Rat River Biodiversity, Cultural and Historical Assessment

Shannon Haszard and Jennifer Shaw
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Gwich'in Renewable Resource Board
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Executive Summary

The Gwich'in communities of Fort McPherson, Aklavik, Tsiigehtchic and Inuvik have identified the Rat River watershed as a proposed protected area for its wildlife and cultural significance. In 1999 the Gwich'in Renewable Resource Board (GRRB) conducted a biodiversity and cultural assessment of the area to document the biological and cultural factors that make this area important to the Gwich'in.

The objectives of the study were:

1. To document the traditional and historical use of the Rat River watershed.
2. To document the biodiversity of the Rat River watershed.

The Rat River watershed is a traditional use area of cultural and historical significance to the Gwich'in. The area has been used for centuries as an important harvesting area and travel route. Many important cultural sites are found in the watershed and numerous camps still exist along the lower Rat River. Gwich'in still use the area throughout the year for fishing, hunting, trapping and berry picking. More recently the Rat River has been used by fur traders, Klondikers and recreational travellers.

Two physiographic ecozones and three ecoregions make up the Rat River watershed. The upper portion of the Rat River Pass is known as the British-Richardson Mountains ecoregion, part of the Taiga

Hiking the Rat River Pass

Cordillera ecozone. The lower portion of the pass consists of two ecoregions, the Peel River Plateau and the Mackenzie Delta, both are part of the Taiga Plains ecozone.

Plant adaptations and the factors that effect plant distribution play an important role in the arctic environment. At least 23 species of lichen, 32 species of moss and 274 species of vascular plants have been identified in the Rat River area. Seven rare or endangered plants have been found within the watershed. Broad vegetation communities within the Rat River Pass were consistently associated with specific habitat types. These five habitat types are; alpine, mixed wood, black spruce, sedge tundra and riparian.

Fourteen species of fish are found throughout the Rat River system. The watershed is a spawning and nursery area for Dolly Varden charr, arctic grayling, broad whitefish, lake whitefish, round whitefish, burbot, northern pike, ninespine stickleback and slimy sculpin. The population of Dolly Varden charr that spawn and overwinter in the fish holes of Fish Creek are an important subsistence food for the Gwich'in.

At least twenty one species of mammals are known to inhabit the Rat River Pass. Porcupine caribou move through the area during their spring and fall migration. The mountains are an important lambing and rutting area for Dall's sheep. The watershed also provides important habitat for grizzly bears, black bears, wolves, moose, wolverine, lynx, and small furbearers.

Fifty-six species of birds spend at least part of the year in the Rat River area. Birds of prey such as golden eagles, bald eagles, peregrine falcons and gyrfalcons nest throughout the pass. Tundra swans, Canada geese, surf and white-winged scoters and other waterfowl are hunted by Gwich'in in the lower part of the watershed. Warblers, sparrows, and other passerines constitute a large portion of the animal diversity in the Rat River Pass.

The information presented in this report is a compilation of data gathered during 21 days of fieldwork in June and July 1999 and previous research in the area. It compiles all information into one document and is a source of baseline information to be referred to for future research. It supports the Rat River's status as a potential protected area and will be used as a resource by communities, government and resource managers in the decision-making and land use planning of this important area.

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Acknowledgements

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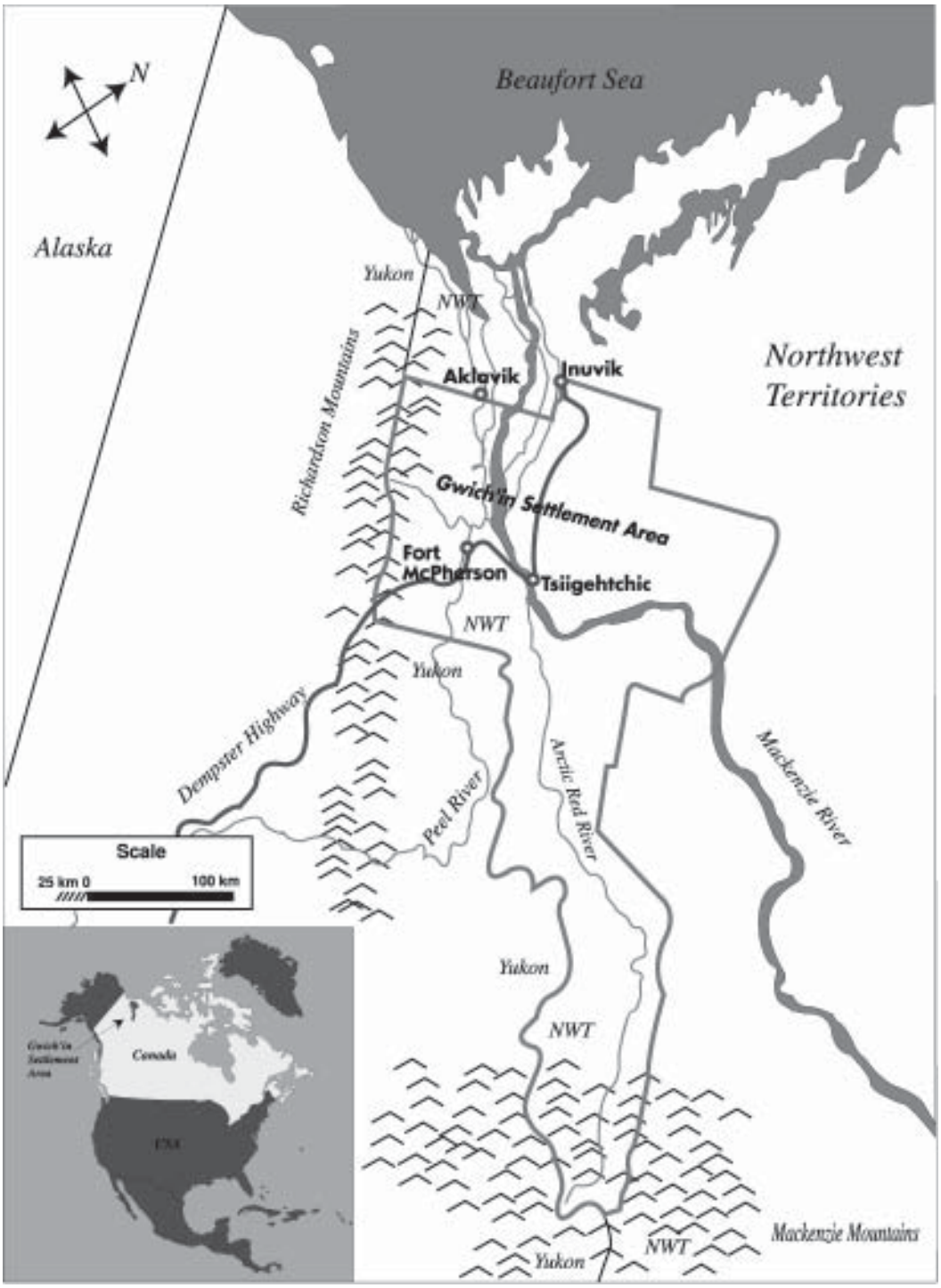
Inside photos by Gwich'in Renewable Resource Board, Neil Colin (hiking the Rat River Pass p. i, caribou feast p.4), Werner Stebner (caribou p. v, grizzly bear p.39), Phillip Allen *One Came Late*, Quality Colour Press, 1992 (Destruction City p.6), Dick North *The Mad Trapper of Rat River*, MacMillian Paperbacks, 1969 (Lazarus Sittichinli p.8), Liz Wright (catch of wolverine and lynx p.41), Sarma Liepins (peregrine falcon p.47), G.W. Beyersbergen (white-winged scoter p.49).

Figure 1.1: *Location of the Rat River in the Gwich'in Settlement Area.*



1.0 Introduction

The Rat River is located in the northern Richardson Mountains of the Gwich'in Settlement Area (GSA) (Figure 1.1). The river runs from the Yukon and Northwest Territories border east through McDougall Pass and empties into the Husky Channel of the Mackenzie River Delta, draining an area of 2,800 square km (Figure 1.2).

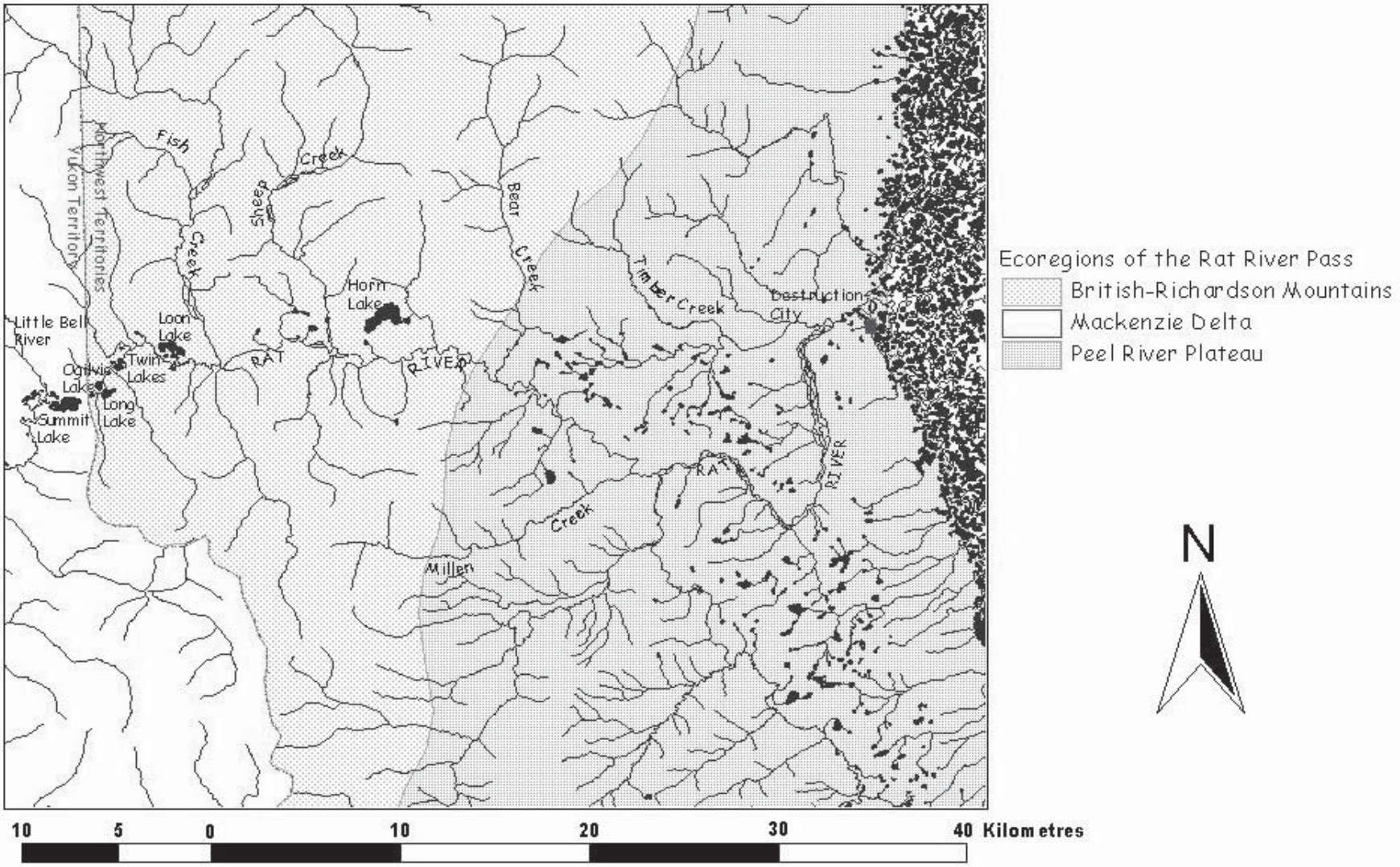
The Rat River watershed has been identified as a proposed protected area by the Gwich'in communities of Fort McPherson, Aklavik, Tsiigehtchic and Inuvik for its wildlife and cultural significance. The watershed provides important habitat for many species of mammals, fish and birds. The river and its tributaries provide important spawning and over wintering habitat for Dolly Varden charr, arctic grayling and lake and broad whitefish. Porcupine caribou migrate through the area during their spring and fall migration. The northern Richardson Mountains are an important lambing and rutting area for a northern population of Dall's sheep. The steep cliffs and mountain slopes provide excellent habitat for nesting peregrine falcons.

The Rat River watershed is a traditional use area of cultural and historical significance to the Gwich'in. Many cultural and archaeological sites are found in the Rat River area, such as the traditional caribou corral at Horn Lake. Numerous camps still exist along the lower Rat River for summer and fall fishing. Gwich'in currently use the area year round for hunting, fishing, trapping and berry picking.

In September 1999, the Gwich'in Tribal Council approved the Gwich'in Land Use Plan (GLUP), in principle. The GLUP was approved by the Minister of the Department of Resources, Wildlife and Economic Development (DRWED) for the Government of the Northwest Territories and is presently waiting to be approved by the Minister of the Department of Indian and Northern Affairs for the Government of Canada. Once the plan has passed through this final stage of approval, the Rat River watershed will have interim protection as part of the Rat, Husky, Black Mountain Protected Area, an area encompassing 2826 km^2. This status will protect the area from most commercial development activities for the next five years. Every five years the GLUP is reviewed and changes to the plan can be made.

This report supports the Rat River's status as a potential protected area. It documents the biological and cultural factors that make this area important to the Gwich'in. It compiles all information about the area into one document and acts as a source of baseline information for future research or studies in the Rat River area. This report will be used as a resource by communities, government and resource managers in the decision-making and land use planning of this important area.

Figure 1.2: *Rat River Pass.*



2.0 Historical Use

The Rat River watershed has always been an important geographic region. For centuries the Gwich'in have used the pass as an important travel route from one side of the Richardson Mountains to the other. The area has always been recognized as having an abundance of wildlife and is an important harvesting area for the Gwich'in. The fur traders and Klondikers made use of the pass during the 1800s as a route for trade and travel from the Mackenzie Delta to the Yukon. Since the early 1900s recreational travellers have tackled this one manageable canoe route across the continental divide.

Today, the area is used predominantly for hunting, trapping and fishing by Gwich'in who live in nearby camps and in the communities of Aklavik and Fort McPherson. A small number of recreational hikers and paddlers fly into the area each summer. The wilderness of the Rat River area remains relatively pristine due to the low level of use, lack of development and the sustainable use of the areas' resources by Gwich'in today and in the past.

Caribou feast on the Rat River

2.1 Traditional Use by the Gwich'in

The Gwich'in name for the Rat River and surrounding area is Ddhah Zhit Han or 'the river inside the mountain' (Greenland 1999). Many residents of the Mackenzie Delta have never known the river to be called anything other than 'the Rat'. This name may have come about during the time of the fur trade, when trapping muskrats and other furbearers became a way of life for many Gwich'in people.

The Rat River Pass was historically used as a trade and travel route between Gwich'in on the west side of the mountains and those who lived in the Mackenzie Delta. Families would meet at Summit Lake, a gathering place at the top of the pass, to visit and trade goods (Vyvyan 1998). The area just before the first rough water on the Rat River, now known as Destruction City, was traditionally called Canoe Landing, or Tr'ih zhit tagwehdii in Gwich'in (Vyvyan 1998). This is where people left their birch bark canoes on their way up the pass into the foothills and mountains. From this point they travelled on foot and supplies were often carried by dog team (Bonnetplume 1974a). Today Gwich'in communities of the Mackenzie Delta have strong family ties to the Vuntut Gwitchin who live in the Yukon. The map in Figure 2.1 outlines traditional travel routes, cabin locations, and the Gwich'in names of geographic features within the Rat River Pass.

The Rat River watershed is rich in animal and plant life. It was historically used year round by families who travelled into the area from the Aklavik and Fort McPherson regions. Late summer and fall was the time for berry picking and caribou hunting in the mountains (Bonnetplume, 1974a). The Porcupine caribou herd migrates through this part of the Richardson Mountains every spring and fall. Caribou trails cut into the ground through forest and tundra mark this historical migration route. Remnants of a traditional caribou corral can still be found north of Horn Lake. Each year just before freeze-up families would travel to Fish Creek (Luk Han) to catch charr with nets and spears (Peters (no date)). The Gwich'in have a legend about Fish Creek and the charr that spawn there. The following is a version of the legend told by Paul Bonnetplume (1974b).

"On the Rat River the arctic charr comes up on the river. In the fall the people would go down and try to get all the fish they can. No way of getting these fish but with spears. There was a man there, he stays on that river and he didn't like anyone to stay with him. He was greedy and mean and wanted all the fish for himself while there was no meat to get. Yet he wouldn't give nothing away. So he said to himself I am a medicine man and I will do something about the fish. He figured he would block the fish up. One morning he got up, climbed this mountain and started making medicine. He was being watched by people from a distance.

All at once half of the mountain slid down into the river. That really blocked the fish right there and he figured he had all the fish to himself now, but the people were getting hard up. This man had a son so they asked his son to open up the river again. The son, knowing how mean his father was, did not tell the people he was going to help them, but he walked around the

shore and saw a small fish. He tied a string to the fish tail and at the end of the string was tied a piece of copper. Then he went up to the other side of where his father had blocked the water. It was very deep. Soon as he let the fish go in the water, it turned into a big monster. It had enough power to move the rocks. Finally the fish broke through the bridge the man had made. Up until today, if anyone goes up that creek, they still can see where the mountain had falling blocking the river. This is where another person has helped the people out."

2.2 The Fur Trade

The Hudson Bay Company had a strong interest in trading routes across the north. The most frequently used trade route between the Mackenzie River and Old Crow was the Peel River Portage, which ran through the southern Richardson Mountains. In 1839 John Bell, the first manager of the Hudson Bay Trading Post in Fort McPherson, travelled with the help of a Gwich'in guide down the Peel, into the Husky Channel and up the Rat River as far as Canoe Landing. The two rivers flowing west of Summit Lake are now known as the Little Bell and Bell Rivers, after John Bell (Vyvyan 1998).

