A SPATIAL ANALYSIS AND LITERATURE REVIEW OF WILDLIFE AND WILDLIFE HABITAT IN THE DEH CHO TERRITORY, NWT

Project No. 1740038

May, 2003

A SPATIAL ANALYSIS AND LITERATURE REVIEW OF WILDLIFE AND WILDLIFE HABITAT IN THE DEH CHO TERRITORY, NWT

Submitted To:

DEH CHO LAND USE PLANNING COMMITTEE
FORT PROVIDENCE, NWT

Prepared by:

EBA ENGINEERING CONSULTANTS LTD.
YELLOWKNIFE, NORTHWEST TERRITORIES

Project No. 1740038

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EBA Engineering Consultants Ltd.

Creating and Delivering Better Solutions

May 1, 2003

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Heidi Wiebe
Deh Cho Land Use Planning Committee
General Delivery
Fort Providence, NWT
X0E 0L0

Attention: Ms. Heidi Wiebe

Re: A Spatial Analysis and Literature Review of Wildlife and Wildlife Habitat in the Deh Cho Territory, NWT

EBA Engineering Consultants Ltd. is pleased to submit six copies and a digital copy of the above final report. We trust that the information presented in this report addresses the requirements of the project.

Should you have further questions or comments regarding this report, please do not hesitate to contact our office.

Respectfully submitted,
EBA ENGINEERING CONSULTANTS LTD.

Steve Moore
Wildlife Biologist / Environmental Scientist

Attachments

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1.0 INTRODUCTION

The Deh Cho Land Use Planning Committee (Committee) is responsible for the preparation of a land use plan for the Deh Cho territory within the Northwest Territories (NWT). The Committee is currently in the information collection and analysis phase of plan preparation that involves the collection and analysis of biophysical, cultural and socio-economic information for the Deh Cho territory. To assist with this phase, the Committee retained the services of EBA Engineering Consultants Ltd. to collect and summarize information pertaining to wildlife and wildlife habitat in the Deh Cho territory.

In December 2002 the Committee initiated a project to assess ecological components in the Deh Cho territory. The objective was to map the distribution of sensitive wildlife species and their associated habitat; and in addition, map important International Biological Programme Ecological Sites (IBP), key migratory bird sites and unique landscape features that possess rare flora and fauna features (*i.e.* karst topography) within the Deh Cho.

The project goal was to document the current knowledge of wildlife and their associated habitat, and to spatially represent information (maps) to determine areas of biological importance for protection and as a management tool to support ongoing and future planning, assessment and effective environmental management in the Deh Cho. This was accomplished through literature searches and interviews with researchers whom have worked in the region. Specific project objectives included the following:

- Collect, review and summarize available documentation, data and research in progress (including, as available, wildlife surveys, vegetation inventories and habitat capability analysis);
- Consult with officials with responsibility for and/or involvement in, wildlife management and research in the Deh Cho territory;
- Prepare a final report with supporting maps, which address the following for terrestrial wildlife, birds, fish and related habitat;
- Generate a species list present for the Deh Cho territory including populations, their distribution and historical changes; and,

- Identify species and important habitat for species listed as extirpated, endangered or threatened on the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) list.

  In addition to the mapping component, the Committee requested information pertaining to environmental initiatives occurring within the Deh Cho.

2.0 STUDY AREA

2.1 Introduction

The Deh Cho territory covers an area of approximately 208,830 km^2 (Figure 1). For this project, a larger study area was used which included the Deh Cho territory proper, plus a buffer zone extending beyond its geopolitical boundaries. The larger buffer zone was included to intentionally capture areas of importance or influence that may lie outside of the Deh Cho territory boundaries. The study area covers approximately 378,990 km^2 (Figure 1).

The Deh Cho territory covers a large and diverse area and encompasses three different ecozones: *Taiga Plains*, *Taiga Cordillera* and *Boreal Cordillera.* These ecozones are further subdivided into 18 Ecoregions (Figure 2). An ecozone represents a large generalized unit at the top of the ecological hierarchy as defined by the Canada Committee on Ecological Land Classification. An ecoregion is part of an ecozone characterized by distinctive regional ecological factors, including climate, physiography, vegetation, soil, water, fauna and land use (Ecological Stratification Working Group, 1995).

The *Taiga Plains Ecozone* is located mainly in the southwesterly corner of the NWT, northeastern British Columbia and northern Alberta, and is dominated by Canada's largest river, the Mackenzie and its tributaries. It is bordered on the west by cordilleran mountain ranges oriented north-south, to the east by two large lakes – Great Slave Lake and Great Bear Lake, to the north by the extensive Mackenzie Delta, and to the south by the closed forests of the Boreal Plains Ecozone. The *Taiga Cordillera Ecozone* is located along the northernmost extent of the Rocky Mountain system and covers most of the northern half of the Yukon and southwest corner of the Northwest Territories. In this ecozone are found Canada's largest waterfalls, deepest canyons and wildest rivers. The *Boreal Cordillera Ecozone* is located in the midsection of the cordilleran system. It covers sections of northern British Columbia, the southern Yukon and includes a small area in the NWT.

Figure 1: **Deh Cho Spatial Analysis Study Area**

Legend

- Provincial and Territorial Borders
- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- All Weather Roads

N

Scale 1:8,000,000

300 0 300 Kilometers

Prepared by: EBA Engineering Consultants Ltd.
Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic,
122 W Central Meridian,
60 N Reference Latitude,
60 N Standard Parallel 1
65 N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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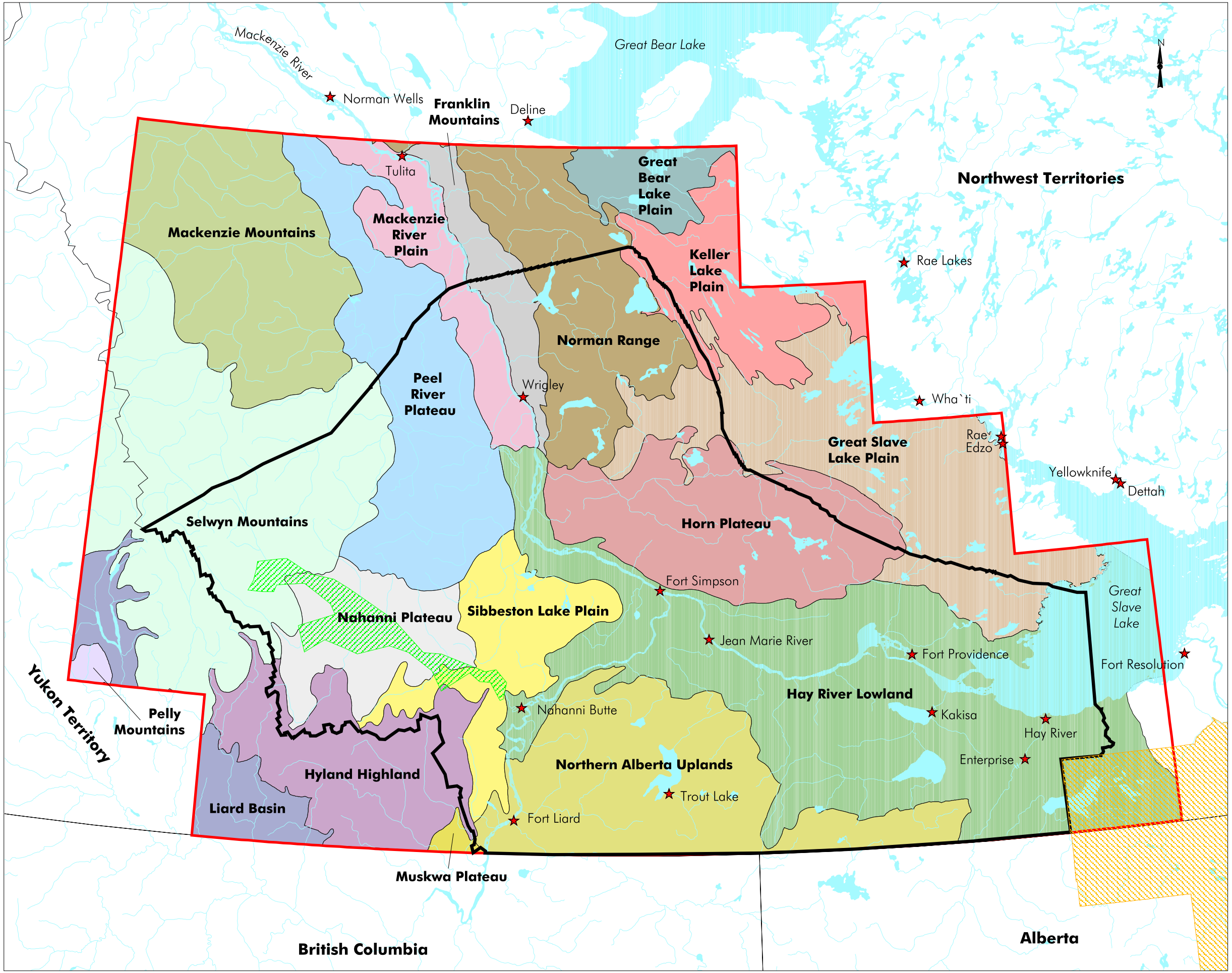
Figure 2:

Ecoregions within the Deh Cho Study Area

Scale 1:3,000,000

50 0 50 100 Kilometers



Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park

- Franklin Mountains
- Great Bear Lake Plain
- Great Slave Lake Plain
- Hay River Lowland
- Horn Plateau
- Hyland Highland
- Keller Lake Plain
- Liard Basin
- Mackenzie Mountains
- Mackenzie River Plain
- Muskwa Plateau
- Nahanni Plateau
- Norman Range
- Northern Alberta Uplands
- Peel River Plateau
- Pelly Mountains
- Selwyn Mountains
- Sibbeston Lake Plain

Prepared by: EBA Engineering Consultants Ltd.
Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic, 122° W Central Meridian, 60° N Reference Latitude, 60° N Standard Parallel 1, 65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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2.2 Climate

These ecozones cover a large geographic area containing diverse climate patterns. Consequently, the climate within these three ecozones varies from subhumid to semiarid. The region is marked by long, cold winters and short, warm summers and modified by vertical zonation and aspect in the mountainous regions.

Mean annual temperatures for the three ecozones range from 1°C to 5.5°C. The coldest mean annual temperatures occur in the Yukon Plateau region. Mean annual temperatures range from -10°C in the north to -4.5°C in the south. Mean summer temperatures range from 6.5°C to 14°C and are modified by vertical zonation and aspect. Mean winter temperatures range from -26°C in the north to -23°C in the south. Winters are long and cold with short daylight hours. Weather patterns from the Arctic and Alaskan coasts have a marked influence on these ecozones.

2.3 Vegetation

The vegetation communities are as diverse as the region's climate. Vegetation of the *Taiga Cordillera Ecozone* ranges from arctic tundra (dwarf or low shrubs, mosses, lichens and cottongrass) in the north, to alpine tundra (dwarf shrubs, lichens, saxifrages and mountain avens) in higher elevations and taiga or open woodland in the south (white spruce and white birch), mixed with medium to low shrubs (dwarf birches and willows), mosses and lichens. The vegetation of the *Boreal Cordillera Ecozone* is characterized by boreal forest species, ranging from closed to open canopies over much of the plateaus and valleys. And finally, vegetation of the *Taiga Plains Ecozone* is characteristic of open, generally slow-growing, conifer-dominated forests of predominantly black spruce. The shrub component is often well developed and includes dwarf birch, Labrador tea and willow. Bearberry, mosses and sedges are dominant understory species.

3.0 METHODS

3.1 Introduction

The primary objectives for this project included determining what wildlife species were present within the Deh Cho territory, identifying their associated habitats, researching species population status, selecting Valued Ecosystem Components (VECs) and ascertaining areas of high conservation values.

Determination of wildlife species present was based mainly on published literature. Species lists were generated for amphibians, fish, birds and mammals and based on range maps found in taxonomic guides, government reports, and on-going research in the region. The list was based on animals that have been documented as occurring within the Deh Cho territory. In addition, any animal species documented as occurring within the larger study area was also included as a species hypothetically occurring within the Deh Cho. Species hypothetically occurring in an area include animals whose distributions cover, or are adjacent to, the Deh Cho territory but have not yet been documented as occurring inside its boundaries. Using this approach a species list was generated for animals known to occur, or hypothetically occur, within the Deh Cho territory.

Obtaining species' associated habitat and their respective population status is based on empirical knowledge, available literature and interviews with biologists.

Selection of VECs was based on species, or species groups, that have been previously identified as being important in other northern studies. These include species that stakeholders, researchers and government regulators consider important and possess high inherent conservation values.

Ascertaining areas of high conservation value involved using ArcView®, a geographic information system (GIS), to map species distribution and their habitat requirements. The project goal was to spatially represent information for determining important areas for wildlife. This was achieved by:

- Selecting appropriate environmental attributes that contribute to the overall delineation of sensitive areas;

- Devising an ordinal approach to ranking selected environmental attributes; and,

- Spatially representing the relative importance of various ecological attributes within the Deh Cho territory based on their respective ranking.

A parametric approach was applied in the GIS analysis for determining areas of high conservation value where individual landscape parameters or attributes (wildlife species and wildlife habitat) could be separately assigned ordinal values, ranked and mapped (Westman, 1985). Key assumptions are explicitly defined, making the ranking of wildlife species and wildlife habitat a transparent process. The methodological approach is analogous to the wildlife habitat assessment developed in British Columbia (MELP, 1999), but adapted and simplified for use in this project. The approach had to be modified to accommodate the available data source. This was a desktop study utilizing available map data in an area of the NWT where species data are limited. The GIS analysis is not an assessment, but a spatial representation of areas of high conservation value in the Deh Cho territory based on existing literature.

3.2 Determination of Areas of High Conservation Value

Determination of areas of high conservation value comprised of four main components:

- Determination of VECs in analysis;
-
- Writing Species Accounts;
-
- Ranking Landscape Units; and,
-
- Mapping

3.2.1 Determination of Valued Ecosystems Components

Wildlife species, IBP sites, key migratory bird sites and unique landscape features were selected to represent the range of important biological conservation values existing within the Deh Cho territory. However, Beanlands and Duinker (1983) stated that it is impossible for an analysis to address all potential environmental components. Therefore, an essential step in selection and analysis of high

conservation values is the identification of important Valued Ecosystems Components (VECs) at the beginning of a project. This process requires selecting indicator species, or indicator habitat, to serve as VECs. VECs can be defined as "the environmental attributes or components identified as a result of a social scoping exercise as having legal, scientific, cultural, economic or aesthetic value" (Sadar, 1994).

VECs selected for this project included wildlife species and wildlife habitat that possess inherently high conservation values, and was dependent upon the availability of reports and scientific literature for each attribute. Wildlife species selection was based on species, or species groups, that have been previously identified as being important in other northern studies. These are species that stakeholders and researchers consider important and possess high inherent conservation values. Data on species distribution were determined from available reports and the scientific literature. VECs were selected using the following six categories:

- Species listed as extirpated, endangered or threatened by COSEWIC;
- Species considered sensitive to exogenous disturbance;
- Species considered culturally important (*i.e.* important food source such as moose);
- Species that are dependent upon major vegetation community types in the study area;
- Areas identified as being biologically important such as IBP sites and Key Migratory Bird sites; and,
- Landscape uniqueness such as karst topography.

Not all species/habitats selected as potential VECs encompassed all of the above criteria; some were selected on the basis of one category only. In addition, a species, or species groups, considered by COSEWIC (2002) as being extirpated, endangered or threatened were automatically considered as potential VECs. Appendix A contains detailed information pertaining to COSEWIC's designations. Important areas of wildlife habitat were also selected based on information

contained in available reports and scientific literature. VECs selected for this project are listed in Table 1.

Table 1: Select Valued Ecosystem Components

VEC Grouping	VECs
Ungulates	Dall's sheep Moose Wood Bison Woodland Caribou Mountain Goat
Carnivores	Bear (Grizzly and Black)
Birds	Waterfowl (species treated collectively) Trumpeter Swan Whooping Crane Peregrine Falcon
Fish	Fish (species treated collectively)
International Biological Programme Ecological Sites	14 Sites
Key Migratory Bird Sites	1 Site
Karst Topography	51 Sites

Other species were considered potential candidates for VECs but were removed for a number of reasons such as lack of, limited, or not relevant map data for a given species, or a species possessing plasticity in their ecology. For example, foxes display a high level of plasticity in their behaviour and exhibit a high level of tolerance towards disturbance. Consequently, impacts on these adaptable species are of lesser concern and were not rated within this project. Other species excluded from the VEC grouping included carnivores (wolverines, wolves and foxes), furbearers (lynx, beaver, mink, marten, muskrat and weasel), raptors (Golden Eagle), waterfowl (Harlequin duck) and passerines. Excluded species, *i.e.* non-VECs, will be treated under a separate section entitled Non-VECs (Section 4.3).

Non-VECs include those species where species accounts were not provided. As already presented, Beanlands and Duinker (1983) stated that it is impossible for a detailed analysis to address all potential environmental components (or species). Therefore, those species not included under VECs are treated under Non-VECs.

3.2.2 Writing Species Accounts

Although this analysis is not a wildlife habitat assessment exercise, it is certainly analogous in many areas of its methodological approach. Optimally, wildlife habitat assessment models are based on extensive knowledge about wildlife-habitat relationships in the ecological zone of interest. High-quality models result from a long-term approach that includes thorough testing under a variety of conditions and locations. In reality, this level of detail and opportunity for verification is rarely available. Species specialists often serve as surrogates for multiple years of population and habitat data.

For this project, information was limited to existing reports, literature and digital maps. A northern wildlife biologist was employed who has extensive northern experience working with the species of concern and their respective habitat requirements. A key assumption in using species experts lies in their empirical wildlife knowledge, where they have an image or mental model of the species' habitat requirements, obtained through years of research and/or practical experience.

Species accounts for selected VECs were developed to provided background information on wildlife-habitat relationships and list the assumptions used to rank landscape units. The overall ranking assesses and rates each VEC's life requisite and specified assumptions and applies a ranking to habitat polygons. A life requisite is an attribute that is necessary for a species reproduction and survival. For example, life requisites include feeding, hibernation, migration, reproduction and staging.

Common names of species have been used where possible, for those that do not have common names Latin nomenclature was used. By convention, the common names of fish and bird species typically begin with capital letters, whereas plants and mammals often begin with lower case letters. In some cases, the genus name is

used as a common name with the first letter capitalized. These conventions were followed in this report.

3.2.3 Ranking Landscape Units

A table for ranking was compiled for each landscape unit (species, seasons, landscape features, IBP sites and key migratory bird sites). Rankings related:

- Species habitat requirements by seasonal usage, as described in the species accounts;
- IBP sites and key migratory bird sites to geographical areas that provide life requisites for a given species during a particular season; and
- Landscape features that are unique and fulfill a life requisite for wildlife species, although that may vary among species.

A sample of the ranking table used for assessing and applying ranking values to wildlife and environmental attributes is provided below (Table 2). The entire ranking table is included in Appendix B.

A ranking is a relative comparison (ordinal value) of how a given landscape unit compares to neighbouring units based on wildlife species life requisites. Rankings related the habitat requirements described in the species account to the relevant ecosystem attributes. Rankings were also provided for landscape features based on their perceived level of uniqueness, *i.e.* karst topography. The assigned rankings reflect the level of conservation significance of a given landscape unit based on wildlife species' needs within the Deh Cho territory. However, these rankings are limited by the extent of knowledge about a species and ecosystems within an area, the accuracy of the assumptions made about a species' use of habitat and digital data available. They are solely a reflection of the current state-of-knowledge. Population-related factors such as annual variability in densities were not considered in the rankings. However, the completed mapping exercise can provide supportive information for evaluating the effects of exogenous disturbances in a given area.

Table 2: Sample[1] of Ranking Table for Valued Ecosystem Components

Species	Habitat Description	Seasonal Description	Rank	Comments
Black Bear	Denning Areas	Fall or Winter	4	All denning areas receive a ranking of 4 because it is a critical life requisite.
Dall's Sheep	Range	Fall or Winter	1	All "Range" receives a value of 1 as it recognizes that the species occur throughout the region but does not necessarily use this particular habitat polygon.
Dall's Sheep	Range	Spring or Summer	1	All "Range" receives a value of 1 as it recognizes that the species occur throughout the region but does not necessarily use this particular habitat polygon.
Dall's Sheep	Calving Area	Spring or Summer	4	All calving, nesting and staging areas receive a ranking of 4 because it is a critical life requisite.
Fish	Spawning	Spring or Fall	4	All spawning areas receive a ranking of 4 because it fulfills a critical life requisite.
Fish	Migratory Route	Spring or Fall	3	All migratory routes receive a ranking of 3, as they fulfill an important life requisite.
Grizzly Bear	Denning Areas	Fall or Winter	4	All denning areas receive a ranking of 4 because it is a critical life requisite.
Rankings for IBP Sites and Key Migratory Bird Sites				
Site			**Rank**	**Comments**
Horn Plateau	N/A	N/A	2	Ranking increased from a 1 for range to a 2 because of its good habitat for fishers and woodland caribou.
Mills Lake	N/A	N/A	4	Important waterfowl area.

1 The entire ranking table has been included in Appendix B.

3.2.3.1 How Polygons Were Ranked

How an animal uses habitat (landscape units) is closely associated with the season or time of year and the specific activity or life requisite that that habitat provides. A habitat polygon is therefore ranked for a specified season and life requisite. Seasons were considered at different levels of detail depending on the species, species groups and their distribution and the degree of knowledge available. Details are provided under species accounts.

Ranking Schemes

The ranking scheme reflects the knowledge of a given species' habitat use (or use of an area *e.g.* calving ground) and the scale at which that knowledge is applied. For example, Dall's sheep use a particular area and habitat type for calving each year. A four-class scheme was used for ranking species, IBP sites, key migratory bird sites and unique landscape features for which adequate data was provided. Landscape units were ranked between 1 to 4, 4 representing very high, the highest ranking for contributing the most towards conservation values. The ranking scheme was divided as follows:

1. Low - indicates that this landscape unit falls within the range of a given species;
2. Medium - indicates that this landscape unit provides for all habitat functions;
3. High - indicates that this landscape unit serves a more critical role in the life requisite for a given species, *i.e.* migrational corridor; and
4. Very High - indicates that this landscape unit provides for the most critical attributes of a species life requisite, *e.g.* calving, nesting, staging and denning areas.

Areas of high conservation value reflect how important a particular landscape unit is for a species' life requisites. Thus, conservation value rankings reflect a given landscape unit's level for contributing towards the overall life requisites for a given species. They do not represent actual numbers of animals but reflect the potential or *expected use* of an area by the species of concern. Rankings indicate the value of a landscape unit to provide life requisites for a particular species.

3.2.3.2 Ranking Assumptions

Project personnel recognize that problems exists with all "unitized" mapping procedures which breakdown and dissect naturally occurring landscape units (habitat polygons) or other coherent landscape areas into small grid units for ranking and mapping. The importance of juxtaposed habitat and the ecological interactions between subunits is ignored. The holistic nature of ecosystems is easily lost sight of when interacting landscape segments or ecosystems are subdivided.

3.2.4 Ranking Table

The ranking table presents species, IBP sites, key migratory bird sites, unique landscape features, habitat descriptions and seasonal descriptions; and ranks the dependence of a given species on a given landscape unit according to its habitat and seasonal needs. The ranking table for this project is provided in Appendix B.

3.2.5 Mapping

GIS analysis allows landscape characteristics to be used alone, or in combination, to rank conservation values for various environmental attributes. Selected environmental features were separately ranked and plotted, and relevant map layers overlaid to determine areas that contained various combinations of ranked landscape attributes (*i.e.* the higher the ranking the more valuable the area was for conservation purposes).

The mapping portion of this project comprised of a number of steps and employed ArcView® (Geographically Information Systems software). Acquiring suitable digital base-map data of the selected VECs was required. Spatial data containing species range maps, seasonal habitat use, IBP site locations, key migratory bird sites and unique landscape features provided the basis for the project and was obtained from a number of sources and included: government reports, personnel communications, species at risk in Canada (Environment Canada, 2002), *World Wildlife Federation* (*WWF) Northwest Territories Digital Atlas,* and the *South Nahanni River Watershed Study: Resource Mapping Phase I and Phase II* (Cizek, 2002).

Digital data provided to the project was verified for accuracy. For example, range maps and important habitat areas were examined and confirmed for accuracy. Digital data not originally available (*e.g.* denning areas) were researched and plotted on GIS. For each species' attribute (*e.g.* range, migratory corridors, winter range, summer range, etc.) GIS map themes were generated.

For the composite map, polygons were ranked between 1 to 4 for each VEC (see Figure 19 Areas of High Conservation Value). Data descriptions and their respective rankings can be found in Appendix B. All polygons for each VEC were laid down over each other generating a composite map consisting of many themes.

Polygons ranked with a value of 1 were coloured a light-yellow. These areas represent a "Low" ranking value and indicate that this landscape unit falls within the range of a given species. Range recognizes that a given species occurs throughout the region but does not necessarily occupy this particular habitat polygon.

Polygons ranked with a value of 2 were coloured yellow and represent a "Medium" ranking value. This level of ranking indicates that this landscape unit provides for all habitat functions or all habitat features. These areas possess all the necessary habitat features for a given species, and is therefore ranked higher than a 1, but a given species may not be presently using the area.

Polygons ranked with a value of 3 were coloured orange and represent a "High" ranking value. This level of ranking indicates that this landscape unit serves a more critical role in the life requisite for a given species, *i.e.* migrational corridor.

Polygons ranked with a value of 4 were coloured red and represent the highest ranking, "Very High." This level of ranking indicates that this landscape unit provides for the most critical attributes of a species life requisite, *e.g.* calving, nesting, staging, spawning and denning areas. Those areas on the composite map containing red polygons represent areas of highest conservation value and reflect how important a particular landscape unit is for fulfilling a species' life requisites.

4.0 RESULTS

4.1 Introduction

A species list was generated for wildlife and was based on government reports and range maps in field guides. A comprehensive list was also developed for wildlife species likely to occur in the area and additional species that could hypothetically occur in the area. A total of 308 different species are listed: 3 amphibians (Table 3), 36 fish (Table 4), 213 birds (Table 5) and 56 mammals (Table 6).

Species accounts describe wildlife-habitat relationships and list the assumptions used to rank landscape units. The overall ranking considers the combined values of life requisites such as food, security and thermal cover, for the species of concern and is based on published data.

Areas of high conservation value must be presented in an ecological framework, where animals are linked to habitats. For example, the data provided for this desktop study required that habitat extrapolation be done at a large map scale level and that "habitat" be applied in a general sense, *i.e.* how an individual animal uses an area such as winter range habitat, calving area (calving grounds), spawning grounds, etc. This required mapping to be done at a macro-level scale involving a very broad and general approach. Data were not available for a micro-level assessment. In addition to the large-scale species-habitat extrapolation, data were limited to available databases and reports, and no new data were generated. Within the Deh Cho territory there are three ecozones and 20 ecoregions (Figure 2) (Table 7) (Ecological Stratification Working Group, 1995). Consequently, there is considerable diversity and complexity in habitats, species and their respective habitat needs throughout the Deh Cho territory.

The following section presents justification for ranking selected VECs occurring within the Deh Cho territory. Four different categories of VECs were assessed and include the following:

- *Species Accounts*, which include ungulates, carnivores, birds and fish;
- *IBP Sites*, of which there are 14 sites;

- *Key Migratory Bird Site*, of which there is one site; and
- *Karst Topography Sites*, of which there are 51 sites;

Detailed information is provided for each VEC to support the individual rankings.

Species Accounts provide background information on species status, distribution within the NWT, general ecology, key habitat requirements (to tie the species to specific habitat requirements), population status and specific ranking assumptions are clearly stated.

Background information is provided for the IBP Sites and one Key Migratory Bird Site, and forms the basis for the ranking values. The background information includes the size of a given site, the ecosystem for which it occurs, overall habitat characteristics (where known information was available), animal usage of the site (if applicable), comments on site uniqueness (if relevant), and specific ranking assumptions are clearly stated.

Very little, if any, information exists for sites containing karst topographic features. This VEC was ranked based on general ecological factors known about karst features and their landscape uniqueness. For ranking karst topography, general background information is provided on how animals use karst features and the plant communities associated with them. Specific ranking assumptions are clearly stated.

Table 3: Amphibian Species Occurring or Hypothetically Occurring within the Study Area

No.	Common Name	Latin Name
1	Wood Frog[1]	*Rana sylvatica*
2	Boreal Chorus Frog[1]	*Pseudacris triseriata maculata*
3	Western Toad[1]	*Bufo boreas*
4	Toad[1]	*Bufo* sp. *

* *Bufo* sp. - Specimen not identified to species level; however, presumed to be the boreal toad, *Bufo boreas boreas* (Parks Canada's Nahanni Hational Park Reserve Resource Description Analysis states, toads observed in eastern park area (Pg 8 - 60).

