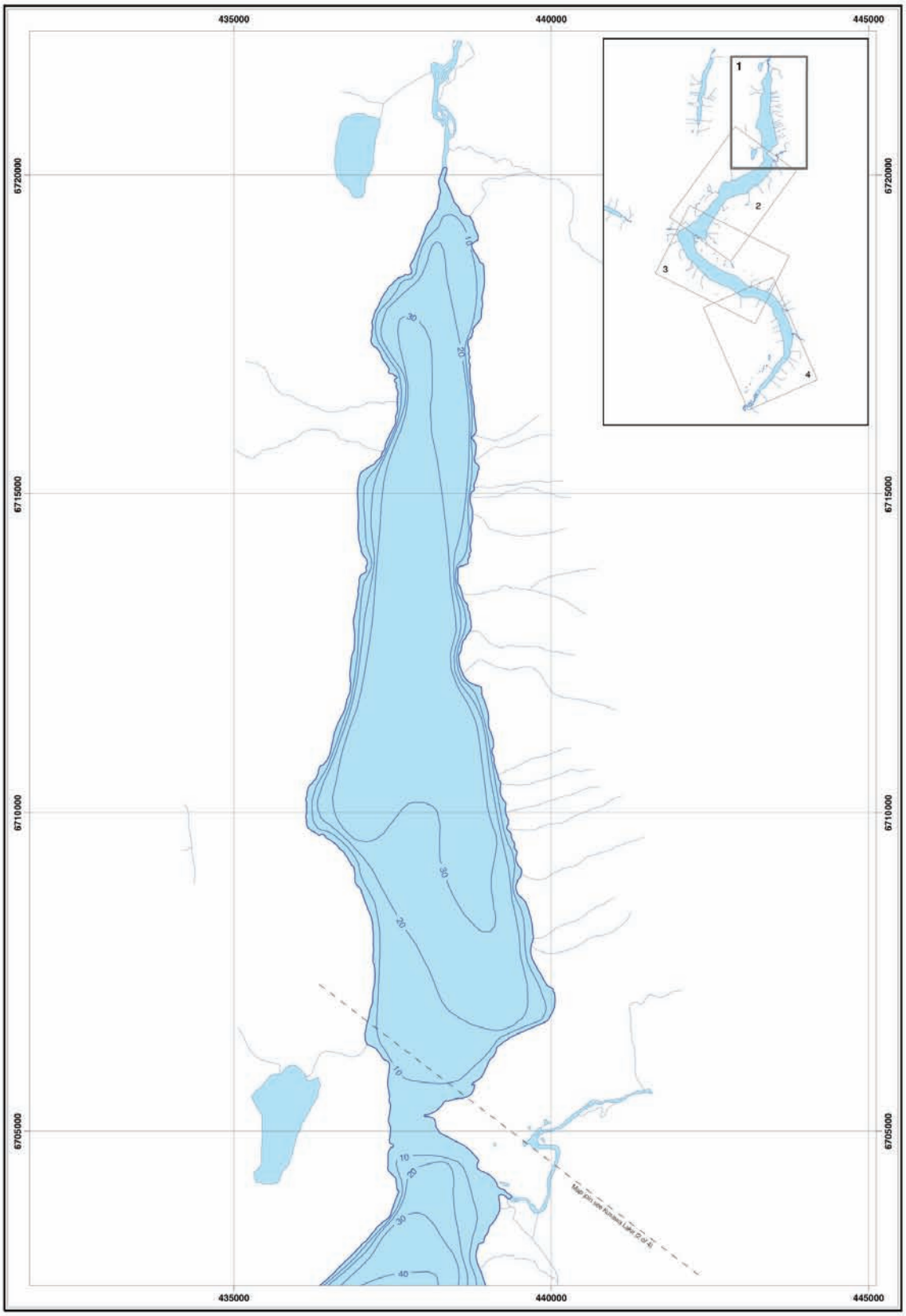
## GLOSSARY OF FISH SPECIES:

Note: Species in parentheses are not confirmed.