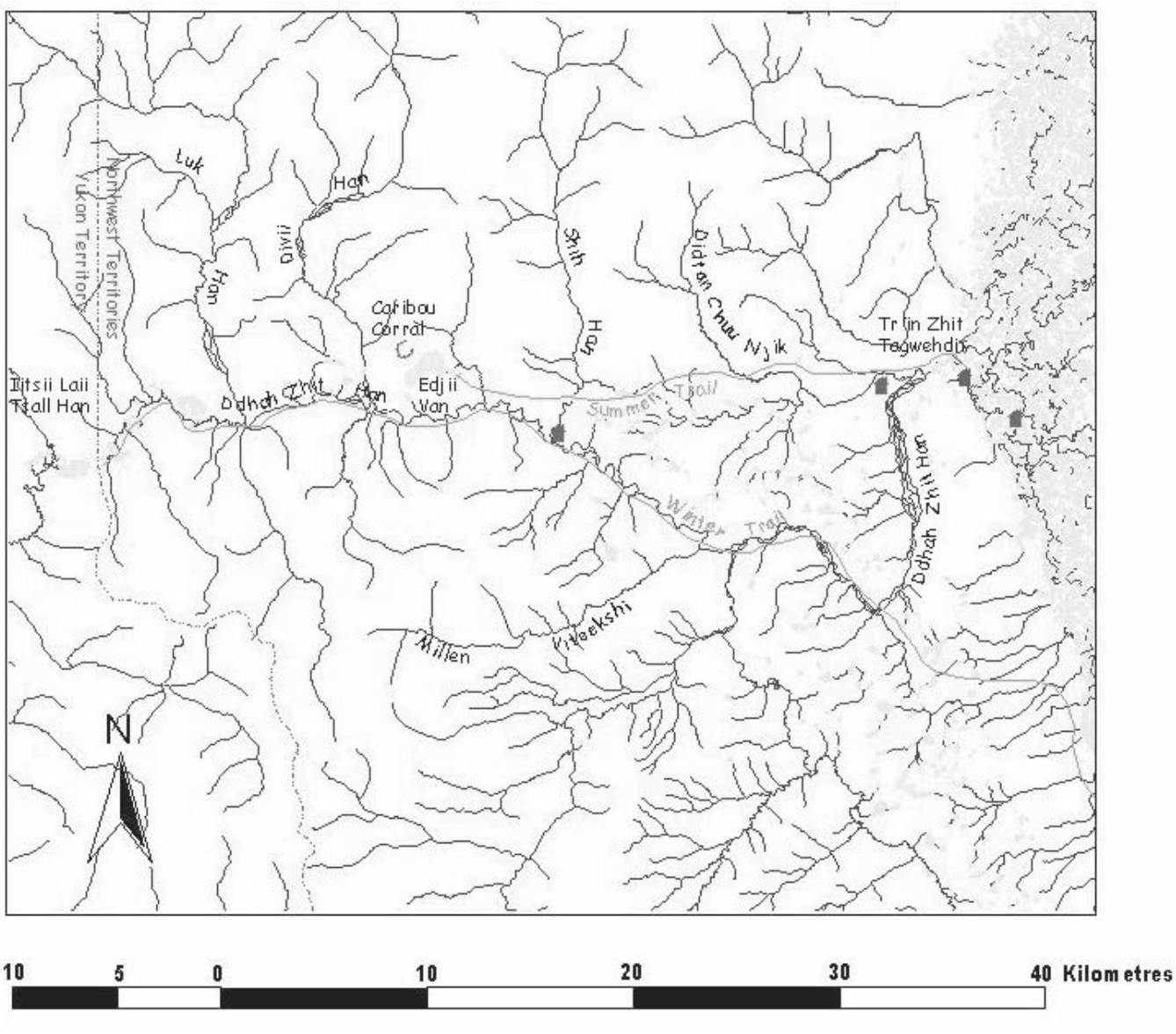
In 1872 James McDougall explored the pass further and reported it to be a very functional trade route, possibly better and less swampy than the Peel River Portage. It was for this reason that when William Ogilvie surveyed the area in 1888 for the Geological Survey of Canada, he suggested that the pass be named McDougall Pass (Vyvyan 1998).

2.3 The Gold Rush and Destruction City

The Mackenzie River - Rat River route to the Yukon became known as 'The Back Door to the Klondike' when in 1897 and 1898 nearly 400 men and women travelled the route hoping to strike it rich in Dawson. This route was the longest route from Edmonton to the Yukon, but was also

Camp at Destruction City

Figure 2.1: *Traditional use map of the Rat River Pass*



thought by some to be the easiest (Vyvyan 1998).

The Klondikers frequently hired Gwich'in guides from Fort McPherson to help them through the pass (Edwards (no year)). They would boat down the Peel River to Husky Channel and up the Rat River as far as Canoe Landing and the first rough water. Some people spent the winter at this spot and some stopped only long enough to prepare themselves for the next leg of the journey. Here they broke apart their large boats and built smaller and lighter crafts to make the trip up the Rat (Vyvyan 1998). Canoe Landing soon became known as Destruction City after the gold miners' disassembled boats.

2.4 The Mad Trapper of Rat River

In December 1931 William Nerysoo, a Gwich'in trapper, registered a complaint with the RCMP in Aklavik that a man named Albert Johnson was interfering with his trapline. The RCMP sent two constables to the Rat River to question Johnson. He refused to speak to the men and they returned with a search warrant and two Gwich'in special constables, Lazarus Sittichinli and John Mosses. When they returned one RCMP constable was shot and was rushed back to Aklavik to recover (Peters 1973). When news of the shooting made the radio, Johnson was being referred to as the 'Mad Trapper'.

After the shooting Johnson headed through the mountains into the

Lazarus Sittichinli

Yukon. He attempted to outsmart the RCMP on his trail by walking with his snowshoes on backwards. With the help of Sittichinli and Moses, RCMP tracked Johnson on foot and by dog sled for 250 kilometres. Johnson killed one man and seriously injured another before he was finally shot and killed on February 17, 1932 on the Eagle River. Although his true identity remains a mystery, the Mad Trapper of Rat River was buried in Aklavik under the name Albert Johnson.

2.5 Recreational Use

Two women, Gwendolen Dorrien Smith and Clara Vyvyan were among the first documented recreational visitors to the Rat River Pass. In 1926 the women travelled up the Rat to Summit Lake, then down the Bell, Porcupine and Yukon Rivers as part of a trip through Canada. Two Gwich'in men, Lazarus Sittichinli and Jim Koe guided the women up the Rat and part way down the Bell River (Vyvyan 1998).

Since 1926 parties have attempted this route almost every year. Today, the second half of the journey is a more popular canoe route. Canoes and passengers are flown into the Rat River Pass by floatplane and begin their voyage down the Bell River at Summit Lake.

3.0 Climate

Classified as a subarctic cordilleran ecoclimate, the study area is characterized by long periods of extreme cold in winter, short cool summers and light precipitation. Fort McPherson is the closest weather station to the Rat River area with a comprehensive set of climatic data (Environment Canada 1994). It is located 30 km south of the Rat River on the east edge of the Richardson Mountains.

Winters are cold and long in the area with a mean daily temperature of –27.7 °C in January. Summers are short and cool with a mean daily temperature of 15.1 °C in July. The mean extreme daily minimum for the month of January is –44.8 °C. The mean extreme daily maximum for July is 28.6 °C. The Rat River Pass is subject to strong outflow winds, causing severe wind chill conditions. In the mountains, at higher elevations, winters may be more moderate during frequent periods of temperature inversion. This occurs when colder air close to the ground is trapped by warmer air above (Ecological Stratification Working Group 1995).

Precipitation is generally light throughout the area. Total annual precipitation is low with an average of 292.3 mm. Total annual rainfall is 127.4 mm while total annual snowfall is 170.8 cm. Most of the snowfall occurs from October to May. The accumulation of snow is not excessive, however snow cover generally persists into June throughout the mountains.

Solar radiation is minimal during December and January. The mean total bright sunshine hours for December is 0.0 while January has 7.3 hours of sun. Solar radiation increases rapidly from February until June with the onset of continuous daylight. June has a monthly mean of 375.1 hours of bright sunshine.

4.0 Geology

4.1 Bedrock Geology

The Richardson Mountains are made of sedimentary rock. They consist of a series of north-south running ridges that are generally smooth on top and separated by broad valleys (Catto 1996). The orientation of the ridges and divides reflects the structural geology of the region. Resistant quartzite and sandstone form the ridges and weathered siltstone and shale are present in the valleys (Norris 1986). The only known igneous intrusion is on the west side of the Mackenzie delta near Mount Goodenough (Bostock 1965).

4.2 Glacial Geology

Three glacial events have been recognized in the Richardson Mountains (Catto 1996). An initial glaciation occurred around 800,000 years ago, depositing sediments that were subsequently reworked. A second glacial advance occurred approximately 38,000 years ago. During these first two glaciations ice moved west covering the eastern portion of the Richardson Mountains. Both times glacial ice extended through the Rat River Pass.

Summit Lake

The most recent major glacial advance that occurred 15,000 years ago, was less extensive than the first two events. The majority of the Richardson Mountains were not glaciated and glacial ice did not penetrate the entire Rat River Pass. The Laurentide ice sheet pushed from the east across the Peel Plateau. Joined by ice coming from the Mackenzie and Selwyn Mountains, it pushed north around the north end of the Richardson Mountains (Bostock 1965). An ice wedge from the sheet pushed up the Rat River valley through McDougall pass resulting in the U-shaped valley. The ice wedge appears to have gone

as far as the Horn Lake area (Hughes 1972). The lakes in the pass probably owe their existence to glaciation. On the valley floors glacial features such as pitted till, outwash plains and terraces, drumlin fields, eskers and lake terraces formed from surficial materials. The action of alpine glaciation in the mountains during this time was very light.

5.0 Physiography

The Rat River watershed can be subdivided into three physiographic ecoregions (Figure 1.2). The British-Richardson Mountains ecoregion is found in the Taiga Cordillera ecozone. The Mackenzie Delta and Peel River Plateau ecoregions are found in the Taiga Plains ecozone (Ecological Stratification Working Group 1995).

The majority of the Rat River watershed and the upper portion of the river, is classified as the British-Richardson Mountains ecoregion. This region is characterized by alpine tundra at upper elevations and sub-alpine open woodland at lower elevations. In the Rat River watershed the northern Richardson Mountains reach heights up to 1500m. The region includes a portion of unglaciated plateau composed of tertiary sediments. Mineral soils with and without frost action are dominant in the area. These soils are developed from clay, silt, sand and gravel deposited by modern rivers and weathered material from rocky outcrops that have moved down a slope as a result of gravity. Limestone rock outcrops and barren talus slopes are also common in the area. Examples of landforms resulting from cold climate processes such as summits and terraces exist in the sedimentary rock of the mountains. As a result of the extreme and harsh climate, continuous permafrost exists throughout the area with medium to high ice content. Frost action disturbing the surface material results in a landscape marred by earth hummocks and polygons.

The foothills along the Richardson Mountains are classified as the Peel River Plateau ecoregion. The dominant vegetation in this region is made up of open, stunted stands of black spruce, tamarack and some white spruce. The ground is covered with dwarf birch, willow, ericacious shrubs, cotton grass, lichen and moss. The northern portion of this ecoregion was glaciated and covered with hummocks, glacial drift and organic deposits. Permafrost is continuous, characterized by some ice wedges and massive ground ice bodies with high to medium ice content. Mineral and organic soils with and without frost action are dominant in this ecoregion.

The lower portion of the Rat River meanders through the Mackenzie Delta ecoregion and drains a series of delta lakes. The predominant vegetation consists of open stunted trees with a ground cover of willow,

shrubs, lichen and moss. Poorly drained sites usually support sedge and grass tussocks. The delta is a complex area of wetlands made up of peat deltas and marine deposits. Wet, organic and new mineral soils that do not undergo frost action are dominant in the area. These soils are developed on river and marine deposits. Extensive discontinuous permafrost with low to medium ice content is prevalent throughout the region.

6.0 Hydrology

The Rat River flows from its headwaters for 129 km, emptying into the Husky Channel of the Mackenzie River Delta. The river originates at the Yukon and Northwest Territories border at Long and Ogilvie Lakes and flows east from McDougall Pass. The entire watershed drains an area of 2,800 km^2.

The Rat River is typical of a mountain stream. Most of the river has clear flowing water over a gravel and rocky bottom. It is ice free from the beginning of June to the end of September. Water levels in the river fluctuate greatly, producing flood conditions that can increase the water level by two metres a day. The change in water level is caused by precipitation in the mountain drainage and spring floods. This usually results in the water becoming silt laden.

Characteristics of the Rat River vary over three main regions. The upper portion of the river is a single channel with gravel banks. The riverbed consists of boulders, gravel, sand and light silt. The water is clear with a moderate flow except during flood conditions. The major tributaries that enter the Rat River in this section are Bear, Sheep and Fish Creeks. Fish Creek is a clear stream flowing for 115 km over large areas of gravel. Some deep pools exist, as well as fast and shallow areas. Bear and Sheep Creeks are clear with gravel bottoms and moderate flows.

The middle portion of the river is multi-channelled and shallow, flowing through a wide valley. The bottom is composed of boulders, gravel, sand and silt. The water is generally clear, except during flood conditions. Although the river is mostly shallow in this section some deep pools exist. Barrier River and Timber Creek are the major tributaries that enter this section of the river. Both are clear with moderate flows.

The lower portion of the river flows through the Mackenzie Delta and forms a series of single, meandering channels with a heavy silt load and steep mud banks. This section of the river drains a series of delta lakes. Nineteen km upstream from the mouth, five channels carry water to the

Husky Channel. Two main channels carry the majority of the flow. The other three channels have a low flow and are probably not important as fish migration routes.

During the winter aufeis (pronounced 'off ice') forms on a portion of the Rat River and Fish Creek. Aufeis is caused by an upwelling of water from spring fed areas of a river or creek. This water subsequently floods the river and adjacent valley forming a large thick ice sheet. On the Rat River aufeis forms during the winter over the river and valley between Fish and Bear Creeks. Aufeis is also formed downstream from the spring fed areas of Fish Creek. This ice on Fish Creek persists throughout the summer.

A number of small lakes and ponds exist within the Rat River valley. The largest lake in the watershed is Horn Lake which covers about two km^2. Long Lake and Ogilvie Lake, the headwater lakes of the river, cover an additional one km^2. Beyond the river valley, creeks flow into the river from the mountains, but ponds and lakes are scarce.

7.0 Vegetation

The Rat River watershed is characterized by alpine tundra at upper elevations and sub-alpine open woodland vegetation at lower elevations. The dominant types of alpine vegetation are lichens, mountain avens, dwarf birch and willow. Barren talus slopes are also common. Subalpine vegetation is characterized by discontinuous open stands of stunted white spruce mixed with willow, dwarf birch and Labrador tea. Black spruce, sedge, cottongrass and moss occur in wetter sites.

The following sources have collected and identified vegetation in the Richardson Mountains and contributed to the knowledge of vegetation in the area. Exact locations of the collections are not known. In 1931 O. Bryant gathered specimens on the east slope of the Richardson Mountains. James A. Calder made a collection of plants along the Yukon border in the Richardsons while working with the Canadian Department of Agriculture in 1962. In 1973, J. Nolan and B. Goski from the Canadian Wildlife Service collected plants in the Richardson Mountains during wildlife related studies. W.J. Cody collected plants and fungi in the Richardsons during the summer of 1982.

Some plants were identified and collected in a variety of studies around Canoe Lake in the Richardson Mountains, an area 50 km north of the Rat River. W.J. Cody surveyed vegetation around the lake in 1963 (Cody 1965). During the summer of 1963 Vladimir Krajina conducted ecological studies there for the University of British Columbia. John

Monkshood

Lambert also conducted research in the Canoe Lake area of the Richardson Mountains in 1965 and 1966 for his is doctoral thesis at the University of British Columbia (Lambert 1968).

Little work has been done specifically in the Rat River area. Clara Vyvyan collected and identified plants while travelling up the Rat River in 1926 (Vyvyan 1998). John Packer visited Summit Lake in 1961 while conducting research on plant genetics (Packer 1964). Val Loewen, working with Yukon Renewable Resources, collected species around the Summit Lake area in 1991 while working on vegetation classification of the Richardson Mountains (unpublished data).

7.1 Plant Adaptations

Arctic plants show a variety of adaptations (Savile 1972). Vegetation has adapted to low summer temperatures in many different ways. Some plants form basal rosettes (cinquefoil, saxifrage) or cushions (moss campion, chickweed), growing low to the ground where the air is warmer. Hairs grow on the stems and leaves of lousewart and avens that trap warm air around the plant. Some plants like the saxifrage are deeply pigmented to absorb more light. Other plants turn their flowers towards the sun to obtain more direct solar radiation (poppy, avens).

Many plants growing in the arctic have adapted to the short growing season by undergoing rapid growth in the spring. Fleshy roots or stems can act as storage organs and store excess nutrients throughout the

winter for food in the spring (lousewart, bistort, mountain sorrel). Plants such as Labrador tea and cranberry, possess evergreen leaves that remain green under the snow and can immediately start to photosynthesize when the snow melts. Other semi-evergreen plants will produce one last set of leaves in the summer that remain green throughout the winter to function in early spring of the next year (wintergreen, mountain avens, poppy). In the arctic, production and growth of new seedlings is often limited by the short season. For this reason, many plants reproduce vegetatively through rhizomes and stolons (arctic willow, grasses, sedges).