[1] Canadian Nature Federation, 2002; Fourier, pers. comm.; Fourier, 1997; Parks Canada, 1984

Table 4: Fish Species Occurring or Hypothetically Occurring within the Study Area[1]

No.	Common Name	Scientific Name
1	Arctic Lamprey	*Lampetra japonica*
2	Chum Salmon	*Oncorhynchus keta*
3	Bull Trout	*Salvelinus confluentus*
4	Dolly Varden	*Salvelinus malma*
5	Lake Trout	*Salvelinus namaycush*
6	Cisco, Lake Herring	*Coregonus artedii*
7	Arctic Cisco	*Coregonus autumnalis*
8	Least Cisco	*Coregonus sardinella*
9	Shortjaw Cisco	*Coregonus zenithicus*
10	Lake Whitefish	*Coregonus clupeaformis*
11	Broad Whitefish	*Coregonus nasus*
12	Round Whitefish	*Prosopium cylindraceum*
13	Inconnu	*Stenodus leucichthys*
14	Arctic Grayling	*Thymallus arcticus*
15	Goldeye	*Hiodon alosoides*
16	Northern Pike	*Esox lucius*
17	Northern Redbelly Dace	*Chrosomus eos*
18	Finescale Dace	*Chrosomus neogaeus*
19	Lake Chub	*Couesius plumbeus*
20	Emerald Shiner	*Notropis atherinoides*
21	Spottail Shiner	*Notropis hudsonius*
22	Fathead Minnow	*Primephales promelas*
23	Flathead chub	*Platygobio gracilis*
24	Longhose Dace	*Rhinichthys cataractae*
25	Pearl Dace	*Margariscus margarita*
26	Longnose Sucker	*Catostomus catostomus*
27	White Sucker	*Catostomus commersoni*
28	Burbot	*Lota lota*
29	Brook Stickleback	*Culaea inconstans*
30	Ninespine Stickleback	*Pungitius pungitius*
31	Trout-Perch	*Percopsis omiscomaycus*
32	Yellow Perch	*Perca flavescens*
33	Walleye	*Stizostedion vitreum*
34	Slimy Sculpin	*Cottus cognatus*
35	Spoonhead Sculpin	*Cottus ricei*
36	Deepwater Sculpin	*Myoxocephalus quadricornis*

[1] Scott and Crossman, 1979; RWED, 2001d

Table 5: Bird Species Occurring or Hypothetically Occurring within the Study Area[1]

No.	Common Name	Scientific Name
1	Common Loon	*Gavia immer*
2	Pacific Loon	*Gavia pacifica*
3	Red-throated Loon	*Gavia stellata*
4	Red-necked Grebe	*Podiceps grisegena*
5	Horned Grebe	*Podiceps auritus*
6	Pied-billed Grebe	*Podilymbus podiceps*
7	Tundra Swan	*Cygnus Columbianus*
8	Trumpeter Swan	*Cygnus buccinator*
9	Greater White-fronted Goose	*Anser albifrons*
10	Canada Goose	*Branta canadensis*
11	Snow Goose	*Anser caerulescens*
12	Ross's Goose	*Anser rossii*
13	Mallard	*Anas platyrhynchos*
14	Gadwall	*Anas strepera*
15	Northern Pintail	*Anas acuta*
16	Green-winged Teal	*Anas crecca*
17	Blue-winged Teal	*Anas discors*
18	American Wigeon	*Anas americana*
19	Northern Shoveler	*Anas clypeata*
20	Redhead	*Aythya americana*
21	Ring-necked Duck	*Aythya collaris*
22	Canvasback	*Aythya valisineria*
23	Greater Scaup	*Aythya marila*
24	Lesser Scaup	*Aythya affinis*
25	Common Goldeneye	*Bucephala clangula*
26	Barrow's Goldeneye	*Bucephala islandica*
27	Bufflehead	*Bucephala albeola*
28	Long-tailed Duck	*Clangula hyemalis*
29	Harlequin Duck	*Histrionicus histrionicus*
30	White-winged Scoter	*Melanitta fusca*
31	Surf Scoter	*Melanitta perspicillata*
32	Ruddy Duck	*Oxyura jamaicensis*
33	Common Merganser	*Mergus merganser*
34	Red-breasted Merganser	*Mergus serrator*
35	Northern Goshawk	*Accipiter gentilis*
36	Sharp-shinned Hawk	*Accipiter striatus*
37	Red-tailed Hawk	*Buteo jamaicensis*
38	Broad-winged Hawk	*Buteo platypterus*
39	Swainson's Hawk	*Buteo swainsoni*
40	Rough-legged Hawk	*Buteo lagopus*
41	Golden Eagle	*Aquila chrysaetos*
42	Bald Eagle	*Haliaeetus leucocephalus*
43	Northern Harrier	*Circus cyaneus*
44	Osprey	*Pandion haliaetus*

Table 5: Continued

No.	Common Name	Scientific Name
45	Gyrfalcon	*Falco rusticolus*
46	Peregrine Falcon	*Falco peregrinus*
47	Merlin	*Falco columbarius*
48	American Kestrel	*Falco sparverius*
49	Blue Grouse	*Dendragapus obscurus*
50	Spruce Grouse	*Dendragapus canadensis*
51	Ruffed Grouse	*Bonasa umbellus*
52	Willow Ptarmigan	*Lagopus lagopus*
53	Rock Ptarmigan	*Lagopus mutus*
54	White-tailed Ptarmigan	*Lagopus leucurus*
55	Sharp-tailed Grouse	*Tympanuchus phasianellus*
56	Whooping Crane	*Grus americana*
57	Sandhill Crane	*Grus canadensis*
58	Sora	*Porzana carolina*
59	American Coot	*Fulica americana*
60	American Bittern	*Botaurus lentiginosus*
61	Semipalmated Plover	*Charadrius semipalmatus*
62	Killdeer	*Charadrius vociferus*
63	Lesser Golden-Plover	*Pluvialis dominica*
64	Black-bellied Plover	*Pluvialis squatarola*
65	Ruddy Turnstone	*Aernaria interpres*
66	Common Snipe	*Gallinago gallinago*
67	Whimbrel	*Numenius phaeopus*
68	Solitary Sandpiper	*Tringa solitaria*
69	Wandering Tattler	*Heteroscelus incanus*
70	Greater Yellowlegs	*Tringa melanoleuca*
71	Lesser Yellowlegs	*Tringa flavipes*
72	Pectoral Sandpiper	*Calidris malanotos*
73	White-rumped Sandpiper	*Calidris fuscicollis*
74	Baird's Sandpiper	*Calidris bairdii*
75	Least Sandpiper	*Calidris minutilla*
76	Dunlin	*Calidris alpina*
77	Long-billed Dowitcher	*Limnodromus scolopaceus*
78	Spotted Sandpiper	*Actitis macularia*
79	Stilt Sandpiper	*Calidris himantopus*
80	Upland Sandpiper	*Bartramia longicauda*
81	Semipalmated Sandpiper	*Calidris pusilla*
82	Western Sandpiper	*Calidris mauri*
83	Buff-breasted Sandpiper	*Tryngites subruficollis*
84	Hudsonian Godwit	*Limosa haemastica*
85	Sanderling	*Calidris alba*
86	Wilson's Phalarope	*Phalaropus tricolor*
87	Red-necked Phalarope	*Phalaropus lobatus*

Table 5: Continued

No.	Common Name	Scientific Name
88	Herring Gull	*Larus argentatus*
89	California Gull	*Larus californicus*
90	Mew Gull	*Larus canus*
91	Bonaparte's Gull	*Larus philadelphia*
92	Arctic Tern	*Sterna paradisaea*
93	Black Tern	*Chlidonias niger*
94	Mourning Dove	*Zenaida macroura*
95	Great Horned Owl	*Bubo virginianus*
96	Nothern Hawk-Owl	*Surnia ulula*
97	Barred Owl	*Strix varia*
98	Great Gray Owl	*Strix nebulosa*
99	Short-eared Owl	*Asio flammeus*
100	Boreal Owl	*Aegolius funereus*
101	Common Nighthawk	*Chordeiles minor*
102	Ruby-throated Hummingbird	*Archilochus colibris*
103	Belted Kingfisher	*Ceryle alcyon*
104	Northern Flicker	*Colaptes auratus*
105	Pileated Woodpecker	*Dryocopus pileatus*
106	Yellow-bellied Sapsucker	*Sphyrapicus varius*
107	Hairy Woodpecker	*Picoides villosus*
108	Downy Woodpecker	*Picoides pubescens*
109	Black-backed Woodpecker	*Picoides arcticus*
110	Three-toed Woodpecker	*Picoides tridactylus*
111	Olive-sided Flycatcher	*Contopus cooperi*
112	Dusky Flycatcher	*Empidonax oberholseri*
113	Eastern Kingbird	*Tyrannus tyrannus*
114	Eastern Phoebe	*Sayornis phoebe*
115	Say's Phoebe	*Sayornis saya*
116	Yellow-bellied Flycatcher	*Empidonax flaviventris*
117	Least Flycatcher	*Empidonax minimus*
118	Hammond's Flycatcher	*Empidonax hammondii*
119	Western Wood-Pewee	*Contopus sordidulus*
120	Alder Flycatcher	*Empidonax alnorum*
121	Horned Lark	*Eremophila alpestris*
122	Violet-green Swallow	*Tachycineta thalassina*
123	Tree Swallow	*Tachycineta bicolor*
124	Bank Swallow	*Riparia riparia*
125	Barn Swallow	*Hirundo rustica*
126	Cliff Swallow	*Petrochelidon pyrrhonota*
127	Gray Jay	*Perisoreus canadensis*
128	Common Raven	*Corvus corax*
129	American Crow	*Corvus brachyrhynchos*

Table 5: Continued

No.	Common Name	Scientific Name
130	Clark's Nutcracker	Nucifraga columbiana
131	Black-capped Chickadee	Poecile atricapillus
132	Boreal Chickadee	Poecile hudsonicus
133	Red-breasted Nuthatch	*Sitta canadensis*
134	American Dipper	*Cinclus mexicanus*
135	Winter Wren	*Troglodytes troglodytes*
136	Marsh Wren	*Cistothorus palustris*
137	American Robin	*Turdus migratorius*
138	Varied Thrush	*Ixoreus naevius*
139	Hermit Thrush	*Catharus guttatus*
140	Swainson's Thrush	*Catharus ustulatus*
141	Gray-cheeked Thrush	*Catharus minimus*
142	Mountain Bluebird	*Sialia currucoides*
143	Townsend's Solitaire	*Myadestes townsendi*
144	Golden-crowned Kinglet	*Regulus satrapa*
145	Ruby-crowned Kinglet	*Regulus calendula*
146	Water Pipit (American Pipit)	*Anthus rubescens*
147	Bohemian Waxwing	*Bombbycilla garrulus*
148	Cedar Waxwing	*Bobycilla cedrorum*
149	Northern Strike	*Lanius excubitor*
150	European Starling	*Sturnus vulgaris*
151	Blue-headed Vireo (Solitary Vireo)	*Vireo soliatrios*
152	Red-eyed Vireo	*Vireo olivaceus*
153	Philadelphia Vireo	*Vireo philadelphicus*
154	Warbling Vireo	*Vireo gilvus*
155	Black-and-white Warbler	*Mniotilta varia*
156	Tennessee Warbler	*Vermivora peregrina*
157	Orange-crowned Warbler	*Vermivora celata*
158	Yellow Warbler	*Dendroica petechia*
159	Magnolia Warbler	*Dendroica magnolia*
160	Yellow-rumped Warbler	*Dendoica caerulescens*
161	Cape May Warbler	*Dendroica tigrina*
162	Townsend's Warbler	*Dendroica twonsendi*
163	Bay-breasted Warbler	*Dendroica castanea*
164	Black-throated Green Warbler	*Dendroica virens*
165	Blackpoll Warbler	*Dendroica striata*
166	Palm Warbler	*Dendroica palmarum*
167	Ovenbird	*Seiurus aurocapillus*
168	Northern Waterthrush	*Seiurus novemboracensis*
169	Connecticut Warbler	*Oporornis agilis*
170	Mourning Warbler	*Oporornis philadelphia*
171	MacGillivray's Warbler	*Oporornis tolmiei*
172	Common Yellowthroat	*Geothlypis trichas*

Table 5: Completed

No.	Common Name	Scientific Name
173	Wilson's Warbler	Wilsonia pusilla
174	Canada Warbler	Wilsonia canadensis
175	American Redstart	Setophaga ruticilla
176	Yellow-headed Blackbird	Xanthocephalus xanthocephalus
177	Red-winged Blackbird	*Angelaius phoeniceus*
178	Rusty Blackbird	*Euphagus carolinus*
179	Brewer's Blackbird	*Euphagus cyanocephalus*
180	Common Grackle	*Quiscalus quiscula*
181	Brown-headed Cowbird	*Molothrus ater*
182	Western Tanager	*Piranga Iudoviciana*
183	Rose-breasted Grosbeak	*Pheucticus Iudovicianus*
184	Evening Grosbeak	*Coccothraustes vespertinus*
185	Purple Finch	*Carpodacus purpureus*
186	Pine Grosbeak	*Pinicola enucleator*
187	Gray-crowned Rosy Finch	*Leucosticte tephrocotis*
188	Hoary Redpoll	*Carduelis hornemanni*
189	Common Redpoll	*Carduelis flammea*
190	Pine Siskin	*Carduelis pinus*
191	House Sparrow (English Sparrow)	*Passer domesticus*
192	Red Crossbill	*Loxia curvirostra*
193	White-winged Crossbill	*Loxia leucoptera*
194	Savannah Sparrow	*Passerculus sandwichensis*
195	Le Conte's Sparrow	*Ammodramus leconteii*
196	Vesper Sparrow	*Pooecetes gramineus*
197	Lark Sparrow	*Chondestes grammacus*
198	Dark-eyed Junco	*Junco hyemalis*
199	American Tree Sparrow	*Spizella arborea*
200	Chipping Sparrow	*Spizella passerina*
201	Clay-colored Sparrow	*Spizella pallida*
202	Harris's Sparrow	*Zonotrichia querula*
203	White-crowned Sparrow	*Zonotrichia leucophrys*
204	Golden-crowned Sparrow	*Zonotrichia atricapilla*
205	White-throated Sparrow	*Zonotrichia albicollis*
206	Fox Sparrow	*Passerculus iliaca*
207	Lincoln's Sparrow	*Melospiza lincolnii*
208	Swamp Sparrow	*Melospiza georgiana*
209	Song Sparrow	*Melospiza melodia*
210	Lapland Longspur	*Calcarius lapponnicus*
211	Smith's Longspur	*Calcarius pictus*
212	Snow Bunting	*Plectrophenax nivalis*
213	Rosy Finch	*Leucosticte arctoa*

[1] Dunn and Garrett, 1997; Godfrey, 1979; Machtans, 2000; Parks Canada, 1984; Scotter et al., 1985; Sibley, 2000

Table 6: Mammal Species Occurring or Hypothetically Occurring

No.	Common Name	Scientific Name
1	Masked Shrew	*Sorex cinereus*
2	Dusky Shrew	*Sorex monticolus*
3	Water Shrew	*Sorex palustris*
4	Artic Shrew	*Sorex arcticus*
5	Pygmy Shrew	*Microsorex hoyi*
6	Keen's Bat *	*Myotis Keenii*
7	Little Brown Bat	*Myotis lucifugus*
8	Hoary Bat	*Lasiurus cinereus*
9	Snowshoe Hare	*Lepus americanus*
10	Collared Pika	*Ochotona collaria*
11	Least Chipmunk	*Eutamias minimus*
12	Woodchuck	*Marmota monax*
13	Hoary Marmot	*Marmota caligata*
14	Arctic Ground Squirrel	*Spermophilus parryii*
15	Red Squirrel	*Tamiasciurus hudsonicus*
16	Northern Flying Squirrel	*Glaucomys sabrinus*
17	Beaver	*Castor canadensis*
18	Deer Mouse	*Peromyscus maniculatus*
19	Bushy-tailed Wood Rat	*Neotoma cinerea*
20	Northern Red-backed Vole	*Clethrionomys rutilus*
21	Southern Red-backed Vole	*Cleithrionomys gapperi*
22	Brown Lemming	*Lemmus sibiricus*
23	Northern Bog Lemming	*Synaptomys borealis*
24	Heather Vole	*Phenacomys intermedius*
25	Muskrat	*Ondatra zibethicus*
26	Meadow Vole	*Microtus pennsylvanicus*
27	Long-tailed Vole	*Microtus longicaudus*
28	Chestnut-cheeked Vole	*Microtus xanthrognathus*
29	Meadow Jumping Mouse	*Zapus hudsonius*
30	Tundra Vole	*Microtus oeconomus*
31	Insular Vole	*Mircotus abbreviatus*
32	Common Porcupine	*Erethizon dorsatum*
33	Coyote	*Canis latrans*
34	Wolf	*Canis lupus*
35	Red Fox	*Vulpes vulpes*
36	Black Bear	*Ursus americanus*
37	Grizzly Bear	*Ursus arctos*
38	Marten	*Martes americana*
39	Fisher	*Martes pennanti*
40	Ermine	*Mustela erminea*
41	Least Weasel	*Mustela nivalis*
42	Mink	*Mustela vison*
43	Wolverine	*Gulo gulo*
44	Striped Skunk	*Mephitis mephitis*

Table 6: Continued

No.	Common Name	Scientific Name
45	River Otter	*Lutra canadensis*
46	Cougar	*Felis concolor*
47	Lynx	*Lynx canadensis*
48	Woodland Caribou	*Rangifer tarandus caribou*
49	Barrenground Caribou	*Rangifer tarandus groenlandicus*
50	Mule Deer	*Odocoileus hemionus*
51	White-tailed Deer	*Odocoileus virginianus*
52	Moose	*Alces alces*
53	Elk	*Cervus elaphus*
54	Wood Bison	*Bos bison athabascae*
55	Mountain Goat	*Oreamnos americanus*
56	Dall's Sheep	*Ovis dalli*

* Keen's Bat - RWED does not list this species as occurring within the NWT; however, Parks Canada's Nahanni National Park Reserve Resource Description Analysis states, one specimen from Nahanni Hotsprings was collected, representing a new park record and a northern range extension (Pg 8-8).

[1] Banfield, 1974; Chapman and Feldhamer, 1982; Decker, pers. comm.; Hagen, pers. com.; Parks Canada, 1984

Table 7: Ecozones and Ecoregions within the Deh Cho territory

Ecozone	Ecoregion
Taiga Cordillera	Mackenzie Mountains Selwyn Mountains
Taiga Plains	Franklin Mountains Great Bear Lake Plain Great Slave Lake Plain Hay River Lowland Horn Plateau Keller Lake Plain Mackenzie River Plain Muskwa Plateau Nahanni Plateau Norman Range Northern Alberta Uplands Peel River Plateau Sibbeston Lake Plain
Boreal Cordillera	Hyland Highland Liard Basin Pelly Mountains

4.2 VECs - Species Accounts

4.2.1 Dall's Sheep

Background

Name: *Ovis dalli dalli*
Status: Nationally Dall's sheep are not listed by COSEWIC; however, in the NWT the Department of Resources, Wildlife and Economic Development (RWED) lists them as "Secure" (RWED, 2001a).

Distribution

Range in the Northwest Territories

Dall's sheep occur in the Mackenzie Mountains west of the Mackenzie River and in the Richardson Mountains (Cochrane, 1976; Comin et al., 1981; Case, 1989; Decker, pers. comm.; Ferguson et al., 1985; Hoefs, 1978; Hoffmann, 1974). Sheep distribution is limited to mountain ranges (Figure 3).

Territorial Context

The number of Dall's sheep in the NWT is unknown. However, based on limited aerial surveys their numbers are estimated to range from 15,500 to 27,500 (RWED, 2001a). Dall's sheep do not exhibit large migratory movements and confine almost all their movements to a particular mountain block. For example, a subpopulation of sheep may occupy a particular mountain range and use the same winter and summer ranges each year and from generation to generation. Dall's sheep occur within the study area at varying densities and unknown population levels. Figure 3 shows the distribution of Dall's sheep in the NWT based on five wildlife surveys conduct between 1978 to 1985 and the Northern Land Use Information Series (1972). Ferguson (Ferguson et al., 1985) and Case (1989) reported individual sheep populations on the following ranges: Liard, Kotaneelee, Nahanni, Tlogotsho Plateau and the Prairie Creek Area. Aerial surveys conducted by Simmons (1982) provided sheep distribution in the Mackenzie Mountains. The level of detail available on the location of individual subpopulations is provided by polygon detail or polygon coarseness. More recent survey results from Ferguson et al. (1985) and Case (1989) provided detailed information allowing mapping of individual mountain blocks containing known subpopulations of sheep. Simmons (1982) however, covered a much larger area and provided coarser distributional information, which is reflected in the extent of polygon detail in Figure 3.

General Ecology and Key Habitat Requirements

Sheep are grazers and require food supplies juxtaposed with security cover. Grasses and sedges make up about 70% of their diet. The leaves and stems of some shrubs and certain flowering plants are also selected and may be seasonally important.

Security cover is important and is normally found in the form of precipitous escape areas.

Minerals from mineral licks are an essential component of the diet of Dall's sheep. Well-established trails commonly lead to licks, which are used most frequently in the spring and early summer. Ewes with lambs are the most frequent visitors, and they may linger for days in the vicinity of a lick. Simmons (1982) suggests that the location of mineral licks determine the size and shape of summer ranges in the Mackenzie Mountains, particularly family groups containing lactating ewes.

Dall's sheep distribution is determined by climate. Wind action, snow depth and hardness appear to be limiting factors in determination of suitable habitat (Heimer, 1987). Winter weather is considered the major factor influencing sheep numbers and severe winters may cause population declines (AMAX, ND). In some localities, snow deposition may cover winter forage and, consequently, influence winter habitat selection. Low plateaus and ridges that are swept free of snow by the wind provide important Dall's sheep winter range. In addition, other characteristics of optimum winter range include proximity to timberline and areas with easy access to graminoids (Simmons, 1982). The total size of the winter range used by Dall's sheep is typically smaller than the summer range. In early summer, as the snow melts, sheep merely expand their movements to incorporate recently exposed, vegetation that is beginning to grow, generally at higher elevations. The main characteristic of summer range is alpine tundra located close to rugged terrain that can be used as escape cover (Simmons, 1982).

Individual Dall's sheep confine almost all their movements to a particular mountain block, or range, that contains both the winter and summer range, and may use the same ranges each year and from generation to generation. Fidelity to seasonal ranges and one mountain block means that Dall's sheep are very slow to re-colonize an area if the population is severely reduced for some reason and, consequently, sheep are very sensitive to intense human activity on their ranges.

Population Status

The Dall's sheep population is estimated to range between 15,500 to 27,500 in the NWT, of which 14,000 to 26,000 reside in the Mackenzie Mountains and 1,500 in

the Richardson Mountains (RWED, 2001a). Sheep density is dependent on habitat quality and can range between 20 to 100 sheep per 100 km^2; however, density is typically less than 55 per 100 km^2.

Current research suggests that the population stable. Threats to the population include disease (pneumonia-lungworm complex), human disturbance, slow to colonize new areas and potential over-harvesting. Predators and hunting pressure can limit and depress sheep populations (Heimer, 1987).

Ranking Assumptions

1. Individual Dall's sheep restrict their movements to a particular mountain block(s).
2. Animals exhibit high fidelity to lambing areas, mineral licks and winter and summer ranges.
3. The proximity of escape terrain increases the value of a lesser-rated habitat.
4. Access to quality winter range is critical for survival.
5. Mineral licks are important to Dall's sheep nutritional requirements and are considered critical habitat (Simmons, 1982).
6. Winter range and lambing areas are considered critical habitat.

Rankings

All map polygons showing Dall's sheep "Range" were assigned a low ranking of 1. Range recognizes that the species occurs throughout the region but does not necessarily occupy this particular habitat polygon.

Polygons showing "All Habitat Features" were assigned a ranking of 2. "All Habitat Features" recognizes that a particular polygon possesses all the necessary habitat features for Dall's sheep, and is therefore ranked higher than a 1, but a population of sheep may not be presently using the area.

Those polygons identified as calving areas and mineral licks received a high ranking of 4, as they provide for critical life requisites.

There are no polygons for Dall's sheep ranked with a value of 3.

4.2.2 Moose

Background

Name: *Alces alces*
Status: Moose in the NWT are considered "Secure" (RWED, 2001a). Moose have not been evaluated COSEWIC.

Distribution

Range in the Northwest Territories

Moose occur throughout the boreal forest of the NWT, and are infrequently observed on arctic or mountain tundra. Their distribution in NWT is believed to be increasing (RWED, 2001a).

Territorial Context

The number of moose in the NWT is unknown, but is estimated at more than 10,000 (RWED, 2001a). Densities are relatively low in the NWT, ranging from 3 to 17 moose per 100 km² (Graf, 1992). Moose are generally non-migratory and occupy the boreal forest throughout the year (Figure 4).

General Ecology and Key Habitat Requirements

Moose are primarily browsers and require abundant food supplies close to security cover. High quality browse is considered to consist of shrubs and trees; and, therefore conifer-dominated landscapes are sub-optimal moose habitat. Riparian willow communities appear to be a major factor determining moose distribution and are used throughout the year. Moose occurring in the mountainous regions rely heavily on birch-moss tundra habitat during the spring, summer and fall (AMAX, ND).

Moose habitats can be broadly categorized as fire-influenced, non- or limited-fire influenced or aquatic (Peek, 1998; Kelsall et al., 1977). Within the first two (forested) habitats, moose generally prefer semi-open successional stages with an

abundance of browse. Such sites are commonly found on floodplains and in riparian areas or wetlands, as well as in regenerating burns. Use of aquatic habitats may occur during all non-winter months, but generally peaks during late June to early August, when plant nutrition and digestibility are highest (Peek, 1998). This period coincides with the peak of insect harassment and moose may seek relief in water for this reason as well.

Population Status

The NWT moose population is estimated at approximately 20,000 individuals with density estimates ranging between 3 to 17 per 100 km^2 (RWED, 2001a; RWED, 2002a). Moose are on the edge of their northern range in the NWT. Therefore, their density is quite low when compared to other areas in North America. A winter moose survey in the Liard Valley in February 1978 revealed densities of 1 to 24 individuals per 100 km^2 (Decker and Mackenzie, 1980).

Fall moose surveys, adjacent to Deh Cho's northern boundary, revealed densities of 13 individuals per 100 km^2 (Jingfors et al., 1987), 15 individuals per 100 km^2 (Latour, 1992), 6 (in low quality habitat) to 19 (in medium quality habitat) individuals per 100 km^2 (MacLean, 1994), and 17 individuals per 100 km^2 (Veitch et al., 1996). In the Mills Lake and Mackenzie Bison Sanctuary area moose densities varied between 12, 13 and 25 individuals per 100 km^2 at Falaise Lake, Mills Lake, and 25 individuals per 100 km^2 at Mink Lake, respectively. Along the eastern boundary of the Deh Cho territory, mid-winter moose densities, in a burn area (low quality habitat), revealed 5 individuals per km^2 (Graf, 1992). In the Mills Lake and Mackenzie Bison Sanctuary area moose densities varied between 12, 13 and 25 individuals per 100 km^2 at Falaise Lake, Mills Lake, and 25 individuals per 100 km^2 at Mink Lake, respectively. The lowest moose densities were documented adjacent to Fort Providence where 7 individuals per 100 km^2 (Bradley et al., 1998) and 3 individuals per 100 km^2 (Bradley and Johnson, 2000) were recorded during fall surveys. The difference in densities may reflect the presence of wood bison (Shank, 1992) and the seral stage of fire regeneration. Moose densities in the NWT are low compared to those in other parts of North America. Average densities in the Territories range from 3 to 9 moose per 100 km^2 (Treseder, 1985; Bromley and Buckland, 1995). These densities are considerably lower than those reported in Manitoba, Saskatchewan and Alberta.

Current research suggests that the population trend is variable and typically related to environmental factors such as forest fires. Moose prefer early successional forests, and fire has been responsible for sustaining much of the present moose range (Bromley and Buckland, 1995). RWED (2001a) suggests that the moose population is declining in the Fort Providence area, but increasing in other areas such as the Sahtu and Gwich'in as a result of forest fires and age of habitat associated with fire regeneration.

Threats to the population include disease, predation, and potential localized over-hunting near communities. In addition, preliminary results suggest that increasing wood bison populations in the Mackenzie Bison Sanctuary may be causing a decline in local moose. If this situation is occurring, future moose populations can be expected to decline as wood bison numbers increase (Shank, 1992).

Ranking Assumptions

1. Moose – habitat relationships in the NWT are similar to those in other comparable areas of the species' distribution.
2. Moose range throughout the boreal forest east of the mountains.
3. Moose range is restricted in the Cordillera zone, favouring valley bottoms, recent burns and deciduous zones in the narrow transition from subalpine forest to alpine tundra (Parks Canada, 1984).
4. Riparian willow communities appear to be a major factor influencing moose distribution.
5. Thermal cover is not a life requisite except during summer.
6. Winter is the critical period and influences moose habitat selection.

Ranking

All map polygons showing moose "Range" were assigned a low ranking of 1. Range recognizes that the species occurs throughout the region but does not necessarily occupy this particular habitat polygon.

Polygons showing "All Habitat Features" were assigned a ranking of 2. "All Habitat Features" recognizes that a particular polygon possesses all the necessary

habitat features for moose, and is therefore ranked higher than a 1, but a population of moose may not be presently using the area.

Those polygons identified as mineral licks received a high ranking of 4, as it provides critical life requisites. There are no polygons for moose ranked with a value of 3.

4.2.3 Wood Bison

Background

Name: *Bos bison athabascae*
Status: Bison in the NWT are considered "At Risk" by RWED (2001a) and "Threatened" by COSEWIC (2002).

Distribution

Range in the Northwest Territories

Wood bison ranged prehistorically throughout much of the mountain and northwestern boreal regions of western Canada and historically, north and west too at least Fort Liard and the Fort Simpson area. Their numbers and distribution are increasing in the NWT (RWED, 2001a).