BB –Burbot
BW – Broad whitefish
CH – Chinook salmon
CM – Chum salmon
CS – Least cisco
GR – Arctic grayling
IN – Inconnu
LKC – Lake chub
LNS – Longnose sucker
LT – Lake trout
LW – Lake whitefish
NP – Northern pike
SS – Slimy sculpin

# Appendix II

## Kusawa Lake Bathymetry Map(s)




Kusawa Lake (1 of 4)

# Bathymetry

Yukon Territory

Bathymetric interval: 10m

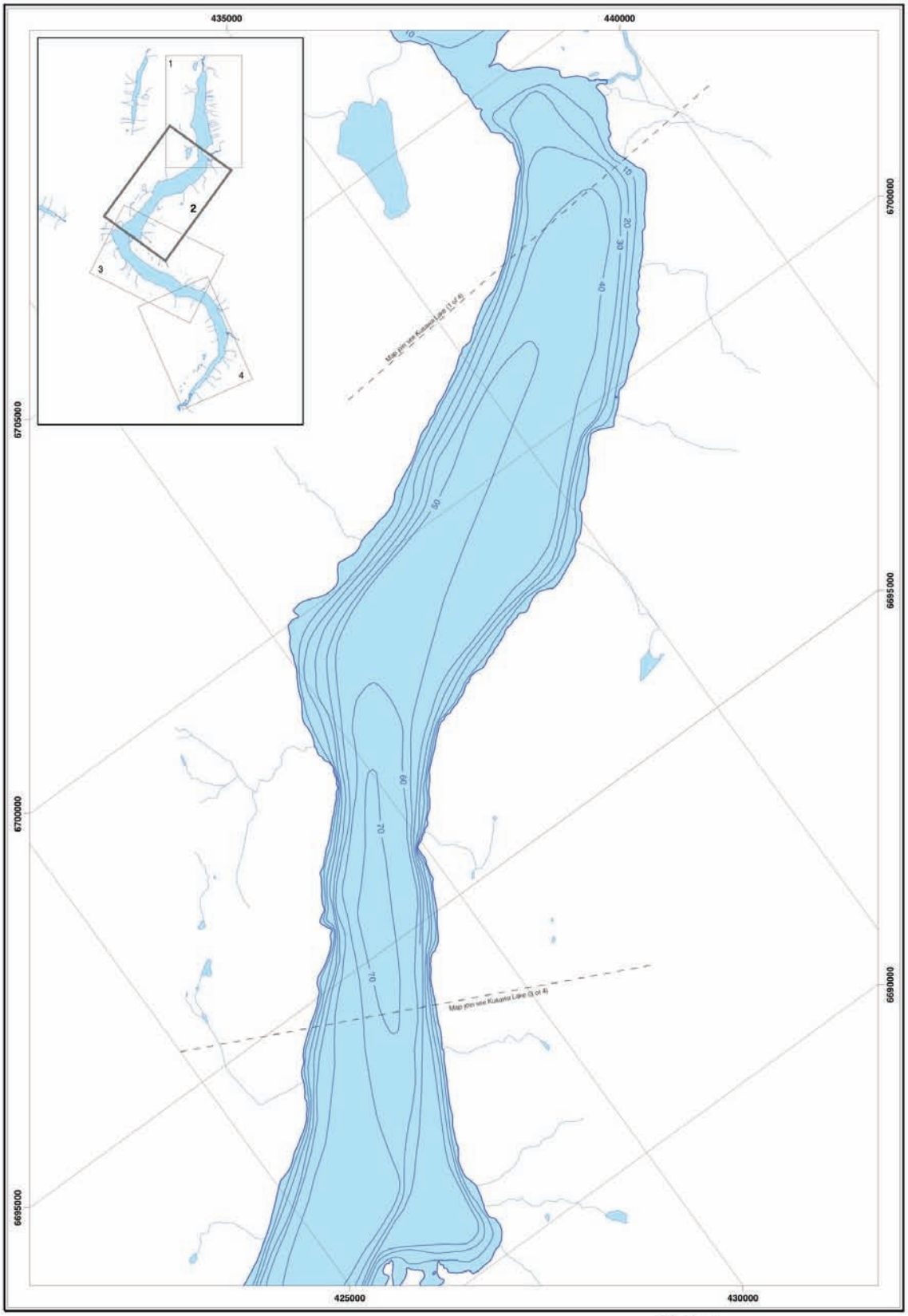
N

SCALE 1:50,000

1 0 1 2 3 4 5 km

1 0 1 2 mi

Universal Tranverse Mercator Projection, Zone 8
North American Datum 1983




Kusawa Lake (2 of 4)