7.2 Plant Distribution

Climate is an important factor affecting the distribution of plants. The temperature and moisture characteristics of an area are largely controlled by climate. The latitude of an area affects temperature; the farther north you go, the colder the mean daily air temperature. Higher elevations also produce colder temperatures. The proximity of an area to open water or the distance inland can effect both the temperature and moisture. Areas close to large water bodies tend to experience warmer temperatures and more precipitation. The topography of microhabitats can also affect both the temperature and moisture of an area. Valley bottoms tend to have lush vegetation as they receive more moisture and are usually warmer than exposed alpine slopes.

The distribution of plants is also largely controlled by geography. All vegetation needs certain soil conditions for survival. Soil development in the arctic is minimal due to cool temperatures that slow organic decay and chemical weathering. Soil chemistry also controls distribution as some soils are too acidic or too alkaline for plants to grow. Other soils are void of essential nutrients. The continuous permafrost in the mountains and the thin active layer present in the summer has a limiting effect on plant distribution. A disturbed surface can limit plant growth due to the continuous churning of material by frost action and the erosion of soils by wind. In the arctic, plants root in physically weathered bedrock, glacial deposits, lake sediments, river terraces and deltas without a buffering soil layer. Therefore surface materials exert a major control on these plants.

7.3 Rare or Endangered Species

Seven vascular plants found in the Rat River area by Val Loewen from Yukon Renewable Resources are listed as rare plants of the Northwest Territories (NWT) (McJannet et al. 1995). Wormwood (*Artemisia alaskana),* a member of the aster family, is also rare in British Columbia but is secure worldwide. It is found in arctic-alpine vegetation regions on cliffs and scree slopes. *Douglasia arctica* is found in arctic-alpine

areas on gravelly alpine slopes. It is an endemic plant existing only in a small geographical area and is rare in the Canadian arctic and worldwide. Another plant, *Douglasia ochotensis*, is a new addition to the flora of the NWT. It grows in arctic-alpine areas on stony mountain slopes. Sandwort (*Minuartia yukonensis)* is also rare in the Canadian arctic and rare worldwide. It grows in arctic-alpine regions on mountain scree slopes and in dry places. A lousewort, *Pedicularis oederi,* is found in arctic-alpine areas in moist alpine tundra. It is also rare in British Columbia but abundant worldwide. *Synthyris borealis*, is found in mountain regions on alpine cliffs, shale and heath slopes. It is endemic in northern Canada and rare worldwide. Richardson's Phlox (*Phlox richardsonii)*, although rare in the NWT, is secure worldwide and is found in arctic-alpine areas on stony slopes.

An additional 25 rare vascular plants are found in the northern Richardson Mountains in close proximity to the Rat River area (Appendix 1). It is not known if these species grow specifically in the Rat River watershed.

7.4 1999 Survey Results

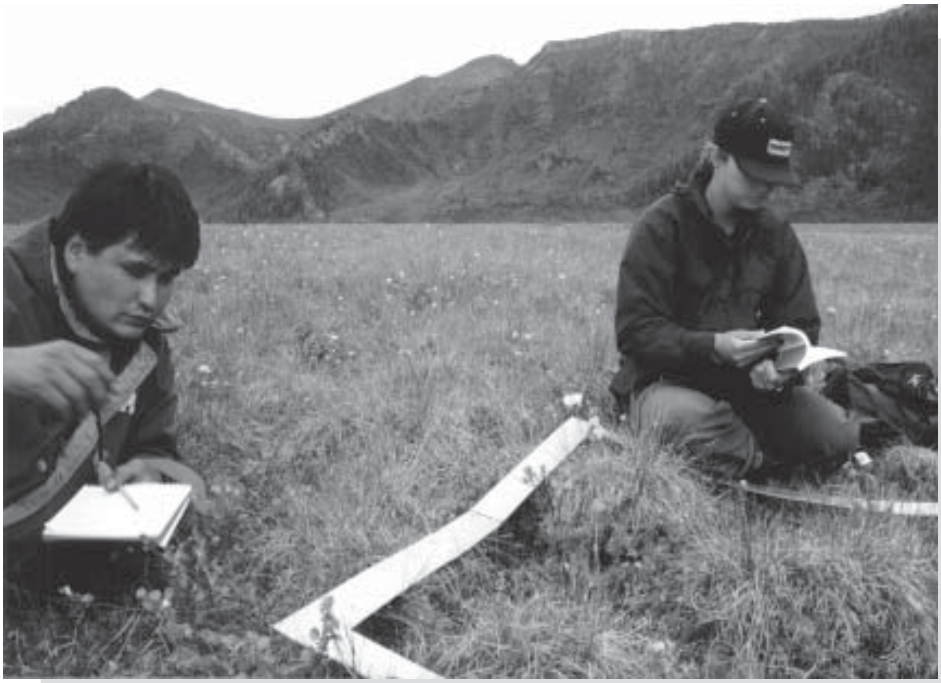
7.4.1 Methods

The GRRB surveyed vegetation at three different study sites within the Rat River watershed in the summer of 1999. At Summit Lake, Loon Lake and Horn Lake (see Figure 1.2 for map of Rat River Pass) we surveyed plants in five different habitat types that are representative of the Rat River area: alpine, mixed wood, black spruce, sedge tundra and riparian . We set up a 100 metre transect line in each habitat type. Along that transect line we placed a one metre square quadrat every 20 metres. Within each quadrat individual plants species were identified using field guides (Cody 1996, Porsild and Cody 1980) and the percent cover of each species was estimated.

7.4.2 Results

Appendix 2 contains the habitat type and study site where plants were found. An additional 14 species have been added to the known species of the area. No rare or endangered plants were found. The five habitat types and associated vegetation communities will be discussed in section 7.6 of this report.

7.5 Plant Biodiversity



Donald Andre and Jennifer Shaw identifying plants at Loon Lake

The Rat River area is home to a variety of different plants, mosses and lichens. At least 23 species of lichen, 32 species of moss and 274 species of vascular plants have been identified in the area (Appendix 3). Val Loewen working for Yukon Renewable Resources in 1991 identified all the species of lichen and moss and 239 species of vascular plants. An additional 14 species of vascular plants were identified in the area by C. Vyvyan in 1926, an additional 7 species were recorded by John Packer in 1961 and an additional 14 species were identified by GRRB in 1999 (Vyvyan 1998 and Packer 1964).

7.6 Habitat Types and Associated Vegetation Communities

Differences in vegetation within the study area can be related to the geography and climatic characteristics of different sites. Further differences are caused by local landforms offering exposure or protection from the elements. It was found that broad vegetation communities within the Rat River Pass were consistently associated with specific habitat types that can be readily recognized. These five general habitat types are; alpine, mixed wood, black spruce, sedge tundra and riparian.

7.6.1 Alpine

Alpine areas are characterized by well-drained soils. They are dominated by small plants and shrubs growing close to the ground and are subject to high winds. Lichens are found on bedrock outcrops and boulder fields that exist on many mountain slopes. Dwarf birch (*Betula glandulosa*) and arctic willow (*Salix arctica*) spread outwards, growing close to the ground. Avens (*Dryas spp.*), saxifrage (*Saxifrage spp.*) and alpine bearberry (*Vaccinium alpina*) are the dominant herbaceous plants. Small flowering plants such as moss campion (*Silene acaulis*), alpine forget-me-nots (*Eritrichium spp.*) and Siberian aster (*Aster sibiricus*) are common on alpine summits.

7.6.2 Mixed Wood

Mixed wood areas are associated with well-drained soils on moderate slopes and hilltops in the sub-alpine region, in valleys and along streambeds. This vegetation community is dominated by open stands of stunted white spruce (*Picea glauca*). The dominant understory shrub species include alder (*Alnus crispa*), willow (*Salix spp.*) and dwarf birch. Ground cover is usually composed of blueberry *(Vaccinium uliginosum*), bearberry (*Arctostaphylos rubra*), crowberry (*Empetrum nigrum*), moss and lichens.

7.6.3 Black Spruce

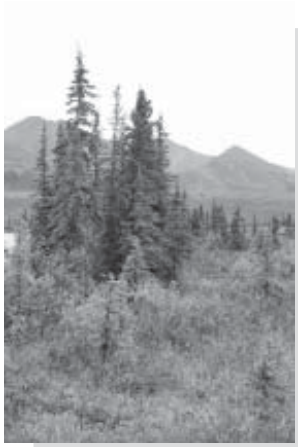
This habitat type is found on poorly drained soils in boggy or wet areas. It is dominated by open stands of short, stunted black spruce (*Picea mariana*). Hummocks are commonly covered with lichens and small vascular plants while depressions between the hummocks

contain moss. Dominant species in this plant community are Labrador tea (*Ledum spp.*), cranberry *(Vaccinium vitis-idaea*), blueberry, crowberry and knuckleberry (*Rubus chamaemorus*).

7.6.4 Sedge Tundra

Lowland areas support extensive communities of sedge meadow dominated by sedge (*Carex spp*.) and cottongrass (*Eriophorum spp.*) tussocks. Areas between hummocks support moss communities. Low-lying willow and dwarf birch are scattered throughout drier areas. Small woody species such as Labrador tea, crowberry and cranberry cover the ground.

7.6.5 Riparian



Areas around streams, ponds, rivers and lakes support distinctive vegetative communities. Abundant moisture and shelter are characteristics of riparian habitats that support lush vegetation. These communities are dominated by small trees and shrubs such as willow, dwarf birch and alder. White spruce is common in the riparian areas of larger streams and rivers. Other important species are cranberry, Labrador tea, horsetail (*Equisetum spp.*) and coltsfoot (*Petasites frigidus).*

7.7 Local Uses of Plants

Plants are an important source of food, medicine, shelter and tools for Gwich'in living in the area and travelling on the land. Cranberry, blueberry, blackberry and knuckleberry are a few of the many berries in the area that are an important food source. The stems, leaves or roots of some plants such as wild rhubarb, fireweed, bear root and wild onions are also harvested and eaten. Gwich'in use many other plants for medicine. Spruce gum is boiled and used for colds and congestion (Andre 1995). Rose hips are boiled and used as eye drops for eye infections (Pascal (no date)). Gwich'in elders say birch tree tea can be drunk to help stomach sickness (Andre 1995). Willow bark is boiled and rubbed on skin to heal sores, sunburns, insect bites and rashes.

Gwich'in also use trees and plants for shelter and tools. Spruce tree logs are used for buildings and tent poles. Spruce bows are cut and used for tent floors. Many different trees and shrubs are burned as firewood. Gwich'in elders say long ago willow and spruce roots were used to make rope and fish nets (Andrew (no date) and Mitchell 1998). Birchbark was used to make baskets, dishes and canoes (Andre 1995).

The importance of plants in the Rat River area to Gwich'in communities today is mostly an indirect one, as a food for harvested animals and as a component of the scenic environment. However, families living near the mouth of the river still pick berries and harvest trees in the area for shelter and firewood (P.J. Kaye and J. Charlie Jr. pers. comm.).

8.0 Fish

The Rat River and its tributaries are important habitat for many different fish. Some fish are anadromous, migrating up the river and its tributaries to over winter and spawn and then venturing back to the ocean. Other fish live in the river all year long. Fourteen different fish species are known to inhabit the Rat River system (Table 8.1).

Dolly Varden charr, arctic grayling, broad whitefish, round whitefish, jackfish, loche, ninespine stickleback and slimy sculpin spawn in the river and use it as a nursery area for their young. Broad whitefish, lake whitefish and jackfish spawn and rear their young in watershed lakes (Stewart 1996, GRRB in 1999). All other species appear to use the river as a feeding and nursery area.

Table 8.1: *Fish found in the Rat River watershed.*

Common names	Latin name	Gwich'in name
Dolly Varden charr	Salvelinus malma	Dhik'ii
Arctic grayling	*Thymallus arcticus*	Sriijaa
Broad whitefish	*Coregonus nasus*	Luk zheii
Round whitefish	*Prosopium cylindraceum*	
Lake whitefish, crooked back	*Coregonus clupeaformis*	Dalts'an
Inconnu, coney	*Stenodus leucichthys*	Sruh
Arctic cisco, herring	*Coregonus Autumnalis*	Treeluk
Least cisco, herring	*Coregonus sardinella*	Treeluk
Northern pike, jackfish	*Esox lucius*	Eltin
Longnose sucker	*Catostomus catostomus*	Das Sum
Burbot, loche	*Lota lota*	Chehluk
Pond smelt	*Hypoesus olidus*	
Slimy sculpin	*Cottus cognatus*	
Ninespine stickleback	*Pungitius pungitius*	

The Rat River watershed is an important subsistence harvesting area for the Gwich'in. For centuries people have lived in the area or travelled to the lower reaches of the river to fish. Many people fish for charr with nets during their fall migration. In the past, people travelled to Fish Creek to catch charr but today most of the harvesting occurs from Destruction City to the mouth of the Rat River (Gwich'in Harvest Study data). The river is also home to broad whitefish, crooked back, grayling, jackfish and loche which are also harvested. Today, the Rat River is still an important fishing area for the Gwich'in.

Baseline studies of the fish resources in the Rat River took place from 1971 to 1974 during the Mackenzie Valley pipeline studies (Hatfield et al. 1972a and 1972b, Dryden et al. 1973, Jessop et al. 1973 and 1974, Shotton 1973, Stein et al. 1973a and 1973b, McCart et al. 1974, Jessop and Lilley 1975). The Department of Fisheries and Oceans (DFO) conducted many studies of the Dolly Varden charr population in the 1980s and 1990s as a result of concerns over depletion of the stock (Gillman and Sparling 1985, Sparling and Stewart 1986, Kristofferson and Baker 1987, Stephenson and Lemieux 1990, Lemieux and Kristofferson 1990, Harwood et al. 1994, Sandstrom and Chetkiewicz 1996, Sandstrom and Harwood 1997). In 1999 the GRRB surveyed the Rat River, Fish Creek and lakes within the watershed. Results of this survey appear in the following section.

Jennifer Shaw checking a net at Long Lake

8.1 1999 Survey Results

8.1.1 Methods

GRRB staff surveyed Long Lake, Ogilvie Lake, Loon Lake, Horn Lake, Fish Creek, Rat River and an unnamed creek between Long and Ogilvie Lake in the summer of 1999. We surveyed Long and Ogilvie Lakes for one day each. Loon and Horn Lake were surveyed for two days each. Each day we set one trap net and eight minnow traps for 24 hours at random locations within the lake. One experimental gill net was set for 12 hours at a random location within the lake and was checked periodically to reduce fish mortality. We sampled Rat River, Fish Creek and the unnamed creek using an electroshocking backpack unit. All fish were identified, measured and released.

8.1.2 Results

The number of each species caught at each location, the mean fork length and the range of fork lengths appear in Appendix 4. Loon Lake is a very shallow lake with an average depth of approximately two metres. It was surveyed but no fish were caught. An attempt to survey the Rat River near Horn Lake with an electroshocker failed as heavy rains raised the water level and silt content of the river to a point where electrofishing was not possible. Some small back channels were surveyed but nothing was captured.

8.2 Dolly Varden Charr – Salvelinus malma – Dhik'ii

Dolly Varden charr, a genetically distinct stock of anadromous charr, inhabit the Rat River system. Charr have been caught throughout the Rat River and in Fish Creek (Hatfield et al 1972a, Stein et al. 1973a, Jessop et al. 1973, Jessop et al. 1974, Gillman and Sparling 1985, Sparling and Stewart 1986, Stephenson and Lemieux 1990, Harwood et al. 1994, Sandstrom and Chetkiewicz 1996, Sandstrom and Harwwood 1997, GRRB in 1999). The only known spawning and over wintering site is located in the spring-fed areas of Fish Creek. They migrate upstream through the western channels of the Mackenzie Delta in late August and early September to spawn and over winter. The female digs a redd in gravel areas of the stream and lays eggs, which are fertilized by the male. The eggs develop over winter and hatch in early spring. Juveniles live in the river for five to seven years before migrating back through the Mackenzie Delta to feed in the Beaufort Sea. Adult charr feed on other fish, aquatic insect larvae and gastropods. Charr are a sensitive species vulnerable to environmental disruption as they require clear, swift flowing water and clear gravel to spawn. During migration and spawning they are vulnerable to over fishing as their migration routes and spawning sites are predictable.

Concern by residents over declining stocks promoted population and harvests studies by DFO in 1983, 1986 and 1989. In 1989 they estimated a population of 11,191 at Fish Creek and an 18% harvest rate of the stock (Stephenson and Lemieux 1990). DFO recommends a safe removal rate of 10-15% to ensure sustainability of the stock. This resulted in annual monitoring of the subsistence harvest since 1989.

Participants at the 1995 GRRB Rat River Charr Workshop identified the need for a plan to manage the Rat River charr. The Rat River Charr Fishing Plan Working Group was established with representation from the Aklavik and Fort McPherson Renewable Resource Councils, Aklavik Hunters and Trappers Committee, DFO, GRRB and the Fisheries Joint Management Committee. The working group meets yearly to update and revise the fishing plan. Population estimates in 1996 and 1998 indicated the population to be relatively stable (Rat River Charr Fishing Plan 1999). The monitoring program shows the charr harvest has increased from 2,251 in 1995 to 4,234 in 1998. Assuming the DFO safe removal rate of 10-15%, no more than 2000 charr per year should be harvested. In 1999 the plan recommended that all persons fishing for Rat River charr cut back their own harvest by 50%. The 1999 harvest of Rat River charr was below the 2,000 recommended safe level (Harwood pers. comm.).

Drying charr

Rat River charr are an important subsistence fish for the Gwich'in. This stock is the only significant charr run in the GSA. The red meat is considered a delicacy and is usually dried and smoked (Gwich'in Elders 1997). Historically, people harvested charr at the fish holes of Fish Creek using gill nets, seines and spears (Gwich'in Elders 1997). Today charr are fished during fall migration in August and September with gill nets at Destruction City, the mouth of the Rat River and in Husky Channel. Charr are still caught in large numbers in the river and remain an important subsistance fish for the Gwich'in (Gwich'in Harvest Study data).