Territorial Context

The number of wood bison in the NWT is estimated between 2,500 to 2,850 individuals and is divided up amongst four different herds in four different locations. Two wood bison herds (Wood Buffalo National Park and Slave River Lowlands) contain diseased individuals, while the other two herds (Liard River and Mackenzie Bison Sanctuary) are believed to be disease free. The Liard River and Mackenzie Bison Sanctuary populations are the only two herds residing within the Deh Cho territory (Figure 5). Limited information is available of their seasonal distribution. However, the orange polygon in Figure 5 shows winter concentrations of wood bison in the vicinity of Falaise and Dieppe Lake, within the Mackenzie

Bison Sanctuary. It is important to note that the orange polygon does not confer that this is the only place that wood bison occur in concentrations during the winter season; it is merely an area periodically surveyed by RWED during winter. Wood bison over-winter throughout the grey-shaded areas.

Wood bison range throughout the Liard River Valley in the Northwest Territories and have expanded their movements into British Columbia and the Yukon. Suitable habitat for this species is extremely limited in the Liard River Valley. Fifty-two wood bison were counted during a survey in January 1992. Herd size was estimated in June 1997 when 103 wood bison were counted during timber harvest surveys. In March 1998, 61 more wood bison were introduced into the valley (RWED, 2001b).

The Mackenzie Sanctuary population was established in 1963 and rapidly increased in numbers. By 1987 it had reached in excess of 1,700 wood bison. Population growth has slowed since then and has stabilized at about 2,000 head. A survey in March 1998 estimated the total population at 1908 wood bison (RWED, 2001b). Flooding of some key habitat patches has reduced the amount of forage available to the wood bison and wolf predation has started to affect population growth. The herd occupies a wilderness area of approximately 10,000 km^2 north of the Mackenzie River near Fort Providence. The Mackenzie population is the largest of any free-roaming wood bison population found in northern Canada. As this herd expands in numbers, its distribution increases (Gates et al., 1991). In 1981 and 1983, approximately 10 and 84 animals, respectively, were documented east of Mink Lake. This represents a significant western expansion from the core population in the Sanctuary (Chowns and Graf, 1987; Graf et al., 1990). This herd continues to expand westerly, and recently individuals have been observed occupying range on top of the Horn Plateau during the summer and adjacent lowlands during the winter (Larter, pers. comm.).

General Ecology and Key Habitat Requirements

Wood bison are grazers, feeding on grasses and sedges that grow in meadow openings. Willow leaves and twigs are an important part of the early summer diet, providing a rich source of protein and other nutrients. Wood bison use a variety of habitats during the year but rely heavily on grasses and sedges at all times, particularly in the winter.

Wood bison use different habitats depending on the season. In summer, they can be found in small willow pastures and uplands where they feed on sedges, forbs and willows. In winter, they move to frozen wet sedge meadows and lakeshores where they feed on sedges. In the fall, they can be found in the forest where they feed on lichens.

Population Status

The NWT wood bison population is estimated to range between 2,500 to 2850 individuals, comprising of four herds of which two herds occur within the Deh Cho territory (RWED, 2001b; RWED, 2002a). Two of the four herds are diseased. The two herds occurring in the Deh Cho are believed to be disease-free. Reporting densities for wood bison can be misleading, as this species normally display clustered distributions in response to habitat differences, seasonal weather patterns and environmental changes. They do not occur randomly across extensive areas, but rather in clustered herds in restricted areas based on habitat.

The population trend for wood bison is increasing as they are slowly recovering form near extinction. Threats to the population include disease, predation, vehicular collisions and drownings during high water seasons.

Ranking Assumptions

1. Wood bison – habitat relationships in the NWT are similar to those in other comparable areas of the species' distribution.
2. Wood bison favours range in valley bottoms, recent burns and deciduous zones (Parks Canada, 1984).
3. Wood bison will likely continue to increase in areas were habitat permits; however, they will likely never be numerous in the western half of the Deh Cho due to the absence of enough suitable habitat (Parks Canada, 1984).

Ranking

All map polygons showing wood bison "Range" were assigned a low ranking of 1. Range recognizes that the species occurs throughout the region but does not necessarily occupy this particular habitat polygon.

There are no polygons for wood bison ranked with a value of 2, 3 or 4. This can occur as there is limited, or no information, available for justifying higher rankings.

4.2.4 Woodland Caribou

Background

Name: *Rangifer tarandus caribou*
Status: Woodland caribou in the NWT are divided into two ecotypes, the boreal population and the northern mountain population. RWED lists the boreal population and the northern mountain population as "Sensitive" (RWED, 2001a). COSEWIC lists the boreal population as "Threatened" and the northern mountain population as "Special Concern" (COSEWIC, 2002).

Distribution

Range in the Northwest Territories

Historically, woodland caribou were found throughout most of the boreal and subalpine forests of Canada. In southern Canada the majority of the woodland caribou have been extirpated or seriously reduced through habitat modification or degradation (Olsen, 2001). Within the NWT, their range has remained relatively unchanged over recent history. The NWT woodland caribou are divided into two ecotypes, the boreal and mountain caribou. These caribou have different habitat requirements, but are otherwise the same species.

Mountain caribou are found primarily in the mountainous region of the NWT from Nahanni National Park Reserve in the South to the Richardson Mountains in the north. Boreal caribou occur along the Mackenzie Valley from the NWT/Alberta border north to the Mackenzie Delta (Olsen et al., 2001), and from the eastern edge

of the Mackenzie Mountains to the Canadian Shield and Great Slave Lake (Environment Canada, 2002) (Figure 6).

Mountain caribou are classified into three herds; Bonnet-Plume Herd (est. 5,000 individuals), Redstone Herd (est. 5,000 to 10,000 individuals), and the South Nahanni Herd (est. 3,000) (Parks Canada, 1984). However, more recent surveys (Gunn et al., 2002; Gunn, pers. comm.) reveal that the South Nahanni Herd can be subdivided into smaller herds. The boreal herd is dispersed over a large area throughout the boreal forest east and southeast of the mountain ranges (Figure 6).

General Ecology and Key Habitat Requirements

Northern Mountain Caribou Population

Northern mountain caribou occur over the majority of the mountain region within the Deh Cho. Annual movements of these caribou, in relation to seasonal habitat changes, are presumed to be similar to those documented by Gullickson and Manseau (2000) in Nahanni National Park Reserve. Caribou exhibit directional movements from valleys to higher elevations in the spring; residency in alpine/subalpine areas from June to November; and directional movements back down to lower elevations during the winter.

Caribou migrate to known calving areas, such as plateaus and upland sites, to give birth (Figure 7). Post-calving areas include moist alpine tundra and open meadows in the mountains (Gray and Panegyuk, 1989). Known wintering areas include: the Keele, Little Keele, Mountain and Carcajou River valleys, the Arctic Red and South Nahanni Rivers, the rolling hills in the Wrigley area, the Camsell Bend area, the Drum Lake area, the Moose Horn, Redstone, and Dahadinni River valleys, and around Virginia Falls. East of the Mackenzie River caribou are known to winter in the Ebbutt and Redknife Hills and on the Horn Plateau (Gray and Panegyuk, 1989). Gunn (2001) has documented mountain caribou calving in a large region in the northwestern corner of the Deh Cho, and includes approximately the northwest half of Nahanni National Park Reserve, and continuing northwest and north to the Natla River (Figure 7).

Lichens are an important food source for mountain caribou and during the winter they seek out mature forests containing terrestrial lichens. Mature forests also provide thermal cover during extreme winter conditions.

Lortie (1982) referred to the mountain caribou population as three different herds: *Bonnet Plume, Redstone*, and *South Nahanni* caribou herds. Demarcation of these herds has been defined based on known annual ranges, *i.e.* herd fidelity to specific ranges.

The *Bonnet Plume* caribou herd occupies the northern Mackenzie Mountains around the Arctic Red River and Bonnet Plume watersheds (Benn, 2001). This herd lies outside the Deh Cho and the study area as defined in this report.

The *Redstone* caribou herd is presumed to occupy the summer ranges along the NWT/Yukon border near MacMillan Pass, moving down to lower elevations along the Keel, Moose Horn and Redstone River basins on the eastern slopes of the Mackenzie Mountains during the winter (Olsen, 2001). The northern portion of this herd's range lies outside the Deh Cho and the study area.

The *South Nahanni* caribou herd ranges over an area of 18,000 km^2 and inhabits an area in and around Nahanni National Park Reserve (Selwyn-Logan-Mackenzie Mountains). This herd lies within the Deh Cho.

More recent studies (Gunn, 2001; Gunn, pers. comm.) reveal that these mountain caribou may be further divided into additional subpopulations, based on site fidelity to particular calving/rutting areas (Figure 8). The subpopulations occurring within the Deh Cho territory include the following herds: La Biche, Coal, Finlayson, Redstone and South Nahanni.

Boreal Caribou Population

Boreal caribou prefer mature or old growth coniferous forests associated with bogs, lakes and rivers. Veitch (2001) states that these caribou select old coniferous forests greater than 100 years old. These forests offer high concentrations of ground (caribou moss) and tree lichens (arboreal lichens). In winter, woodland caribou tend to favour uplands, bogs and south facing slopes where the snow is not too deep.

Their winter diet consists of up to 80 per cent ground and tree lichens. In summer, they prefer areas such as forest edges, marshes and meadows that provide the fresh green growth of flowering plants and grasses. Calving grounds are vital to the well being of all caribou populations. Jacobson (1979) stated that some of the best-known woodland caribou calving areas in the NWT could be found in the Mackenzie Bison Sanctuary and on the islands off the northwest shore of Great Slave Lake. Females migrate to these islands when there is still ice on the lake and swim back to shore a few weeks after calving, although use of these islands for calving could never be substantiated in subsequent years (Decker, pers. comm.). Caribou are known to calve on small prairies within the Mackenzie Bison Sanctuary, and it is probable that caribou inhabiting the boreal forest throughout the southwestern NWT use similar areas for calving (Gray and Panegyuk, 1989).

Population Status

The NWT woodland caribou population is estimated at 13,000 individuals (RWED, 2001a). Very little information is known about the boreal population's demography and, consequently, the population status is unknown. More information has been collected for the northern mountain population. Lortie (1982) referred to these northern mountain herds as three distinct herds: the *Bonnet Plume*, *Redstone*, and *South Nahanni* caribou herds.

Population demography of the *Bonnet Plume* herd is not known but the herd is estimated at 5,000 individuals (Benn, 2001). Although harvest levels are low, between 50-55 caribou per year, not enough is known on the status of this herd to determine the population trend.

The *Redstone* Herd is the largest of the three herds and is estimated to be between 5,000 to 10,000 individuals (Caribou Management Team, 1996). Classification counts reveal a calf:cow ratio of 28 calves per 100 cows, which is below the threshold needed for a stable or growing herd (Gunn, 2001) and may indicate that the herd is currently in decline (Veitch et al., 2000)

The *South Nahanni* caribou herd ranges over an area of 18,000 km^2 and inhabits an area in and around Nahanni National Park (Selwyn-Logan-Mackenzie Mountains). Herd size is estimated between 940 to 1140 individuals (Gunn et al., 2002). Hunter

harvests were estimated at 4-5% annually and the Yukon Management Guidelines for woodland caribou indicate a sustainable harvest of 1-3% of a herd's size annually for maintaining a stable population (Gunn et al., 2002). Classification counts reveal a calf:cow ratio of 10 calves per 100 cows, well below the recruitment needed to maintain a stable herd.

RWED (2001a) suggest that the calf:cow ratios for the northern mountain caribou herds are low and may be in indicative of a declining population. Traditional knowledge indicates mountain caribou numbers are decreasing in the Sahtu and Inuvik area. In addition, empirical evidence for the boreal caribou population in the Mackenzie Bison Sanctuary may also be declining. Decker (Decker, pers. comm.) suggests that the declining caribou numbers in the Sanctuary may be attributable to changing habitat conditions and an increase in moose numbers.

Threats to the population include potential over-hunting, habitat loss, disease and human activity.

Ranking Assumptions

1. Calving does occur within the Deh Cho territory.
2. Animals exhibit high fidelity to particular ranges for calving, post-calving, rutting and winter distribution.
3. For mountain caribou, females seek out and disperse in alpine habitats over much of their total range (Gullickson and Mansequ, 2000).
4. For mountain caribou, woodland caribou do exhibit spring migrations from lower elevations in watersheds to higher elevations in the mountains (Gullickson and Mansequ, 2000).
5. Annual movements of mountain caribou in the Deh Cho are likely similar to those documented by (Gullickson and Mansequ, 2000) in the Nahanni region. Caribou exhibit directional movements from valleys to higher elevations in the spring; residency in alpine/subalpine areas from June to November; and directional movements back down to lower elevations during the winter.
6. During extreme winter conditions, forest stands provide caribou with thermal cover.
7. As lichens are important winter foods for caribou, the value of a forest stand for caribou is directly related to the abundance and accessibility of terrestrial

lichens. Climax forests possess these requirements and, consequently, are considered important habitat to caribou.

Rankings

All map polygons showing woodland caribou "Range" were assigned a low ranking of 1. Range recognizes that the species occurs throughout the region but does not necessarily occupy this particular habitat polygon.

Polygons showing "All Habitat Features" or a very specific habitat function, *i.e.* fall rut or late winter range, where assigned a ranking of 2. "All Habitat Features" recognizes that a particular polygon possesses all the necessary habitat features for woodland caribou, and is therefore ranked higher than a 1, but a population of caribou may not be presently using the area.

Those polygons identified as suspected calving areas received a ranking of 3. Those polygons of known calving areas and mineral licks received a high ranking of 4 because these areas provide a critical life requisite.

4.2.5 Mountain Goat

Background

Name: *Oreamnos americanus*
Status: Nationally mountain goats are not listed by COSEWIC, however, in the NWT RWED lists them as "May Be At Risk" (RWED, 2001a). The status rank of "May Be At Risk" is automatically applied to mountain goats because of their small population size, number of occurrences and small distribution within the NWT.

Distribution

Range in the Northwest Territories

Mountain goats have a restricted range occurring only in the southwest corner of the NWT, in and adjacent to Nahanni National Park Reserve (Figure 9). Their range has remained relatively unchanged in recent history. Data from the Northern Land

Use Information Series (1972), Parks Canada (1984) and Decker (Decker, pers. comm.) revealed that their range is restricted to limited areas in the Nahanni Plateau, Peel River Plateau and the Selwyn Mountain ecoregions, with the greatest proportion of the population occurring within the Selwyn Mountain ecoregion.

General Ecology and Key Habitat Requirements

Little is known about the ecology of mountain goats in the NWT. However, goats prefer rugged-exposed mountain terrain comprising of cliffs, ledges, pinnacles and talus slopes. Goat range is associated with areas having well-defined glaciation at elevations between 1,524 and 3,353 m elevation (Wigal and Coggins, 1982). Consequently, only the most rugged, high elevation areas can be expected to maintain populations.

In the NWT, as in other regions, habitat preferences reveal an affinity towards areas above timberline in subalpine and alpine zones, typically comprising of exposed rock faces. Results from a 1978 summer (August) survey revealed that 95.9% of the mountain goat observations were on exposed rock habitats with the remainder on alpine tundra. In addition, all mountain goat observations were found to occupy habitat between 1,707 – 2,164 m. Rarely were they observed below 1,219 m (Comin et al., 1981).

Mountain goats generally occupy the same ranges in summer and winter and have no marked seasonal migrations (Banfield, 1974). Goats show seasonal habitat preferences to some degree, moving to exposed precipices during snow-free periods and less steep terrain during snow cover. During spring nannies seek out known natal areas. Proximity to escape cover is important during all seasons.

Mountain goats in the NWT are at the northern extent of their range. The trend in population size is unknown for the NWT, however, the North American population is expanding in distribution. Limiting factors include lack of access to suitable forage during the winter, snow slides and over-hunting.

Population Status

The NWT mountain goat population is unknown but is estimated to be more than 400 but less than 1,000 individuals. The population is restricted to a small, rugged area in the southwestern corner of the NWT. The prime habitat lies on the northwest corner of Nahanni National Park Reserve, adjacent to Tungsten, and is surrounded by the Flat River to the south, the South Nahanni River to the east and the Little Nahanni River to the north. The trend in the population is unknown, but believed to be stable (RWED, 2001a).

Threats to the population include lack of suitable forage in winter, snow slides, possible re-activation of mine, potential over-hunting and helicopter disturbance (RWED, 2001a).

Ranking Assumptions

1. Calving occurs within the study area, Deh Cho territory.
2. The NWT population is restricted to a small area of the Selwyn Mountains.
3. Animals seek out and calve in known natal areas.
4. Escape terrain is important for predator avoidance.
5. Access to suitable winter forage is critical for survival.
6. Mineral licks are important to mountain goat's nutritional requirements.

Rankings

All map polygons showing mountain goat "Range" were assigned a ranking of 1. Range recognizes that the species occurs throughout the region but does not necessarily occupy this particular habitat polygon.

There are no polygons for mountain goats ranked with a value of 2, 3 or 4.

4.2.6 Grizzly Bear

Background

Name: *Ursus arctos*
Status: Nationally grizzly bears are listed as a species of "Special Concern" by COSEWIC (2002). In the NWT they are listed as "Sensitive:" species that are not at risk of extinction or extirpation but may require special attention or protection to prevent them from becoming at risk (RWED, 2001a).

Distribution

Range in the Northwest Territories

Grizzly bears occupy much of the NWT, particularly throughout the Mackenzie Mountains and north of the treeline.

Territorial Context

In the NWT, grizzly bears are divided into two groups depending on where they live. Mountain grizzlies are generally found in the mountainous areas west of the Mackenzie River, while barren-ground grizzlies typically occur on the tundra, above the treeline. The NWT is home to an estimated 3,500 - 4,000 grizzly bears. The highest concentrations of grizzly bears in the NWT are found in the Mackenzie Mountains. Within the Deh Cho, grizzly bears are normally restricted to the mountains (Figure 10).

General Ecology and Key Habitat Requirements

Grizzly bears in the NWT occur primarily in open alpine or tundra habitats, but they also can be found in forested areas. They have large home ranges relative to most other bear species. On average, a male's range can extend over 2000 km^2 while a female's range is about half that size (RWED, 2002a). Grizzly bear habitat use outside of the denning season is complex and a function of many factors including plant phenology and the availability of mammalian prey.

Grizzly bears are omnivorous. In spring they graze first on roots and then switch to new grasses and sedges as they emerge. Bears in mountainous areas move up and down slopes in response to available vegetation. During late summer and fall they feed primarily on berries. They also eat many lemmings and ground squirrels, which they excavate from burrows. With respect to large animals, bears are opportunistic predators and will kill caribou, moose and sheep if the occasion arises.

Population Status

The solitary nature and low densities of grizzly bears in the NWT make it is extremely difficult and expensive to survey populations. Information about grizzly bears often comes from individual sightings made during other animal surveys. The number of bears is estimated to be between 3,500 to 4,800 grizzly bears, with the highest concentrations occurring in the Mackenzie Mountains. Despite the difficulty in assessing the population, grizzly bear numbers are thought to be stable, and possibly increasing, in the NWT (RWED, 2001a; RWED, 2001c). Grizzly bear density is estimated to range from 1 per 10 to 560 km^2 depending on habitat quality. Threats to the population include potential over-hunting and defense kills (generally high female %), development activity and increased access (RWED, 2001a).

Ranking Assumptions

1. Grizzly bears prefer open, alpine areas.
2. Alpine areas are used intensively during June and July, then shift to subalpine areas in August and return to alpine areas in September (Parks Canada, 1984).
3. All willow riparian communities are assumed to be high quality habitats.
4. Spruce riparian habitat is assumed to be of similar habitat quality as willow riparian habitat.

Rankings

Little is known about grizzly bear habitat relationships in the Deh Cho territory. The digital map data available for this species was limited to available digital data.

All map polygons designated grizzly bear "Range" were assigned a ranking of 1. Range recognizes that the species occurs throughout the region but does not necessarily occupy this particular habitat polygon.

Polygons showing "All Habitat Functions" were assigned a ranking of 2. "All Habitat Features" recognizes that a particular polygon possesses all the necessary habitat features for grizzly bears, and is therefore ranked higher than a 1.

Those polygons identified as known denning areas received the highest ranking, 4, because these areas provide a critical life requisite.

There are no polygons for grizzly bears ranked with a value of 3; this can occur as there is limited, or no information, available for justifying this ranking.

4.2.7 Black Bear

Background

Name: *Ursus americanus*
Status: Black bears in the NWT are considered "Secure" (RWED, 2001a).

Distribution

Range in the Northwest Territories

Black bears occur throughout treed portions of the NWT. Occasionally, they are observed on mountain tundra habitats. Black bears can be expected to occur throughout the Deh Cho territory (Figure 10).

Territorial Context

The size of the black bear population of the NWT is unknown, but is estimated between 3,000 and 10,000 (RWED, 2001a). Black bears are non-migratory and occupy the boreal forest throughout the year. Their distribution includes the Deh Cho territory, but presumably densities decline with decreasing abundance of forested escape cover. The relative abundance of grizzly bears (*Ursus arctos*) and

wolves (*Canis lupus*), and the scarcity of trees large enough to provide security cover probably restrict black bear distribution in the Deh Cho territory to lower elevations. Little is known about black bear occurrence within the Deh Cho territory.

General Ecology and Key Habitat Requirements

Black bears are generally closely associated with treed environments, presumably in response to threats from other predators (Herrero, 1978). In areas where adequate escape cover exists, black bear habitat quality is primarily related to the abundance of seasonally important food items. Black bears are functional omnivores. In most areas, their diet is dominated in all seasons by vegetation. However, meat, especially winter-killed ungulates during spring, insects during summer, and possibly fish, can be locally important.

After den emergence, bears gravitate towards areas with early-emerging vegetation such as wetlands dominated by sedges (*Carex* spp.) and cottongrass (*Eriophorum* spp.); grasses (*Graminae*) and horsetails (*Equisetum* spp.) are also important, and may be found in sites such as meadows; over-wintering berries, such as bog cranberry (*Vaccinium vitis-idaea*), are eaten (Chatalain, 1950; Hatler, 1972); winter-killed ungulate carcasses can be important, but are usually scarce and may not be predictably available to bears in the boreal forest.

In summer, bears consume a variety of species of grasses, sedges, horsetails and forbs (Hatler, 1972; Pelton , 2000). Insect activity peaks during summer, and black bears feed heavily on colonies of ants, bees and wasps.

By fall, the nutritional quality of many plants declines but berries become ripe and available. Major berry-producing species of the boreal forest include blueberry (*Vaccinium* spp.), crowberry (*Empetrum nigrum*), bearberry (*Arctostaphylos uva-ursi*) and cloudberry (*Rubus chamaemorus*).

Black bears require security from predators, which include grizzly bears, wolves and other black bears. During the active season trees provide security, as visual cover for hiding, and as escape features for climbing. Dense shrub communities are also important and are used for bedding (Jonkel, 1978).

Population Status

There have been no surveys and no formal attempts to estimate black bear population size anywhere in the NWT. Black bears have not been studied in the NWT except for research on deterrents at the Norman Wells dump (Clarkson, 1993; Latour and Hagen, 1993). The number of black bears in the NWT is not known but is estimated to be between 3,000 to 10,000 individuals. Population densities are unknown but are believed to be low along the treeline, higher in the forested areas, and highest along the Mackenzie River and Great Slave Lake (Clarkson, 1985; Department of Renewable Resources, 1990). RWED (2001a) estimates their densities to be 10 bears per 100 km^2. The population trend is unknown but thought to be healthy across its entire range.

Threats to the population include intraspecific competition, illegal trade in bear parts, defense kills and increased human activities (RWED, 2001a).

Ranking Assumptions

1. Black bear – habitat relationships in the NWT are similar to those in comparable areas of the species' distribution.
2. Black bears do not generally occur above timberline.
3. Little is known about black bear – habitat relationships in the Deh Cho territory and, in general, the NWT.

Rankings

Little is known about black bear habitat relationships in the Deh Cho territory. All map polygons designated black bear "Range" were assigned a ranking of 1. Range recognizes that the species occurs throughout the region but does not necessarily occupy this particular habitat polygon.

Those polygons identified as known denning areas received the highest ranking, 4, because these areas provide a critical life requisite.

There were no polygons assigned a value of 2 or 3.

4.2.8 Waterfowl

Background

Name: Waterfowl (Species treated collectively)

The term "waterfowl" is used in a general sense; species are grouped together and treated collectively. The term "waterfowl" is typically used in the context of swans, geese and ducks (Order: Anseriformes), however, for this report it also includes loons (Order: Gaviiformes) and grebes (Order: Podicipediformes). This approach has been adopted because the available data lumped "waterfowl" in this manner. Consequently, individual species will not be treated separately, except for Trumpeter Swans. Separate and unique data were available for Trumpeter Swans and are presented in the following section.

Status: A total of 34 waterfowl species are estimated to occur within the Deh Cho territory; of which seven species are considered "Sensitive," 25 species are classified as "Secure," one species is assessed as "Undetermined," and one species is considered "May Be At Risk" (RWED, 2001a). COSEWIC has assessed only three of the 34 waterfowl species listed and has ascribed a status of "Not At Risk;" the remaining 31 species have not been evaluated (COSEWIC, 2002) (Table 8).

Distribution

Range in the Northwest Territories

Waterfowl breed throughout much of North America with select areas attracting high breeding densities, and include areas such as the Prairie Pothole and Parklands Region in central Canada, the Peace-Athabasca Delta and the Mackenzie Delta (Anonymous, 1998). Within the Deh Cho territory waterfowl breed throughout the boreal forest and at lesser densities in the alpine and subalpine areas of the mountains. Waterfowl can be expected to breed wherever their habitat requirements are met (Figure 11).

Territorial Context

Thirty-eight species of waterfowl occur within the NWT (RWED, 2001a; Sibley, 2000), of which 34 are expected to occur within the Deh Cho territory (Table 3). Some species are summer residents within the Deh Cho territory while others are transient migrants, some breed in the valleys containing boreal forest cover while others breed above the timberline on the alpine ponds, *i.e.* Long-tailed Ducks. They represent a large and diverse assemblage but throughout their range, the majority of wetland types are important habitats.

Waterfowl are common throughout the Deh Cho territory during early spring, summer and fall. Waterfowl are not present in the NWT during winter.

General Ecology and Key Habitat Requirements

Waterfowl migration is influenced and governed by weather (Terres, 1982). Birds advance northward as the weather warms and ice recedes from the wetlands and lakeshores. The speed of migration varies among species and is influenced by the prevailing weather patterns. Birds bound for the Arctic typically leave their wintering grounds later and overtake ones that have departed earlier.

The corridors between wintering and breeding grounds are traditional and are used each year. By the time birds reach the NWT the large flocks associated with more southerly locations begin to disband and disperse across nesting territories. Most waterfowl will return to the same marsh where they hatched, and in many cases, adults return to the same nest site (Terres, 1982).

The chronology of spring arrivals is presumed to be similar to that of Yellowknife. In the Yellowknife region, waterfowl begin to return as early as mid-April and may continue until the last week of May, depending on the weather. Birds follow a progression that indicates a sequence of early, mid-season and late nesters. In the Yellowknife region the chronology of arrivals (earliest to latest) in the spring is: Mallard, Northern Pintail, Green-winged Teal, American Wigeon, Common Goldeneye, Horned Grebe, Red-necked Grebe, Canada Goose, Northern Shoveler, Ring-necked Duck, Canvasback, Lesser Scaup, Bufflehead, Long-tailed Duck, Greater White-fronted Goose, White-winged Scoter and Blue-winged Teal

Table 8: Waterfowl Species Occurring or Hypothetically Occurring within the Study Area and Their Status

Common Name	Scientific Name	RWED Status [1]	COSEWIC Status [2]
Harlequin Duck [3]	*Histrionicus histrionicus*	May Be At Risk	Not evaluated
Pied-billed Grebe	*Podilymbus podiceps*	Sensitive	Not evaluated
Trumpeter Swan	*Cygnus buccinator*	Sensitive	Not At Risk
Northern Pintail	*Anas acuta*	Sensitive	Not evaluated
Lesser Scaup	*Aythya affinis*	Sensitive	Not evaluated
Long-tailed Duck	*Clangula hyemalis*	Sensitive	Not evaluated
Surf Scoter	*Melanitta perspicillata*	Sensitive	Not evaluated
White-winged Scoter	*Melanitta fusca*	Sensitive	Not evaluated
Common Loon	*Gavia immer*	Secure	Not At Risk
Pacific Loon	*Gavia pacifica*	Secure	Not evaluated
Red-throated Loon	*Gavia stellata*	Secure	Not evaluated
Red-necked Grebe	*Podiceps grisegena*	Secure	Not At Risk
Horned Grebe	*Podiceps auritus*	Secure	Not evaluated
Tundra Swan	*Cygnus Columbianus*	Secure	Not evaluated
Canada Goose	*Branta canadensis*	Secure	Not evaluated
Greater White-fronted Goose	*Anser albifrons*	Secure	Not evaluated
Snow Goose	*Anser caerulescens*	Secure	Not evaluated
Ross's Goose	*Anser rossii*	Secure	Not evaluated
Mallard	*Anas platyrhynchos*	Secure	Not evaluated
Green-winged teal	*Anas crecca*	Secure	Not evaluated
Blue-winged teal	*Anas discors*	Secure	Not evaluated
American Wigeon	*Anas americana*	Secure	Not evaluated
Northern Shoveler	*Anas clypeata*	Secure	Not evaluated
Ring-necked Duck	*Aythya collaris*	Secure	Not evaluated
Canvasback	*Aythya valisineria*	Secure	Not evaluated
Redhead	*Aythya americana*	Secure	Not evaluated
Greater Scaup	*Aythya marila*	Secure	Not evaluated
Common Goldeneye	*Bucephala clangula*	Secure	Not evaluated
Barrow's Goldeneye [3]	*Bucephala islandica*	Secure	Not evaluated
Bufflehead	*Bucephala albeola*	Secure	Not evaluated
Ruddy Duck	*Oxyura jamaicensis*	Secure	Not evaluated
Common Merganser	*Mergus merganser*	Secure	Not evaluated
Red-breasted merganser	*Mergus serrator*	Secure	Not evaluated
Gadwall	*Anas strepera*	Undetermined	Not evaluated

1 (RWED, 2001a)
2 (COSEWIC, 2002)
3 Barrow's Goldeneye and Harlequin Duck - Western Population only.