# Bathymetry

Yukon Territory

Bathymetric interval: 10m

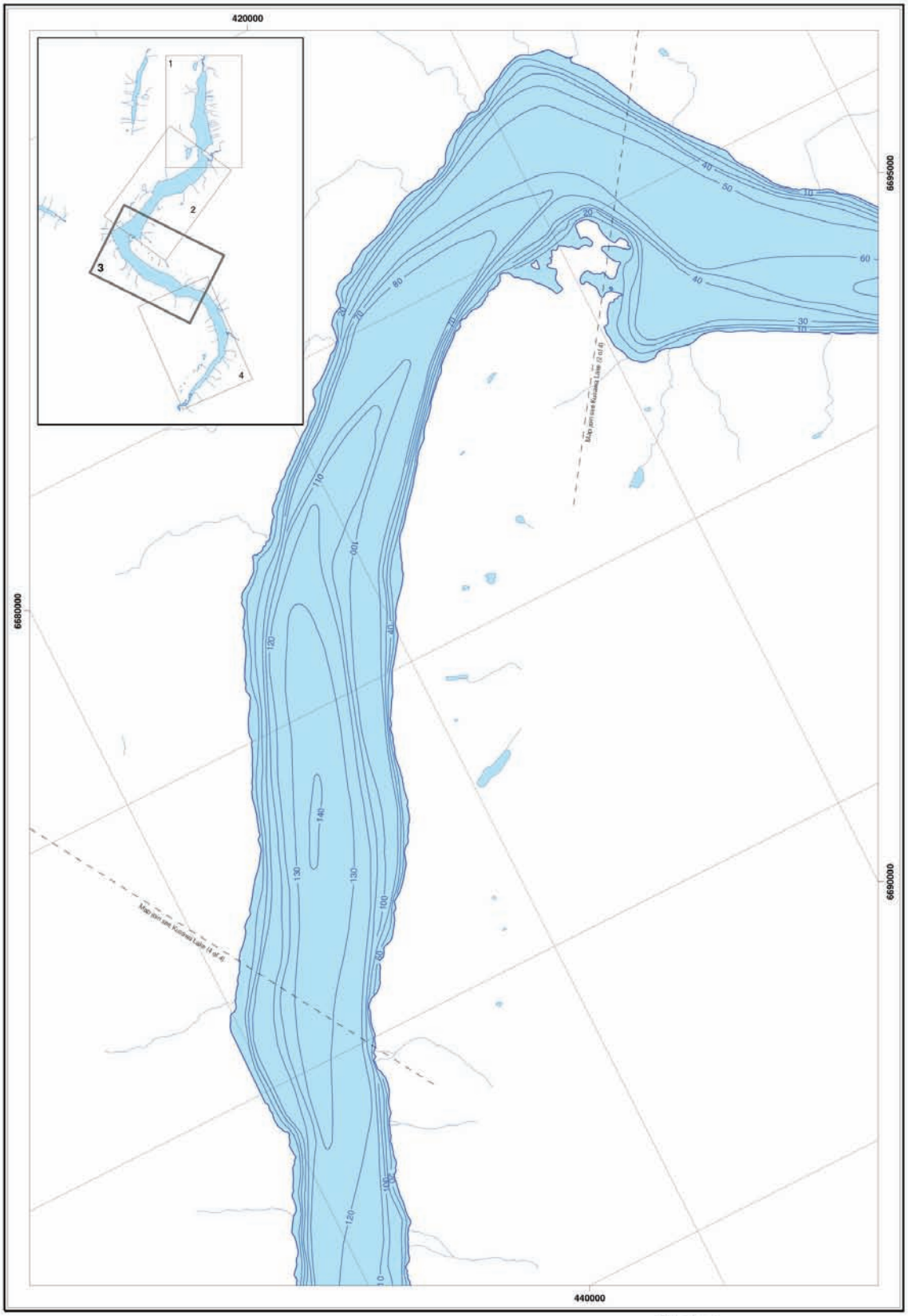
N

SCALE 1:50,000

1 0 1 2 3 4 5 km

1 0 1 2 mi

Universal Tranverse Mercator Projection, Zone 8
North American Datum 1983




Kusawa Lake (3 of 4)