8.3 Arctic Grayling - Thymallus arcticus - Sriijaa

Grayling are widely distributed throughout the Mackenzie system. They are found in clear, swift flowing tributaries and remain in these habitats throughout the year. Grayling move from lakes and large rivers into small tributaries after ice breakup in late May to early June (Hatfield et al. 1972b, Stein et al. 1973a). The female lays eggs over gravel or rocky bottoms without construction of a nest. The eggs hatch within two to three weeks. Grayling are opportunistic feeders, eating terrestrial and aquatic insects.

Grayling have been captured in both Rat River and Fish Creek (Hatfield et al. 1972a, Stein et al. 1973a, Jessop et al. 1973, Jessop et al. 1974, Jessop and Lilley 1975, GRRB in 1999). Grayling use the Rat River and Fish Creek as a spawning and nursery area (Stein et al. 1973a, Jessop et al. 1973, Hatfield et al. 1972b). This population probably spends its entire life cycle in the Rat River system. The clear water and rocky bottom of the river make it an ideal habitat for grayling. Grayling are sensitive to environmental disruption as they have a slow growth rate and a long recovery period for depleted stocks (McPhail and Lindsey 1970, Stein et al. 1973a).

Grayling have historically been fished by the Gwich'in. Gwich'in elders say they were caught in small tributaries using willow nets, basket traps and by jigging with hooks (Bonnetplume 1974b and Kunnizzi (no date)). They were an important food source in the past because they are non-migratory and are available all year. Today, no known harvesting of this species occurs on the Rat River (Gwich'in Harvest Study data).

8.4 Broad Whitefish – Coregonus nasus – Luk zheii

Broad whitefish inhabit the lower Mackenzie system. They are found in rivers and lakes and in some areas are anadromous, venturing into salty river mouths. In the Western Arctic an upstream migration occurs in September and October as they move to smaller rivers to spawn (Stein et al. 1973b, Jessop et al. 1973). Spawning usually takes place in back eddies of larger, silty rivers (Stein et al. 1973b). A downstream run of broad whitefish occurs in November. Broad whitefish are bottom feeders eating mainly aquatic insect larva and small crustaceans. They are a resilient species because of their wide age class distribution, high numbers in the system and their tolerance to high turbidity levels (Stein et al. 1973a). However, broad whitefish do not feed during spawning so stress at this time may be harmful.

Broad whitefish have been captured in the lower reaches of the Rat River (Jessop et al. 1973, Stein et al. 1973a). Fish migrate into the lower reaches of the Rat River from the Mackenzie Delta in early fall to spawn, although the exact locations are unknown (Jessop et al. 1973). Due to their preference of slow moving, silty water they probably inhabit the middle and lower reaches of the river. In the Rat River watershed, Broad whitefish have been captured in Long Lake, Ogilvie Lake and Twin Lake South (Reist 1987). These populations are probably resident and non-migratory.

Broad whitefish are an important subsistence fish for the Gwich'in. They are caught in large numbers with gill nets set in back eddies of larger tributaries during summer months and in late fall under the ice (Gwich'in Elders 1997). Gwich'in elders say whitefish makes good dryfish in the summer and are usually frozen in the winter (Gwich'in Elders 1997). Today local fishermen catch broad whitefish in gill nets in the lower reaches of the Rat River (Gwich'in Harvest Study data).

8.5 Round Whitefish – Prosopium cylindraceum

Round whitefish are found throughout the Mackenzie system preferring swifter currents in clear tributaries. They inhabit lakes, rivers and sometimes venture into brackish water. Up river migration occurs in the early fall to spawn in gravely shallows of streams and lakes (Hatfield et al. 1972b). Eggs are shed over gravel with no nest construction and hatch in the spring. Bottom organisms such as aquatic insect larva, small gastropod and fish eggs form the bulk of their diet.

Round whitefish inhabit the Rat River and have been captured in the lower reaches of the river (Jessop et al. 1973, Stein et al. 1973a). Their habitat preference of swift clear tributaries would indicate they probably venture to the middle and upper reaches of the river. Ripe fish captured in late August and early September in the Rat River indicate an upstream spawning migration (Jessop et al. 1973). The location of spawning sites in the Rat River is not known. Round whitefish are not abundant in the Mackenzie River drainage. Their small numbers and preference for clear swift flowing streams could make the population vulnerable to environmental disruption. Round whitefish are similar to other whitefish species and are often not distinguished to the species level by local fisherman. There is no harvest study data for round whitefish.

8.6 Lake Whitefish – Crooked Back – Coregonus clupeaformis – Dalts'an

Crooked back are found throughout the entire Mackenzie River drainage. This fish typically inhabits lakes and large rivers but will venture into the salty water of estuaries at the ocean. An upstream migration occurs in the early fall as fish travel to their spawning grounds. Spawning takes place from late summer to late fall over rocky shoals of lakes or in the shallows of rivers (McPhail and Lindsey 1970). Eggs are deposited randomly and hatch in late winter and early spring. A post-spawning downstream migration occurs in late fall. In most areas lake whitefish are bottom feeders consuming mainly molluscs, aquatic insect larva and amphipods.

Bertha Francis cutting fish

Crooked back have been captured in the lower portion of the Rat River (Stein et al. 1973a, Jessop et al. 1973). They appear to migrate upstream in late September along main channels of the Mackenzie River Delta to spawn in back eddies. A post-spawning migration down river occurs in October. Delta lakes, channels and back eddies in the Mackenzie River are important nursery areas for juvenile whitefish (Jessop et al. 1974). This species probably uses the mouth and lower reaches of the Rat River as a feeding and rearing area. It is not known if spawning occurs in the Rat River. Lakes throughout the Rat River watershed are also important habitats for Crooked back. They have been captured in Ogilvie Lake, Long Lake, Twin Lake South and Horn Lake (Reist 1987, GRRB in1999). These lakes act as feeding, spawning and rearing sites for the non-migratory populations. Crooked back appear to be resilient to environmental disruption due to their wide age class distribution,

high numbers in the system and tolerance to a wide range of water turbidity (Stein et al. 1973a).

Crooked back are an important species to the Gwich'in and are eaten by people and dogs. They are caught by setting gill nets in lakes and the back eddies of large rivers. Gwich'in fishermen say they can be fished in spring and summer, but the best time is in the fall. Like Broad whitefish, they make good dryfish in the summer and are usually frozen in the winter. Today little harvesting of crooked back occurs on the Rat River (Gwich'in Harvest Study data).

8.7 Inconnu - Coney – Stenodus leucichthys – Sruh

Coney are found throughout the Mackenzie system and are unique to the Western Arctic. They are an anadromous fish that are abundant in large muddy northern rivers and associated lakes. Coney are voracious predators that feed on small fish. They grow rapidly, reaching up to 1.5 m in length. They spawn over gravel in clear tributaries in the fall. A rapid downstream migration occurs in October after freeze-up.

Coney inhabit the Rat River system and have been caught in the lower sections (Stein et al. 1973a, Jessop et al. 1973). There is no evidence of coney spawning in the Rat River but they probably use it for feeding and rearing. Coney commonly reside in delta and coastal areas during the summer (Jessop and Lilley 1975). An upstream migration occurs in channels of the Mackenzie in September as coney travel to spawning sites in smaller tributaries (Stein et al. 1973a). A rapid post-spawning downstream migration occurs in October after freeze-up (Stein et al. 1973a).

Coney are unique to northwest North America and are significant to the subsistence fishery of the Gwich'in. They make excellent dry fish and the livers, stomach and head are considered a delicacy (Gwich'in Elders 1997). Gwich'in elders say long ago coney were fished with basket traps and nets in June and October before and after freeze-up (Gwich'in Elders 1997). Today they are caught by setting gill nets in quiet eddies and jigging under the ice in late fall. Coney are still harvested in small numbers in the lower reaches of the Rat River (Gwich'in Harvest Study data).

8.8 Arctic Cisco - Herring – Coregonus autumnalis – Treeluk

Arctic cisco are found throughout the Mackenzie system, usually travelling in large schools. They are anadromous, migrating upstream to spawn and then travelling back to the ocean (Scott and Crossman

1971). Spawning takes place in late summer and early autumn over gravel beds in fast flowing water. Eggs are broadcast and abandoned, left to hatch in the spring (McPhail and Lindsey 1970). They feed mainly on aquatic insects, small crustaceans and small fish.

Arctic cisco have been captured in the lower third of the Rat River (Stein et al. 1973a, Jessop et al. 1973). In the Mackenzie their upstream migration begins in the summer and peaks in early August (Stein et al. 1973a). A post-spawning run downstream occurs in October. Arctic cisco appear to use the Rat River as a feeding and rearing area. It is not known if they spawn in the river. Arctic cisco may be vulnerable to over fishing as the species congregate in eddies and the spawning populations are of uniform size (Stein et al. 1973a). They do not appear to feed during spawning migration and are therefore vulnerable to added stress at this time.

Arctic cisco and Least cisco are locally called herring. They are not as important to the Gwich'in today as they were in the past. Historically, they were an important food source for people and dogs because they travel in large groups and are easily caught in gill nets throughout the summer and fall (Gwich'in Elders 1997). Today they are used mainly as dog food although people still like the taste of good smoked herring. Cisco are not fished on the Rat River today (Gwich'in Harvest Study data).

8.9 Least Cisco – Herring – Coregonus sardinella – Treeluk

Least cisco occur in almost all lakes and rivers along the Arctic coast in either anadromous or non-migrating forms (McPhail and Lindsey 1970). They are found throughout the Mackenzie River system and usually travel in large schools. An upstream migration occurs in the summer as fish travel up river to spawn. Spawning takes place over sand and gravel in shallow areas. Eggs are scattered, abandoned and hatch in early spring. A downstream migration occurs in the fall as cisco travel back to the coast. They feed on plankton, aquatic insects and aquatic insect larva.

Least cisco have been captured in the lower reaches of the Rat River (Stein et al. 1973a, Jessop et al. 1973). They appear to migrate upstream in the Mackenzie in late August but the actual spawning areas are not known. A downstream migration occurs in October. Least cisco do not appear to run up the Rat River to spawn although juvenile fish were captured indicating a possible nursery area (Jessop et al. 1973). Delta channels and the sea coast near Shingle Point are known nursery areas (Jessop et al. 1974). Least cisco were also captured in Long Lake and were observed moving between Long and Ogilvie Lake at the

headwaters of the Rat River (GRRB in 1999). This population is probably a resident population. Like Arctic cisco, least cisco are vulnerable to environmental disruption (Stein et al. 1973a). They are susceptible to over fishing because they congregate in eddies and the spawning population is of uniform size. They do not feed during spawning migration and are therefore vulnerable to added stress at this time.

8.10 Northern Pike – Jackfish – Esox lucius – Eltin

Jackfish are widespread throughout Canada and inhabit the entire Mackenzie system. They prefer clear, warm, slow, heavy vegetated rivers and warm, weedy bays of lakes (Scott and Crossman 1971). Jackfish spawn in the spring shortly after ice break up in weedy, shallow areas (McPhail and Lindsey 1970). They lay adhesive eggs which are scattered on the bottom or on submerged vegetation. Young fry hatch within two to three weeks. Jackfish are voracious feeders eating mainly fish, but also insects, small birds and mammals.

Alfred Francis fishing

Jackfish are abundant in the Rat River system and in lakes within the watershed. They have been captured in the lower reaches of the Rat River, but do not appear to spawn in the river (Stein et al. 1973a, Jessop et al. 1973, Jessop and Lilley 1975). Spawning takes place in late May

to early June in tributary mouths and lake shallows with flooded vegetation. After spawning they disperse to large weedy back eddies and the mouths of tributaries with an abundance of forage fish. Jackfish appear to use the Rat River as a feeding and nursery area. They are abundant in lakes within the watershed and were captured in Long Lake, Ogilvie Lake, Twin Lake South and Horn Lake (Reist 1987, GRRB in 1999). These are probably resident populations completing their entire life cycle within the lakes. Jackfish are a resilient species due to their wide habitat tolerance, high numbers and extensive distribution (Stein et al. 1973a). A decrease in their numbers could be compensated by re-population from other areas if conditions return to normal.

Jackfish are not eaten as much as in the past, but they are still used as dog food. Gwich'in elders say Jackfish are caught in gill nets in lakes and rivers throughout the summer and jigging with hooks under the ice in the winter (Snowshoe (no year) and Furlong 1998). A small amount of harvesting of jacks occurs on the Rat River today (Gwich'in Harvest Study data).

8.11 Longnose Sucker – Catostomus catostomus – Das Sum

Longnose suckers are widely distributed throughout the Mackenzie River. They have been found in both large and small lakes and streams, and are tolerant of a wide range of turbidity (Hatfield et al. 1972b). They prefer clear cold water and are usually found in freshwater lake bottoms, tributary streams and salty river mouths (Scott and Crossman 1971). Spawning occurs in the spring after breakup in streams or lake shallows (Stein et al. 1973b). Sticky eggs are laid, adhere to gravel and hatch within two weeks. Suckers are bottom feeders eating mainly aquatic insects, insect larva and gastropods.

Longnose suckers have been captured in small numbers in the lower Rat River (Stein et al. 1973a, Jessop et al. 1973). In the Mackenzie they appear to spawn from late May to mid June in clear tributaries (Stein et al. 1973a). They do not appear to spawn in the Rat River, but probably use the area as a nursery and feeding ground. This species is an important forage fish for other species. Longnose suckers are resilient due to their wide habitat tolerance, high numbers and extensive distribution within the Mackenzie system (Stein et al. 1973a). A decrease in numbers could be compensated by re-population from other areas if conditions return to normal.

Suckers are caught by Gwich'in in nets although they are not a desired species. They are very bony and are not eaten when other fish are available (English 1996). Suckers were caught in the Rat River in the past, but no known harvest occurs today (Gwich'in Harvest Study data).

8.12 Burbot – Loche – Lota lota – Chehluk

Loche are distributed throughout the Mackenzie system. They generally prefer deep lakes and large rivers but can be found inhabiting small streams and ponds. In the fall loche appear to migrate into smaller tributaries. Spawning usually occurs under the ice in late winter, over sand or gravel bottom, in lake or stream shallows (Hatfield et al. 1972b). Eggs are shed randomly and hatch within four weeks. Loche are voracious, feeding almost entirely on fish. In the Mackenzie they are known to feed on pike, longnose sucker, arctic grayling, lake whitefish and smaller loche.

Loche have been captured in small numbers in the lower reaches of the Rat River (Stein et al. 1973a, Jessop et al. 1973) and in Fish Creek by GRRB in 1999. They seem to move out of delta lakes in the late fall and migrate upstream into creeks and tributaries to feed on forage fish and eventually spawn (Stein et al. 1973a, Stein et al. 1973b). The catch of a loche in a land locked side channel of Fish Creek by GRRB in July 1999 indicates a possible spawning site in the creek. Although loche seem to be resilient to environmental stress due to their wide habitat tolerance, high numbers and extensive distribution, they do require clear tributaries to spawn (Stein et al. 1973a).

Loche are an important subsistence fish for the Gwich'in. They are usually caught by jigging under the ice after freeze-up when ice is only a few inches thick (Gwich'in Elders 1997). Gwich'in like loche for their delicious white, firm meat and the liver and eggs which are especially valued (Gwich'in Elders 1997). Loche are still caught in the Rat River today in relatively small numbers (Gwich'in Harvest Study data).

8.13 Pond Smelt – Hypomesus olidus

Pond smelt are a small fish found in the lower Mackenzie River. They are a freshwater species inhabiting lakes and streams that also venture into salty river mouths. Spawning occurs in the spring in shallow areas that are largely covered with organic debris (Hatfield et al. 1972b). Eggs attach to vegetation and debris and young fry hatch in three weeks.

Pond smelt feed on zooplankton, algae and aquatic insects.

Pond smelt have been caught in the lower reaches of the Rat River in small numbers (Stein et al. 1973a, Jessop et al. 1973). They do not appear to spawn in the river and probably use it as a feeding area. Because of their small size, pond smelt are not eaten for food, but they may be an important food source for other fish.

8.14 Slimy Sculpin – Cottus cognatus

Slimy sculpin are small, bottom dwelling fish found throughout the Mackenzie system. They are widespread in rivers and streams of the north. Sculpins prefer cool running water with gravely or sandy bottoms and are spring spawners. Eggs are attached to the undersides of stones which are guarded by the males (Hatfield et al. 1972b). They feed on aquatic insects, vegetation and small crustaceans.

Slimy sculpin have been captured in small numbers throughout the Rat River (Jessop et al. 1973) and in larger numbers in Fish Creek (Dryden et al. 1973, GRRB in 1999). They were also found in the head water lakes of the Rat River by GRRB staff in 1999. Spawning appears to take place in Fish Creek (Dryden et al. 1973). Slimy sculpin are not sought after as a food source due to their small size.

8.15 Ninespine Stickleback – Pungitius pungitius

Ninespine stickleback are distributed throughout the Mackenzie River system. They are a small fish inhabiting shallow bays of lakes, slow streams and ponds. Spawning takes place in the summer in shallow areas with dense vegetation and ground cover (McPhail and Lindsey 1971). The male builds a tunnel shaped nest out of algae and debris in submerged vegetation, 10-15cm off the bottom of the pond. Once the eggs are laid, they are fanned by the male throughout development and hatch one week later. Sticklebacks are carnivorous feeding on bottom organisms such as insects, insect larvae, small crustaceans and molluscs.