(Bromley and Trauger, ND). Presumably the arrival dates for each species occurring in the Deh Cho territory parallel those in the Yellowknife region, but may be marginally delayed, especially in alpine habitats. Most species of waterfowl remain in the north as long as food and open water are available.

Food Habitat

Aquatic vegetation accounts for approximately three-quarters of waterfowl diets, with aquatic invertebrates and minnows providing the balance (Lamoureux, 1970).

Pondweeds (*Potamogeton* spp.) comprise the largest single component, followed by bulrushes (*Scirpus* spp.) and smartweeds (*Polygonum* spp.) (Lamoureux, 1970). Many researchers believe that pondweeds are the single most important component in the diet of waterfowl in North America (Lamoureux, 1970).

In general, the majority of waterfowl exploit food resources found in shallow water of lakes, ponds, marshes, sedge meadows and bogs. Shallow bays containing emergent and submergent vegetation are important feeding areas.

Ranking Assumptions

1. Wetlands are important habitats but occur in relatively low densities in the Deh Cho territory. Consequently, any wetlands receive a high ranking.
2. Known migratory corridors for waterfowl received a high ranking.

Ranking

All map polygons showing waterfowl “Range” were assigned a low ranking of 1. Range recognizes that the species occurs throughout the region but does not necessarily occupy this particular habitat polygon. All lakes and rivers that meet waterfowl requirements can be assumed to be potential waterfowl habitat, e.g. rivers and lakes shaded green in Figure 11.

Polygons showing “All Habitat Features” where assigned a ranking of 2. “All Habitat Features” recognizes that a particular polygon possesses all the necessary habitat features for waterfowl, and is therefore ranked higher than a 1.

All map polygons showing waterfowl "migrational corridors" received a ranking of 3 because these are linear corridors used repeatedly each year.

Those polygons identified as nesting areas received a ranking of 4 because this area provides a critical life requisite.

4.2.9 Trumpeter Swan

Background

Name: *Cygnus buccinator*
Status: Trumpeter Swans in the NWT are considered "Sensitive" by RWED (2001a) and "Not At Risk" by COSEWIC (2002).

Distribution

Range in the Northwest Territories

Trumpeter Swans have a restricted range in the NWT. Nesting is restricted to the southwestern corner of the NWT (Figure 12). Nests have been documented occurring along the Laird Valley near Nahanni Butte and north to the eastern boundary of Nahanni National Park Reserve, an area the Canadian Wildlife Service (CWS) has identified as "*Site 43 – Southeastern Mackenzie Mountains*." During the 1970's CWS conducted trumpeter swan surveys and delineated their range, which includes the region mentioned above and extends further north to Camsell Bend in the Mackenzie River just south of Wrigley. In 1986, a more extensive survey re-confirmed this distribution and documented six new locations adjacent to Nahanni National Park Reserve, specifically west of the Park along the South Nahanni River, and south of the Park near the Yukon/NWT boarder (McCormick and Shandruk, 1987).

Territorial Context

Trumpeter swans occur within the Deh Cho territory (RWED, 2001a) in a limited area along the Liard Valley, in the wetlands adjacent to the Nahanni Range north to

Camsell Bend in the Mackenzie River, and in a few pockets outside the Park along the South Nahanni and Caribou Rivers (Figure 12) (McCormick and Shandruk, 1987). However, the majority of swans occur in the Nahanni Butte area and in the vicinity of Camsell Bend.

The size of the population is unknown, but is probably less than 1,000 individuals (RWED, 2001a). The CWS estimated a minimum of 137 Trumpeter Swans (120 adults) in the southern Mackenzie district in the summer 1986 (McCormick and Shandruk, 1987). Approximately 15% of the Canadian population of Trumpeter Swans nest in the wetlands adjacent to the rivers, creeks and lakes in the area (Alexander et al., 1991). Swans are migratory, and occupy the Deh Cho territory during the spring, summer and fall. Nesting adults arrive in early June and depart by the end of September (Alexander et al., 1991).

General Ecology and Key Habitat Requirements

Swan migration is influenced and governed by weather (Terres, 1982). Species advance northward as the weather warms and ice recedes from the wetlands and lakeshores. The speed of migration varies and is influenced by the prevailing weather patterns.

Trumpeter Swans are associated with wetlands occurring on floodplains adjacent to rivers, creeks or lakes. During CWS's 1986 survey, the majority of swans were observed below 300 m asl, with a few individuals at approximately 600 m asl and 900 m asl (McCormick and Shandruk, 1987). Breeding birds select nest sites that are surrounded by shallow water. Typical nesting habitat include the following: lakes where water levels do not have marked seasonal fluctuations; quiet waters, without strong wave action or currents; shallow water so swans can dig for tubers and roots of aquatic plants; isolation and security from disturbance; and areas of emergent vegetation. Nests are rarely located in upland areas but are usually located near shore, on small islands, or on muskrat and beaver lodges. Habitats supplying high abundance of aquatic invertebrates and/or aquatic plants have the greatest swan production. Most nests are used year after year, usually by the same pair.

Trumpeter swans in the NWT are part of the Rocky Mountain population and over-winter in the United States in the tri-state area where the borders of Montana, Idaho and Wyoming meet (McKelvey, 1975).

Except for people, wild Trumpeters have few natural enemies. Eagles, owls, coyotes, and mink may take swans at certain times but these instances are infrequent and usually affect very young birds or adult birds that have become weakened and unable to fend off predators. Diseases and parasites, alone or combined with bad weather or local food shortages, may also result in some deaths.

Population Status

The NWT Trumpeter Swan population is unknown but is estimated to be less than 1,000 individuals. The CWS estimated a minimum of 137 Trumpeter Swans (120 adults) in the southern Mackenzie district in the summer 1986 (McCormick and Shandruk, 1987). The population is restricted to a small region of wetlands oriented north to south between Nahanni Butte and Wrigley, NWT. Globally, the population trend is increasing but is probably stable in the NWT (RWED, 2001a). Research conducted by Hawkings (Hawkings et al., 2002) reveal the Pacific Coast population and the Mountain population, of which the birds occurring along the Liard River belong, have grown at substantial rates. This growth is attributed to an increase in breeding density within established breeding areas and due to expansion into previously unoccupied areas.

There are no known threats to the NWT population (RWED, 2001a).

Ranking Assumptions

1. Similar to waterfowl.
2. Known nesting sites were rated high.
3. Wetlands are important habitats but occur in relatively low densities in the Deh Cho territory. Consequently, any wetlands receive a high ranking.
4. Known migratory corridors for waterfowl received a high ranking.

Ranking

All map polygons showing Trumpeter Swan "Range" were assigned a ranking of 4 because a significant proportion of the Canadian population nests in the southwestern corner of the NWT, habitat is limited and their distribution is restricted in the NWT. In addition, all known nesting locations were assigned a ranking of 4 because this area provides a critical life requisite.

4.2.10 Whooping Crane

Background

Name: *Grus americana*
Status: Whooping Cranes in the NWT are considered "At Risk" by RWED (2001a) and "Endangered" by COSEWIC (2002).

Distribution

Range in the Northwest Territories

Whooping Cranes have a restricted range in the NWT limited to summer breeding grounds in the Sass River area of northern Wood Buffalo National Park (WBNP).

Territorial Context

WBNP is the only nesting area for Whooping Cranes in the NWT. Nesting is limited to the Sass River area of northern WBNP, which lies outside the Deh Cho territory (Figure 13). However, Cranes have been documented in the Mackenzie Bison Sanctuary in the Dieppe Lake region. This area is considered critical habitat for a non-breeding segment of the Whooping Crane population (Decker, pers. comm.; Anonymous, 1972). The size of the population is estimated to be 144 individuals (RWED, 2001a).

General Ecology and Key Habitat Requirements

Historically, the Whooping Cranes' summer breeding range extended from the southern NWT down through the Great Plains. Their wintering grounds were located in Texas, Louisiana, and northern Mexico. Currently, Whooping Cranes are limited to summer breeding grounds in the Sass River area of northern WBNP. Their present wintering grounds are in the Aransas National Wildlife Reserve in Texas.

Whooping Cranes are wetland birds. They spend the summer breeding season in swampy areas. On the fall southern migration, the cranes stop in the prairies where they feed on grain around sloughs and marshes. On their winter range, cranes can be found on inland tidal marshes and tidal mud flats.

Wild Whooping Cranes are believed to live up to 20 years of age, and are sexually mature at about age five. They mate for life but will take a new mate if their current partner dies. Whooping Cranes generally lay two eggs but the chicks compete for food and usually only one chick survives to fledge. In breeding season, the cranes feed on berries, insects, snails, small fish and, sometimes, carrion.

Population Status

The population is very small at 144 individuals, and is restricted to a small breeding area where a single event could affect most or all individuals. Whooping Crane density averages 1 pair per 0.9 km radius. The population trend is very slowly increasing from near extinction.

The main factor limiting the Whooping Crane is the size and location of its wintering grounds. Whooping Cranes each require a minimum territory, which they guard. Calculations show that the Aransas Reserve could only sustain a wintering population of 200 cranes. It is impossible to extend the size of the refuge because it is surrounded by concentrated human development.

Threats to the population formerly included hunting, however, presently population pressures include natural mortality, shooting during migration, collision with power lines, predation at nest sites, pollution and destruction of wintering habitat. Threats

to population most likely to occur on migration and wintering areas but they are also vulnerable on their breeding grounds (RWED, 2001a).

Ranking Assumptions

1. Whooping Cranes are wetland birds and, consequently, wetlands provide critical habitat.
2. Nesting sites have not been recorded in the Deh Cho territory.

Ranking

All map polygons showing Whooping Crane "Range" were assigned a ranking of 4 because it supports an endangered wildlife species. In addition, the Mackenzie Bison Sanctuary is considered critical habitat for many other species (Anonymous, 1972; Ferguson, 1987; Beckel, 1975).

4.2.11 Peregrine Falcon (Anatum)

Background

Name: *Falco peregrinus anatum*
Status: Anatum Peregrine Falcons in the NWT are considered "At Risk" by RWED (2001a) and "Threatened" by COSEWIC (2002).

Distribution

Range in the Northwest Territories

The NWT is home to two of the three subspecies of Peregrine Falcons found in Canada. The *Falco peregrinus anatum* subspecies are distributed generally throughout portions of the NWT below the treeline, with a large population located along the Mackenzie River Valley (Figure 14). The second subspecies, *F. p. tundrius*, generally breed widely in those areas above the treeline.

Territorial Context

The Anatum Peregrine Falcon subspecies is one of three subspecies occurring in Canada. It occurs below the treeline and is the only breeding subspecies in the Deh Cho territory. Anatum also live in southern Canada and the U.S. The *F. p. tundrius* subspecies is found from the treeline to the arctic coast and Arctic Islands.

General Ecology and Key Habitat Requirements

Wild peregrines live an average of five years. They begin breeding in their second year. In the NWT, two to four eggs are laid between May and early June. Both parents incubate the eggs for an average of 36 days. After hatching, the female cares for the chicks while the male brings her food. Peregrine chicks begin to fly about 35 to 40 days after hatching. Peregrines feed on many types of birds including perching birds, waterfowl and shorebirds. They are opportunistic feeders and will take small mammals when they can.

Peregrines have three main habitat requirements. They need proper nesting sites, usually on cliff ledges near water. They also need nesting ranges. These ranges are actively guarded and can extend up to 1 km from the nest. The third requirement is a home range. The birds do not defend this range but they do hunt within it. The home range overlaps the nesting range and can extend up to 27 km from the nest. Peregrines mainly hunt other birds in the air; so open tundra, grasslands, prairies and waterways are important habitats.

Population Status

The historical population estimate of Peregrine Falcons in North America is about 5,000 birds. Local populations in Canada suffered a massive reduction between the 1950s and 1970s. However, since the mid-70s, the peregrine population in Canada has increased dramatically. In 1995, 58 nesting pairs with eggs were identified along the Mackenzie River Valley. There were only 38 pairs in the same area in 1985. However, it's not clear how much of this increase is due to increased effort and knowledge of nest sites.

The range of peregrines in Canada has remained stable but population numbers have decreased, particularly in southern Canada. There are over 220 documented breeding pairs of Peregrine Falcons in northern Canada (NWT, Yukon, Nunavut, northern Quebec), including 83 pairs of known breeders in NWT (Mackenzie Valley) (RWED, 2001a). In the past, RWED conducted periodic Peregrine surveys along the Mackenzie Valley and has documented 83 nests on a linear 600 km transect along the Mackenzie River, or 0.7 nests per 100 km^2 (1995). Breeding densities of peregrines appear to be adjusted to local food supply through territorial behaviour, with pairs spacing themselves more widely in years and areas as prey density fluctuates (Bromley, 1992). There is an increasing trend in population numbers since 1980.

Threats to Peregrine Falcons have included organochloride contamination and human interference from falconry, habitat loss, etc. Present threats are particularly limited in the NWT due to the remoteness of the country (RWED, 2001a).

Ranking Assumptions

1. Ranking of Peregrine sites were based on documented nests and known range.

Ranking

Based on the methodology described in this report, rankings for the Anatum Peregrine Falcon should be increased by a value of one as it is designated as a threatened wildlife species by COSEWIC.

However, at the request of the committee, the falcon's ranking for "Range" remained at a value of 1. This was intentional since the Anatum Peregrine Falcon range covers an expansive area across the northern half of the Deh Cho territory. The Committee felt that by increasing this large area by a value of one would overstate and misrepresent the true significance of the area. For other species such as the Whooping Crane and Trumpeter Swan, their respective areas are small compared to the Peregrine Falcon and, consequently, warrants increasing the ranking value by 1.

For the Peregrine Falcon, all map polygons showing "Range" were assigned a ranking of 1.

All known nesting areas were ranked a 4.

There were no polygons assigned a value of 2 or 3.

4.2.12 Fish

Background

Name: Fish (Species treated collectively)

The term "fish" is used in a general sense; species are grouped together and treated collectively. The term "fish" is used in context to all species of fish occurring in the Deh Cho territory, for which information was available. As with waterfowl, this approach was adopted because the available data were presented in a "lumped manner." Consequently, individual species have not been treated separately.

Status: A total of 49 fish species occur within the NWT (RWED, 2001a), of which 36 species occur or hypothetically occur within the Deh Cho territory (Scott and Crossman, 1979; Page and Burr, 1991). Of the 36 species potentially occurring within Deh Cho, 3 species are classified as "May Be At Risk," 11 species are considered "Secure," 8 species are assessed as "Sensitive," and 14 species are considered "Undetermined" (RWED, 2001a). COSEWIC has assessed only one of the 36 fish species listed and has ascribed a status of "Special Concern" to the Shortjaw Cisco (RWED, 2001d; COSEWIC, 2002) (Table 9).

Distribution

<u>Range in the Northwest Territories</u>

Of the 49 fish species occurring in the lakes and rivers of the NWT, 36 occur, or potentially occur, in the Deh Cho territory. Fish can be expected to occur in most lakes and rivers within the Deh Cho territory that are deep enough to provide a good supply of oxygenated water, if not on a permanent bases then on a season bases, *e.g.*

migration or spawning (Figure 15). Fish are expected to over-winter in areas where ice does not freeze down to the substrate and in pools and rivers that are fed by underground springs.

Territorial Context

Fish occur throughout most of the aquatic habitat in the Deh Cho territory. Some of these species are year-round residents residing in the larger bodies of water (*e.g.* lakes) while some water bodies are used only during migration and/or spawning (*e.g.* mountain creeks).

General Ecology and Key Habitat Requirements

The 36 species occurring within the Deh Cho territory represent a large and diverse group of fish, with unique food and cover requirements. They occur in most of the rivers and lakes and, consequently, not any one particular habitat can be considered more important than another.

Ranking Assumptions

1. All known spawning routes were ranked a value of 4, the highest ranking.
2. All known migration routes were ranked a value of 3.

Ranking

Limited information was available for ranking fish habitat.

All map polygons showing fish "Range" were assigned a low ranking of 1. Range recognizes that the species occurs throughout the region but does not necessarily occupy this particular habitat polygon. All lakes and rivers that meet fish requirements can be assumed to be potential fish habitat. In addition, all possible spawning areas were assigned a ranking of 1.

All map polygons showing fish "migrational corridors" received a ranking of 3 because these are linear corridors used repeatedly each year.

Table 9: Fish Species Occurring or Hypothetically Occurring within the Study Area

Common Name	Scientific Name	RWED Status [1]	COSEWIC Status [2]
Shortjaw Cisco	*Coregonus zenithicus*	May Be At Risk	Special Concern
Inconnu	*Stenodus leucichthys*	May be at Risk	Undetermined
Bull Trout	*Salvelinus confluentus*	May be at Risk	Undetermined
Dolly Varden	*Salvelinus malma*	Sensitive	Undetermined
Arctic Cisco	*Coregonus autumnalis*	Sensitive	Undetermined
Least Cisco	*Coregonus sardinella*	Sensitive	Undetermined
Arctic Grayling	*Thymallus arcticus*	Sensitive	Undetermined
Pearl Dace	*Semotilus margarita*	Sensitive	Undetermined
Walleye	*Stizostedion vitreum*	Sensitive	Undetermined
Brook Stickleback	*Culaea inconstans*	Sensitive	Undetermined
Deepwater Sculpin	*Myoxocephalus quadricornis*	Sensitive	Undetermined
Lake Trout	*Salvelinus namaycush*	Secure	Undetermined
Cisco, Lake Herring	*Coregonus artedii*	Secure	Undetermined
Lake Whitefish	*Coregonus clupeaformis*	Secure	Undetermined
Broad Whitefish	*Coregonus nasus*	Secure	Undetermined
Goldeye	*Hiodon alosoides*	Secure	Undetermined
Northern Pike	*Esox lucius*	Secure	Undetermined
Longhose Dace	*Rhinichthys cataractae*	Secure	Undetermined
Longnose Sucker	*Catostomus catostomus*	Secure	Undetermined
White Sucker	*Catostomus commersoni*	Secure	Undetermined
Burbot	*Lota lota*	Secure	Undetermined
Ninespine Stickleback	*Pungitius pungitius*	Secure	Undetermined
Arctic Lamprey	*Lampetra japonica*	Undetermined	Undetermined
Chum Salmon	*Oncorhynchus keta*	Undetermined	Undetermined
Round Whitefish	*Prosopium cylindraceum*	Undetermined	Undetermined
Northern Redbelly Dace	*Chrosomus eos*	Undetermined	Undetermined
Finescale Dace	*Chrosomus neogaeus*	Undetermined	Undetermined
Lake Chub	*Couesius plumbeus*	Undetermined	Undetermined
Emerald Shiner	*Notropis atherinoides*	Undetermined	Undetermined
Spottail Shiner	*Notropis hudsonius*	Undetermined	Undetermined
Fathead Minnow	*Primephales promelas*	Undetermined	Undetermined
Flathead chub	*Platygobio gracilis*	Undetermined	Undetermined
Trout-Perch	*Percopsis omiscomaycus*	Undetermined	Undetermined
Yellow Perch	*Perca flavescens*	Undetermined	Undetermined
Slimy Sculpin	*Cottus cognatus*	Undetermined	Undetermined
Spoonhead Sculpin	*Cottus ricei*	Undetermined	Not At Risk

1 (RWED, 2001a)
2 (COSEWIC, 2002)

Those polygons identified as spawning areas received a ranking of 4 because these areas provide a critical life requisite.

There are no polygons for fish ranked with a value of 2; this can occur as there is limited, or no information, available for justifying these rankings.

4.3 Non-VECs – Selected Accounts

4.3.1 Introduction

The non-VECs includes those species not already dealt with under the VECs (Section 4.2). As already discussed, the selection of VECs was based on species, or species groups, that have been previously identified as being important in other northern studies. These include species that stakeholders, researchers and government regulators typically consider important and possess high inherent conservation values. For example, the woodland caribou is considered a VEC as it represents a species of high interest and concern to stakeholders, researchers and government regulators; whereas, the Least Flycatcher, for example, is a species that is not normally highlighted by stakeholders and researchers as being important enough to warrant costly monitoring. In addition, very little biological information is known about the Least Flycatcher, its ecology and distribution within the Deh Cho territory compared to species such as the woodland caribou.

Those species not listed as VECs, *i.e.* the remainder of the documented species occurring within the Deh Cho territory, are discussed and presented as follows under "Selected Accounts." The Non-VECs include an estimated 231 species (Tables 3, 4, 5 and 6), consisting of 3 amphibians, 179 birds and 49 mammals.

A species list was generated for wildlife and was based on government reports, range maps in field guides, and personal observations from biologists working in the region. The references used in developing these lists appear at the bottom of each respective table. A comprehensive list was also developed for wildlife species likely to occur in the area and additional species that could hypothetically occur in the area.

Location maps for each of the 231 species were not generated for the following reasons:

- The large number of species;
- The lack of distributional data for most of the species, *i.e.* known inaccuracies would be portrayed if distributions were extrapolated and mapped; and
- Many of the distributional maps would simply show a continuous polygon across the entire Deh Cho and would be meaningless.

Consequently, a table was generated in lieu of mapping, listing each species, their respective conservation status, and their known distribution based on cardinal quadrants, *i.e.* northern half of the Deh Cho territory, southeastern corner of Deh Cho, etc. Species' distributions are based on the available literature.

Approach

Much of the Deh Cho territory is remote, and approximately one-third, the mountainous region, is isolated. Historically, little research has been conducted in the more isolated areas, particularly the mountainous section, as compared to other regions of the NWT. Nevertheless, numerous sources of information do exist on wildlife occurring in the Deh Cho territory, however, these studies exhibit spatial and temporal limitations, *e.g.* many studies represent limited geographic extent, short-term, time-specific, and sometimes are simply opportunistic efforts. The majority of the wildlife information has been limited to short-term summer efforts, which limits their representativeness and possibly accuracy.

Non-VEC species are presented in phylogenetic order (*i.e.* from the most primitive to the most advanced): amphibians, birds and mammals. However, arrangement of these species varies, and was dictated by the large number of species and the diversity within each taxonomic group. For example, amphibians are listed in order by genus, as there are only a few species. Nomenclature and arrangement of amphibians follows the convention in *Amphibians in Decline: Canadian Studies of a Global Problem* (Green, 1997). The bird list is considerably more extensive and considered too extensive to present by family order. Instead, it has been presented in phylogenetic order by general groupings, *e.g.* waterfowl, raptors, woodpeckers,

shorebirds and passerines. Nomenclature and arrangement of birds follows the convention used in the American Ornithologists' Union (2003). Finally, mammals are listed in phylogenetic order by small mammals, furbearers, carnivores and ungulates. To avoid further divisiveness, liberties were exercised in placing certain species within these four categories. For example, the red squirrel and hares are frequently referred to as furbearers, however, they have been placed under small mammals; the porcupine was also placed under small mammals. Nomenclature and arrangement of mammals follows Chapman and Feldhamer (1982).

4.3.2 Amphibian Species Accounts

Three species of amphibians are known to occur in the Deh Cho territory: western toad, *Bufo boreas,* boreal chorus frog, *Pseudacris triseriata,* and wood frog, *Rana sylvatica* (Table 3).

Very little information is known about the occurrence and distribution of these amphibians in the Deh Cho, and most of what is known consists of anecdotal observations and notes. No comprehensive surveys have been conducted on these species in this area. The wood frog has the most extensive distribution in the region and is expected to be the most common of the three species. Fournier (1997) reports them to be common in the forested regions from the NWT border north to the Mackenzie Delta. The boreal chorus frog is the second most common of the three species, being wide spread in the NWT at least as far north as the mouth of the South Nahanni River. The western toad is believed to be less common than the other two frog species. It has only recently been confirmed as occurring within the NWT, having been documented from limited sightings along the Liard Valley (Fournier, pers. comm.; Canadian Nature Federation, 2002).

Nationally the wood frog, boreal chorus frog and western toad are not listed by COSEWIC, however, in the NWT, RWED lists these species as, “Secure,” “Sensitive” and “Undetermined,” respectively (RWED, 2001a).

4.3.3 Bird Species Accounts

Based on range maps, government reports and on-going research in the region, an estimated 213 potential bird species occur within the Deh Cho (Table 5).

A number of bird species were addressed under VECs (Section 4.2) including waterfowl, Trumpeter Swan, Whooping Crane and Peregrine Falcon. The remaining bird species have been sorted into species groupings, which include raptors, shorebirds, woodpeckers and passerines. Raptors include hawks, falcons and owls. Shorebirds include cranes, rails, coots, plovers, sandpipers, phalaropes, gulls and terns. Some of the birds are not typically considered shorebirds, such as gulls and terns, but they were included in this grouping for ease of presentation. Passerines include those species typically considered in the "Passeriformes" order, plus 10 additional species outside that order. Again, this was intentionally done for ease of presentation.

4.3.3.1 Raptors

Raptors, also known as "Bids of Prey," make up a small but important group of birds occurring in the Deh Cho. Although this group covers a small number of species, it is diverse and includes hawks and osprey (Accipitridae), falcons (Falconidae) and owls (Strigidae). This group will be referred to as "raptors" in this report.

Background

Name: Raptors

The term "raptor" is used in a general sense; species are grouped together and treated collectively. In this report the term "raptor" includes hawks, falcons, owls and osprey. This approach has been adopted because of the lack of available data and, consequently, individual species will not be treated separately, except for Peregrine Falcons (Section 4.2.11). Separate and unique data were available for Peregrine Falcons, and are presented in its respective section.

Status: A total of 21 raptor species are expected to occur within the Deh Cho territory; of which two species are considered "Sensitive," 15 species are classified as "Secure," three species are assessed as "Undetermined," and one species is considered "May Be At Risk" (RWED, 2001a). COSEWIC has assessed 14 of the 21 raptor species listed and 12 species have been ascribed a status of "Not At Risk;" one species is considered "Threatened" and one species is considered "Special Concern." The remaining 7 species have not been evaluated (COSEWIC, 2002) (Table 10).

Distribution

Range in the Northwest Territories

Raptors breed throughout the Deh Cho territory with select areas attracting higher breeding densities (*i.e.* boreal forest) then other areas (*i.e.* alpine zones). Raptors can be expected to breed wherever their habitat requirements are met.

Territorial Context

Twenty-three species of raptors occur within the NWT (RWED, 2001a), of which 21 are expected to occur within the Deh Cho territory (Table 10) (Clark and Wheeler, 2001; RWED, 2001a; Sibley, 2000). Some species are summer residents while others are transient migrants, some breed in the valleys containing boreal forest habitat (*i.e.* Great Horned Owl) while other species breed above the timberline in alpine habitat (*i.e.* Golden Eagles).

Little is known about the population status of individual species. Seasonally and locally they can be common to abundant. Some are migratory, appearing as early as mid-April and departing in October, while others over-winter in the region. Home ranges can be found in all ecoregions.

Ecology and Key Habitat Requirements:

General

It is difficult to generalize raptor ecology because the group, as a whole, is diverse. Some species are diurnal while others are nocturnal; some nest in trees, while others nest on cliffs and on the ground; some begin egg-laying as early as March while others not until May.

Occurrence and breeding success of raptors are likely governed by prey abundance and availability of suitable nesting habitat (Blood & Anweiler, 1994; Campbell et al., 1990). The primary prey for northern raptors are small mammals (arctic ground squirrels), small birds, ducks, ptarmigan and fish (Bromley and Buckland, 1995). Nest sites and food are the main resources that naturally limit breeding populations of peregrine falcons (Bromley, 1992) and likely other raptors.

Raptors exhibit nest site fidelity, returning to the same nest site each year. Nests are typically large, some even massive, and often made of sticks. Falcons do not construct nests with sticks, but simply scrape out an area on a ledge. Tree structure may be more important than tree species in determining nest site selection (Gerrard et al., 1975; Anthony et al., 1982).

All raptors are considered predators, and some, such as the Bald Eagle, also scavenge. Prey items vary from species to species but commonly include fish, waterfowl, muskrats, hares and squirrels (Blood and Anweiler, 1994; Terres, 1982). As scavengers, they feed on carcasses, commonly mammals.

Forest fires impact only those species of raptors occurring within the forested areas. Forest fires do not impact species nesting above the treeline, except perhaps, from the presence of smoke during particularly large fires, as in 1995. However, for forest dwellers, fire can affect them to varying degrees depending upon the species. Fire creates habitat diversity, which in turn provides for a diversity of bird species (Kelsall et al., 1977). Fires kill and injure trees, while leaving them standing. This condition can encourage nesting. Conversely, forest fires that completely consume the forest remove suitable nesting habitat. Access to adequate nesting, perching and roosting structures is important and contributes to the nesting success of raptors.