# Bathymetry

Yukon Territory

Bathymetric interval: 10m

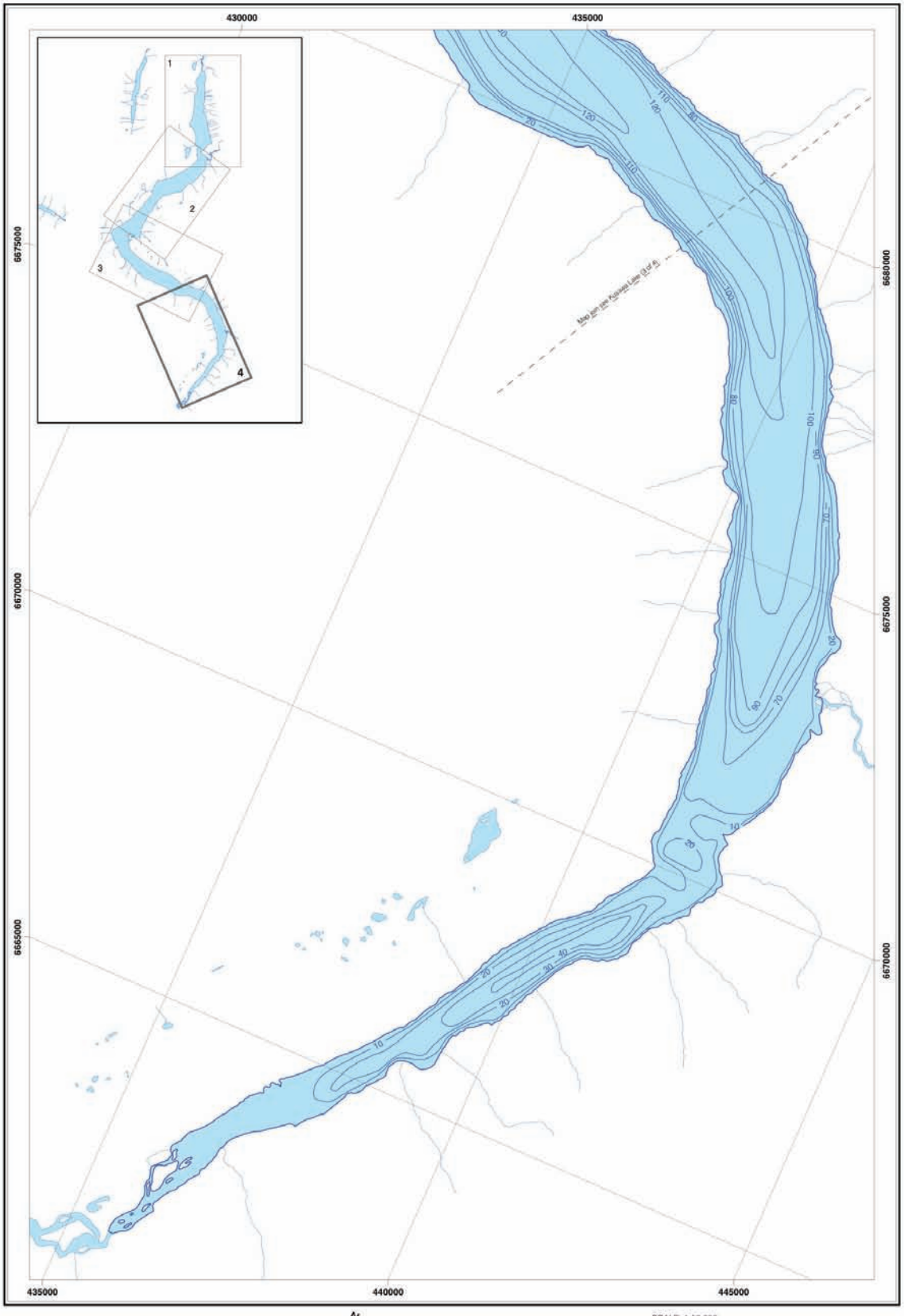
N

SCALE 1:50,000

1 0 1 2 3 4 5 km

1 0 1 2 mi

Universal Tranverse Mercator Projection, Zone 8
North American Datum 1983




Kusawa Lake (4 of 4)

# Bathymetry

Yukon Territory

Bathymetric interval: 10m

N

SCALE 1:50,000

1 0 1 2 3 4 5 km

1 0 1 2 mi

Universal Tranverse Mercator Projection, Zone 8
North American Datum 1983