Ninespine stickleback were captured in the lower reaches of the Rat River (Stein et al. 1973a, Jessop et al. 1973). They were observed spawning in a small clear tributary of the Rat River in late August (Jessop et al. 1973). The substrate was silty with roots, sticks and leaves to provide cover. Stickleback are not sought after for food due to their small size. However, this species is the most abundant forage fish in the river and is important food for other fish.

9.0 Mammals

Twenty species of mammals have been documented in the Rat River watershed (Table 9.1). The watershed provides important habitat for Porcupine caribou, Dall's sheep, moose, grizzly bears and furbearers (Gwich'in Land Use Planning Board 1999). Historically many kinds of animals were harvested in the Rat River area by Gwich'in hunters and trappers. Cultural and archeological sites such as the caribou corral at Horn Lake remind us of the traditional importance this area has for the Gwich'in. The Rat River watershed is still an important trapping and hunting area for many Gwich'in families.

Corral rebuilt at Horn Lake

Table 9.1: *Mammals found in the Rat River watershed.*

Common Name	Latin Name	Gwich'in Name
Dall's sheep	*Ovis dalli*	Divii
Caribou	*Rangifer tarandis granti*	Vadzaih
Moose	*Alces alces*	Dinjik
Wolf	*Canis lupis*	Zhoh
Grizzly bear	*Ursus arctos*	Shih
Black bear	*Ursus americanis*	Shoh
Wolverine	*Gulo gulo*	Nehtr'uh
Lynx	*Lynx canadensis*	Niinjii
Red fox	*Vulpes vulpes*	Neegoo tsoo
Marten	*Martes americana*	Tsuk
Mink	*Mustela vison*	Chiitthee
Ermine	*Mustela erminea*	Dhivii
Beaver	*Castor canadensis*	Tsee
Muskrat	*Ondatra zibethicus*	Dzan
Snowshoe hare	*Lepus americanus*	Geh
Porcupine	*Erethizon dorsatum*	
Arctic ground squirrel	*Spermophilus parryii*	Thaa
Northern red-backed vole	*Clethrionomys rutilus*	Datsoo (mouse)
Tundra vole	*Microtus oeconomus*	
Meadow vole	*Microtus pennsylvanicus*	
Masked shrew	*Sorex cinereus*	

A review of available literature shows that most research on mammals in the Rat River area has been done as part of broader studies. The Department of Resources, Wildlife and Economic Development (NWT) researched grizzly bears in the Richardson Mountains as part of their commitment to manage wildlife resources in the Inuvialuit Settlement Region (Clarkson et al. 1991, Nagy and Branigan 1998). Dall's sheep in the Rat River - Mount Goodenough region have been studied by the Yukon Department of Renewable Resources as part of the Northern Oil and Gas Action Program (Barichello et al. 1987). The Department of Resources, Wildlife and Economic Development (NWT) and Yukon Territorial Government currently conduct surveys to monitor the population every five years (Nagy pers. comm.). The last Richardson Mountain sheep survey took place in 1997. Smits (1989 and 1991) studied moose in the northern Richardson Mountains for the Yukon government. The Yukon Fish and Wildlife Branch researched wolves in the range of the Porcupine caribou herd, covering the Rat River area (Hayes et al. 1997). Many different studies have documented the Porcupine caribou's use of the Rat River watershed (Renewable Resources Consulting Services 1971, Urquhart 1983, Porcupine Caribou Technical Committee 1993, Hayes et al. 1997, Russell et al. 1992).

Little information has been recorded about furbearing mammals in the Rat River watershed. Information about these animals was obtained from status reports (Banci 1999, Dauphine 1989, Stardom 1989), DRWED research reports (Poole 1992a and 1992b) and through personal communication (Dorothy Cooley pers. comm.). Interviews with community members provided us with valuable information about the presence of particular furbearers in the Rat River area (P.J. Kaye pers. comm., J. Charlie Jr. pers. comm., W. Charlie pers. comm.).

GRRB staff trapped and identified small mammals at Summit Lake, Loon Lake and Horn Lake. Methods used and results of the survey are included in section 9.10 of this report.

9.1 Caribou - Rangifer tarandus granti- Vadzaih

The Rat River watershed is a portion of the Porcupine caribou herd's migration route through the Richardson Mountains. The Richardson Mountains route is one major corridor used each spring and fall by the caribou as they travel between their calving grounds on the north coast of Yukon and Alaska and their wintering grounds south of the Peel River (Renewable Resources Consulting Services 1971, Urquhart 1983). The caribou often travel through valleys in the area eating lichens, evergreen shrubs, moss, grass and horsetail. They are preyed upon by wolves and grizzly bears along their way.

The Gwich'in have always depended on caribou for food and hides. They believe that caribou were created by God for people to eat and only the bear deserves more respect than the caribou (Gwich'in Elders 1997). Traditionally, the most common way of hunting caribou in the summer and fall was to use a corral built with spruce and willows. Caribou in the corral were snared, speared or shot by bow and arrow (Gwich'in Elders 1997). There are remnants of one such corral located at Horn Lake.

Leslie Snowshoe and Ben Mitchell hunting caribou on the Rat River

Today, the Porcupine caribou are still relied upon for subsistence use by the Gwich'in. According to Gwich'in Harvest Study data, up to 40 caribou are taken by Gwich'in hunters each year as they migrate through the Rat River area. Many Gwich'in people still eat every edible part of the animal from the head to the organs (Urquhart 1996). The hide is used to make clothes for travelling on the land or to line the bottom of sleds and boats. Crafts people now use caribou antler to create carvings to sell to locals and tourists.

The most serious threat to the Porcupine caribou at the present time is the potential for oil and gas development in the herd's calving grounds, the Arctic National Wildlife Refuge (ANWR), along the north coast of Alaska. The Gwich'in are against any development in the ANWR because of the negative effects it will have on the caribou. By maintaining the habitat used as a migration route through the Rat River Pass and the Richardson Mountains, the Gwich'in are stating their commitment towards the protection of the herd, and are in a better position to oppose development in the ANWR (Jones 1996).

9.2 Dall's Sheep - Ovis dalli – Divii

One of the most northerly population of Dall's sheep in Canada occurs in the Richardson Mountains between the headwaters of the Rat River and Mount Goodenough (Mackenzie River Basin Committee 1981). The rugged terrain of the Rat River Pass is ideal habitat and supports a healthy population of sheep (Nagy pers. comm.). By limiting their range to steeper, mountainous habitat that other animals can not access, sheep avoid competing with other herbivores for food and ensure safety from most predators such as wolves and grizzly bears (Government of the Northwest Territories, Department of Renewable Resources 1989). Dall's sheep normally feed on grass, sedge, willow, avens, horsetail, saxifrage, lichen and moss found in mountainous areas.

The Rat River watershed contains small critical areas relied upon by the this population of Dall's sheep. Barichello et al. (1987) identified four different types of 'critical areas' located in the area. Lambing cliffs and winter ranges are located along the headwaters of Fish Creek, Sheep Creek and an unnamed creek that enters the Rat River south of Fish Creek. Additional winter range use areas are located north and south of Summit Lake, at the headwaters of the Rat River Pass. There are mineral licks located at the headwaters of Sheep Creek and along the continental divide, close to the headwaters of the unnamed creek. Suspected seasonal movement corridors occur near the headwaters of Fish Creek, Sheep Creek, unnamed creek and Timber Creek (see Figure 1.2 for map of Rat River Pass).

Dall's sheep that live throughout the Rat River watershed make up an isolated population at the northern limit of the species' range. This 'island' population is exposed to a harsh environment and may be less able to adapt to changes or disturbance in their habitat than Dall's sheep in the rest of the species' range (Barichello et al. 1987, Jones 1996). Winter ranges with good food reserves are important during the long, harsh winters (Barichello et al. 1987). The rocky cliffs that provide well-protected lambing sites are essential for the survival of lambs born into an already harsh environment (Barichello et al. 1987).

Dall's sheep are an important animal to the Gwich'in who have traditionally hunted sheep in the Rat River and Mount Goodenough area. Although considered to be a difficult species to hunt, people long ago relied on sheep meat to provide some variety in a diet that mainly consisted of caribou and moose meat (Gwich'in Elders 1997). Today, Gwich'in continue to hunt sheep for the tasty meat. A demand exists for sport hunting of Dall's sheep in the Yukon and the Mackenzie Mountains by nonresident hunters. There is increasing interest by Gwich'in to open the Richardson Mountains to a sport hunting industry that would permit the harvest of a sustainable number of Dall's sheep each year.

9.3 Moose - Alces alces – Dinjik

Moose are commonly seen throughout the Rat River area. During moose surveys between 1987 and 1989, Smits (1991) regularly spotted moose in the vicinity of Fish Creek, Sheep Creek, Rat River and other unnamed creeks south of Summit Lake and east of Horn Lake. GRRB staff saw a moose at Horn Lake and signs of moose throughout all study areas in 1999.

Moose found throughout the Rat River Pass are part of the northern Richardson Mountains population. This population consists of two groups of animals. One group winters in the northern Richardsons (including the Rat River area), migrating to the North Slope of Yukon and Alaska for the summer (Smits 1989). The other group spends the entire year in the mountains (Smits 1989). During the summer and fall moose browse on the shrubby vegetation that is found throughout the mountains and above the treeline on the North Slope. During the winter and spring, moose rely on mixed wood forest found on well drained slopes along the valleys of the Rat River and its tributaries (Smits 1989). Their main predators are wolves and grizzly bears.

Beaded moccasins by Pearl Carmichael

Smits (1991) states there is a strong correlation between available suitable habitat and moose abundance in the Richardson Mountains. Moose have a clumped distribution in the Rat River area because suitable habitat occurs in strips along the bottom of the river and creek valleys. It is within these valleys that moose find the shrub and mixed wood vegetation they rely on for food and cover. Given the large home range required by each individual moose, the strong preference for habitat and the small total amount of suitable habitat in the Rat River area, each moose uses a large proportion of available habitat. Moose in

the Rat River Pass are particularly susceptible to disturbance because habitat degradation of these valleys could impact a large portion of their population (Smits 1991).

Traditionally, Gwich'in relied on moose meat when caribou numbers were low. The rest of the animal was used for clothing, footwear, tents, sewing thread, boats, and tools (Gwich'in Elders 1997). Today, not many people hunt moose in the mountainous part of the Rat River area (Gwich'in Harvest Study data). Local residents from Fort McPherson hunt moose in the foothills between Destruction City and Husky Lake. Tanned moose hide is still a preferred material for making moccasins, mukluks and mittens for personal use or to sell as handicrafts.

9.4 Wolf - Canis lupis - Zhoh

Wolves commonly frequent the Rat River area. At least two wolf packs made the watershed part of their permanent home range during the late 1980s and early 1990s (Hayes et al. 1997). Two denning sites were found in the area during this time. GRRB staff observed one wolf on the south side of Loon Lake in July 1999.

The wolves that live throughout the Rat River area are part of a population that remains south of the treeline in the Richardson Mountains and foothills. These wolves are considered to be less migratory and more territorial than their tundra counterparts (Hayes et al. 1997). They hunt caribou and scavenge from hunter killed carcasses when the herd is migrating through the area. These wolves may follow the caribou along their migration route for a short while, returning to their home ranges by midwinter. Home ranges are based on the resident moose and sheep populations they rely on when there is no caribou in the area (Hayes et al. 1997).

The Richardson Mountains have a low density wolf population (Hayes et al. 1997). The wolf population is mainly limited by the availability of prey in the area. For most of the year, moose is the major prey item. The moose population in the area is quite low and will not support many wolves. Any disturbance that would negatively affect the moose population in the Rat River area would have a corresponding negative effect on the wolf population.

In the past wolves were not often harvested by Gwich'in. They are a difficult animal to trap and are known to take bait from a trap without springing it (Gwich'in Elders 1997). Today hunters looking for caribou will hunt wolves if they come across them. Only the hide is used, no one ever eats the meat from a wolf. Tanned hides are used to make heavy over-mitts, hats, rugs and trimming for parkas (Gwich'in Elders 1997).

The wolves in the Rat River area are not exposed to high hunting pressures experienced by their tundra counterparts. The terrain in the Rat River Pass is steep and rugged, limiting the access to hunters (Hayes et al. 1997). According to Gwich'in Harvest Study data, no wolves have been taken in the Rat River area since the study began in 1996.

9.5 Grizzly Bear - Ursus arctos – Shih

Grizzly bears using the Rat River watershed as part of their home range belong to the Richardson Mountains population. Clarkson et al. (unpubl. ms.) estimated that 39 bears live in the 2620 km^2 of the Richardson Mountains found in the Gwich'in Settlement Area. This is a density of about one bear per 67 km^2. Compared to estimated densities of one bear per 100 km^2 to one bear per 154 km^2 for barren-ground grizzly populations in the Western Arctic (Clarkson et al. unpubl ms.), the Richardson Mountains area has some of the best grizzly habitat in the region. They have a large home range and can be found in river valleys or on alpine slopes. One female grizzly with two cubs was observed on the south shore of Summit Lake by GRRB staff in June 1999. The next day staff returned to the area to find the bears had dug up several arctic ground squirrel burrows on the slope south of Summit Lake. In 1999, GRRB found tracks and scat of grizzly bears along many rivers and creeks.

Grizzly bear

Preferred food items for grizzly bears in the Rat River area include plants such as licorice root, cranberries, blueberries, cloudberries, bearberries and gooseberries (Banfield 1974, Bullock 1987). They also rely on the abundant arctic ground squirrel population and fish to supplement their diet (Bullock 1987).

Classified as 'vulnerable' by the Committee On the Status of Endangered Wildlife In Canada, the grizzly bear is a species that is sensitive to human activities or natural events (COSEWIC 1999). Besides requiring large areas of undisturbed land to maintain a healthy population, grizzly bears are very slow to reproduce. A female grizzly gives birth to a litter of two or three cubs every three to four years. Frequently, one or all cubs in a litter will die. Such a low rate of reproduction means that the number of bears killed each year by people can easily outnumber the number of cubs that survive to adulthood.

Presently the community of Aklavik has a quota of two grizzly bears that may be harvested by beneficiaries for subsistence use in the Richardson Mountains North habitat zone. Fort McPherson also has a quota of two bears for the Richardson Mountains South habitat zone (GRRB in prep). The Inuvialuit Hunters and Trappers Committee from Aklavik has three tags for bears in their Aklavik Grizzly Bear Management Area (Nagy and Branigan 1998). This means that up to seven bears a year can be taken from the Richardson Mountains grizzly population.

Each year conflicts between bears and people in the Richardson Mountains result in the destruction of the bears involved. Generally grizzly bears will avoid people, but when attracted to food or garbage at camps, bears become a problem. Any problem bears killed in the Richardson Mountains area must be counted in the quota of allowable human kills set for either Aklavik or Fort McPherson.

Gwich'in people have always believed that grizzly bears deserve the utmost respect. A person should never laugh at or be openly angry at a grizzly bear. It is thought that the grizzly can hear everything and bad luck will follow those who are disrespectful (Gwich'in Elders 1997). Traditionally, Gwich'in only hunted grizzly bears when more desired game such as caribou, moose, wolf or wolverine were scarce. People ate the meat and used the hide for clothing and bedding. Generally, females with cubs were avoided when hunting (Bullock 1987). Today, Gwich'in harvest grizzly bears for the hide which is tanned and sold or used to make mitts, parka trimmings and mukluks (Gwich'in Elders 1997). Gwich'in communities have expressed interest in opening the Gwich'in Settlement Area for grizzly bear sport hunts. One grizzly bear was harvested in 1996 in the Rat River area (Gwich'in Harvest Study data).

9.6 Black Bear - Ursus americanis – Shoh

Black bears are commonly seen in the foothills and forested areas along the edge of the delta in the Rat River area. They rarely travel into the mountainous part of the pass. They may be vulnerable to predation by

grizzly bears and avoid areas frequented by grizzlies (Clarkson 1993, Martell et al. 1984). In the Norman Wells area, Clarkson (1993) found that most black bear dens were located on south facing slopes with sandy soil and forested cover. Black bears are omnivorous and will eat just about anything. They have been observed eating berries, roots, grass, wild rhubarb, eggs, snowshoe hares, fish, calf moose and human garbage (Banfield 1974, Gwich'in Elders 1997).

Drying fish, meat caches and garbage in camps along the delta are major attractants for black bears looking for food. Bears can cause damage to camps and may threaten human life. As a result, they are often destroyed.

In the old days, Gwich'in hunted black bears during July and August to supplement their diet when there was no caribou in the area. The meat was enjoyed as a tasty alternative to caribou and the hide was used to make rugs and blankets (Gwich'in Elders 1997). Today, black bears are not normally harvested by Gwich'in unless there is a problem bear at a camp. Two black bears have been harvested by Gwich'in in the Rat River area since 1996 (Gwich'in Harvest Study data).

9.7 Wolverine - Gulo gulo – Nehtr'uh

Wolverine live in low densities throughout a large area and are rarely seen. The home range of a male wolverine varies considerably depending upon the availability of prey in the region (Dauphine 1989). Areas with a high density of prey species would allow a wolverine to survive with a smaller home range than an area with a low prey density.

William and Arlyn Charlie with their catch of a wolverine and lynx

Kelsall (1982) states that wolverine "Habitat is probably best defined in terms of adequate year-round food supplies in large, sparsely inhabited wilderness areas, rather than in terms of particular types of topography or plant association". In the Gwich'in Settlement Area, wolverine are most frequently found in the Richardson Mountains (Chetkiewicz and Marshal 1998). Wolverine in the Rat River watershed likely use that area as part of a larger home range that includes the Richardson Mountains and nearby forests of the Mackenzie Delta (Chetkiewicz and Marshal 1998).

Wolverine are known as scavenging predators who will eat almost anything (Dauphine 1989). Stomach content analysis has shown they eat caribou, fish, snowshoe hare, moose, porcupine, arctic ground squirrel, ducks, roots and berries (Dauphine 1989, Poole 1992b). During the winter months wolverine depend more on carrion, usually caribou that died of natural causes, or hunter-killed carcasses (Poole 1992b).