Table 10: Raptor Species Occurring or Hypothetically Occurring within the Study Area

Common Name	Scientific Name	RWED Status[1]	COSEWIC Status[2]
Peregrine Falcon	*Falco peregrinus anatum*	At Risk	Threatened
Golden Eagle	*Aquila chrysaetos*	Sensitive	Not At Risk
Short-eared Owl	*Asio flammeus*	Sensitive	Special Concern
Northern Harrier	*Circus cyaneus*	Secure	Not At Risk
Sharp-shinned Hawk	*Accipiter striatus*	Secure	Not At Risk
Northern Goshawk	*Accipiter gentilis*	Secure	Not At Risk
Red-tailed Hawk	*Buteo jamaicensis*	Secure	Not At Risk
Rough-legged Hawk	*Buteo lagopus*	Secure	Not Evaluated
Bald Eagle	*Haliaeetus leucocephalus*	Secure	Not At Risk
Osprey	*Pandion haliaetus*	Secure	Not Evaluated
Merlin	*Falco columbarius*	Secure	Not At Risk
American Kestrel	*Falco sparverius*	Secure	Not Evaluated
Gyrfalcon	*Falco rusticolus*	Secure	Not At Risk
Great Horned Owl	*Bubo virginianus*	Secure	Not Evaluated
Snowy Owl	*Nyctea scandiaca*	Secure	Not At Risk
Great Gray Owl	*Strix nebulosa*	Secure	Not At Risk
Boreal Owl	*Aegolius funereus*	Secure	Not At Risk
Northern Hawk Owl	*Surnia ulula*	Secure	Not At Risk
Broad-winged Hawk	*Buteo platypterus*	Undetermined	Not Evaluated
Long-eared Owl	*Asio otus*	Undetermined	Not Evaluated
Barred Owl	*Strix varia*	Undetermined	Not Evaluated

1 (RWED, 2001a)
2 (COSEWIC, 2002)

4.3.3.2 Shorebirds

Shorebirds represent a moderate number and diverse group of birds occurring in the Deh Cho. For this report the term shorebirds will represent cranes, rails, coots, plovers, sandpipers, phalaropes, gulls and terns.

Background

Name: Shorebirds
Status: A total of 35 shorebird species are expected to occur within the Deh Cho territory (Sibley, 2000); of which ten species are considered "Sensitive," 13 species are classified as "Secure," seven species are assessed as "Undetermined," one species is considered "May Be At Risk," one species is considered "At Risk," and three species are "Not Assessed" (RWED, 2001a). COSEWIC has assessed 4 of the 35 shorebird species listed and two species have been ascribed a status of "Not At Risk;" one species is considered "Endangered " and one species is considered "Special Concern." The remaining 31 species have not been evaluated (COSEWIC, 2002) (Table 11).

Distribution

Range in the Northwest Territories

Shorebird species are widely distributed throughout the Northwest Territories, occupying most habitat types from wetlands to dry, alpine tundra. In North America, the breeding grounds of most species of shorebirds occur in the tundra and transition ecoregions of the NWT and Nunavut. A smaller number of species breed in microhabitats of the boreal forest such as grasslands, meadows, marshes, and along beaches and shorelines of lakes or oceans.

Territorial Context

Of the 35 shorebird species potentially occurring within the Deh Cho territory at some time during the year, some are summer residents while others are migrants.

These birds are common in the Deh Cho territory during early spring, summer and fall.

Ecology and Key Habitat Requirements:

General

Shorebirds migrate to the Deh Cho territory, and further north, for the main purpose of breeding. Some of the medium-sized and larger shorebirds require two to three years to mature and until then may remain in the south or migrate only partway to the breeding grounds (Troy, 2000). For most shorebirds, the fall migration route is different than the spring migration route, resulting in an elliptic migration pattern. This is caused by the availability of food resources and varying climatic patterns between the spring and fall migration periods.

The timing of spring migration for shorebirds is influenced by the rate of snowmelt (Troy, 2000). Wetlands are the first habitats to become available. Migrating shorebirds flock to these areas to feed and rest before continuing northward. By the time shorebirds reach the NWT they are no longer in large flocks but have begun to disperse across the landscape (Environment Canada, 2000a).

The breeding season is short, approximately six to eight weeks (Environment Canada, 2000), depending upon latitude. Birds arrive on the breeding grounds while snow and ice are still present, to varying degrees, in adjacent habitats. Food is scarce at the beginning of the season and birds rely on body reserves of fat and protein acquired at staging areas as they migrated northward.

Not all species of shorebirds migrate to the tundra to breed. The breeding grounds for some species include grasslands, wetlands and lakeshores in the boreal forest, while for other species they may include the wetlands, sandy ridges, lakeshores and upland heath tundra near treeline.

Once the birds have arrived on the breeding grounds, territories are established and defended until the eggs hatch (Environment Canada, 2000a). They are among the last of bird species to arrive on the breeding grounds and the first to depart.

Table 11: Shorebirds Occurring or Hypothetically Occurring within the Study Area

Common Name	Scientific Name	RWED Status[1]	COSEWIC Status[2]
Whooping Crane	*Grus americana*	At Risk	Endangered
Yellow Rail	*Coturnicops noveboracensis*	May Be At Risk	Special Concern
American Coot	*Fulica americana*	Sensitive	Not At Risk
Black-bellied Plover	*Pluvialis squatarola*	Sensitive	Not Evaluated
American Golden-Plover	*Pluvialis dominica*	Sensitive	Not Evaluated
Lesser Yellowlegs	*Tringa flavipes*	Sensitive	Not Evaluated
Sanderling	*Calidris alba*	Sensitive	Not Evaluated
Semipalmated Sandpiper	*Calidris pusilla*	Sensitive	Not Evaluated
Least Sandpiper	*Calidris minutilla*	Sensitive	Not Evaluated
Common Snipe	*Gallinago gallinago*	Sensitive	Not Evaluated
Red-necked Phalarope	*Phalaropus lobatus*	Sensitive	Not Evaluated
Black Tern	*Chlidonias niger*	Sensitive	Not At Risk
Sora	*Porzana carolina*	Secure	Not Evaluated
Sandhill Crane	*Grus canadensis*	Secure	Not Evaluated
Ruddy Turnstone	*Arenaria interpres*	Secure	Not Evaluated
Red Knot	*Calidris canutus*	Secure	Not Evaluated
Dunlin	*Calidris alpina*	Secure	Not Evaluated
Pectoral Sandpiper	*Calidris melanotos*	Secure	Not Evaluated
White-rumped Sandpiper	*Calidris fuscicollis*	Secure	Not Evaluated
Bonaparte's Gull	*Larus philadelphia*	Secure	Not Evaluated
Mew Gull	*Larus canus*	Secure	Not Evaluated
California Gull	*Larus californicus*	Secure	Not Evaluated
Herring Gull	*Larus argentatus*	Secure	Not Evaluated
Common Tern	*Sterna hirundo*	Secure	Not Evaluated
Arctic Tern	*Sterna paradisaea*	Secure	Not Evaluated
Semipalmated Plover	*Charadrius semipalmatus*	Undetermined	Not Evaluated
Killdeer	*Charadrius vociferus*	Undetermined	Not Evaluated
Greater Yellowlegs	*Tringa melanoleuca*	Undetermined	Not Evaluated
Solitary Sandpiper	*Tringa solitaria*	Undetermined	Not Evaluated
Spotted Sandpiper	*Actitis macularia*	Undetermined	Not Evaluated
Upland Sandpiper	*Bartramia longicauda*	Undetermined	Not Evaluated
Stilt Sandpiper	*Calidris himantopus*	Undetermined	Not Evaluated
Short-billed Dowitcher	*Limnodromus griseus*	Not Assessed	Not Evaluated
Wilson's Phalarope	*Phalaropus tricolor*	Not Assessed	Not Evaluated
Black-legged Kittiwake	*Rissa tridactyla*	Not Assessed	Not Evaluated

1 (RWED, 2001a)

2 (COSEWIC, 2002)

Incubation varies between the species but is on average three weeks in duration (Environment Canada, 2000a). The adults of most species move the chicks to adjacent areas to rear them 24 hours after hatching (Environment Canada, 2000). For many shorebird species, the female departs on her southward migration before the nestlings have acquired flight feathers. The male will depart about three weeks later once the chicks have fledged. In many areas of the NWT, the females depart as early as mid-July and the males follow in early August. The fledglings remain behind longer, acquiring the strength and body mass needed to complete the southern migration (Environment Canada, 2000a; Troy, 2000).

As a group, shorebirds are primarily insectivorous, feeding on aquatic and terrestrial invertebrates. Troy (2000) noted that many shorebirds at Barrow, Alaska, preyed primarily on larvae and pupae of dipterans. Some of the shorebirds, such as sandpipers, also consume plant matter, *e.g.*, berries (Terres, 1982). In northern Canada, birds may move to areas outside their nesting territories to feed in small flocks. In general, shorebirds commonly exploit food resources found in shallow waters along shorelines of lakes, rivers and wetlands. Not all species use the same habitats for nesting and feeding, although there is some overlap.

As individuals, nesting shorebirds are selective in their use of habitat types, but as a group they occupy a variety of habitats to satisfy their needs (Troy, 2000). Habitats used for nesting include wetlands, dry uplands, sandy ridges, and disturbed areas, depending upon the species. Some species hide their nests while others nest in more open habitat. Some species, such as the least sandpiper, nest on top of cottongrass tussocks in wet areas, while the semipalmated plover nests on open, dry disturbed sites, and the American Golden Plover nests in upland heath tundra. Vegetation type and topography influence shorebird abundance (Troy, 2000).

Most habitats are exploited by some species of nesting shorebirds, particularly north of the treeline; however, this segregation dissolves as the season advances and most birds migrate to more hydric habitats, particularly wetlands for brood rearing (Myers and Pitelka, 1980; Troy, 2000). Troy (2000) speculated that this shift may be related to increased habitat access as a result of receding snow and ice, more stable food sources and improved cover for chicks.

The impacts of forest fires on shorebirds are not well documented. Conclusions regarding the impact of forest fires on shorebirds and their associated habitats are speculative. Forest fires are a concern only below the treeline, not in the alpine zone. Of the 35 species potentially occurring within the Deh Cho only 6 (lesser yellowlegs, common snipe, semipalmated plover, killdeer, solitary sandpiper and spotted sandpiper) nest within the forested zone. Most of these species nest in wetland habitats and presumably forest fires would have little impact on these habitats. The semipalmated plover, killdeer, and to a lesser extent the common snipe, all nest in drier upland areas adjacent to wetland habitats. Depending upon fire intensity and site moisture, impacts from forest fires would vary among these habitats.

Some forest fires would be beneficial such as those that burn off dense vegetation, thus clearing areas for ground nesters, while other fires may be more devastating if they were to occur during the incubation/nestling period. Killdeers have been observed nesting in burnt areas (S. Moore, pers. obs.). The common snipe prefers wetter habitat for nesting than the semipalmated plover or killdeer and a forest fire would, presumably, have less impact on them.

4.3.3.3 Woodpeckers

Background

Name: Woodpeckers
Status: In the Northwest Territories (NWT), only one of the 7 woodpeckers potentially occurring within the Deh Cho territory is listed as sensitive (Table 12). Sensitive species are “not at risk of extinction or extirpation but may require special attention or protection to prevent them from becoming at risk” (RWED, 2001a).

Distribution

Range in the Northwest Territories

There are 7 bird woodpecker species occurring in the NWT and which are widely distributed throughout the boreal forest, subalpine and alpine zones, occupying most

terrestrial habitat types. All 7 species potentially occur within the Deh Cho territory (Sibley, 2000) at some point during the year (Table 12).

Table 12: Woodpeckers Occurring or Hypothetically Occurring within the Study Area

Common Name	Scientific Name	RWED Status[1]	COSEWIC Status[2]
Northern flicker	*Colaptes auratus*	Sensitive	Not Evaluated
Pileated Woodpecker	*Dryocopus pileatus*	Secure	Not Evaluated
Yellow-bellied sapsucker	*Sphyrapicus varius*	Secure	Not Evaluated
Downy woodpecker	*Picoides pubescens*	Secure	Not Evaluated
Hairy woodpecker	*Picoides villosus*	Secure	Not Evaluated
Black-backed woodpecker	*Picoides arcticus*	Secure	Not Evaluated
Three-toed woodpecker	*Picoides tridactylus*	Secure	Not Evaluated

1 (RWED, 2001a)
2 (COSEWIC, 2002)

Territorial Context

Woodpeckers occur throughout most habitat types within the forested portion of the NWT. Some species are year-round residents while others may be present only during their reproductive phase. Woodpeckers are common within the Deh Cho during spring, summer and fall. All of the species listed in Table 12 are potentially present during the summer and five may be present during the winter.

Ecology and Key Habitat Requirements:

General

Each bird species that is dependent on tree cavities has different food, cover and spatial requirements. Cavities fulfill a variety of functions, for provision of food, nesting, and critical roosting habitats, especially for resident species in the winter.

Although many species use tree cavities, only a few excavate their own cavities. These are known as primary excavators or strong excavators, and include mostly woodpeckers. Species that rely on existing tree cavities during some critical

component of their life cycle are classed as secondary cavity excavators, or weak excavators, and include a large number of birds and mammals. In addition, the ability of a species to create a cavity depends upon the species and condition of the tree. A tree killed by lightning or fire may be hardened and difficult to excavate, and not suitable for some cavity excavators (Craig, ND).

Strong excavators, *i.e.*, woodpeckers, select living or partially dead hardwood trees for nesting, whereas weak excavators, *e.g.*, nuthatches and chickadees, show a preference for softwood trees (conifers) for nesting (Steeger and Machmer, 1996). In British Columbia, primary cavity nesters preferred birch trees over conifers for nesting, and trees less than 20 cm dbh were preferred (Machmer et al., ND). Most feeding occurs on partially dead or fully dead hardwood and softwood trees (Greater Fundy Ecosystem Research Group, 1997).

Primary excavators play an important role in the forest ecosystem. They provide nesting, roosting and foraging opportunities for secondary excavator such as small ducks, owls, raptors, passerines and mammals. Sapsuckers drill sap wells that provide nutrients to other species such as warblers and insects (Daily et al., 1993).

Most woodpecker species excavate multiple holes throughout the year for roosting and during foraging activities, in addition to those drilled for nesting purposes (Resource Inventory Committee, 1999). Although woodpeckers comprise only 32% of the potential species of cavity nesters occurring in the NWT, they are the primary excavators of cavities, and hence, influence the population dynamics of secondary cavity nesters. Suitable nesting holes for woodpeckers are often found in poplar trees during the successional stages following fires.

Forest fires affect woodpeckers to varying degrees depending upon the species. Fire creates habitat diversity, which in turn provides for a diversity of bird species. Woodpeckers rely on unhealthy trees, which include diseased and dying or dead trees. Fires kill and injure trees, while leaving them standing. This condition encourages insect infestations, which in turn attract woodpeckers. Woodpeckers play a central role in the diverse community of cavity nesters and users (Environment Canada, 2000b).

Five of the nine woodpeckers occurring in the NWT regularly over-winter in the NWT, and possibly within the Deh Cho: Northern Flicker, Pileated, Yellow-bellied sapsucker, Downy, Hairy, Black-backed, and Three-toed Woodpeckers (Sibley, 2000; Godfrey, 1979; Bromley, pers. comm.).

4.3.3.4 Passerines

Passerines, also known as "Perching" birds, make up the largest and most diverse group of birds occurring in the Deh Cho. The passerines include approximately three-fifths of all living birds (Terres, 1982) ranging in size from the largest, the raven, to the smallest, the kinglets, warblers and sparrows. In addition to passerines, 10 other species were added to this group. Technically, these 10 additional species are not classified as passerines; however, they were included in this group for ease of presentation and are highlighted with an asterisk. This group will be referred to as "Upland Nesting Birds" in this report.

Background

Name: Upland Nesting Birds
Status: A total of 107 upland nesting birds are estimated to occur within the Deh Cho territory; of which 11 species are considered "Sensitive," 51 species are classified as "Secure," 40 species are assessed as "Undetermined," one species is considered "Vagrant," two species are considered "Exotic/Alien," and two species are "Not Assessed" (RWED, 2001a). None of these 107 species has been evaluated by COSEWIC (2002) (Table 13).

Distribution

Range in the Northwest Territories

Passerines occurring in the NWT are widely distributed throughout the boreal forest and alpine/tundra, and occupy all terrestrial habitat types. Of these, 107 passerine species potentially occur within the Deh Cho (Sibley, 2000) at some point during the year (Table 13).

Table 13: Upland Nesting Birds Occurring or Hypothetically Occurring within the Study Area

Common Name	Scientific Name	RWED Status[1]	COSEWIC Status[2]
Rock Ptarmigan*	*Lagopus mutus*	Sensitive	Not Evaluated
Olive-sided Flycatcher	*Contopus cooperi*	Sensitive	Not Evaluated
Bank Swallow	*Riparia riparia*	Sensitive	Not Evaluated
Barn Swallow	*Hirundo rustica*	Sensitive	Not Evaluated
Boreal Chickadee	*Parus hudsonicus*	Sensitive	Not Evaluated
American Pipit	*Anthus spinoletta*	Sensitive	Not Evaluated
Blackpoll Warbler	*Dendroica striata*	Sensitive	Not Evaluated
American Tree Sparrow	*Spizella arborea*	Sensitive	Not Evaluated
Harris' Sparrow	*Zonotrichia querula*	Sensitive	Not Evaluated
White-throated Sparrow	*Zonotrichia albicoll*	Sensitive	Not Evaluated
Rusty Blackbird	*Euphagus carolinus*	Sensitive	Not Evaluated
Spruce Grouse*	*Dendragapus canadensis*	Secure	Not Evaluated
Willow Ptarmigan*	*Lagopus lagopus*	Secure	Not Evaluated
Ruffed Grouse*	*Bonasa umbellus*	Secure	Not Evaluated
Sharp-tailed Grouse*	*Tympanuchus phasianellu*	Secure	Not Evaluated
Common Nighthawk*	*Chordeiles minor*	Secure	Not Evaluated
Belted Kingfisher*	*Ceryle alcyon*	Secure	Not Evaluated
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Secure	Not Evaluated
Alder Flycatcher	*Empidonax alnorum*	Secure	Not Evaluated
Least Flycatcher	*Empidonax minimus*	Secure	Not Evaluated
Eastern Phoebe	*Sayornis phoebe*	Secure	Not Evaluated
Eastern Kingbird	*Tyrannus tyrannus*	Secure	Not Evaluated
Northern Shrike	*Lanius excubitor*	Secure	Not Evaluated
Red-eyed Vireo	*Vireo olivaceus*	Secure	Not Evaluated
Warbling Vireo	*Vireo gilvus*	Secure	Not Evaluated
Gray Jay	*Perisoreus canadensis*	Secure	Not Evaluated
Black-billed Magpie	*Pica pica*	Secure	Not Evaluated
Common Raven	*Corvus corax*	Secure	Not Evaluated
American Crow	*Corvus brachyrhynchos*	Secure	Not Evaluated
Horned Lark	*Eremophila alpestris*	Secure	Not Evaluated
Tree Swallow	*Tachycineta bicolor*	Secure	Not Evaluated
Cliff Swallow	*Hirundo pyrrhonota*	Secure	Not Evaluated
Black-capped Chickadee	*Parus atricapillus*	Secure	Not Evaluated
Red-breasted Nuthatch	*Sitta canadensis*	Secure	Not Evaluated
Ruby-crowned Kinglet	*Regulus calendula*	Secure	Not Evaluated

Table 13: (Cont'd)

Common Name	Scientific Name	RWED Status[1]	COSEWIC Status[2]
American Robin	*Turdus migratorius*	Secure	Not Evaluated
Swainson's Thrush	*Catharus ustulatus*	Secure	Not Evaluated
Gray-cheeked Thrush	*Catharus minimus*	Secure	Not Evaluated
Hermit Thrush	*Catharus guttatus*	Secure	Not Evaluated
Bohemian Waxwing	*Bombycilla garrulus*	Secure	Not Evaluated
Orange-crowned Warbler	*Vermivora celata*	Secure	Not Evaluated
Tennessee Warbler	*Vermivora peregrina*	Secure	Not Evaluated
Yellow Warbler	*Dendroica petechia*	Secure	Not Evaluated
Magnolia Warbler	*Dendroica magnolia*	Secure	Not Evaluated
Yellow-rumped Warbler	*Dendroica coronata*	Secure	Not Evaluated
Palm Warbler	*Dendroica palmarum*	Secure	Not Evaluated
Black-and-White Warbler	*Mniotilta varia*	Secure	Not Evaluated
American Redstart	*Setophaga ruticilla*	Secure	Not Evaluated
Northern Waterthrush	*Seiurus noveboracensis*	Secure	Not Evaluated
Wilson's Warbler	*Wilsonia pusilla*	Secure	Not Evaluated
Western Tanager	*Piranga ludoviciana*	Secure	Not Evaluated
Chipping Sparrow	*Spizella passerina*	Secure	Not Evaluated
Savannah Sparrow	*Passerculus sandwichensis*	Secure	Not Evaluated
White-crowned Sparrow	*Zonotrichia leucophrys*	Secure	Not Evaluated
Lincoln's Sparrow	*Melospiza lincolnii*	Secure	Not Evaluated
Swamp Sparrow	*Melospiza georgiana*	Secure	Not Evaluated
Dark-eyed Junco	*Junco hyemalis*	Secure	Not Evaluated
Red-winged Blackbird	*Agelaius phoeniceus*	Secure	Not Evaluated
Red Crossbill	*Loxia curvirostra*	Secure	Not Evaluated
White-winged Crossbill	*Loxia leucoptera*	Secure	Not Evaluated
Common Redpoll	*Carduelis flammea*	Secure	Not Evaluated
Pine Siskin	*Carduelis pinus*	Secure	Not Evaluated
Blue Grouse*	*Dendragapus obscurus*	Undetermined	Not Evaluated
White-tailed Ptarmigan*	*Lagopus leucurus*	Undetermined	Not Evaluated
Western Wood-pewee	*Contopus sordidulus*	Undetermined	Not Evaluated
Hammond's Flycatcher	*Empidonax hammondii*	Undetermined	Not Evaluated
Say's Phoebe	*Sayornis saya*	Undetermined	Not Evaluated
Blue-headed Vireo	*Vireo solitarius*	Undetermined	Not Evaluated
Violet-green Swallow	*Tachycineta thalassina*	Undetermined	Not Evaluated
Winter Wren	*Troglodytes troglodytes*	Undetermined	Not Evaluated

Table 13: (Cont'd)

Common Name	Scientific Name	RWED Status[1]	COSEWIC Status[2]
American Dipper	*Cinclus mexicanus*	Undetermined	Not Evaluated
Golden-crowned Kinglet	*Regulus satrapa*	Undetermined	Not Evaluated
Northern Wheatear	*Oenanthe oenanthe*	Undetermined	Not Evaluated
Townsend's Solitaire	*Myadestes townsendi*	Undetermined	Not Evaluated
Mountain Bluebird	*Sialia currucoides*	Undetermined	Not Evaluated
Varied Thrush	*Ixoreus naevius*	Undetermined	Not Evaluated
Cape May Warbler	*Dendroica tigrina*	Undetermined	Not Evaluated
Bay-breasted Warbler	*Dendroica castanea*	Undetermined	Not Evaluated
Ovenbird	*seiurus aurocapillus*	Undetermined	Not Evaluated
Connecticut Warbler	*Oporornis agilis*	Undetermined	Not Evaluated
Mourning Warbler	*Oporornis philadelphia*	Undetermined	Not Evaluated
Common Yellowthroat	*Geothlypis trichas*	Undetermined	Not Evaluated
Canada Warbler	*Wilsonia canadensis*	Undetermined	Not Evaluated
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Undetermined	Not Evaluated
Clay-colored Sparrow	*Spizella pallida*	Undetermined	Not Evaluated
Le Conte's Sparrow	*Ammodramus leconteii*	Undetermined	Not Evaluated
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	Undetermined	Not Evaluated
Vesper Sparrow	*Pooecetes gramineus*	Undetermined	Not Evaluated
Golden-crowned Sparrow	*Zonotrichia atricapilla*	Undetermined	Not Evaluated
Fox Sparrow	*Passerella iliaca*	Undetermined	Not Evaluated
Song Sparrow	*Melospiza melodia*	Undetermined	Not Evaluated
Smith's Longspur	*Calcarius pictus*	Undetermined	Not Evaluated
Lapland Longspur	*Calcarius lapponicus*	Undetermined	Not Evaluated
Snow Bunting	*Plectrophenax nivalis*	Undetermined	Not Evaluated
Brown-headed Cowbird	*Molothrus ater*	Undetermined	Not Evaluated
Brewer's Blackbird	*Euphagus cyanocephalus*	Undetermined	Not Evaluated
Common Grackle	*Quiscalus quiscula*	Undetermined	Not Evaluated
Evening Grosbeak	*Coccothraustes vespertinus*	Undetermined	Not Evaluated
Pine Grosbeak	*Pinicola enucleator*	Undetermined	Not Evaluated
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	Undetermined	Not Evaluated
Purple Finch	*Carpodacus purpureus*	Undetermined	Not Evaluated
Hoary Redpoll	*Carduelis hornemanni*	Undetermined	Not Evaluated
Marsh Wren	*Cistothorus palustris*	Vagrant	Not Evaluated
European Starling	*Sturnus vulgaris*	Exotic/Alien	Not Evaluated
House Sparrow	*Passer domesticus*	Exotic/Alien	Not Evaluated

Table 13: (Completed)

Common Name	Scientific Name	RWED Status[1]	COSEWIC Status[2]
Rufous Hummingbird	*Selasphorus rufus*	Not Assessed	Not Evaluated
MacGillivray's Warbler	*Oporornis tolmiei*	Not Assessed	Not Evaluated

1 (RWED, 2001a)
2 (COSEWIC, 2002)
* Species is not a passerine.

Territorial Context

Passerines occur throughout all terrestrial habitat types in the NWT. Some species are year-round residents while the majority are migratory and are present only during their reproductive phase. Upland nesting birds are very common throughout the Deh Cho territory during spring, summer and fall. All of the species listed in Table 13 are potentially present during the summer and approximately 10 may be present during the winter within the boreal forest portion of the region.

Ecology and Key Habitat Requirements:

General

Passeriformes represent a large and diverse group of birds, and each species has different food and cover requirements. They occur in all terrestrial habitats and, consequently, not any one particular habitat can be considered more important than another. However, those species over-wintering are restricted to the boreal forest and feed on seeds or carrion. During summer months, their diets vary but reflect the availability of food items such as insects, seeds, carrion, tree sap, etc. Tree cavities fulfill an important function for a few species by enabling them to survive over winter. There are a number of species that nest in tree cavities; these are considered avian cavity nesters; however, most nest on the ground or in trees or shrubs.

Feeding strategies for upland nesting birds are varied, ranging from seed-eaters to aerial insect- and nectar- feeders, to individuals that take live fish, and many more.

General Ecology and Key Habitat Requirements

Passeriformes represent a large and diverse group of birds and, consequently, their food habits are also varied. Most of the upland nesting birds are omnivores, eating a variety of items that shifts as the availability of food changes over the course of a year. In general, dietary items can include wild fruits and seeds, insects, carrion, and live prey in the form of fish or small mammals.

Foraging occurs in all habitat types and includes aerial feeding by swallows over water, and ground and canopy feeding by sparrows and warblers, respectively.

It is not possible to generalize the nesting habits of 60 different species of passerines. They nest in all terrestrial habitat types: softwood, hardwood, and shrub stands, different seral stages, dry uplands to wet lowlands, and vegetated to sparsely vegetated sites.

The majority of upland nesting birds are migratory and have wintering grounds in southern Canada, the United States, Central and South America. Nine species, however, regularly over-winter in the NWT: Gray Jay, Common Raven, Boreal and Black-capped Chickadee, Pine Grosbeak, Hoary and Common Redpoll, Red and White-winged Crossbill (Godfrey, 1979; Bromley and Trauger, ND).

Forest fires affect upland nesting birds to varying degrees depending upon the species. Fire creates habitat diversity, which in turn provides for a diversity of bird species (Kelsall et al., 1977). Because forest structure (density and height class) determines avian community composition, changes in forest structure lead to changes in avian communities. A stand-replacing fire will, therefore, change the forest structure. Many passeriformes species of passerines, such as sparrows, forage in early successional seral stages and, thus, benefit from fire. Other species, such as the thrushes, require mature forest structure and would be negatively impacted by forest fires.

4.3.4 Mammal Species Accounts

Based on range maps, government reports and on-going research in the region, an estimated 56 mammalian species have been documented as occurring within the

Deh Cho territory (Table 6). Seven mammalian species were discussed under VECs (Section 4.2), the remaining 49 species are presented below. The remaining mammalian species have been sorted into species groupings, which include small mammals, furbearers, carnivores and ungulates.

4.3.4.1 Small Mammal Species

Small mammals are a species grouping placed into their own category based upon various criteria including their overall body size, and the fact that they are not included in either the big game, furbearer, carnivore or ungulate category. Included in the small mammal category are both trapped species like the squirrel and rabbit and other less well known non-game species including bats, shrews, voles, and ground squirrels.

Small mammals are important as keystone species in many northern ecosystems. In the NWT, fluctuations in small mammal abundance are often regular in occurrence (3-4 years) and large in magnitude of change (10-50) times. These population fluctuations have major implications on many aspects of northern ecosystems. They are closely tracked by local populations of avian predators and small mammalian predators (fox, weasel, marten, etc.)

There are 31 species of small mammals occurring in the Deh Cho and which are widely distributed across the region occupying most terrestrial habitat types: boreal forest, subalpine and alpine zones (Table 14).

4.3.4.1.1 Shrews (Family - Soricidae)

The family *Soricidae* is made up of the smallest mammals, the shrews. Shrews all share the common characteristics of small size, a long and pointed snout, smaller than ordinary eyes, and short ears. This small mammal is known to have the highest metabolism of any mammal and can eat more than its body weight in a day. These small mammals are active year round and provide food for a number of species including weasels, hawks, owls, coyotes, etc.