Wolverine may be affected by any development in the Rat River area because they "do not appear to tolerate land-use activities that permanently alter habitats" (Banci 1999). Such disturbance may also have an indirect effect on wolverine if it impacts the caribou and moose populations in the area. Furthermore, the number of hunters and trappers in the area may increase if the area becomes more accessible due to roads or cutlines. An increased harvest of wolverine in the Rat River area may have implications for the wellbeing of the larger Richardson Mountains population (Banci 1999).

Wolverine are trapped in the winter months when the fur is at its best. Wolverine is the preferred fur to be used for parka trimmings. The sparse, straight guard hairs are much longer than the undercoat, preventing frost from building up (Banfield 1974). Most pelts are used locally for this purpose (C. Mitchell 1998).

9.8 Lynx - Lynx canadensis – Niinjii

Lynx are found in the spruce forests throughout the foothills of the Rat River Pass (P.J. Kaye pers. comm.). Their diet is almost entirely made up of snowshoe hares. When the hare population is high, they make up 97 percent of lynx diet, in low years this drops to 65 percent (Stordom 1989). In low hare years lynx may eat ducks, grouse, small mammals, ptarmigan, other birds, beavers and grass (Poole 1992a, Van Zyll de Jong 1963). During these low years in the hare cycle, lynx reproduction almost stops and few kittens are born.

During the 1970s and early 1980s, lynx was one of the most valuable pelts on the fur market. Today there is not such a demand for fur but

lynx pelts are still sent to the fur auction or are made into mitts or parka trimmings locally. Some people enjoy eating roasted, fried or boiled lynx meat (E. Mitchell 1998).

9.9 Other Furbearing Mammals

Although no one has trapped in the mountainous part of the Rat River Pass since the early 1990s, a few families still have trap lines in the delta and foothills (J. Charlie Jr. pers. comm.). Besides wolverine and lynx, people trap red fox (*Vulpes vulpes*), marten (*Martes americana*), mink (*Mustela vison*), ermine (*Mustela erminea*), beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) in this area. These animals are all economically important to Gwich'in. Some pelts are used locally to make mitts, hats, parkas and handicrafts, but most are sold to the fur auctions.

Red fox are able to survive in a variety of habitats, but are mostly found in open forested areas and river valleys (Department of Renewable Resources 1991). The river and creek valleys of the Rat River watershed suit their preference for denning areas with dense shrub growth (Martell et al. 1984). Ermine live in burrows, hollow logs and under roots in forested areas (Banfield 1974). They are common throughout the forests in the delta portion of the watershed (Martell et al. 1984). Marten depend largely on old-growth spruce forests, but are also found in open forested areas (Latour et al. 1994). In the Rat River area they are most commonly found in the foothills of the Richardson Mountains (Martell et al. 1984). Mink, muskrat and beaver are found throughout the lakes and channels of the delta and in small lakes within the Rat River valley.

Beaver and muskrat rely on willows and emergent vegetation for food. Other furbearers depend on the small mammal population for their primary food source. Because of their small size, ermine do not hunt anything larger than a small snowshoe hare. Red fox and marten supplement their diet of voles and shrews with hares, grouse, ptarmigan, muskrats and ground nesting birds. Mink will add fish to this list of food sources (Banfield 1974).

The snowshoe hare (*Lepus americanus*), porcupine (*Erethizon dorsatum*) and arctic ground squirrel (*Spermophilus parryii*) are significant prey items for many species of mammals and birds such as grizzly bears, wolves, wolverine, lynx, hawks, eagles and falcons (Banfield 1974). Gwich'in still depend on snowshoe hare for food. The pelts are sold or used locally to make mitts, hats and parka trimmings (Gwich'in Elders 1997). Porcupine are easily killed and are a source of tasty meat. In 1999 elders and youth participating in a traditional hike through the Rat River Pass enjoyed a meal of roasted porcupine along their way (D. Andre pers. comm.).

Localized disturbance in the Rat River area will have a minor direct impact on these furbearing animals. New development could increase access to the area and may encourage more hunting or trapping. This may impact the populations of furbearing animals.

9.10 Small Mammals

Although rarely seen, small mammals such as shrews and voles serve an important role for meat eating animals. Gwich'in Renewable Resource Board staff trapped small mammals at our three study sites in the Rat River Pass in 1999.

9.10.1 Methods

At each of the three study sites (Summit Lake, Loon Lake and Horn Lake) GRRB staff trapped small mammals in five habitat types for five nights. Habitat types are described in Section 7.6 of this report. Two 'museum special' snap traps were set at 10 metre intervals along a 100 metre transect line in each habitat type. Traps were baited with a mixture of peanut butter and rolled oats and were checked and set each morning. Specimens were identified and shipped to Yellowknife for identification by DRWED staff.

9.10.2 Results

Species collected include northern red-backed voles (*Clethrionomys rutilus*), tundra voles (*Microtus oeconomus*), meadow voles (*Microtus pennsylvanicus*) and masked shrews (*Sorex cinereus*). Appendix 5 outlines the species and numbers found in each habitat type.

Trapped vole

10.0 Birds

Birds in the Rat River watershed contribute over 50 percent of the total number of animal species found in the area. Many birds are relied on as a source of food for other species of birds and mammals, including humans. Gwich'in hunters traditionally harvested waterfowl and ptarmigan in the Rat River Pass. Today waterfowl is hunted in some areas of the pass.

Despite their importance as a component of the ecosystem, little research on birds has taken place in the Rat River area. The Richardson Mountains have been surveyed for raptors in the early 1970's to assess the potential impacts a pipeline would have on the area (Campbell 1972). Another survey was conducted again in the late 1980's by the GNWT Department of Renewable Resources on behalf of the Inuvialuit (Shank and Glaholt 1987). GRRB staff surveyed bird populations in the Rat River Pass in 1999. Results of this work are given in the following section.

10.1 1999 Survey Results

10.1.1 Methods

Five habitat types at the Summit Lake, Loon Lake and Horn Lake study sites were inventoried for birds. A description of the five habitat types is given in Section 7.6 of this report. Our objective was to create a list of species for the area and rate each species as being common, uncommon or rarein the study area, based on certain criteria. To achieve this we surveyed each habitat type for five mornings. We spent equivalent amounts of time in each habitat type depending upon the size of the area, spending more time in large areas than small areas. We identified all birds by sight and sound and recorded the sex and activity of each individual. We surveyed waterfowl on the lakes at each study site from canoe and from shore. Species and sex were recorded for each individual identified. Species were confirmed to breed in the area if we located a nest with eggs or young or an adult bird with flightless young (Scotter et al. 1987). Incidental sightings of all species of birds were also recorded.

10.1.2 Results

In total 56 species of birds were observed at the three study sites. We compiled daily checklists and rated each species' relative abundance as common in the study area (recorded on 51-100 percent of days surveyed), uncommon in the study area (recorded on 21-50 percent of

days surveyed) or rare in the study area (recorded on 1-20 percent of days surveyed) (Henry and Mico 1997). Out of the 56 species observed, 9 were classified as common, 18 as uncommon and 29 as rare. Appendix 6 lists each species observed in the area and their relative abundance. Nine species were confirmed to breed in the area (Table 10.1). It is reasonable to assume many more species breed in the Rat River area due to the number of species observed exhibiting territorial displays and the number of singing males. Since our work was conducted earlier in the summer than the brood rearing period for waterfowl and since we did not actively search for nests, we were only able to confirm breeding records for those species whose nests or young we happened to observe.

Table 10.1: *Birds confirmed to breed in the Rat River area.*

Species	Evidence	Source
Green-winged Teal	female on nest with eggs	GRRB field work, 1999
American Wigeon	female on nest with eggs	GRRB field work, 1999
Surf Scoter	female with brood	GRRB field work, 1999
Bald Eagle	active nest	Campbell, 1973
Golden Eagle	active nest	Campbell, 1973
Peregrine Falcon	active nest	Campbell, 1973
Gyrfalcon	active nest	Campbell, 1973
Willow Ptarmigan	female with young	GRRB field work, 1999
Lesser Yellowlegs	male and female with young	GRRB field work, 1999
Yellow-rumped Warbler	female on nest with eggs	GRRB field work, 1999
Savannah Sparrow	female on nest with eggs & flightless young	GRRB field work, 1999
Fox Sparrow	female on nest with eggs	GRRB field work, 1999
White-crowned Sparrow	female on nest with eggs	GRRB field work, 1999

10.2 Birds of Prey

Five species of raptors and two species of owls were documented in the Rat River Pass during 1999. Bald eagles were spotted flying above lakes at all three study sites. Golden eagles were seen over Summit Lake and Loon Lake. A peregrine falcon and gyrfalcon were observed at the Loon Lake site. One northern harrier was observed flying low along the Rat River near Horn Lake. On several occasions a short-eared owl and a northern hawk owl were observed flying across the open sedge tussocks and riparian areas of Horn Lake. In 1972 Campbell (1973) documented active nest sites along the Rat River for golden eagles, bald eagles, gyrfalcons and peregrine falcons (Table 10.1).

The gyrfalcon is the Rat River Pass's only year round resident raptor. Peregrine falcons, bald eagles, golden eagles and northern harriers all migrate to the continental United States or further south

for the winter. These species are able to coexist because of different nesting habitat and prey preferences (Campbell 1973). Gyrfalcons begin nesting before the peregrine returns from the south in the spring. They may occupy cliff ledges or rocky outcrops that are both species' preferred nesting locations. Gyrfalcons primarily feed on ptarmigan in the Richardson Mountains area while peregrine falcons prey on any small to medium size birds (Poole and Boag 1988, Shank and Glaholt 1987, Campbell 1973, Fisher and Acorn 1998).

Golden eagles build stick nests on wide cliff ledges, rocky outcrops

Peregrine falcon

and sometimes in tall trees. They feed on small mammals such as ground squirrels and hares, birds such as grouse, ptarmigan, waterfowl and larger passerines and carrion. They have even been known to carry off young caribou and Dall's sheep (Campbell 1973, Fisher and Acorn 1998, Government of the Northwest Territories Department of Renewable Resources and Yukon Territorial Government Department of Renewable Resources 1989). Bald eagles usually build large stick nests in trees close to water and in large open areas (Ehrlich et al. 1988, Fisher and Acorn 1998). They are primarily fish and carrion eaters (Ehrlich et al. 1988, Fisher and Acorn 1998). Northern harriers, also referred to as marsh hawks, commonly nest on the ground in low areas close to a wetland. They hunt voles, other small mammals, birds and sometimes rely on carrion (Ehrlich et al. 1988, Fisher and Acorn 1998).

Short-eared owls nest on the ground in open country such as the sedge tundra in the Rat River valley. They eat mainly voles and small birds. If the small mammal population is high enough, short-eared owls may winter in the Rat River area (Ehrlich et al. 1988,

Fisher and Acorn 1998). Northern hawk owls summer in the Rat River watershed and winter in southern Canada. They nest in tree cavities or on platform nests abandoned by other birds in mixed wood forests and black spruce bogs. They rely on small mammals for food during the summer months (Ehrlich et al. 1988, Fisher and Acorn 1998).

Birds of prey are particularly sensitive to habitat disturbance and are sometimes viewed as biological indicators of ecosystem health (Shank and Glaholt 1987, Campbell 1973). Alteration of cliffs, cut-banks or other potential nesting sites and persistent disturbance such as low flying aircraft, nearby ground crews or industrial noise will limit the breeding success of raptors in any area (Campbell 1973). Raptors have suffered long term decline in North America due to the ingestion of pesticides and other pollutants while in their southern wintering grounds (Ehrlich et al. 1988). The peregrine falcon population has been at risk since the 1940s due to eggshell thinning caused by the ingestion of pesticides. Conservation and reintroduction efforts across North America has lead to the peregrine falcon being downlisted in 1999 from the endangered species category to the vulnerable category (COSEWIC 1999). Short-eared owls are sensitive to habitat altering human activities and natural events and have been declining throughout most of their range. This has lead to the species being classified as vulnerable by COSEWIC (1999).

10.3 Waterfowl

Thirteen species of ducks, one species of swan, one species of goose, two species of grebes and two species of loons were observed in the Rat River Pass by GRRB staff during June and July, 1999. Waterfowl are an important subsistence food for the Gwich'in and are hunted in the Rat River watershed predominantly in the delta area between Husky Channel and the foothills. Favoured species are white-winged and surf scoters (locally known as black ducks), mallards, canvasbacks, tundra swans and Canada geese. Traditionally, these large species of waterfowl were used for meat. The feathers and down were also used to make pants, parkas, pillows, blankets, dusters and brooms (Gwich'in Elders 1997).

Many different species of waterfowl are able to coexist in an area because each species has evolved to use a particular size or part of a waterbody. This division of habitat guarantees each species access to preferred food items. Dabbling ducks, such as mallards and green-winged teals have large wings and small feet positioned under the middle of their bodies. The large wings allow them to fly slowly and therefore take off and land with accuracy on small bodies of

water. They paddle around the edge of waterbodies, skimming aquatic insects and seeds off the top of the water and bobbing their heads and necks under the water to pull up sedges and other aquatic vegetation. Diving ducks like scaup, scoters and canvasbacks have smaller wings and large feet on short legs attached to the back of their bodies. The smaller wings force them to fly at faster speeds requiring larger bodies of water for takeoff and landing. Large feet enable these ducks to make use of the middle of a pond, diving to depths up to nine meters to obtain aquatic insects and vegetation off the bottom.

White-winged scoter

The populations of three species of waterfowl found in the GSA, white-winged scoters, surf scoters and lesser scaup, have been suffering from long-term declines (Austin et al. 1999, Canadian Wildlife Service Waterfowl Committee 1999, Gilchrist and Dickson 1999). These species most commonly breed in the boreal forest region of western Canada. The reasons for this decline is not known, but there may be several contributing factors. More adult birds may be dying as a result of bioaccumulation of pollutants from wintering grounds. An already low rate of reproduction may be further reduced by environmental changes in the breeding grounds. These environmental factors may be causing a population decline if more adults die than young survive each year (Austin et al. 1999, Bellrose 1976, Canadian Wildlife Service Waterfowl Committee 1999, Gilchrist and Dickson 1999). Scoters are the most commonly hunted species of waterfowl in the GSA because of their tasty meat, availability and large size (Gwich'in Harvest Study data).

10.4 Ptarmigan

Rock and willow ptarmigan live year round in the Rat River area. Both species were observed by GRRB staff in 1999. Rock ptarmigan are most often found in areas of exposed alpine tundra. Willow ptarmigan are commonly found in shrubby areas at lower elevations (Ehrlich et al. 1988). Ptarmigan have evolved for life in the north. Their white winter plumage includes a thick mat of feathers covering their feet which enables them to walk easily on top of the snow. Many species of birds and mammals such as gyrfalcons, golden eagles and lynx rely on ptarmigan populations as a source of food (Poole and Boag 1988, Poole 1992a, Shank and Glaholt 1987). Gwich'in have traditionally hunted ptarmigan as small game. In the past they were trapped using old fish nets or snares set in the willows (Gwich'in Elders 1997).

10.5 Passerines

Passerines or perching birds were the most common group of birds observed by GRRB staff in 1999. Twenty-one species of passerines were documented, five of these as confirmed breeders. Seven of the nine species of birds classified as common in our study are passerines. These 'song birds' have extremely well developed and species specific songs used by males to defend a territory and to attract a mate. Warblers, sparrows and thrushes are the major passerine species found in the Rat River area. Other significant passerines found in the area are the gray jay and common raven.

Like waterfowl and raptors, passerines are able to coexist because species rely on different habitats and food. Northern waterthrush are found in stands of deciduous forest or willow thickets close to water, nesting low to the ground. Yellow-rumped warblers nest in the fork of coniferous tree (Ehrlich et al. 1988). Most passerines eat a mixture of insects and plant matter. Warblers rely on small insects for food and sparrows rely mostly on seeds. Gray jays and ravens are both extremely bold species that eat a wide range of foods. They will eat insects, vegetation, eggs, young birds or carrion (Ehrlich et al. 1988, Fisher and Acorn 1998).

As well as contributing to a large portion of bird diversity in the area, passerines are relied upon by many other species as a source of food. The peregrine falcon population in the area depends upon this group of birds for a large part of its diet (Ehrlich 1988, Fisher and Acorn 1998). Mammals such as lynx, red fox and marten also rely on these birds as a source of food (Poole 1992a, Banfield 1974).

Many species of passerines are threatened because of habitat destruction in their northern breeding grounds and in their tropical wintering areas. In Central and South America where many of the warblers, sparrows and thrushes spend their winters, mature tropical forests are being cut down to make room for cattle ranching and cash crops. In southern Canada and the continental United States, forests are being cleared for urban development, agriculture and forestry. In eastern North America, where large-scale deforestation has been reducing songbird habitat for several decades, there has been a considerable decline in the numbers and species of birds returning to breed each year. Several species have disappeared from certain regions entirely (Ehrlich 1988). Although it is unlikely that the north will ever face such large-scale habitat destruction, it is possible that the number of birds breeding in northern areas will decline as a result of habitat loss elsewhere along their migration routes.

Gray Jay

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Appendix 1: *Rare vascular plants found in the northern Richardson Mountains.*

Species	Family	Region	Status	Habitat
Botrychium minganense	grape fern	boreal	rare in BC, SK, arctic Canada, widespread rarity	grassy meadow
Botrychium pinnatum	grape fern	mountain	rare in YK, abundant worldwide	grassy tundra
Cardamine microphylla	bitter cress	arctic-alpine	apparently secure worldwide	wet slopes and stream banks
Carex eleusinoides	sedge	mountain	rare in YK, imperiled in Canada	wet gravely river banks and meadows
Cerastium maximum	mouse-ear chickweed	arctic-alpine	rare in arctic Canada, rare worldwide	grassy slopes, open thickets
Cryptogramma stelleri	slender cliff brek	cosmopolitan	rare in YK, NS, BC, arctic Canada	moist shale slopes
Eritrichium splendens	alpine forget-me-not	arctic-alpine	rare YK, critically imperiled in Canada, rare worldwide	alpine scree slopes and rock ledges
Festuca lenensis	fesuce	arctic-alpine	rare YK, arctic Canada, critically imperiled in Canada	dry tundra
Koeleria asiatica		arctic-alpine	rare YK, arctic Canada, critically imperiled in Canada	shale scree slopes and dry tundra
Lesquerella calderi	arctic bladder pool	mountain	endemic in Canada, uncommon worldwide	limestone flats and alpine slopes
Luetkea pectinata		mountain	abundant worldwide	alpine tundra and snow beds
Luzula rufescens	wood rush	boreal	rare in BC, abundant worldwide	bogs, marshes and river beds
Nuphar lutea	yellow pond lilly	aquatic	rare in Canada, abundant worldwide	lakes and slow moving streams
Papaver mcconnellii	poppy	mountain	endemic species, critically imperiled in Canada and worldwide	alpine shale slopes
Poa porsildii	blue grass	mountain	endemic species, imperiled in Canada and worldwide	turfy alpine slopes and meadows
Poa pseudoabbreviata	grass	mountain	rare YK, new to NWT flora	Rocky slopes, snow beds and ridges
Podistera macounii		arctic-alpine	imperiled in Canada, apparently secure worldwide	ridge tops and rocky strips
Primula eximia	primrose	mountain	critically imperiled in Canada, abundant worldwide	meadows and stream margins
Ranunculus turneri	buttercup	arctic-alpine	imperiled in Canada and worldwide, rare arctic Canada	sub-alpine meadows
Rumex acetosa alpestris	dock	arctic-alpine	rare in YK	moist alpine and sub-alpine meadows
Salix chamissonis	willow	arctic-alpine	imperiled in Canada, uncommon worldwide	tundra
Sanguisorba officinalis	great burned	boreal	rare in YK, abundant worldwide	wet tundra
Saxifraga ferrugineae	saxifrage	mountain	isolated population in NWT, abundant worldwide	moist rocky ledges
Smelowskia calycina		arctic alpine	endemic species, rare Canada, apparently secure worldwide	stony slopes and lake shores
Stellaria umbellata	chickweed	mountain	imperiled in Canada, widely separated populations, abundant worldwide	moist alpine slopes

Appendix 2: *Habitat type and study site where plant species were found during 1999 vegetation survey of the Rat River watershed.*

Species	Riparian	Mixed Woods	Tussocks	Black Spruce	Alpine	Summit Lake	Loon Lake	Horn Lake
Aconitum delphinifolium		x				x		
Alnus crispa	x	x		x		x	x	x
Amerorchis rotundifolia				x		x		
Andromeda polifolia				x		x		x
Androsace chamaejame					x	x		
Anemone narcissiflora					x	x		
Anemone parviflora					x		x	
Arctostaphylos rubra		x	x	x	x	x	x	x
Arctostaphylos uva-ursi		x			x	x		
Arnica frigida					x	x		
Aster alpinus					x	x		
Babenaria obtusata		x				x		
Betula occidentalis	x					x		
Betula glandulosa	x	x	x	x	x	x	x	x
Boschniakia rossica				x		x		
Cassiope mertensiana					x	x		
Cassiope tetragona					x	x		
Cerastium beeringianum					x	x		
Corallorhiza trifida		x				x		
Corydalis pauciflora					x	x		
Dryas alaskensis		x		x	x	x	x	
Dryas integrifolia		x				x		
Empetrum nigrum	x	x	x	x	x	x	x	x
Epilobium angustifolium	x						x	
Epilobium latifolium					x	x		
Equisetum spp.	x	x	x	x		x	x	x
Eriophorum spp.			x				x	
Geocaulon lividum	x							x
Hedysarum alpinum		x				x		
Juniperus communis		x				x		
Kalmia polifolia		x				x		
Lagotis glauca					x	x		
Ledum decumbens	x	x	x	x		x	x	x
Ledum groenlandicum	x	x	x	x		x	x	x
Linnaea borealis		x					x	
Lupinus arcticus			x		x	x		x
Mertensia paniculata	x					x		

Appendix 2: *Habitat type and study site where plant species were found during 1999 vegetation survey of the Rat River watershed **(continuity)**.*

Species	Riparian	Mixed Woods	Tussocks	Black Spruce	Alpine	Summit Lake	Loon Lake	Horn Lake
Minuartia macrocarpa					x	x		
Minuartia obtusiloba					x	x		
Papaver macounii		x				x		
Pedicularis capitata		x			x	x		
Pedicularis groenlandica					x		x	
Pedicularis sudetica		x				x		
Petasites hyberboreus			x			x		
Petasitis frigidus	x	x	x	x	x		x	x
Picea glauca	x	x				x	x	x
Picea mariana	x			x		x	x	x
Pinguicula villosa				x		x		
Polygonum alaskanum					x	x		x
Polygonum bistorta				x	x	x	x	x
Polygonum viviparum		x						x
Potentilla fruticosa		x						x
Potentilla uniflora					x	x		
Pyrola grandiflora	x	x	x	x	x	x	x	x
Rhododendron lapponicum					x	x		
Ribes triste	x					x		
Rosa acicularis	x	x					x	x
Rubus chamaemorus	x	x	x	x		x	x	
Salix reticulata		x				x		
Salix spp.	x	x	x	x	x	x	x	x
Saussurea angustifolia		x			x		x	x
Saxifraga hieracifolia					x	x		
Saxifraga punctata					x	x		
Saxifraga reflexa					x	x		
Saxifraga tricuspidata					x	x		
Senecio atropureus					x	x		
Senecio tundricola					x	x		
Silene acaulis					x	x		
Spiraea beauverdiana		x			x		x	x
Tolfieldia pusilla		x				x		
Vaccinium oxycoccus				x		x	x	
Vaccinium uliginosum	x	x	x	x	x	x	x	x
Vaccinium vitis-idaea	x	x	x	x		x	x	x
Total: 73	**20**	**34**	**15**	**21**	**38**	**61**	**26**	**25**

Appendix 3: *Vascular plants, mosses and lichens identified in the Rat River watershe* ***(continuity)****.*

Species	Common Name	Gwich'in Name	Identified by
Achillea millefolium	common yarrow		Vyvyan 1998
Aconitum delphinifolium	monkshood		Loewen 1991, GRRB 1999, Vyvyan 1998
Agropyron boreale	wild rye		Loewen 1991
Alectoria nigricans			Loewen 1991
Alectoria ochroleuca			Loewen 1991
Alnus crispa	green alder	K'oh	Loewen 1991, GRRB 1999
Amerorchis rotundifolia	round-leaved orchis		GRRB 1999
Andromeda polifolia	bog rosemary		Loewen 1991, GRRB 1999, Vyvyan 1998
Androsace chamaejasme	rock-jasmine		Loewen 1991, GRRB 1999
Anemone narcissiflora	anemone		Loewen 1991, GRRB 1999
Anemone parviflora	anemone		Loewen 1991, GRRB 1999
Anemone richardsonii	anemone		Loewen 1991, Vyvyan 1998
Antennaria nitida	pussy toes		Loewen 1991
Arabis lyrata	rock cress		Loewen 1991
Arctagrostics latifolia			Loewen 1991
Arctostaphylos alpina	alpine bearberry		Loewen 1991
Arctostaphylos rubra	red bearberry	Dzhiindee'	Loewen 1991, GRRB 1999
Arctostaphylos uva-ursi	kinnikinick		Loewen 1991, GRRB 1999
Arenaria lateriflora			Vyvyan 1998
Arnica alpina		At'an tsoo	Vyvyan 1998
Arnica frigida			Loewen 1991, GRRB 1999
Arnica lessingii			Loewen 1991
Artemisia alaskana	wormwood		Loewen 1991
Artemisia arctica	wormwood		Loewen 1991
Artemisia borealis	wormwood		Loewen 1991
Artemisia tilesii	wormwood		Loewen 1991
Aster alpinus	alpine aster		Loewen 1991, GRRB 1999
Aster sibiricus	Siberian aster		Loewen 1991
Astragalus alpinus	alpine milk-vetch		Loewen 1991
Astragalus eucosmus	milk-vetch		Loewen 1991, Vyvyan 1998
Astragalus umbellatus	milk-vetch		Loewen 1991
Aulacomnium palustre			Loewen 1991
Aulacomnium turgidum			Loewen 1991
Babenaria obtusata			GRRB 1999
Betula glandulosa	dwarf birch		Loewen 1991, GRRB 1999, Packer 1964
Betula hybrid	hybrid birch		Loewen 1991

Appendix 3: *Vascular plants, mosses and lichens identified in the Rat River watershed* ***(continuity)****.*

Species	Common Name	Gwich'in Name	Identified by
Betula occidentalis	water birch		Loewen 1991, GRRB 1999
Betula papyrifera	paper birch	Aat'oo	Loewen 1991
Boschniakia rossica	ground cone	Duu'ii nahsheih	Loewen 1991, GRRB 1999
Boykinia richardsonii	brome grass		Loewen 1991
Bromus pumpellianus	brome grass		Loewen 1991
Bryocaulon divergens			Loewen 1991
Bupleurum americanum	thoroughwax		Loewen 1991
Bupleurum triradiatum	thoroughwax		Loewen 1991
Calamagrostis inexpansa	reed bent grass		Loewen 1991
Calliergon richardsonii			Loewen 1991
Campanula lasiocarpa	bellflower		Loewen 1991
Campylium stellatum			Loewen 1991
Cardamine digitata	bitter cress		Loewen 1991
Cardamine pratensis	lady's-smock		Loewen 1991
Carex aquatilis	sedge		Loewen 1991
Carex bigelowii	sedge		Loewen 1991
Carex capillaris	sedge		Loewen 1991
Carex concinna	sedge		Loewen 1991
Carex diandra	sedge		Loewen 1991
Carex limosa	sedge		Loewen 1991
Carex lugens	sedge		Loewen 1991
Carex membranacea	sedge		Loewen 1991
Carex microchaeta	sedge		Loewen 1991
Carex misandra	sedge		Loewen 1991
Carex podocarpa	sedge		Loewen 1991
Carex rostrata	sedge		Loewen 1991
Carex scirpoidea	sedge		Loewen 1991
Carex vaginata	sedge		Loewen 1991
Cassiope mertensiana	white mountain heather		GRRB 1999
Cassiope tetragona	arctic white heather		Loewen 1991, GRRB 1999, Vyvyan 1998
Castilleja elegans	Indian-paintbrush		Loewen 1991
Cerastium beeringianum	mouse-ear chickweed		Loewen 1991, GRRB 1999
Cerastium maximum	mouse-ear chickweed		Packer 1964
Cetraria cucullata			Loewen 1991
Cetraria islandica			Loewen 1991
Cetraria nivalis			Loewen 1991

Appendix 3: *Vascular plants, mosses and lichens identified in the Rat River watershed **(continuity)**.*

Species	Common Name	Gwich'in Name	Identified by
Cetraria pinastri			Loewen 1991
Cetraria tilesii			Loewen 1991
Chamaedaphne calyculata	leatherleaf		Loewen 1991
Chandonanthus setiformis			Loewen 1991
Chrysosplenium tetrandrum	golden saxifrage		Loewen 1991, Vyvyan 1998
Cladina mitis			Loewen 1991
Cladina rangiferina			Loewen 1991
Cladina stellaris			Loewen 1991
Cladonia cornuta			Loewen 1991
Climacium dendroides			Loewen 1991
Coeloglossum viride	bracted green orchid		Loewen 1991
Corallorhiza trifida	coralroot		GRRB 1999
Corydalis pauciflora	medic corydalis		GRRB 1999
Crepis elegans	hawk's-beard		Loewen 1991
Crepis nana	hawk's-beard		Loewen 1991, Vyvyan 1998
Cypripedium passerinum	small white lady's slipper		Packer 1964
Dactylina arctia			Loewen 1991
Delphinium glaucum	tall larkspur		Loewen 1991
Deschampsia caespitosa	tufted hair grass		Loewen 1991
Descurainia sophiodes	flixweed		Packer 1964
Dicranum elongatum			Loewen 1991
Dicranum fuscescens			Loewen 1991
Dicranum undulatum			Loewen 1991
Ditrichum flexicale			Loewen 1991
Dodecatheon frigidum	shootingstar		Loewen 1991
Dodecatheon pulchellum	shootingstar		Loewen 1991
Douglasia arctica			Loewen 1991, Packer 1964
Douglasia gormanii			Loewen 1991
Douglasia ochotensis			Loewen 1991
Draba glabella			Loewen 1991
Dryas alaskensis	mountain avens		Loewen 1991, GRRB 1999
Dryas integrifolia	mountain avens		Loewen 1991, GRRB 1999
Dryas octopetala	mountain avens		Loewen 1991
Dryopteris fragrans	fragrant cliff fern		Loewen 1991
Elymus trachycaulus	wild rye		Loewen 1991
Empetrum nigrum	crowberry, blackberry	Dineechuh'	Loewen 1991, GRRB 1999

Appendix 3: *Vascular plants, mosses and lichens identified in the Rat River watershed* ***(continuity)****.*

Species	Common Name	Gwich'in Name	Identified by
Epilobium angustifolium	fireweed		Loewen 1991, GRRB 1999
Epilobium latifolium	dwarf fireweed		Loewen 1991, GRRB 1999, Vyvyan 1998
Equisetum arvense	field horsetail	Khehdi'	Loewen 1991
Equisetum scirpoides	dwarf scouring-rush		Loewen 1991
Equisetum variegatum	variegated horsetail		Loewen 1991
Erigeron acris	fleabane		Loewen 1991
Erigeron compositus	fleabane		Vyvyan 1998
Erigeron humilis	fleabane		Packer 1964
Erigeron uniflorus	fleabane		Vyvyan 1998
Eriophorum angustifolium	cottongrass		Loewen 1991
Eriophorum russeolum	cottongrass		Loewen 1991
Eriophorum scheuchzeri	cottongrass		Loewen 1991
Eriophorum vaginatum	cottongrass		Loewen 1991
Erysimum pallasii	wall flower		Packer 1964
Festuca altaica	northern rough fescue		Loewen 1991
Festuca brachyphylla	fescue		Loewen 1991
Festuca brevissima	fescue		Loewen 1991
Festuca richardsonii	fescue		Loewen 1991
Festuca rubra	red fescue		Loewen 1991
Gentiana acuta	gentian		Vyvyan 1998
Gentiana glauca	gentian		Loewen 1991
Gentianella propinqua	Moench gentian		Loewen 1991
Geocaulon lividum	northern comandra		GRRB 1999
Gexanium richardsonii			Loewen 1991
Geum glaciale	avens		Loewen 1991
Geum rossii	avens		Loewen 1991
Hedysarum alpinum	liquorice-root	Treh	Loewen 1991, GRRB 1999
Hedysarum mackenzii	liquorice-root		Loewen 1991
Hierochloe alpina	alpine holly grass		Loewen 1991
Hylocomium splendens			Loewen 1991
Icmadophila ericetorum			Loewen 1991
Juncus arcticus	bog rush		Loewen 1991
Juncus castaneus	bog rush		Loewen 1991
Juniperus communis	juniper	Deetree jak t'an	Loewen 1991, GRRB 1999
Kalmia polifolia	bog-laurel		Loewen 1991, GRRB 1999
Kobresia myosuroides			Loewen 1991

Appendix 3: *Vascular plants, mosses and lichens identified in the Rat River watershed **(continuity)**.*

Species	Common Name	Gwich'in Name	Identified by
Lagotis glauca			GRRB 1999
Lagotis stelleri			Loewen 1991
Ledum decumbens	Labrador tea	Lidii maskit	Loewen 1991, GRRB 1999
Ledum groenlandicum	Labrador tea	Lidii maskit	Loewen 1991, GRRB 1999
Leptarrhena pyrolifolia	leather-leaved saxifrage		Loewen 1991
Lesquerella arctica	arctic bladderpod		Loewen 1991
Limprichtia revolvens			Loewen 1991
Linnaea borealis	twinflower		Loewen 1991, GRRB 1999, Packer 1964, Vyvyan 1998
Lloydia serotina	alp lilly		Loewen 1991
Loiseleuria procumbens	alpine azalea		Loewen 1991
Lupinus arcticus	arctic lupine		Loewen 1991, GRRB 1999
Luzula confusa	wood rush		Loewen 1991
Luzula multiflora	wood rush		Loewen 1991
Luzula parviflora	wood rush		Packer 1964
Luzula spicata	wood rush		Loewen 1991
Luzula wahlenbergii	wood rush		Loewen 1991
Lycopodium annotinum	bristly club-moss		Loewen 1991
Lycopodium complanatum	flatbranch club-moss		Loewen 1991
Lycopodium selago	mountain club-moss		Loewen 1991
Masonhalea richardsonii			Loewen 1991
Melandrium affine	campion		Loewen 1991
Mertensia paniculata	bluebell		Loewen 1991, GRRB 1999
Minuartia arctica	sandwort		Loewen 1991
Minuartia macrocarpa	sandwort		GRRB 1999
Minuartia obtusiloba	sandwort		Loewen 1991, GRRB 1999
Minuartia rossii	sandwort		Packer 1964
Minuartia yukonensis	sandwort		Loewen 1991
Moehringia lateriflora			Loewen 1991
Moneses uniflora	one-flowered pyrola		Loewen 1991, Vyvyan 1998
Myosotis alpestris	forget-me-not		Loewen 1991, Packer 1964
Nephroma arcticum			Loewen 1991
Oxycoccus microcarpus	cranberry		Loewen 1991, Vyvyan 1998
Oxyria digyna	hill mountain sorrel		Loewen 1991
Oxytropis campestris	late yellow locoweed		Vyvyan 1998
Oxytropis deflexa	locoweed		Loewen 1991
Oxytropis nigrescens	locoweed		Loewen 1991