Table 14: Small Mammals Occurring or Hypothetically Occurring within the Study Area

Common Name	Scientific Name	RWED[1]	COSEWIC[2]
Masked Shrew	*Sorex cinereus*	Secure	Not Evaluated
Dusky Shrew	*Sorex monticolus*	Secure	Not Evaluated
Water Shrew	*Sorex palustris*	Secure	Not Evaluated
Artic Shrew	*Sorex arcticus*	Secure	Not Evaluated
Pygmy Shrew	*Microsorex hoyi*	Secure	Not Evaluated
Snowshoe Hare	*Lepus americanus*	Secure	Not Evaluated
Least Chipmunk	*Eutamias minimus*	Secure	Not Evaluated
Woodchuck	*Marmota monax*	Secure	Not Evaluated
Arctic Ground Squirrel	*Spermophilus parryii*	Secure	Not Evaluated
Red Squirrel	*Tamiasciurus hudsonicus*	Secure	Not Evaluated
Deer Mouse	*Peromyscus maniculatus*	Secure	Not Evaluated
Northern Red-backed Vole	*Clethrionomys rutilus*	Secure	Not Evaluated
Southern Red-backed Vole	*Cleithrionomys gapperi*	Secure	Not Evaluated
Brown Lemming	*Lemmus sibiricus*	Secure	Not Evaluated
Northern Bog Lemming	*Synaptomys borealis*	Secure	Not Evaluated
Heather Vole	*Phenacomys intermedius*	Secure	Not Evaluated
Meadow Vole	*Microtus pennsylvanicus*	Secure	Not Evaluated
Chestnut-cheeked Vole	*Microtus xanthrognathus*	Secure	Not Evaluated
Tundra Vole	*Microtus oeconomus*	Secure	Not Evaluated
Common Porcupine	*Erethizon dorsatum*	Secure	Not Evaluated
Little Brown Bat	*Myotis lucifugus*	Sensitive	Not Evaluated
Collared Pika	*Ochotona collaria*	Sensitive	Not Evaluated
Northern Flying Squirrel	*Glaucomys sabrinus*	Sensitive	Not Evaluated
Hoary Bat	*Lasiurus cinereus*	Undetermined	Not Evaluated
Hoary Marmot	*Marmota caligata*	Undetermined	Not Evaluated
Bushy-tailed Wood Rat	*Neotoma cinerea*	Undetermined	Not Evaluated
Long-tailed Vole	*Microtus longicaudus*	Undetermined	Not Evaluated
Meadow Jumping Mouse	*Zapus hudsonius*	Undetermined	Not Evaluated
Keen's Bat *	*Myotis Keenii*	Not Assessed	Not Evaluated

* - Keen's Bat - RWED does not list this species as occurring within the NWT; however, Parks Canada's Nahanni National Park Reserve Resource Description Analysis states, one specimen from Nahanni Hotsprings was collected, representing a new park record and a northern range extension (Pg 8-8).

1 (RWED, 2001a)

2 (COSEWIC, 2002)

In the Deh Cho territory 5 species of shrews are known to occur. These include the masked shrew, dusky shrew, water shrew, arctic shrew and pygmy shrew. All of the shrews occurring in the Deh Cho are listed as “Secure” by RWED (2001a) and have not been evaluated by COSEWIC (2002).

4.3.4.1.2 Bats (Family - Vespertilionidae)

There is a paucity of information on bat’s and their distribution in the Deh Cho territory. Three bat species have been documented as occurring within the Deh Cho territory: little brown bat *(Myotis lucifugus)*, hoary bat *(Lasiurus cinereus)* and the Keen's bat *(Myotis Keenii)* (Table 6).

The little brown bat and the hoary bat have confirmed permanent distributions in the Deh Cho. However, only one occurrence of the Keen’s bat has been collected and confirmed to date. The little brown bat is perhaps the most common of the bats occurring in the NWT. It has been observed in the Deh Cho exhibiting swarming behaviour, an activity viewed as pre-nuptial behaviour prior to selecting a hibernacula (Parks Canada, 1984). The habitat for this bat species includes areas where trees and water are found, preferring to forage over water. It roosts in natural cavities, crevices, under bark and in buildings. There are no known hibernacula within the Deh Cho, although field observations support their existence.

The hoary bat appears to be less common than the little brown bat (RWED, 2001a). The Keen’s bat appears to have been a singular occurrence. RWED does not list this species as occurring within the NWT; however, Parks Canada's Nahanni National Park Reserve Resource Description Analysis states, one specimen from Nahanni Hot Springs was collected, representing a new park record and a northern range extension (Parks Canada, 1984: Pg 8-8).

No information is available on the population status and distribution trends for the three bat species. The population trend for the little brown bat is unknown but is presumed to be stable. The resident population is very small and at the extreme northern limit of it range. Threats to the NWT population are unknown but probably limited (RWED, 2001a). The hoary bat has a very limited number of occurrences within the Deh Cho and, consequently, its population trend is unknown.

4.3.4.1.3 Hare-like mammals (Order - Lagomorpha)

There are two species occurring within the hare-like mammals (Lagomorpha) and include the snowshoe hare and the collared pika.

Hares (Leporidae)

The snowshoe hare *(Lepus americanus)* is the only species of Leporidae occurring within the Deh Cho territory. Hares prefer deciduous, mixed wood and lowland black spruce-tamarack forest communities. Hare populations are cyclic with oscillations of 9 to 10 years. This species is preyed upon by furbearers such as the lynx, red fox, fisher, and coyote; but, perhaps, the lynx is most closely tied to the hare and its cyclic oscillations. The snowshoe hare is clearly one of the dominant herbivores and key prey species within the Boreal Forest.

Little information is available on the population status and distribution trend for the snowshoe hare. The population trend possesses a naturally large oscillation of 9 to 10 years. Population density is highly variable and determinant on a number of environmental entities. RWED suggests that a density of approximately 32 hares per km^2 is ideal to permit adequate reproduction. In addition, RWED speculates that this species distributional trend many be stable, given its already extensive distribution. Predation and disease are the only threats to the population (RWED, 2001a).

The snowshoe hare is listed as "Secure" by RWED (2001a) and has not been evaluated by COSEWIC (2002).

Pikas (Ochotonidae)

Pikas are small mammals, related to rabbits, and usually live in the talus slopes at the base of mountains. Most pikas use rockpiles for shelter from the weather and predators. They are generalist herbivores, eating almost anything that grows near their rocky habitat. Pikas do not hibernate and store vegetation during the summer months to use as a food source during the winter. They are territorial and defend portions of their talus slope from each other during the summer.

The collared pika is listed as "Sensitive" by RWED (2001a) and has not been evaluated by COSEWIC (2002).

4.3.4.1.4 Squirrels (Family - Sciuridae)

The family *Sciuridae* belongs to the largest and most diverse order of mammals, *Rodentia*, containing about 1,620 species. There are three basic groups of squirrels: flying squirrels, which are active mostly at night; tree squirrels, which are active during daylight hours; and, the ground squirrels. The first two groups spend most of their time in trees and build their nest above ground; the third group, are ground dwelling and nest in underground burrows. Because flying and tree squirrels are dependent upon mature trees, their distribution is limited to forested areas of the Boreal Forest.

Little information is available on the population status and distribution trends of these six species. None of the species are presumed threatened. The woodchuck is one species with an expanding population distribution, expanding into near cleared and deforested areas. Each species occurs in different parts of the Deh Cho (Table 6).

In the Deh Cho territory there are 6 species known to occur and they include: least chipmunk, woodchuck, hoary marmot, arctic ground squirrel, red squirrel and northern flying squirrel. RWED (2001a) lists the northern flying squirrel as "Sensitive;" the least chipmunk, woodchuck, arctic ground squirrel and the red squirrel as "Secure;" the hoary marmot as "Undetermined." These species have not been evaluated by COSEWIC (2002).

4.3.4.1.5 Rats, Mice and Voles (Family - Muridae)

Muridae is a large family within the order *Rodentia*. They are also the most wide spread, living in every habitat from salt marsh to desert to alpine and arctic tundra. There are 13 species within this grouping that can be found within the Deh Cho territory and include: deer mouse, bushy-tailed wood rat, northern red-backed vole, southern red-backed vole, brown lemming, northern bog lemming, heather vole,

meadow vole, long-tailed vole, chestnut-cheeked vole, meadow jumping mouse, tundra vole, and insular vole.

RWED (2001a) lists the deer mouse, northern red-backed vole, southern red-backed vole, brown lemming, northern bog lemming, heather vole, meadow vole, chestnut-cheeked vole, and tundra vole as "Secure;" the bushy-tailed wood rat, long-tailed vole and meadow jumping mouse as "Undetermined;" and the insular vole has not been assessed. These species have not been evaluated by COSEWIC.

4.3.4.1.6 Common Porcupine (Family – Erethizontidae)

The common porcupine is the last species within the small mammals grouping. This species occurs across North America in a wide range of vegetation types from Boreal Forest to tundra to alpine habitats. It can be expected to occur within most of the ecozones of the Boreal Forest.

Population is believed to be stable (RWED, 2001a). RWED lists the common porcupine as "Secure." COSEWIC has not evaluated this species.

4.3.4.2 Furbearer Species

The term furbearer includes mammals which, by definition, possess some form of hair. However, for this report, the furbearer term applies to those mammalian species that have been traditionally trapped or hunted for their fur. There are 9 furbearing animals considered within this section: beaver, muskrat, marten, fisher, ermine, least weasel, mink, striped skunk and river otter (Table 15). Although lynx, fox, wolf, coyote and wolverine are commonly considered furbearers, they have been placed under the carnivore section. The furbearers occurring in the NWT are widely distributed throughout the boreal forest and to a lesser extent, sub-alpine and alpine habitat. The nine furbearers occur within the Deh Cho throughout the year.

Furbearers represent a large and diverse group of mammals, and each species has different food and cover requirements. They occur in most aquatic and terrestrial habitats and, consequently, not any one particular habitat can be considered more important than another. Most are adaptable species ranging over large geographic areas.

Table 15: Furbearer Species Occurring or Hypothetically Occurring within the Study Area and Their Status

Common Name	Scientific Name	RWED[1]	COSEWIC[2]
Beaver	*Castor candensis*	Secure	Not Evaluated
Muskrat	*Ondantra zibethicus*	Secure	Not Evaluated
Marten	*Martes americana*	Secure	Not Evaluated
Ermine	*Mustela erminea*	Secure	Not Evaluated
Least Weasel	*Mustela nivalis*	Secure	Not Evaluated
Mink	*Mestela vision*	Secure	Not Evaluated
Striped Skunk	*Mephitis mephitis*	Secure	Not Evaluated
River Otter	*Lutra canadensis*	Sensitive	Not Evaluated
Fisher	*Martes pennanti*	May Be At Risk	Not Evaluated

1 (RWED, 2001a)
2 (COSEWIC, 2002)

Ranking

All map polygons showing furbearer "Range" were assigned a low ranking of 1. Range recognizes that the species occurs throughout the region but does not necessarily occupy this particular habitat polygon.

All map polygons showing "All Habitat Functions" received a ranking of 2.

There are no polygons for furbearers ranked with a value of 3 or 4; this can occur as there is limited, or no information, available for justifying these rankings.

4.3.4.2.1 Beaver and Muskrat

Beavers and muskrats are common throughout the Deh Cho territory, wherever appropriate aquatic habitat is found such as slow-flowing streams, lakes, rivers, and marshes.

Beaver and muskrat densities are highly variable and dependent upon habitat quality. However, for beaver 0.1 to 0.4 active lodges km^2 may be found in prime river habitat; and 26 to 58 lodges per 100 km^2; for muskrat, 3 per 0.5 ha of pond up

to 25 per 0.5 ha of marsh (RWED, 2001a). The population is believed to be stable, and maybe increasing in the Sahtu and Mackenzie Delta.

RWED (2001a) lists the beaver and muskrat to be "Secure." COSEWIC (2002) has not evaluated this species.

4.3.4.2.2 Marten

Their occurrence in the Northwest Territories (NWT) is tied to the northern boreal forest and they reach the northern limit of their range in the Northwest Territories. They occur throughout the Deh Cho territory. Little is known about these populations. A field study with population-related objectives was conducted in the Fort Smith area (Graf, 1994). Wooley (1974) and Latour et al. (1994) examined marten – habitat relationships in the Mackenzie Valley.

Throughout their range marten associate closely with late-successional stands of mesic (*i.e.*, moist) coniferous forests, especially those with complex physical structure near the ground (Allen, 1984; Buskirk and Powell, 1994; Clark et al., 1987; Thompson, 1994). Physical structure refers to the vertical and horizontal complexity created by a diversity of tree sizes and shapes, light gaps, dead and downed wood, varied shrub understory and layers of overhead cover.

Marten populations in the Northwest Territories are considered "secure" (RWED, 2001a).

4.3.4.2.3 Mink

Mink range across forested areas of the Northwest Territories. Little is known about the ecology of mink in Canada's boreal forest, and has received little management attention, except as an indicator of environmental contamination (Poole et al., 1995). Most studies have been conducted in the United States, and are focused on describing food habits.

Although mink can be found in practically any habitat type, they are obligate riparian animals, never found far from permanent streams, wetlands or other surface water. They are more often associated with coniferous and mixed forests than

deciduous forests, and with open water rather than with particular habitat types. Habitats associated with small streams are preferred over habitats near large, broad rivers (Allen, 1986). Mink favour forested wetlands with abundant cover such as shrubs, fallen trees, and rocks (Allen, 1986).

Population density for mink depends on habitat quality and prey availability. RWED (2001a) report mink densities between 3 to 8 individuals per km^2 in good habitat and as low as 1.5 individuals per km^2 in poor quality habitat. It is difficult to determine what the population trend is for mink, however, RWED (2001a) suggests it may be stable.

Mink populations in the Northwest Territories and Nunavut are considered "secure" (RWED, 2001a). COSEWIC (2002) has not evaluated this species.

4.3.4.2.4 Fisher

Fishers range across most of Canada, including the southern area of the NWT and Yukon (Powell, 1982; Nagorsen, 1990). Within the Deh Cho they are restricted to the southern area, and fur returns show individuals are periodically trapped from the Cameron Hills, Redknife Hills and one individual taken on the south side of the Horn Plateau. There have been 14 individuals trapped between Trout Lake, Tathlina/Kakisa Lake, and the Horn Plateau (Cizek, pers. comm.). The one trapped on the Horn Plateau represents the most northerly individual documented in the NWT, latitude approximately 119^{o} $45^{'}$.

Typically, habitat used by fishers includes climax coniferous forest near watercourses, but also into subclimax deciduous groves and old burns. Continuous forest cover is also important (Buskirk and Powell, 1994; RWED, 2001a). It appears that fishers in western coniferous forests may rely on the structures and ecological process associated with late successional stands to fulfill many of their life requirements (Ruggiero et al., 1994).

Fishers are generalized predators and have been classified by some as opportunistic carnivores with a diverse diet (Powell, 1982; Banci, 1989). Most diet analysis for fishers has been conducted in winter, but Banci (1989) speculated that summer diets

include a greater quantity of vegetation, especially fruits and nuts, and a greater diversity of prey as seasonal species, such as migratory birds, move into an area.

Fishers are found at low densities throughout the boreal forests where they reach the northern extent of their range in British Columbia (Banci, 1989) and the NWT (RWED, 2001a). Fishers within the southeast corner of the Yukon are believed to be rare (Hagmeier, 1956; Penner, 1981; Slough, 1985). Fisher density is roughly estimated to be approximately 1 to 4 individuals per 200 km^2 (RWED, 2001a) and is dependent upon habitat quality and prey abundance.

RWED (2001a) reports that the trend in the population distribution has decreased from historic levels. This species is listed as "May Be At Risk" (RWED, 2001a). COSEWIC (2002) has not evaluated this species.

4.3.4.2.5 Ermine and Least Weasel

Two species of weasels are found across the Deh Cho, the ermine and the least weasel. Parks Canada (1984) reports that the ermine is more common that the least weasel within Nahanni National Park Reserve, and this maybe the case across the Deh Cho territory.

Habitat used by ermine and least weasel is not dissimilar and they share some overlap, which includes boreal coniferous or mixed forest, tundra, meadow boundaries, shrubby riverbanks and lakeshores. Population density for both species depends on habitat quality, prey availability and time of year. For both species, the populations have considerable annual fluctuations and yearly cycles depending upon prey levels.

Both species are listed by RWED (2001a) as being "Secure." COSEWIC (2002) has not evaluated this species.

4.3.4.2.6 Striped Skunk

The striped skunk occurs over most of North America. Godin (1982) shows the northern range extension as occurring within the southern area of the NWT, from Ft. Smith west to Ft. Liard. Although they occur in the NWT they are not frequently

seen. Local observations have been reported from Ft. Smith and possibly Ft. Liard (RWED, 2001a); while one observation was reported from the mouth of the South Nahanni River (Parks Canada, 1984).

Population density for striped skunks is estimated to be 5 individuals per km^2 in good agricultural land (RWED, 2001a). Very little is known about this species and it is difficult to determine what the population trend is for the skunk, however, RWED (2001a) speculates that it may be stable.

This species is listed by RWED (2001a) as being "Secure." COSEWIC (2002) has not evaluated this species.

4.3.4.2.7 River Otter

The river otter is the largest member of the Mustelidae family. Historically, they were found in all major waterways of North America. Presently, their distribution still covers the majority of Canada, except in the central prairies. Toweill and Tabor (1982) show the range of the river otter occurring throughout the Deh Cho territory and extending northward to the treeline.

Otters are aquatic mammals and are well adapted to a wide variety of aquatic habitats, from lowland rivers and marshes to high elevation mountain lakes (Toweill and Tabor, 1982). Although they frequent lakes and ponds, they typically live in marshes and along wooded rivers and streams with sloughs and backwater areas.

Otters are opportunistic and will take foods that are most available. The most available fish tend to be the slower-swimming species and those that are most abundant.

Population density for otters is unknown for the NWT but RWED (2001a) estimates it is "low to moderate." The trend in the population is believe to be stable in the Sahtu but increasing in the Inuvik region (RWED, 2001a).

This species is listed by RWED (2001a) as being "Sensitive." COSEWIC (2002) has not evaluated this species.

4.3.4.3 Carnivore Species

Carnivores are placed into their own category based upon various criteria including their overall body size, and the fact that they are large predators. Included in the carnivore category are coyote, wolf, red fox, grizzly bear, black bear, wolverine, lynx and cougar. Some of these carnivores, such as wolves, are important keystone species in many northern ecosystems. In the NWT, fluctuations in small mammal abundance are often regular in occurrence (3-4 years) and large in magnitude of change (10-50) times. These population fluctuations have major implications predator populations.

There are 8 species of carnivores within this species grouping occurring in the Deh Cho. Most of these species are widely distributed across the region occupying most terrestrial habitat types throughout the boreal forest, subalpine and alpine zones (Table 16).

Table 16: Carnivore Species Occurring or Hypothetically Occurring within the Study Area and Their Status

Common Name	Scientific Name	RWED Status [1]	COSEWIC Status [2]
Wolf	*Canis lupus*	Secure	Not At Risk – 1999
Red Fox	*Vulpes vulpes*	Secure	Not Evaluated
Black Bear [3]	*Ursus americannus*	Secure	Not at Risk – 1999
Wolverine	*Gulo gulo*	Secure	Specieal Concern
Lynx	*Lynx canadensis*	Secure	Not At Risk
Grizzly Bear [3]	*Ursus arctos*	Sensitive	Special Concern
Coyote	*Canis latrans*	Undetermined	Not Evaluated
Cougar	*Puma concolor*	Undetermined	Not Evaluated

1 (RWED, 2001a)
2 (COSEWIC, 2002)
3 Bears have been discussed under section 4.2

4.3.4.3.1 Wolf

Wolves were once distributed throughout Canada. They are now extinct in New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland, the settled and agricultural parts of Quebec, Ontario and the western provinces. In the Northwest

Territories, they are still found on most of their traditional range (RWED, 2002b). Wolves are found throughout the Deh Cho territory and occupy most terrestrial habitat types.

In the Northwest Territories three different groups of wolves can be distinguished based on behaviour and distribution: timber wolves, arctic wolves and tundra wolves. Timber wolves live below the treeline or in the mountains and rely mostly on non-migratory prey like moose and bison. These wolves maintain regular territories. The arctic wolves live on the arctic islands and prey mostly on caribou, muskox and arctic hare. The tundra wolf follows the mainland caribou herds above and below the treeline on their annual migration. Theses wolves depend largely on barren-ground caribou, and do not maintain regular territories (RWED, 2003b). Wolves are the predominant predators of large ungulates and as such they hold a pivotal role in all levels of northern ecosystems.

Wolves are habitat generalists, and their strongest affinity is for habitats occupied by their prey. However, they have very specific requirements for denning habitat. In the Slave Geological Province (SGP), nearly all den sites have been found on eskers or in other glacial deposits (Mueller, 1995; Rescan 1996; BHP, 1998; Cluff, pers. comm.). Use of other habitats by wolves on the barrens to date has not been documented.

No wolf studies could be found occurring in the NWT, other than those conducted in the SGP. There is no data on abundance of wolves in the NWT, however, RWED (2001a) speculates that wolf densities may be one individual per 100 km^2 in the southern NWT. Within the Northwest Territories, the highest density of wolves occur in areas where barren-ground caribou winter (RWED, 2002b). Wolf population sizes in the Northwest Territories are unknown, variable and unpredictable. The population trend appears to be stable, with some populations increasing.

This species is listed by RWED (2001a) as being “Secure.” COSEWIC (2002) has assigned a designation of “Not At Risk” for the *Canis lupus occidentalis,* the subspecies occurring within the Deh Cho.

4.3.4.3.2 Coyote

Little information is available on the distribution of coyotes within the NWT and, more specifically, the Deh Cho territory. Bekoff (1982) shows the distribution of coyotes throughout the forested region of the NWT. This species occupies many diverse habitats including alpine tundra, boreal forest and aspen parklands. Coyotes can, and are known to, interbreed with wolves and produce fertile hybrids.

The population number and density estimates for the NWT are unknown. However the trend in its distribution is expanding. In Alberta coyote densities range between 10 to 40 individuals per 100 km^2. Coyote densities are expected to be lower in the NWT.

This species is listed by RWED (2001a) as being "Undetermined," but has not been evaluated by COSEWIC (2002).

4.3.4.3.3 Red Fox

The red fox is the most widely distributed carnivore in the world. It occurs throughout most of North America, Asia and Europe. It ranges across Canada as far north as some of the Arctic islands. Large numbers occur below the treeline of the NWT. This species occupies many diverse habitats.

The population estimate for the NWT is unknown but is estimated to be greater than 10,000 individuals (RWED, 2001a). The population is cyclic and fluctuates on an 8 to 10 year cycle. The distribution of red fox is believed to be stable. The population density of red fox is estimated to be 10 individuals per 100 km^2 (RWED, 2001a).

This species is listed by RWED (2001a) as being "Secure," and has not been evaluated by COSEWIC (2002).

4.3.4.3.4 Wolverine

Wolverines range throughout most of northern and western Canada. They occur throughout the Deh Cho territory. Little is known regarding their population size in

the NWT. Wolverines are difficult to locate during snow-free periods, lead a largely solitary lifestyle, and have a lower population density than wolves or foxes. They have large home ranges and live at low densities even under optimal conditions (Banci, 1994). Reproductive rates are low and sexual maturity is delayed, in comparison with some (or most) other carnivores.

Wolverines are scavengers and predators of birds and small mammals, relying on a diversity of foods to offset the uncertainty of availability in the harsh northern environment. There appears to be a correlation between wolverine numbers, ungulate populations, and the presence of more (successful) efficient predators such as wolves (Van Zyll de Jong, 1975).

The denning habitats of wolverines are also poorly understood. There is evidence that adult females show fidelity to maternity den sites (Bromley and Buckland, 1995; Banci and Moore, 1997).

The population estimate for wolverines in the NWT is unknown but is estimated to be greater than 3,000 individuals (RWED, 2001a). The trend in their distribution is unknown. Population density is estimated to be one individual per 625 to 265 km^2, depending on the gender of a given individual and food availability (RWED, 2001a).

This species is listed by RWED (2001a) as being "Secure." COSEWIC (2002) has assigned a designation of "Special Concern" to the western population of wolverine.

4.3.4.3.5 Lynx

Lynx occur throughout the forested areas of the Deh Cho. The size of the population within the NWT is unknown. There has only been one study conducted on lynx in the NWT. A long-term live-trapping and radio-collaring program was begun in 1989 on lynx in the Mackenzie Bison Sanctuary. Results showed that the home range size for lynx in the Mackenzie Bison Sanctuary is similar for males and females, but varies from year to year depending on the density of snowshoe hares. Generally, home range size was smallest during the year of hare decline. After the number of hares dropped, home range size increased significantly, and dispersal of lynx intensified. (Poole, 1992 and 1994).

The main prey of lynx is the snowshoe hare. Because population levels of hares are cyclic, habitat use by lynx in relation to food varies considerably depending on the stage of the prey cycle.

There are no data available on the numbers of lynx in the NWT. RWED (2001a) speculate their numbers to be greater than 3,000 and perhaps even greater than 10,000 individuals. Densities have been determined for lynx in the Mackenzie Bison Sanctuary since 1989. Peak densities were estimated at 30 per 100 km^2, and declined to about 3 per 100 km^2 (Poole, 1994). The trend in their distribution is cyclic dispersion; that is they disperse when prey levels decline.

This species is listed by RWED (2001a) as being "Secure." COSEWIC (2002) has assigned a designation of "Not At Risk."

4.3.4.3.6 Cougars

Gau and Mulders (2001) documented 31 occurrences of cougar from the NWT between the years 1978 to 2001. These authors believe that transient cougars are periodic visitors to the NWT and, possibly a small, but viable, breeding population may reside in the Territory. Of these 31 occurrences, 18 occur across the Deh Cho study area; plus 12 lie east of the study area boundary in, and adjacent to, WBNP, and one north of the study area boundary near Edzo, NWT. These records represent direct visual sightings of cougars between 1978 and 2001.

Very little information exists on cougars occurring at their northern range. However, the cougar is a year-round resident, found in most forested areas of British Columbia and Alberta. Documented records from the Northern Boreal Mountains and Taiga Plains ecoprovinces are lacking but it is thought that cougars occur there at very low densities. This conclusion is reasonable considering that cougars are resident in the southern Yukon (Anderson, 1983).

Cougars can be found in most forested habitats which support ungulate populations. They often prefer areas with rock ledges or outcrops which can be used as vantage points for hunting, for resting, and to escape wolves or dogs. Maternity dens can be located in dense thickets and brush piles, in rock crevices, or under large fallen trees

(Anderson, 1983). Cougars prey primarily on ungulates (Toweill, 1977; Ross and Jalkotzy, 1992). Beavers, rabbits and hares, porcupines, domestic stock, and raccoons are also preyed upon.

It appears that cougars have expanded their range into the NWT and, perhaps, have established a small, but viable, breeding population with the Territory (Gau and Mulders, 2001). Cougars can be found in most forested habitats which support ungulate populations. They often prefer areas with rock ledges or outcrops which can be used as vantage points for hunting, for resting, and to escape wolves or dogs.

White-tailed deer, mule deer and elk are known to regularly range into the NWT, and in some instances, have establish permanent breeding populations. If there is a viable breeding population of cougars in the NWT, than these small ungulate populations are likely providing the prey base to sustain these cats. Cougars prey primarily on ungulates (Toweill, 1977; Ross and Jalkotzy, 1992). Beavers, rabbits and hares, porcupines, domestic stock, and raccoons are also preyed upon.

Cougar home ranges and population densities are variable, depending on abundance of prey species. RWED (2001a) speculates that cougar densities range from one individual cat per 20 km^2 to 333 km^2. Male cougars are the most territorial. Territories are well scent-marked and are defended against other individuals, although cougars usually try to avoid each other temporally thereby reducing direct conflicts (Ross and Jalkotzy, 1992). In general, cougars are solitary animals, except for mother and kittens and during mating periods.

The population trend for cougars in the NWT is believed to be increasing (RWED, 2001a), hence, the increase in sightings and range expansion. Populations are expected to fluctuate primarily with available prey numbers.

This species is listed by RWED (2001a) as being “Undetermined.” COSEWIC (2002) has not evaluated this species.

4.3.4.4 Ungulate Species

Ungulate species include Dall’s sheep, moose, bison, barrenland and woodland caribou, elk, white-tailed and mule deer and mountain goat (Table 17).

Table 17: Ungulate Species Occurring or Hypothetically Occurring within the Study Area Their Status

Common Name	Scientific Name	RWED Status [1]	COSEWIC Status [2]
Dall's sheep[3]	*Ovis dalli dalli*	Secure	Not Evaluated
Moose[3]	*Alces alces*	Secure	Not Evaluated
Barrenland Caribou	*Rangifer tarandus*	Secure	Not Evaluated
Woodland Caribou[3] (Boreal Population)	*Rangifer tarandus caribou*	Sensitive	Threatened
Woodland Caribou[3] (Mountain Population)	*Rangifer tarandus caribou*	Sensitive	Special Concern
Mountain Goat[3]	*Oreamnos americanus*	May be at Risk	Not Evaluated
Wood Bison[3]	*Bos bison athabascae*	At Risk	Threatened
White-tailed Deer	*Odocoileus virginianus*	Undetermined	Not Evaluated
Mule Deer	*Odocoileus hemionus*	Undetermined	Not Evaluated
Elk	*Cervus elaphus*	Not Assessed	Not Evaluated

1 (RWED, 2001a)
2 (COSEWIC, 2002)
3 Species have been discussed under section 4.2

4.3.4.4.1 Barrenland Caribou

The northeast corner of the Deh Cho lies within the extreme southwest range of the barrenland caribou. These animals are from the herd that occurs near the east end of Great Bear Lake (Larter, pers. comm.). The eastern shore of Great Bear Lake is an area of range overlap between two different herds, the Bathurst and Bluenose East herds. Based on range maps, the Bathurst herd is the most likely herd to occasionally occur within the Deh Cho territory, and the extent of incursion would be limited and restricted to the northwest corner (Wright et al., 2003; Latour, 1989; Heard, 1989). It is likely that these barrenland caribou only occur periodically within the Deh Cho, as the area represents the extreme southwest corner of their winter range.

The Bathurst caribou herd is the largest of the major herds in the NWT. In 1996, the population was estimated at 349,000 $\pm$ 95,000. This estimate has varied in size between 174,000 in 1982 to 486,000 in 1986. The herd's range covers approximately 250,000 km^2, with calving grounds near Bathurst Inlet and wintering grounds below the treeline. The distribution and density varies from year to year,

with the herd rarely using the same area for more than two or three years out of ten (Case et al., 1996).

The population estimate for the Bathurst caribou herd is approximately 349,000 individuals as of 1996. RWED (2001a) states that the trend in population and distribution is stable, although natural fluctuations do occur and they are seasonally migratory within their range.

The Bathurst caribou herd is listed by RWED (2001a) as being "Secure." COSEWIC (2002) has not evaluated this species.

4.3.4.4.2 Mule and White-tailed Deer

Parks Canada (1984) provides a succinct summary of historical occurrence for the mule and white-tailed deer occurring within the Deh Cho. Mule deer reach the northern limit of their range in the southwestern NWT and southeastern Yukon. The first known occurrence in the Deh Cho was recorded in 1929. This correlates with the northward spread of mule deer in the Fort Smith area in 1922.

White-tailed deer appeared to have populated the Liard Valley region in the mid- to late 1960's. The first reported white-tailed deer occurrence in the NWT was from Fort Smith in the early 1960's. White-tailed deer have continued to expand their distribution northward through the Liard Valley and been seen as far north as Norman Wells (Hagen, pers. comm.). One deer was shot just north of Norman Wells (Decker, pers. comm.).

White-tailed deer have established populations at low densities in the southwestern area of the NWT. Anecdotal information suggests that the size of the populations and their distribution is expanding for both species. Knowledge of population status for these two species is lacking. Observations for both species indicated a northern range extension that has been gradually occurring over time has suitable habitat becomes available.

The status of white-tailed and mule deer are listed by RWED (2001a) as being "Undetermined." COSEWIC (2002) have not evaluated these species.

4.3.4.4.3 Elk

There is a paucity of information on elk ecology and their distribution in the Deh Cho territory. There have been no specific elk habitat studies, inventories, or surveys completed within this region.

Populations of elk along the Liard River are at the northern limit of their distribution, are scattered, and are found in low numbers (Goulet and Haddow, 1985). Individuals have been seen occasionally along the Liard River from the Toad River to Nelson Forks and east along the Fort Nelson River.

Elk have been slowly expanding their distribution northward and tracks have been documented in the 1960's and 1970's around Peace Point, WBNP. However, it is believed that no animals ventured into the NWT (Decker, pers. comm.). Elk have been shot along two rivers near Fort Liard, the Kotaneellee and Petitot rivers, and have been documented overwintering in cutblocks along the Liard River (Decker, pers. comm.).

Elk distribution and habitat selection is determined by a combination of many factors including topography, vegetation structure, forage quality and quantity, traditional and habitual behavior, weather conditions, predators, and human activities (Morgantini and Russell, 1983). Generally, foraging areas for elk are found in open habitats. Thermal cover is best provided by coniferous forested stands, while predator relief is provided by dense forests with well-developed understories (MELP, 1992).

Elk are primarily grazers, preferring grasses and forbs (Kufeld, 1973). They prefer open, wet areas such as wetlands, riparian areas by lakes and streams, marshy meadows, and floodplains. They can also be found in a wide range of habitats including coniferous and deciduous forests in all seral stages, plus non-forested habitats such as vegetated slides and rock outcrops (Goulet and Haddow, 1985). During the summer, moist, open forests are preferred, and forests with dense canopies receive little use (Peek *et al.*, 1982). Elk often select for the edge between vegetation types (Cairns and Telfer, 1980).

The population status and trends are unknown for elk occurring within the NWT. The presence of this species in the NWT represents a northern range expansion. The status of elk has not been assessed by RWED, nor has COSEWIC (2002) evaluated this species.

4.4 International Biological Programme

Background

Entity: International Biological Programme Ecological Sites (IBP)
Status: Fourteen IBP sites occur within the Deh Cho territory and 27 exist within the larger study area. Figure 17 is a map showing the IBP sites.

4.4.1 Introduction

The IBP is a cooperative effort between the International Council of Scientific Unions and participating nations around the world dedicated to studying the land so that life-supporting systems may be better understood. Canada participated in the International Biological Programme between 1964 and 1974, and 120 IBP Sites were identified in the NWT. Many of the sites were selected based on their importance to migratory bird populations. There are no special regulatory controls in place for protecting IBP Sites, but their designation serves to highlight the ecological importance of particular areas (Alexander et al., 1991; McCormick et al., 1984; McCormick and Adams, 1984).

IBP Ecological Sites are special areas, which have been nominated for a variety of reasons, *e.g.* altitudinal variation, archaeology, disturbance, geomorphology, representative, research and limit of the range of a species (*i.e.* unique plant and animal communities) (Eng et al., 1989). The most common reason for designating an area is endemic plant and animal populations. In these areas, the vegetation, wildlife, soils and other physical characteristics form balanced ecosystems. Many of these sites contain features such as relict or endangered populations, unique plant associations, breeding areas, critical range for animals, pristine lakes and mineral springs.

There are a total of 27 IBP Sites that occur within the Deh Cho study area. However, of these 27 IBP Sites, only 14 lie within the Deh Cho territory. The following table lists the 27 IBP sites that occur within the Deh Cho Study Area. Of the 28 IBP sites occurring within the study area, only 14 occur with the Deh Cho territory.

Sites can be designated based on plant and/or animal species present, or landscape uniqueness. Each IBP site is unique, possessing singular attributes. Only those IBP sites occurring within the Deh Cho territory and have been designated based on importance to wildlife are discussed in detail in this report. Other IBP sites do occur within the Deh Cho territory but have been nominated based on features other than wildlife such as limnology, geomorphology, etc. and, consequently, will not be discussed within this report. Table 12 lists those IBP sites that are within the Deh Cho territory and have been designated based on wildlife and wildlife/plant attributes.

IBP Site accounts describe the ecological importance of a given area and list the assumptions used in ranking these landscape units. The overall ranking considers the combination of life requisites such as food, security and thermal cover for the species of concern or unique environmental attributes and is based on published data. IBP Sites and their level of conservation value have been presented in an ecological framework, where animals are linked to habitats, and based on how an individual animal uses that area. Such areas may include winter range habitat, calving area habitat (calving grounds), spawning grounds, etc.

Detailed information is provided for each IBP Site as a way of justifying individual rankings. Table 2 presents sample data on how the IBP Sites were ranked. Appendix B contains the entire data set and justification for rankings. *IBP Site* accounts provide background information on site name, site number, location, size, ecosystem, a brief description of the environmental attribute being ranked, and specific ranking assumptions are clearly stated.

Table 18: IBP Sites Occurring within the Deh Cho Study Area and the Deh Cho territory

IBP Sites within the Deh Cho Study Area	IBP Sites within the Deh Cho territory
1. Alexandra/Louis Falls	1. Alexandra/Louis Falls
2. Carcajou Lake	2. Coal River Springs
3. Caribou Flats	3. Deep Bay Wood Bison Sanctuary
4. Cartridge Lakes	4. Ebbutt Hills
5. Cirque Lake Area	5. Glacier Lake
6. Coal River Springs	6. Heart Lake
7. Deep Bay Wood Bison Sanctuary	7. Horn Plateau
8. Ebbutt Hills	8. Horn River (Mink & Fawn Lakes Area)
9. Glacier Lake	9. Kakisa River
10. Heart Lake	10. Liard River
11. Horn Plateau	11. Mills Lake
12. Horn River (Mink & Fawn Lakes Area)	12. Rabbitkettle Hotsprings
13. Kakisa River	13. Raven's Throat
14. Liard River	14. Virginia Falls
15. Lymnaea Springs	
16. Mackenzie Mountain Barrens	
17. Mills Lake	
18. Mirror Lake	
19. Moosehorn Headwaters	
20. Plains of Abraham	
21. Rabbitkettle Hotsprings	
22. Raven's Throat	
23. Sculpin Springs	
24. Toitye Hotsprings	
25. Virginia Falls	
26. Willow Lake (Brackett Lake)	
27. Whooping Crane Nesting Area	

Table 19: IBP Sites within the Deh Cho territory with Wildlife Attributes

IBP Site Name	IBP Site No.	Reasons for Nomination of the Site
Deep Bay Wood-Bison Sanctuary	22	Wildlife (bison, limnology and waterfowl
Horn Plateau	32	Wildlife (woodland caribou) and representative flora
Horn River	49b	Waterfowl, aquatic flora, and representative flora
Kakisa River	25	Waterfowl (nesting) and wildlife
Mills Lake	49a	Waterfowl, aquatic flora, and fish
Raven's Throat	29	Wildlife, research (future possibility), research soil, and geomorphology

4.4.2 Deep Bay Wood-Bison Sanctuary – IBP Site 22

The Deep Bay Wood-Bison Sanctuary is located between the western shore of Great Slave Lake and Highway No. 3. This large IBP site covers approximately 4168 km^2 in area.

The Wood-Bison Sanctuary is located within the northern boreal forest zone ecosystem where various stages of regeneration following fire are evident. The area is characterized by flat to undulating features with many ephemeral lakes and peat plateaus. Vegetation in the Deep Bay Wood-Bison Sanctuary consists of white spruce-larch, ground birch-willow, Labrador tea-lichen, black spruce and white birch-white spruce.

Ranking Assumptions

1. The size of the IBP site is large (4168 km^2).
2. Limnology of numerous lakes in various stages of infilling with diatoms and mollusca.
3. Yearlong range of wood bison.
4. Non-breeding population of whooping cranes have been known to frequent Falaise Lake.
5. Important habitat for swans, diving ducks, moose, woodland caribou, wolves and lynx.

This IBP site possesses many exceptional attributes: it is large in size, largely untouched by human influence, and is a known area for wood bison and Whooping Cranes. Whooping Cranes in the NWT are considered "At Risk" by RWED (2001a) and "Endangered" by COSEWIC (2002). Wood bison in the NWT are considered "At Risk" by RWED (RWED, 2001a) and "Threatened" by COSEWIC (2002).

The overall Mackenzie Bison Sanctuary is ranked with a value of 2. However, select areas of the MBS have been upgraded to a value of 4 based on known habitat usage by bison and Whooping Cranes. These upgraded areas appear as highlighted polygons in the wood bison species range map (Figure 5) and are represented in Figure 19, Areas of High Conservation Value.

4.4.3 Horn Plateau – IBP Site 32

The Horn Plateau IBP site is located on the west side of Willow Lake, approximately 65 km east of Fort Simpson. This is a large site encompassing 1276 km^2.

The large Plateau lies within the Slave Lowland, rising 730 m (above sea level). It is within the Boreal Forest ecosystem and is characterized by black spruce and Labrador Tea community, and willow shrub communities representing various stages of fire regeneration. The south-facing escarpment contains notable stands of white and black spruce.

This area supports woodland caribou and is considered to be the "best fisher habitat in the Mackenzie Lowland region" (Beckel, 1975). Although extensive tracts of prime fisher habitat have been burnt some high quality habitat remains. Of particular interest is the extensive lichen development occurring on raised peat, and because it is part of the range of the woodland caribou.

Ranking Assumptions

1. The size of this IBP site is large (1276 km^2).
2. This site possesses excellent woodland caribou range and they are known to occupy the area.
3. The area contains good fisher habitat.

Limited information is available for the Horn Plateau IBP site. The ranking was upped from a 1, for general animal range, to a 2 because of its mature plant communities supporting fisher and woodland caribou. Consequently, the Horn Plateau was assigned a value of 2.

4.4.4 Horn River – IBP Site 49b

The Horn River IBP site is located on a stretch of land along the Horn River, from Mink Lake to Fawn Lake. This site covers an area of approximately 208 km^2.

The Horn River site is situated within the boreal forest zone ecosystem, Northwestern Transition Section. The river and shallow lake outlets in this region are rich in aquatic vegetation and are often visited by migrant swans, ducks and white fronted geese.

Ranking Assumptions

1. The size of this IBP site is medium (208 km^2).
2. This site has rich aquatic vegetation and is often visited by waterfowls.

This IBP site has been designated with a ranking value of 1.

4.4.5 Kakisa River – IBP Site 25

The Kakisa River IBP site is located on the Kakisa River and some of its branches about 24 km west of Tathlina Lake. This relatively medium size site covers an approximate area of 365 km^2.

Kakisa River is situated within the northern boreal forest, Hay River Section. It comprises broad active floodplain with dominant plant community consisting of sedge-dwarf birch-larch. The Kakisa River site is a low-lying deltaic region in a broad active floodplain containing floating bogs and numerous shallow lakes and ponds. This IBP site is abundant in wildlife (waterfowls, beavers, muskrats and moose) and aquatic and emergent vegetation (sedge-dwarf birch-larch, white spruce-larch, dwarf birch-aspen-pine and black spruce).

Ranking Assumptions

1. The size of this IBP site is medium (365 km^2).
2. Important waterfowl nesting area and possible staging area.
3. Abundant animal life including moose, beaver and muskrats.

This IBP site has been designated with a ranking value of 4.

4.4.6 Mills Lake – IBP Site 49a

The Mills Lake IBP site is located on the Mackenzie River just west of the entrance into Great Slave Lake. The site covers approximately 339 km^2 in area.

Mills Lake is situated within the Boreal Forest Zone, Upper Mackenzie Section. It is the former location of glacial Lake McConnell. Large shallow lakebeds, marsh and low shoreline characterize the area. Vegetation common in this region consists of aquatic vegetation, sedge-grass and tall willow. Wildlife seen in the Mills Lake site includes ducks, geese and other waterfowls.

Ranking Assumptions

1. The IBP site is medium in size (339 km^2).

2. Aquatic vegetation is important to waterfowl habitats.

This IBP site has been designated based on its importance for staging waterfowl and, therefore, received a ranking value of 4.

4.4.7 Raven's Throat – IBP Site 29

Raven's Throat is part of the Backbone Range of the Mackenzie Mountains south of the Redstone River. This site covers an area of approximately 339 km^2.

This IBP site is within the boreal forest (alpine forest-tundra section ecosystem), characterized by alpine tundra, glaciated and unglaciated terrain, forested valleys and subalpine communities. Dall's sheep inhabit the area.

Ranking Assumptions

1. The IBP site is medium in size (339 km^2).
2. The area is within Dall's sheep range.
3. The area has high mineral potential.
4. The IBP site has geomorphological interests.

This IBP site has been designated with a ranking value of 1.

4.5 Key Migratory Bird Sites

Background

Entity: Site 43 - Southeastern Mackenzie Mountains
Site 44 – Mills Lake
Site 45 – Beaver Lake
Site 46 – Northwest Point

Status: There are 4 Key Migratory Bird Sites within the Deh Cho territory (Figure 17).
Note: The numbering of system for Key Migratory Bird Sites has changed over the years. A few sites that were assigned Site Numbers in earlier documents (McCormick et al., 1984;

McCormick and Adams, 1984) have been reassigned new Site Numbers in a later publication (Alexander et al., 1991).

Site 42 – South Nahanni River is a former Key Migratory Bird Site but has since been removed from the present day designations (Alexander et al., 1991; McCormick et al., 1984; McCormick and Adams, 1984).
Site 43 – Mills Lake has been renumbered and is now Site 44 (Alexander et al., 1991; McCormick et al., 1984; McCormick and Adams, 1984).
Site 44 – Beaver Lake has been renumbered and is now Site 45 (Alexander et al., 1991; McCormick et al., 1984; McCormick and Adams, 1984).

4.5.1 Introduction

Under the Migratory Birds Convention Act, the CWS is responsible for managing populations of migratory birds that occur within Canada. Adequate habitat is fundamental to the conservation of all wildlife species. Consequently, the CWS identifies, protects and manages lands of particular ecological value to wildlife. The CWS has identified 80 Key Migratory Bird Sites occurring within the NWT and Nunavut, of which 4 occur within the Deh Cho territory (Figure 17). The CWS identifies Key Habitat Sites as areas that are essential to the welfare of various migratory bird species in Canada (Alexander et al., 1991; McCormick et al., 1984; McCormick and Adams, 1984).

The CWS employs guidelines for determining and selecting Key Habitat Sites. Sites that are believed to support at least 1% of the national population are considered Key Habitat Sites. This criterion has been used extensively in Europe and in the selection of sites of international importance designated under the Convention on the Conservation of Wetlands of International Importance (Alexander et al., 1991; McCormick et al., 1984; McCormick and Adams, 1984).

4.5.2 Southeastern Mackenzie Mountains - Site 43

The CWS's Key Migratory Bird Site 43, Southeastern Mackenzie Mountains, includes the floodplains that occur between the Nahanni and Camsell ranges along the east edge of the Mackenzie Mountains. River systems in the area include the

Liard, South Nahanni, Tetcela, Ram, Root Rivers, Carlson and Fishtrap creeks. This is a large site encompassing 6,208 km^2.

This site lies within the boreal forest ecosystem and is characterized by a diversity of habitat types that include conifer forest, alpine tundra, oxbow lakes, ponds and pond complexes. The theoretical northern limit of Trumpeter Swan breeding habitat is 64^o N (Hansen et al., 1971).

Approximately 15% of the Canadian population of Trumpeter Swans nest in the wetland adjacent to waterbodies in this area. The Trumpeter Swan is a rare species in Canada (Mackay, 1978). All wetlands in this area are characterized by extensive emergent vegetation, making them important for waterfowl nesting, rearing and feeding.

In addition to being important for Trumpeter Swans and other waterfowl, this area of wetlands is also important to other wildlife species. Dall's sheep are found in some of the alpine tundra areas, while moose and woodland caribou frequent the lower elevations along the river. Grizzly and black bears also inhabit the area (Cairns et al., 1978).

Ranking Assumptions

1. This key migratory bird site is large in size (6,208 km^2).
2. 15% of the Canadian population of Trumpeter Swans nests in the wetlands adjacent to the rivers, creeks and lakes of the area.
3. This is an important area for other species of waterfowl.
4. Other species utilizing this area include Dall's sheep, moose, woodland caribou, grizzly and black bears.

Limited information is available for CWS's Key Migratory Bird Site 43, Southeastern Mackenzie Mountains. However, this site provides important life requisites for Trumpeter Swans, other waterfowl species, Dall's sheep, moose, woodland caribou and grizzly and black bears. Consequently, it was assigned a value of 4.

4.5.3 Mills Lake – Site 44

Mills Lake is a large widening of the Mackenzie River at the north and west end of the Horn River delta. Well-developed emergent and aquatic vegetation communities and floating sedge mats are a major feature of the lake.

Thousands of waterfowl stage at this lake, primarily during fall migration. The emergent sedge zone on the north shore, the marsh on the Horn River delta, and the area near Meridian Island are most frequently used as resting and feeding sites. Peak waterfowl numbers occur during fall between mid-September to early October. Surveys conducted during the 1970's revealed high rates of usage for this site during fall migration and include approximately 10,000 White-fronted Geese, 2,000 Tundra Swans, 4,000 Lesser Snow Geese, 1,400 Canada Geese, approximately 27,000 ducks (mostly American Widgeon, Northern Pintail, Mallard and Canvasback) (Salter, 1974) and 2,200 shorebirds (McCormick and Adams, 1984). Note estimated numbers rounded off for ease of interpretation. The data do not take into account any turnover of birds; therefore, the actual number of birds staging at Mills Lake was probably considerably higher than reported.

At the time of the surveys, these numbers represented approximately 8% of the White-fronted Geese, and 3% of the Tundra Swans in Canada. Most geese are present from early to late September while ducks may remain in the area until mid-October. Few numbers of most waterfowl species stage on the lake during spring migration (Salter et al., 1974).

Ranking Assumptions

1. This key migratory bird site is medium in size (393 km^2).
2. At the time of the aerial surveys, approximately 8% of the Canadian population of White-fronted Geese and 3% of the Canadian population of Tundra Swans staged at this site during spring and fall migration.
3. This is an important staging area for many other migrating birds species, especially waterfowl and shorebirds.

Based on the available literature (Alexander et al., 1991; McCormick et al., 1984; McCormick and Adams, 1984) this site provides important life requisites for many

bird species, especially Tundra Swans and White-fronted Geese; and it is a known staging area during spring and fall migration. Mills Lake is also a designated IBP Site. Consequently, it was assigned a value of 4.

4.5.4 Beaver Lake – Site 45

Beaver Lake is a widening of the Mackenzie River at the outlet of Great Slave Lake. It is approximately 40 km upriver from the settlement of Fort Providence. The north shores of both channels around Big Island are low with extensive sedge-grass marsh along alluvial flats. The south shores have a narrower margin of marsh before the transition to spruce-poplar forest. The islands at the outlet of the North Channel are low and marshy whereas those in the South Channel are higher and more forested.

The channel islands and the North Channel are favoured resting sites for migrant Tundra Swans and ducks. Peak waterfowl numbers occur during fall between mid-September to early October. Surveys conducted during the 1970's revealed high rates of usage for this site and include approximately 1,200 (spring) and 4,500 (fall) Swans (6% of the Canadian population), 5,000 ducks and 8,000 Canvasbacks (Salter, 1974).

Ranking Assumptions

1. This key migratory bird site is medium in size (461 km^2). At the time of the aerial surveys, approximately 6% of the Canadian population of Tundra Swans staged at this site during spring and fall migration.
2. This is an important staging area for many other migrating birds species, especially waterfowl and shorebirds.

Based on the available literature (Alexander et al., 1991; McCormick et al., 1984; McCormick and Adams, 1984) this site provides important life requisites for many bird species, especially Swans; and it is a known staging area during spring and fall migration. Consequently, it was assigned a value of 4.

4.5.5 Northwest Point – Site 46

This site is a small, exposed islet off Northwest Point on the west shore of Great Slave Lake. The island rises 2-3 m above water level and is composed of boulders, rock rubble, and gravel, with thin soil and sparse vegetation.

This key migratory bird site is an important nesting area for Caspian Terns, a rare species in Canada (Martin, 1978). This site is the largest known colony of Caspian Terns in the Northwest Territories, comprising of 110 pairs of nesting birds in 1989 (Sirois et al., 1991), and 157 nests in 1989 (Sirois et al., 1995). This represents over 1% of the Canadian population, approximately one-third the known breeding population in the NWT, and about one-half of the Great Slave Lake population.

Surveys conducted in 1989 revealed other birds nesting on site included 12 pairs of Herring Gulls and 35 pairs of California Gulls. On adjacent islands there was a colony of 300 pairs of California Gulls and 70 pairs of Herring Gulls, one of the largest gulleries in Great Slave Lake. Small numbers of Greater Scaup, Red-breasted Mergansers, Mew Gulls, Ring-billed Gulls and Common Terns also nest on these islands (Alexander et al., 1991).

The Caspian Tern is listed by RWED as being "Sensitive" (RWED, 2001a) and "Not at Risk" by COSEWIC (2002).

Ranking Assumptions

1. This key migratory bird site is very small in size (1 km^2).
2. The Caspian Tern is listed as "Sensitive" by RWED.
3. In 1989 the number of Caspian Terns nesting on this island represented over 1% of the Canadian population, approximately one-third the known breeding population in the NWT, and about one-half of the Great Slave Lake population.
4. This is a critical nesting colony for Caspian Terns.
5. This is a critical nesting colony for multiple gulls species.

Based on the available literature this site provides important life requisites for a number of birds, especially terns, gulls and waterfowl (Alexander et al., 1991; Sirois

et al., 1995; Sirois et al., 1991). This site provides critical nesting habitat for Caspian Terns and, consequently, it was assigned a value of 4.

4.6 Karst Topography and Hotsprings

Karst topography was selected as a VEC representing a unique and important landscape feature, supporting extensive and sometimes unique biological diversity. The data set contained 51 known karst topographic sites (Ford, ND) and 10 known hotsprings sites (Kaeser, ND) (Figure 18).

Karst is a distinctive topographic feature in which the landscape is largely shaped by the dissolving action of water on bedrock. This geological process results in unusual surface and subsurface features ranging from sinkholes, vertical shafts, disappearing streams and springs, to complex underground drainage systems and caves.

Karst and hotsprings ecosystems frequently have unique flora and fauna associated with them. Many wildlife species use various these features for habitat. Carnivores are known to use karst caves intermittently for shelter or resting. Birds and small mammals often nest in karst caves and other cavities. Caves, and their stable environments, can be critically important habitat for bat species that depend on them for roosting and hibernation.

Research conducted in southeast Alaska suggests that karst stream systems play a significant role in the productivity of downstream aquatic habitat. The research indicates that karst can increase fish productivity in the following ways:

- the leaching of calcium carbonate from bedrock has important buffering effects on acidic streams,
- the groundwater associated with karst results in cool, even stream temperatures throughout the year,
- the storage capacity in karst stream systems buffers seasonal flow rates to produce lower peak flows and higher low flow periods,
- karst streams tend to supply more nutrients and encourage more algae and moss growth,

- aquatic insect populations within karst streams are larger and more diverse,
- karst stream systems provide more protective sites for fish to rest, breed, and avoid predators.

Karst topography and hotsprings plays a significant role in modifying adjacent environments and allowing, in some instances, the maintenance of endemic species. Many of the IBP sites possessing karst topography or hotsprings contain unique flora and fauna.

Ranking Assumptions

There are 51 known karst sites within the Deh Cho territory.
The are 10 known hotsprings within the Deh Cho territory
Karst topography and hotsprings represents a singular type of landscape unit.
Many karst areas and hotsprings provide modified environments, supporting unique flora and fauna.

Limited information is available for the karst and hotsprings sites within the Deh Cho territory. However, many of them are known to provide important life requisites for multiple species. Consequently, karst topography and hotsprings were assigned a value of 4.

4.7 Ranking Areas of High Conservation Value

The primary objectives for this project included determining what wildlife species were present within the Deh Cho territory, identifying their associated habitats, researching species population status, selecting Valued Ecosystem Components (VECs) and ascertaining areas of high conservation values. The project goal was to generate a composite map for determining important areas for wildlife and wildlife habitat (Figure 19).

Areas of high conservation value reflect how important a particular landscape unit is for a species' life requisites. Thus, conservation value rankings reflect a given landscape unit's level for contributing towards the overall life requisites for a given species. They do not represent actual numbers of animals but reflect the potential or *expected use* of an area by the species of concern. Rankings indicate the value of a landscape unit to provide life requisites for a particular species.

For the composite map, polygons were ranked between 1 to 4 for each VEC. Polygons ranked with a value of 1 were coloured a light-yellow. These areas represent a "Low" ranking value and indicate that this landscape unit falls within the range of a given species.

Polygons ranked with a value of 2 were coloured yellow and represent a "Medium" ranking value. This level of ranking indicates that this landscape unit provides for all habitat functions or all habitat features. These areas possess all the necessary habitat features for a given species, and is therefore ranked higher than a 1, but a given species may not be presently using the area.

Polygons ranked with a value of 3 were coloured orange and represent a "High" ranking value. This level of ranking indicates that this landscape unit serves a more critical role in the life requisite for a given species, *i.e.* migrational corridor.

Polygons ranked with a value of 4 were coloured red and represent the highest ranking, "Very High." This level of ranking indicates that this landscape unit provides for the most critical attributes of a species life requisite, *e.g.* calving, nesting, staging, spawning and denning areas. Those areas on the composite map containing red polygons represent areas of highest conservation value and reflect how important a particular landscape unit is for fulfilling a species' life requisites.

5.0 EXISTING WILDLIFE INITIATIVES AND CURRENT RESEARCH

5.1 Introduction

By definition an initiative means to take the first step and/or lead an activity. In this report the initiatives presented below reflect the present wildlife initiatives and current research occurring in the NWT, and more specifically, the Deh Cho territory. Historically, Territorial and Federal governments have been responsible for implementing wildlife initiatives in the NWT. However, recently non-government organizations have been implementing initiatives. Today, most initiatives are pursued as partnerships and cooperative joint-ventures between various governments, non-government agencies and stakeholders.

Governments typically take the lead role, at least initially, and provide policies to encourage and improve opportunities for local people to pursue initiatives or certain programs. The number of initiatives in existence in the Deh Cho territory is limited, existing under the guise of individual research projects. Much of the individual research address specific issues that in turn provide the foundation of larger, national and international initiatives.

5.2 Federal Government

The CWS and Parks Canada implement a number of initiatives that focus on protecting the environment. For example the CWS have been responsible for initiating a number of ongoing and emerging national and continental conservation initiatives. These include the North American Bird Conservation Initiative; the North American Waterfowl Management Plan and its related regional Joint Ventures; the Canadian and continental Partners in Flight and Canadian Landbird Monitoring Strategy; the Canadian Shorebird Conservation Plan; and the Wings Over Water (colonial waterbird/seabird) Conservation Plan. Under the guise of these initiatives various programs are carried out, from fundamental research, to applied Research to habitat protection.

Parks Canada also carries out a number of initiatives as part of their national park policy. For example some of their initiatives focus on the establishment of national parks, protection of ecological integrity within already established parks, visitor management, etc.

(Parks Canada, 2003). These initiatives are implemented at the national level. Perhaps the most relevant program for the Deh Cho territory lies within Parks Canada's "Heritage Resource Protection" initiative, *i.e.* protection of ecological integrity within Nahanni National Park Reserve.