Appendix 3: *Vascular plants, mosses and lichens identified in the Rat River watershed **(continuity)**.*

Species	Common Name	Gwich'in Name	Identified by
Oxytropis varians	locoweed		Loewen 1991
Paludella squarrosa			Loewen 1991
Papaver macounii	poppy		GRRB 1999
Papaver nudicaule	arctic poppy		Vyvyan 1998
Parnassia kotzebuei	grass-of-Parnassus		Loewen 1991, Packer 1964
Parrya nudicaulis			Loewen 1991
Pedicularis capitata	lousewort		Loewen 1991, GRRB 1999
Pedicularis groenlandica	lousewort		GRRB 1999
Pedicularis hirsuta	lousewort		Loewen 1991
Pedicularis Labradorica	Labrador lousewort		Loewen 1991
Pedicularis lanata	wooly lousewort		Loewen 1991
Pedicularis lapponica	Lapland lousewort		Loewen 1991
Pedicularis oederi	lousewort		Loewen 1991
Pedicularis sudetica	lousewort		Loewen 1991, GRRB 1999, Packer 1964
Pedicularis verticillata	lousewort		Vyvyan 1998
Peltigera aphthosa			Loewen 1991
Peltigera canina			Loewen 1991
Petasites arcticus	sweet coltsfoot		Loewen 1991
Petasites frigidus	sweet coltsfoot		Loewen 1991
Petasites hyberboreus	sweet coltsfoot		GRRB 1999
Petasites sagittatus	sweet coltsfoot		Loewen 1991
Phlox alaskensis	phlox		Loewen 1991
Phlox richardsonii	Richardson's phlox		Loewen 1991
Picea glauca	white spruce	Ts'iivii	Loewen 1991, GRRB 1999, Packer 1964
Picea glauca x mariana	spruce hybrid	Ts'iivii	Loewen 1991
Picea mariana	black spruce	Ts'iivii	Loewen 1991, GRRB 1999
Pinguicula villosa			Loewen 1991, GRRB 1999, Vyvyan 1998
Pinguicula vulgaris	butterwort		Loewen 1991
Pleurozium schreberi			Loewen 1991
Poa abbreviata	blue grass		Loewen 1991
Poa alpina	alpine blue grass		Loewen 1991
Poa arctica	arctic blue grass		Loewen 1991
Poa glauca	blue grass		Loewen 1991
Polemonium acutiflorum	Jacob's ladder		Loewen 1991, Packer 1964
Polygonum alaskanum	wild rhubarb	Ts'iigyuu'	Loewen 1991, GRRB 1999
Polygonum bistorta	bistort		Loewen 1991, GRRB 1999

Appendix 3: *Vascular plants, mosses and lichens identified in the Rat River watershed **(continuity)**.*

Species	Common Name	Gwich'in Name	Identified by
Polygonum viviparum	alpine bistort		Loewen 1991, GRRB 1999, Vyvyan 1998
Polytrichum juniperinum			Loewen 1991
Polytrichum piliferum			Loewen 1991
Polytrichum strictum			Loewen 1991
Populus balsamifera	balsam poplar		Loewen 1991
Pontentilla anserina	cinquefoil		Vyvyan 1998
Potentilla biflora	cinquefoil		Loewen 1991
Potentilla fruticosa	shrubby cinquefoil	Thak dachan	Loewen 1991, GRRB 1999
Potentilla nivea	cinquefoil		Loewen 1991, Vyvyan 1998
Potentilla palustris	marsh cinquefoil		Loewen 1991
Potentilla uniflora	cinquefoil		GRRB 1999
Primula borealis	primrose		Loewen 1991
Ptilium crista-castrensis			Loewen 1991
Pyrola asarifolia	pink wintergreen		Loewen 1991
Pyrola chlorantha	wintergreen		Loewen 1991
Pyrola grandiflora	arctic wintergreen	Dzhii ndee'	Loewen 1991, GRRB 1999
Pyrola secunda	one-sided wintergreen		Loewen 1991
Racomitrim lanuginosum			Loewen 1991
Ranunculus nivalis	snow buttercup		Loewen 1991
Ranunculus pallasii	Palla's buttercup		Vyvyan 1998
Rhizocarpon geographicum			Loewen 1991
Rhododendron lapponicum	Lapland rose-bay		Loewen 1991, GRRB 1999
Rhytidium rugosum			Loewen 1991
Ribes hudsonianum	northern black current		Loewen 1991
Ribes oxyacanthoides	wild gooseberry		Loewen 1991
Ribes triste	wild red current		Loewen 1991, GRRB 1999, Packer 1964
Rorippa islandica	yellow cress		Loewen 1991
Rosa acicularis	prickly rose, rosehips	Nichih	Loewen 1991, GRRB 1999
Rubus chamaemorus	cloudberry	Nak'al	Loewen 1991, GRRB 1999
Rumex arcticus	arctic dock		Loewen 1991
Salix alaxensis	willow	K'aii'	Loewen 1991
Salix arbusculoides	willow	K'aii'	Loewen 1991
Salix arctica	arctic willow	K'aii'	Loewen 1991
Salix barrattiana	willow	K'aii'	Loewen 1991
Salix bebbiana	beaked willow	K'aii'	Loewen 1991
Salix fuscescens	willow	K'aii'	Loewen 1991

Appendix 3: *Vascular plants, mosses and lichens identified in the Rat River watershed **(continuity)**.*

Species	Common Name	Gwich'in Name	Identified by
Salix glauca	blue-green willow	K'aii'	Loewen 1991
Salix lanata	Richardson's willow	K'aii'	Loewen 1991
Salix longistylis	willow	K'aii'	Loewen 1991
Salix myrtillifolia	willow	K'aii'	Loewen 1991
Salix phlebophylla	skeleton willow	K'aii'	Loewen 1991
Salix polaris	snow-bed willow	K'aii'	Loewen 1991
Salix pulchra	willow	K'aii'	Loewen 1991
Salix reticulata	net-veined willow	K'aii'	Loewen 1991, GRRB 1999
Salix serissima	willow	K'aii'	Loewen 1991
Sanionia uncinata			Loewen 1991
Saussurea angustifolia	saussurea		Loewen 1991, GRRB 1999, Packer 1964
Saxifraga bronchialis	saxifrage		Loewen 1991, Packer 1964
Saxifraga cernua	nodding saxifrage		Loewen 1991
Saxifraga exilis			Loewen 1991
Saxifraga flagellaris	spiderplant		Loewen 1991, Packer 1964
Saxifraga hieracifolia	saxifrage		Loewen 1991, GRRB 1999, Packer 1964
Saxifraga hirculus	yellow marsh saxifrage		Loewen 1991, Packer 1964
Saxifraga lyallii	saxifrage		Loewen 1991
Saxifraga nivalis	alpine saxifrage		Loewen 1991
Saxifraga oppositifolia	purple saxifrage		Loewen 1991
Saxifraga punctata	saxifrage		Loewen 1991, GRRB 1999, Packer 1964, Vyvyan 1998
Saxifraga reflexa	saxifrage		Loewen 1991, GRRB 1999, Packer 1964, Vyvyan 1998
Saxifraga tricuspidata	prickly saxifrage		Loewen 1991, GRRB 1999
Selaginella sibirica	spike-moss		Loewen 1991
Senecio atropurpureus	groundsel		Loewen 1991, GRRB 1999
Senecio frigidus	groundsel		Vyvyan 1998
Senecio fuscatus	groundsel		Loewen 1991
Senecio hyperborealis	groundsel		Loewen 1991
Senecio lugens	groundsel		Loewen 1991
Senecio resedifolius	groundsel		Loewen 1991
Senecio tundricola	groundsel		GRRB 1999
Senecio yukonensis	groundsel		Loewen 1991
Shepherdia canadensis	soapberry	Dinjih jak	Loewen 1991
Silene acaulis	moss campion		Loewen 1991, GRRB 1999
Silene douglasii	campion		Vyvyan 1998
Solidago multiradiata	goldenrod		Loewen 1991, Vyvyan 1998
Sphagnum angustifolium		Nin'	Loewen 1991

Appendix 3: *Vascular plants, mosses and lichens identified in the Rat River watershed* ***(continuity)****..*

Species	**Common Name**	**Gwich'in Name**	**Identified by**
Sphagnum capillifolium		Nin'	Loewen 1991
Sphagnum centrale		Nin'	Loewen 1991
Sphagnum fuscum		Nin'	Loewen 1991
Sphagnum lenense		Nin'	Loewen 1991
Sphagnum magellanicum		Nin'	Loewen 1991
Sphagnum rubellum		Nin'	Loewen 1991
Sphagnum russowii		Nin'	Loewen 1991
Sphagnum squarrosum		Nin'	Loewen 1991
Sphagnum warnstorfii		Nin'	Loewen 1991
Spiraea beauverdiana	spiraea		Loewen 1991, GRRB 1999
Stellaria arctica	chickweed		Loewen 1991
Stellaria edwardsii	chickweed		Loewen 1991
Stellaria laeta	chickweed		Loewen 1991
Stellaria longipes	chickweed		Loewen 1991
Stellaria monantha	chickweed		Loewen 1991
Stellaria media	chickweed		Loewen 1991
Stereocaulon tomentosum			Loewen 1991
Synthyris borealis			Loewen 1991
Taraxacum ceratophorum	dandelion		Vyvyan 1998
Taraxacum phymatocarpum	dandelion		Loewen 1991
Thalictrum alpinum	alpine meadow rue		Loewen 1991
Thamnolia subuliformis			Loewen 1991
Thuidium abietinum			Loewen 1991
Tofieldia coccinea	false asphodel		Loewen 1991
Tofieldia glutinosa	false asphodel		Loewen 1991
Tofieldia pusilla	false asphodel		Loewen 1991, GRRB 1999
Tomenthypnum nitens			Loewen 1991
Tortella fragilis			Loewen 1991
Tortula ruralis			Loewen 1991
Trisetum spicatum			Loewen 1991
Vaccinium oxycoccus			GRRB 1999
Vaccinium uliginosum	blueberry	Jak zheii	Loewen 1991, GRRB 1999
Vaccinium vitis-idaea	cranberry	Natl'at	Loewen 1991, GRRB 1999
Valeriana capitata	valerian		Loewen 1991
Viburnum edule	bush-cranberry		Loewen 1991
Wilhelmsia physodes			Loewen 1991
Woodsia glabella	northern woodsia		Loewen 1991
Zygadenus elegans	death-camass		Loewen 1991, Packer 1964

Appendix 4: *Results from 1999 fish survey of the Rat River watershed.*

		Dolly varden	Arctic grayling	Crooked back	Least cisco	Jackfish	Loche	Slimy sculpin
Long Lake	**total # caught**	0	0	16	136	11	0	1
	mean length (mm)	-	-	394.7	110.4	508.4	-	58
	range (mm)	-	-	302-469	80-185	457-630	-	-
Ogilvie Lake	**total # caught**	0	0	12	0	5	0	0
	mean length (mm)	-	-	409.6	-	459.6	-	-
	range (mm)	-	-	363-431	-	410-505	-	-
Loon Lake	**total # caught**	0	0	0	0	0	0	0
	mean length (mm)	-	-	-	-	-	-	-
	range (mm)	-	-	-	-	-	-	-
Horn Lake	**total # caught**	0	0	9	0	20	0	0
	mean length (mm)	-	-	345.8	-	556.4	-	-
	range (mm)	-	-	164-432	-	413-810	-	-
Long/Ogilvie Creek	**total # caught**	0	0	0	1	0	0	8
	mean length (mm)	-	-	-	147	-	-	58.1
	range (mm)	-	-	-	-	-	-	50-70
Fish Creek	**total # caught**	65	1	0	0	0	1	8
	mean length (mm)	92.2	141	-	-	-	300	65.1
	range (mm)	60-550	-	-	-	-	-	37-115
Rat River	**total # caught**	0	0	0	0	0	0	0
	mean length (mm)	-	-	-	-	-	-	-
	range (mm)	-	-	-	-	-	-	-

Appendix 5: *1999 small mammal trapping results of the Rat River watershed by study site and habitat type.*

Study Site	Vegetation Community	Trap Nights	Northern Red-backed Voles	Tundra Voles	Meadow Voles	Masked Shrews
Summit Lake	Alpine	80	0	0	0	0
	Mixed Woods	110	2	0	0	0
	Black Spruce	100	4	0	0	0
	Sedge Hummocks	100	4	0	0	0
	Riparian	100	12	0	0	7
Summit Totals		**490**	**22**	**0**	**0**	**7**
Loon Lake	Alpine	100	3			0
	Mixed Woods	100	2			0
	Black Spruce	100	23	1		0
	Sedge Hummocks	100	0			0
	Riparian	100	6			1
Loon Totals		**500**	**34**	**1**	**0**	**1**
Horn Lake	Alpine	100	1			0
	Mixed Woods	100	28			2
	Black Spruce	100	9	2		0
	Sedge Hummocks	100	11		3	4
	Riparian	100	37		2	3
Horn Totals		**500**	**86**	**2**	**5**	**9**
TOTALS		**2480**	**198**	**3**	**5**	**17**

Appendix 6: *Relative abundance of birds in the Rat River watershed during 1999 bird survey.*

Common Name	Latin Name	Gwich'in Name	Days Observed	*Relative Abundance
Common Loon	*Gavia immer*		7	U
Red-throated Loon	*Gavia stallata*		2	R
Red-necked Grebe	*Podiceps grisegena*		1	R
Horned Grebe	*Podiceps auritus*		1	R
Tundra Swan	*Cygnus columbianus*	Daazraii	8	C
Canada Goose	*Branta canadensis*	Kheh	2	R
Mallard	*Anas platyrhynchos*	Neet'aii	2	R
Northern Pintail	*Anas acuta*		1	R
American Widgeon	*Anas americana*		6	U
Northern Shoveler	*Anas clypeata*		2	R
Green-winged Teal	*Anas crecca*		5	U
Canvasback	*Aythya valisineria*	T'aaviii gwidits'an	2	R
Greater Scaup	*Aythya marila*	Nitsihdin	3	U
Lesser Scaup	*Aythya affinis*		1	R
Common Goldeneye	*Bucephala clangula*		5	U
Bufflehead	*Bucephala albeola*		1	R
Oldsquaw	*Clangula hyemalis*		2	R
White-winged Scoter	*Melanitta fusca*	Njaa	2	R
Surf Scoter	*Melanitta perspicillata*	Deetree'aa	5	U
Bald Eagle	*Haliaeetus leucocephalus*	Ishen (Eagle)	4	U
Northern Harrier	*Circus cyaneus*		1	R
Golden Eagle	*Aquila chrysaetos*	Ishen (Eagle)	3	U
Peregrine Falcon	*Falco peregrinus*		1	R
Gyrfalcon	*Falco rusticolus*		1	R
Willow Ptarmigan	*Lagopus lagopus*	Daa goo	6	U
Rock Ptarmigan	*Lagopus mutus*	Daak'yaa	2	R
Sandhill Crane	*Grus canadensis*		1	R
Lesser Yellowlegs	*Tringa flavipes*		2	R
Upland Sandpiper	*Bartramia longicauda*		1	R
Spotted Sandpiper	*Actitis hypoleucos*		1	R
Common Snipe	*Gallinago gallinago*		3	U
Semipalmated Sandpiper	*Calidris pusilla*		2	R
Mew Gull	*Larus canus*		10	C
Short-eared Owl	*Asio flammeus*	Vi'iidzee (Owl)	6	U
Northern Hawk Owl	*Sernia ulula*	Vi'iidzee (Owl)	2	R
Horned Lark	*Eremophila alpestris*		1	R
Gray Jay	*Perisoreus canadensis*	Ediingwat'an	12	C
Common Raven	*Corvus corax*	Deetrin	3	U
Boreal Chickadee	*Parus hudsonicus*		2	R
American Robin	*Turdus migratorius*		9	C

Appendix 6: *Relative abundance of birds in the Rat River watershed during 1999 bird survey* ***(continuity)****.*

Common Name	Latin Name	Gwich'in Name	Days Observed	*Relative Abundance
Varied Thrush	*Ixoreus naevius*		1	R
Gray-cheeked Thrush	*Catharus minimus*		1	R
American Pipit	*Anthus rubescens*		1	R
Yellow Warbler	*Dendroica petechia*		6	U
Yellow-rumped Warbler	*Dendroica coronata*		10	C
Blackpoll Warbler	*Dendroica striata*		1	R
Northern Waterthrush	*Seiurus noveboracensis*		3	U
Wilson's Warbler	*Wilsonia pusilla*		7	U
American Tree Sparrow	*Spizella arborea*		12	C
Chipping Sparrow	*Spizella passerina*		2	U
Savannah Sparrow	*Passerculus*		13	C
Fox Sparrow	*Passerella iliaca*		11	C
White-crowned Sparrow	*Zonotrichia leucophrys*		14	C
Dark-eyed Junco	*Junco hyemalis*		4	U
Snow Bunting	*Plectrophenax nivalis*	Guugeh Zhyuu	1	R
Pine Grosbeak	*Pinicola enucleator*		1	R

*RELATIVE ABUNDANCE CODES: PERCENTAGE OF DAYS SPECIES WERE RECORDED IN THE STUDY AREA: 0-20% = RARE, 21-50% = UNCOMMON, 51-100% = COMMON**
**CODES REFER TO THE RELATIVE ABUNDANCE IN THE STUDY AREA ONLY