5.2.1 Canadian Wildlife Service Initiatives and Current Research

Most of the CWS's initiatives are implemented at the national level, *e.g.* the North American Bird Conservation Initiative; the North American Waterfowl Management Plan and its related regional Joint Ventures; the Canadian and continental Partners in Flight and Canadian Landbird Monitoring Strategy; the Canadian Shorebird Conservation Plan; and the Wings Over Water (colonial waterbird/seabird) Conservation Plan. However, there are a number of existing projects in the NWT that contribute to the overall implementation of the initiatives listed above, and they include the following:

5.2.1.1 Productivity of Boreal Forest Duck and Grebe Populations

The boreal forest covers one-third of Canada and supports an estimated 25-50% of the continent's breeding ducks. This study is intended to: 1) document the long-term population trends and productivity of waterfowl in the boreal forest; 2) determine factors which might limit the growth of these populations; 3) determine the habitat preferences and requirements of northern waterfowl; and 4) evaluate methods for surveying northern aquatic birds. In conjunction with this study, CWS is investigating waterfowl, gull and tern populations using the North Arm of Great Slave Lake during migration, nesting and moulting periods.

Area: North Arm of Great Slave Lake
Duration: This is an ongoing project.
Partners: Ducks Unlimited (DU), Department of Indian Affairs and Northern Development (INAC), Arctic Hydrometric Surveys Division (AHSD)/Environment Canada (EC)

5.2.1.2 Ecological and Resource Assessment of the Proposed Edehzhie Wildlife Area

In October 2002, CWS obtained a 5 year land withdrawal for the Edehzhie candidate protected area (25,000 km^2), which includes pristine boreal forest and important boreal wetlands. During this period CWS will be cooperating with its partners in conducting an assessment of the ecological and mineral resources of the Edehzhie area as outlined in Step 5 of the NWT Protected Areas Strategy. The location of boundaries will be identified and an area management plan developed. This information will be used in the final determination of whether to proceed with formal designation of the candidate area through such instruments as the Canada Wildlife Act, Wildlife Area Regulations.

Duration: 2002-2006
Area: Edehzhie (Horn Plateau Region)
Partners: Deh Cho First Nations, Ducks Unlimited Canada, GNWT, World Wildlife Fund (WWF), Department of Indian Affairs and Northern Development (INAC).

5.2.1.3 North American Breeding Bird Survey

This survey provides long-term trend information on many of the forest birds in the southern NWT. The NWT surveys are part of a larger program which is conducted across Canada and the United States.

Duration: Ongoing
Area: Fort Liard area, NWT
Partners: CWS

5.2.1.4 Forest Bird Studies in the Liard Valley in Relation to Timber Harvesting

The Liard Valley is one of the key areas of resource development in the Northwest Territories. Exploration and development of natural gas reserves and some commercial forestry in the area is changing the landscape. A five year project assessed bird-habitat relationships in the area and created a baseline data set for monitoring long term changes of birds in the area. Periodic resampling is planned to track population changes.

Duration: 1998 to 2002
Partners: Department of Indian Affairs and Northern Development (INAC0), Government of the Northwest Territories (GNWT), Acho Dene Koe First Nation

5.2.1.5 Assessing the Impacts of Seismic Lines on Forest Songbirds

The effect of seismic lines on forest birds has not been studied. Conjecture based on other fragmentation studies or expert advice has been the primary source of information on impacts of seismic activity. At one extreme, very high densities of small individual disturbances destroy habitat, and impacts are inevitable. However, there are many areas of the boreal where seismic lines are common but not super-abundant, where the actual impact is still speculative. The lack of any research on this topic creates problems. This study will aim to quantify the impact of the 4-6m linear lines on forest songbirds. This represents the current "worst-case" scenario for seismic lines, and if effects cannot be documented for this level of disturbance, it is reasonable to assume that the more conservative approaches are even lower in impact.

Duration: 2002 to 2003
Area: Fort Liard area, NWT
Partners: Anadarko Canada Corp., Canadian Forest Oil, INAC,GNWT, Acho Dene Koe First Nation

5.2.1.6 Recovery of Wood Bison

Wood Bison are presently classified as "threatened" by COSEWIC. CWS, in cooperation with provincial and territorial governments and other interested parties, is working to establish a least four discrete, free-ranging, disease-free, and viable populations of 400 or more Wood Bison in suitable habitat within their original range in Canada. Presently, the total population is estimated at nearly 4000, including 3000 in six free-ranging, disease-free herds.

Duration: This is an ongoing project.
Area: WBNP
Partners: Parks Canada Agency (PC), Governments of NWT, Alberta, Manitoba, Yukon, and British Columbia; Alaska Department of Fish and Game, US Fish and

Wildlife Service (USFWS), Government of the Republic of Sakha (Yakutia), Russia; First Nation governments

5.2.1.7 Ecology of Whooping Crane

Annual surveys are undertaken to determine the extent of breeding areas in WBNP, numbers of nests, eggs and young, and the location of non-breeding birds. A joint project between CWS, WBNP and the University of Alberta is investigating food availability and chick survival on the breeding grounds.

Duration: This is an ongoing project.
Area: WBNP
Partners: USFWS, PC, University of Alberta

5.2.1.8 Monitoring Boreal Forest Birds

The need for baseline information on bird distribution and population status is strongly defined in many regional and national documents. Several proposed initiatives are being pursued to achieve a regional monitoring program to help collect this information. Proposed work will likely include intensive and extensive surveys of birds throughout the Northwest Territories, and will be linked to national strategies and plans for monitoring boreal forest birds.

Duration: This is an ongoing project.
Area: General NWT
Partners: CWS

5.2.1.9 Taiga and Boreal Shorebird Monitoring Program

The taiga and boreal shorebird monitoring program in the NWT will attempt to identify long term trends in relative abundance of Lesser Yellowlegs and other shorebirds, and determine which species merit further study and/or conservation. These actions will help to implement the Northern Shorebird Conservation Strategy and Action Plan.

Duration: 1999 to 2006

Area: General NWT
Partners: CWS

5.2.1.10 Northern Shorebird Conservation Strategy

The CWS, as the federal wildlife agency, has the lead responsibility for the conservation of migratory birds and their habitats in the Northwest Territories and Nunavut. Traditionally, bird conservation focused on species that were hunted or otherwise of direct use to humans. In recent years conservation efforts have also been directed toward non-hunted birds. Shorebirds (plovers, sandpipers, and associated species) fall into this category and are addressed by this strategy.

The Northern Shorebird Conservation Strategy and Action Plan will guide CWS efforts in maintaining the diversity and abundance of shorebird species in the Northwest Territories and Nunavut. It will be used as a tool to help CWS plan specific monitoring and conservation initiatives as called for in the Canadian Shorebird Conservation Plan.

Duration: This is an ongoing project.
Area: General NWT
Partners: CWS

5.3 Territorial Government

5.3.1 Department of Resources, Wildlife and Economic Development

RWED implements a number of initiatives that focus on trapping and include the following: Training and Educational/Recruitment Initiatives for At-Risk Sahtu Youth, Trapper Training Program for North Slave Region, Take a Kid Trapping Program and The Sahtu Trapping School. While these programs are relatively new and occur in areas outside the Deh Cho, RWED is in the process of implementing them in other regions of the NWT.

5.3.1.1 Training and Educational/Recruitment Initiatives for At-Risk Sahtu Youth

This project consists of a seven-month training/educational program for youth selected from the Sahtu communities of Deline, Tulita and Fort Good Hope.

Participants have and are continuing to be trained in all aspects of trapping, survival skills, first aid and pelt preparation. Participants in the program are also being given the opportunity to earn credits towards their high school equivalency.

Duration: This is an ongoing project.
Area: Presently in the Sahtu region only.
Partners: RWED

5.3.1.2 Trapper Training Program for North Slave Region

This initiative is intended to teach students the various skills needed for winter and spring hunting and trapping activities. The program is comprised of six units focusing on different aspects of trapping and include: hanging fish; skinning, stretching and drying pelts; winter trapping for marten, mink, lynx and fox, caribou hunting and fishing; first time hunter program; beaver and muskrat trapping (under ice); and, beaver, muskrat trapping (open water) and duck hunting. The learning units are delivered during the fall, winter and spring (October, November, December, March, and two units in April).

Duration: This is an ongoing project.
Area: North Slave region.
Partners: RWED

5.3.1.3 Take a Kid Trapping Program

RWED has designed a new program under Trapper Training. The program is focused towards youths in co-ordination with the schools. The target audience involves children from kindergarten to grade 6. Sessions are limited to one hour per class where children are taken on visits to traplines, learn about very basic traditional lifeskills and have some hands on experience with setting traps and nets. Indoor sessions consist of pelt preparation and short presentations with Visual aids such as pictures and fur. The outdoor sessions are within two or three kilometers from the school, introductory in nature and suited to the age group involved. Take a Kid Trapping program places emphasis on “learning by doing” which is a common medium throughout the traditional lifestyles of the NWT.

Duration: This is an ongoing project.
Area: Various schools
Partners: RWED

5.3.1.4 The Sahtu Region Trapping School

A “Pilot Project” Trapping School Program is underway in the NWT, Sahtu Region. Participants include 10 Aboriginal youth aged 16 – 19. The training covers all aspects of trapping, bush survival, first aid, pelt preparation, sorting, grading and fur marketing. Participants will have the opportunity to earn credits toward high school equivalency. The Board of Education supplies a schoolteacher in order for the participants to continue their academics while trapping.

Duration: This is an ongoing project.
Area: Presently in the Sahtu region only.
Partners: RWED

5.4 Non-Government Agencies

5.4.1 Ducks Unlimited

Ducks Unlimited is a non-profit organization dedicated to the preservation of wetlands. Their efforts contribute to the conservation, restoration and management of wetlands and associated habitats for North America's waterfowl. These habitats also benefit other wildlife and people.

In the Deh Cho territory, Ducks Unlimited has purchased the Sapp Farm, which was located on delta of the Horn River, which flows into Mills Lake. During 2001/2002, Ducks Unlimited purchased the farm and returned the land to its original pristine condition. This is parcel of land is approximately 43 hectares in size.

In addition, Ducks Unlimited continues to conduct waterfowl research throughout the NWT and supports other conservation initiatives, most recently that of Edehzhie (Horn Plateau region).

6.0 LITERATURE CITED

Alexander, S.A., R.S. Ferguson and K.J. McCormick.
1991: Key migratory bird terrestrial habitat sites in the Northwest Territories. Canadian Wildlife Service, Western and Northern Region, Northern Operations. Occasional Paper Number 71. Yellowknife, NWT. 184 pp.

Allen, A.W.
1984: Habitat suitability index models: marten. FWS/OBS-82/10.11(Revised). U.S. Department of the Interior, Fish and Wildlife Service. Washington, DC. 13pp.

1986: Habitat suitability index models: mink, revised. U.S. Fish Wildl. Serv. Biol. Rep. 82(10.127). 23 PP. [First printed as: FWS/OBS-82/10.61, October 1983.]

AMAX Northwest Mining Company Ltd.
ND: Initial environmental evaluation, MacTung Project, Yukon and Northwest Territories.

American Ornithologists' Union.
2003: The A.O.U. Check-list of North American Birds, Seventh Edition: http://www.aou.org/aou/birdlist.html

Anderson, A.E.
1983: A critical review of literature on puma (*Felis concolor*). Colorado Div. Wildl. Spec. Rep. 54, 91 pp.

Anonymous.
1972: Arctic ecology map series, critical wildlife areas, descriptive reports. Second edition. Canadian Wildlife Service, Ottawa. 324 pp, text only

1998: North American waterfowl management plan - update. Joint publication between the U.S. Department of the Interior, Fish and Wildlife Service, SEMARNAP Mexico, and Environment Canada, Canadian Wildlife Service. 34 pp.

Anthony, R. G., R. L. Knight, G. T. Allen, B. R. McClelland, and J. I. Hodges.
1982: Habitat use by nesting and roosting bald eagles in the Pacific Northwest. Trans North American Wildlife Natural Resource Conference 47: 332-342.

Banci, V.
1987: Ecology and behavior of wolverine in Yukon. M.S. Thesis, Univ. British Columbia, Vancouver. 178 pp.

Banci, V. (cont'd)
1989: A fisher management strategy for British Columbia. Wildlife Bulletin No. B-63. Prepared for Ministry of Environment, Wildlife Branch, Victoria, B.C.

1994: Wolverine. Pages 99-127 *In:* Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon and W.J. Zielinski, eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx and wolverine in the western United States. General Technical Report RM-254, U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. Ft. Collins, CO.

Banci, V. and S. Moore.
1997: 1996 Wildlife studies, Lac de Gras, Northwest Territories. Prepared for BHP Diamonds Inc. Rescan Environmental Services, Vancouver BC.

Banfield, A.
1974: The mammals of Canada. University of Toronto Press, Toronto, Canada. B.C. Wildlife Branch.

1991: Managing wildlife to 2001: A discussion paper. B.C. Min. Environ., Victoria, BC, 152 pp.

Beanlands, G.E. and P.N. Duinker.
1983: An ecological framework for environmental impact assessment in Canada. Institute for Resource and Environmental Studies, Dalhousie Univ., Halifax. 132 pp.

Beckel, D.K.B. (ed.)
1975: IBP ecological sites in subarctic Canada. Areas Recommended as Ecological Sites in Region 10, Yukon and Northwest Territories. The University of Lethbridge Production Services, Lethbridge, Alberta. 163 pp.

Bekoff, M.
1982: Coyote. Chapter 20. Pages 447-459. *In*: Wild mammals of North America: Biology, Management and Economics. Chapman, J.A. and G.A. Feldhamer. (Eds.). John Hopkins Univ. Press, Baltimore. 1147 pp.

Benn, B.
2001: Woodland caribou studies in the northern Mackenzie Mountains. *In:* Co-management of Woodland Caribou in the Sahtu Settlement Area: Workshop on Research, Traditional Knowledge, Conservation and Cumulative Impacts. Page 17, Section 5.3. Special Publication No. 1, Sahtu Renewable Resource Board, Tulita, NWT. 22 pp.

BHP Diamonds Inc.
1995: Eskers, carnivores and dens. Baseline Study Update. Prepared by Rescan Environmental Services Ltd. for BHP Diamonds Inc. 26 pp.

1996: Environmental impact statement for the BHP Diamonds Project. Prepared by Rescan Environmental Services and BHP Diamonds Inc, Yellowknife, NT and Vancouver, BC.

1999: 1998 wildlife monitoring program - construction phase. NWT Diamonds Project, BHP. Unpubl. report to BHP Diamonds Inc. Prepared Golder Associates Ltd., Yellowknife, NT.

Blood, D. A. and G. G. Anweiler.
1994: Status of the bald eagle in British Columbia. Wildlife Working Report No. WR-62. Prepared for the Wildlife Branch of the Ministry of Environment, Lands and Parks, Victoria, B. C.

Bradley, M. and F. Johnson.
2000: Fort Providence moose census, November/December 1997. Department of Resources, Wildlife and Economic Development, G.N.W.T. Fort Smith, NWT. Manuscript Report No. 135. 16 pp.

Bradley, M., T. Ellsworth and L. Kearey.
1998: Fort Providence moose census, November/December 1994. Department of Resources, Wildlife and Economic Development, G.N.W.T. Fort Smith, NWT. Manuscript Report No. 104. 15 pp.

Bromley, M.
1992: Update report on the status of tundra peregrine falcons in Canada, Prepared for COSEWIC.

Bromley, M. and L. Buckland.
1995: Biological information for the Slave Geological Province. Department of Renewable Resources, Government of the Northwest Territories. Manuscript Report No. 83.

Bromley, R.G.
2001: Wildlife Biologist. Whole Arctic Consulting. Yellowknife, Northwest Territories. Personal Communication.

Bromley, R.G. and D.L. Trauger.
ND: Birds of Yellowknife, a regional checklist. 12 pp.

Buskirk, S. W. and R. A. Powell.
1994: Habitat ecology of fishers and American martens. Pages 283-296 *In:* S. W. Buskirk, A. S Harestad, M. G. Raphael, and R. A. Powell. (eds.) Martens, Sables, and Fishers: Biology and Conservation. Comstock Publishing Associates, Cornell University Press, Ithaca and London, Ontario.

Cairns, A. L. and E. S. Telfer.
1980: Habitat Use By 4 Sympatric Ungulates in Boreal Mixed Wood Forest. Journal of Wildlife Management, 44(4):849-857.

Cairns, A.L., J.D. Henry, G.W. Scotter.
1978: Vegetation, wildlife, and recreation assessment of the Flat-South Nahanni Rivers confluence area, Nahanni National Park. Unpubl. Rep., Can. Wildl. Serv., Edmonton. 259 pp.

Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. W. Kaiser, and M. C. E. McNall.
1990: The birds of British Columbia. Vol.II. Non-passerines. Diurnal Birds of Prey Through Woodpeckers. Royal B.C. Museum, Victoria, B.C.

Canadian Nature Federation.
2002: Western Toad, *Bufo boreas*. http://www.cnf.ca/frog/toad_west.html

Caribou Management Team
1996: Woodland caribou management guidelines. Yukon Department of Renewable Resources, Whitehorse, YT. 8 pp.

Case, R.
1989: Distribution and abundance of Dall's Sheep in the southern Mackenzie Mountains, NWT. Wildlife Management Division, Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. 39 pp.

Case, R., L. Buckland, and M. Williams.
1996: The status and management of the Bathurst Caribou Herd, Northwest Territories, Canada. Department of Renewable Resources, Government of the NWT. Yellowknife, NT.

Chapman, J.A. and G.A. Feldhamer. (Eds.).
1982: Wild mammals of North America: Biology, Management and Economics. John Hopkins Univ. Press, Baltimore. 1147 pp.

Chapman, R.C.
1977: The effects of human disturbance on wolves (*Canis lupus* L.). M.S. thesis, Univ. Alaska, Fairbanks. 209pp.

Chatalain, E. F.
1950: Bear-moose relationships on the Kenai Peninsula. Transactions of the North America Wildlife Conference 15:224-234.

Chowns, T. and R. Graf.
1987: Numbers and distribution of the Mackenzie Wood Bison herd, March 1983. Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. File Report No. 68. 13 pp.

Cizek, Petr.
2002: South Nahanni River watershed study: resource mapping phase I and II. Prepared for Canadian Parks and Wilderness Society, NWT Chapter. July, 2002. Prepared by by Cizek Environmental Services. Yellowknife, Northwest Territories.

2003: Director, Deh Cho Land Use Planning Committee. Yellowknife, Northwest Territories. Personal Communication.

Clark, T.W., E. Anderson and C. Douglas.
1987: *Martes americana*. Mammalian Species Number 289. American Society of Mammalogists. 8pp.

Clark, T.W., P.C. Paquet, and A.P. Curlee.
1996: Introduction to special section: large carnivore conservation in the Rocky Mountains of the United States and Canada. Cons. Biol. 10: 936-939.

Clark, W.S. and B.K. Wheeler.
2001: A field guide to hawks of North America. Houghton Mifflin Company. New York, New York. 316 pp.

Clarkson, P.
1985: The status and management of black bear in the NWT, Canada, 1986. Proc. Third Western Black Bear Workshop.

Clarkson, P.L. and I.S. Liepins.
1993: Inuvialuit wildlife studies: Grizzly bear population estimate and characteristics in the Anderson and Horton River area, NWT, 1987-1989.

Cluff, Dean.
1998: North Slave Regional Biologist, Department of Resources, Wildlife and Economic Development, G.N.W.T., Yellowknife, NT. Personal Communication.

Cochrane, G.A.
1976: Moose winter range on the South Nahanni River. Unpubl. Parks Canada Rep., Nahanni National Park. 8 p + 5 maps.

Comin, L. A., Cochrane, S. Cooper, C. Hammond and T. Elliot.
1981: Large mammal distribution and abundance in Nahanni National Park. Unpubl. Parks Canada Rep., Nahanni National Park. 59 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada)
2002: Canadian species at risk, May 2001. Committee on the Status of Endangered Wildlife in Canada. Ottawa ON. 31 pp.

Craig, V.
ND: Wildlife management in action. Guest lecturer, University of British Columbia. www.forestry.ubc.ca/FRST395/mmar30.htm.

Daily, C.G., P.R. Ehrlich and N.M. Haddad.
1993: Double keystone bird in a keystone species complex. Proceeding of the National Academy of Science. USA 90:592–594.

Decker, Robert.
2003: Forest Ecologist, Department of Resources, Wildlife and Economic Development, Hay River, G.N.W.T. Personal Communication.

Decker, R. and J. Mackenzie.
1980: Population, distribution and density of moose in the Liard Valley, 1978. Wildlife Management Division, Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. File Report No. 7. 22 pp.

Department of Renewable Resources.
1990: Status and management of the black bear in the NWT: a response to possible listing on a CITES Appendix. Wildlife Management Division. Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. unpublished report.

Dunn, J.L. and K.L. Garrett.
1997: A field guide to warblers of North America. Houghton Mifflin Company. New York, New York. 656 pp.

Ecological Stratification Working Group.
1995: A national ecological framework for Canada. Agriculture and Agra-Food Canada, Research Branch, Centre or Land and Biological Resources Research, Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch, Ottawa-Hull. 125 pp.

Eng, M., J. Green, L. Little and S. Auchterlonie.
1989: A Review of international biological programme sites in the Northwest Territories. For the IBP Working Group of the Conservation Advisory Committee. Yellowknife, NWT. 55 pp.

Environment Canada.
2000a: Shorebirds. Hinterland Who's Who. http://www.cws-scf.ec.gc.ca/hww-fap/shorebd/shorebirds.html. 6 pp.

2000b: Woodpeckers main thread in the web. Science and the Environment Bulletin. Issue No. 16. January/February 2000. 8 pp.

2002: Species at risk in Canada. Environment Canada Interactive Website: Map Search for Species at Risk in Canada: http://www.speciesatrisk.gc.ca/search/enda_e.cfm

Ferguson, R.
1987: Wildlife areas of special interest to the Department of Renewable Resources. Wildlife Management Division, Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. 207 pp.

Ferguson, R.S., K.D. Davidge and R.S. Douglas.
1985: Distribution and abundance of Dall's Sheep near Jackfish River, Northwest Territories in June 1984. Wildlife Management Division, Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. 20 pp.

Ford, Dr. Derek.
ND: Karst landforms of the Nahanni Belt, Northwest Territories. Location of karst landforms as identified by Dr. Derek Ford, 1:50,000. Obtained from Claude Mondor, Parks Canada, claude_mondor@pc.gc.ca

Fournier, Michael.
2003: Environmental Assessment Coordinator, Environmental Protection Service, Environment Canada. Yellowkinfe, NWT. Personal Communication.

Fournier, Michael. (cont'd)
1997: Amphibians in the Northwest Territories. *In*: Amphibians in decline: Canadian Studies of a Global Problem. Pages 100-106. Green, D.M. (Ed.). Herpetological Conservation. No. 1.

Gates, C.C., N.C. Larter and P.E. Komers.
1991: Size and composition of the Mackenzie Wood Bison population in 1989. Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. File Report No. 93. 24 pp.

Gau, R. J. and R. Mulders.
2001: Cougars (*Puma concolor*) in the Northwest Territories. Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. Manuscript Report No. 140. 39 pp.

Gerrard, J. M., P. N. Gerrard, W. J. Mather, and D. W. A. Whitfield.
1975: Factors Influencing Nest Site Selection of Bald Eagles in Northern Saskatchewan and Manitoba. Blue Jay 33: 169-176.

Godfrey, W.E.
1979: The Birds of Canada. National Museum of Canada. Ottawa. 428 pp.

Godin, A.J.
1982: Striped and hooded skunks. Chapter 35, pages 674 – 687. *In*: Wild mammals of North America: Biology, Management and Economics. Chapman, J.A. and G.A. Feldhamer. (Eds.). John Hopkins Univ. Press, Baltimore. 1147 pp.

Goulet, L. A. and D. J. Haddow.
1985: An Inventory of Wildlife Resources on the Liard River, Northern British Columbia: A Report of the 1978, 1980, and 1981 Field Studies. B.C. Hydro. Report No. Ess-30.

Graf, R.
1992: Fire/Fur/Moose, annual report 1991/92. Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. Manuscript Report No. 61. 19 pp.

1992: Status and management of moose in the Northwest Territories, Canada. Alces Suppl. 1:22-28.

1994: Experimental overharvest of martens, *Martes americana*, in Northwest Territories, Canada. Pages 229-232. *In:* I.D. Thompson, (ed.). Forests and Wildlife. Towards the 21st Century. Proceedings of the International Union of Game Biologists XXI Congress. Halifax, NS.

Graf, R., T. Chowns and J. Beaulieu.
1990: Distribution and abundance of the Mackenzie wood bison herd, July 1983. Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. Manuscript Report No. 27. 11 pp.

Gray, P. and P. Panegyuk.
1989: Woodland Caribou. *In*: People and caribou in the Northwest Territories. Pages 159-163. E. Hall, Ed. Department of Renewable Resources. Yellowknife, NWT. 190 pp.

Greater Fundy Ecosystem Research Group.
1997: Forest management guidelines to protect native biodiversity in the Fundy Model Forest. S. Woodley and G. Forbes, eds. UNB Faculty of Forestry and Environmental Management. Greater Fundy Ecosystem Research Project. http://www.unb.ca/forestry/centers/cwru/opening.htm

Green, D.M. (Ed.)
1997: Amphibians in decline: Canadian Studies of a Global Problem. Herpetological Conservation. No. 1.

Gunn, A.
2001: Seasonal range use and demography of the South Nahanni caribou herd. In: Co-management of Woodland Caribou in the Sahtu Settlement Area: Workshop on Research, Traditional Knowledge, Conservation and Cumulative Impacts. Pages 16-17, Section 5.2. Special Publication No. 1, Sahtu Renewable Resource Board, Tulita, NWT. 22 pp.

2003: Ungulate Biologist, Department of Resources, Wildlife and Economic Development, Government of the Northwest Territories, Yellowknife, NT. Personal Communication.

Gunn, A., R. Farnell, J. Adamczewski, J. Dragon and L. Laberge.
2002: Census for the South Nahanni Mountain caribou herd, September 2001. Department of Resources, Wildlife and Economic Development, G.N.W.T. Yellowknife, NWT. Manuscript Report No. 147. 31 pp.

Gullickson and Mansequ.
2000: South Nahanni Woodland Caribou Herd Seasonal Range Use and Demographics. Parks Canada Agency. 79 pp.

Hagen, Ross.
2003: Renewable Resource Officer II. Department of Resources, Wildlife and Economic G.N.W.T., Fort Liard, NT. Personal Communication.

Hagmeier, E. M.
1956: Distribution of Marten and Fisher in North America. The Canadian Field Naturalist. 70(4): 149-168.

Hansen, H.A., P.E.K. Sheperd, J.G. King and W.A. Trozer.
1971: The trumpeter swan in Alaska. Wildl. Monogr. No. 26, Wildl. Soc. 83 pp.

Hatler, D.F.
1972: Food habits of black bears in interior Alaska. Canadian Field-Naturalist 86:17-31.

Hawkings, J.S., A. Breault, S. Boyd, M. Norton, G. Beyersbergen and P. Latour.
2002: Trumpeter swan numbers and distribution in western Canada, 1970-2000. Waterbirds 25 (Special Publication 1): 8-21 pp.

Herad, D.
1989: Bathurst Herd. *In*: People and caribou in the Northwest Territories. Pages 108-115. E. Hall, Ed. Department of Renewable Resources. Yellowknife, NWT. 190 pp.

Heimer, W.E.
1987: Publication of Dall Sheep findings and development of future research direction. Alaska Department of Fish and Game, Division of Game, Federal Aid in Wildlife Restoration Research Final Report. Juneau, AK. 33 pp.

Herrero, S.
1978: A comparison of some features of the evolution, ecology, and behavior of black and grizzly/brown bears. Carnivore 1:7-16.

Hoefs, M.
1978: Dall Sheep in the Richardson Mountains: distribution, abundance and management concerns. Yukon Game Branch Report No. 78 – 2. 44 pp.

Hoffmann, W.H.
1974: Dall Sheep survey – Mount Goodenough winter range, Richardson Mountains, Northwest Territories. Game Management Division, Aklavik, N.W.T. 6 pp.

Jacobson, R.
1979: Wildlife and wildlife habitat in the Great Slave and Great Bear lake Regions 1974-1977. Canada Department of Indian and Northern Affairs. Environmental Studies 10. Pages 42-52.

Jingfors, K., R. Bullion and R. Case.
1987: Abundance and population composition of moose along the Mackenzie River, November 1984. Department of Renewable Resources, G.N.W.T. Inuvik, NWT. File Report No. 70. 39 pp.

Jonkel, C.
1978: Black, brown (grizzly) and polar bears. Pages 227-248 *In:* J. L. Schmidt and D. L. Gilbert, editors. Big game of North America: ecology and management. Stackpole, Harrisburg, Pennsylvania.

Kaeser, C.
ND: Known hotsprings. Digitized by Christina Kaeser, Parks Canada, Christina_kaeser@pc.gc.ca

Kelsall, J.P., E.S. Telfer and T.D. Wright.
1977: The Effects of Fire on the Ecology of the Boreal Forest, With Particular Reference to the Canadian North: a Review and Selected Bibliography. Canadian Wildlife Service, Occasional Paper Number 32. 58 pp.

Kufeld, R. C.
1973: Food Eaten by the Rocky Mountain Elk. J. Range Manage. 26:106-113.

Lamoureux, W.J.
1970: Aquatic plants for fish and wildlife. A Conservation Bulletin. Royal Botanical Gardens. Hamilton, Ontario. 29 pp.

Larter, Nick.
2003: Regional Biologist, Department of Resources, Wildlife and Economic Development. Fort Simpson, NWT. Personal Communication.

Latour, P.
1989: Bluenose Herd. *In*: People and caribou in the Northwest Territories. Pages 103-107. E. Hall, Ed. Department of Renewable Resources. Yellowknife, NWT. 190 pp.

1992: Population size and composition of moose west of Norman Wells. Wildlife Management Division, Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. File Report No. 42. 17 pp.

Latour, P. and R. Hagen.
1993: Use of electric fencing to deter black and grizzly bears fro the Norman Wells dump. Department of Renewable Resources, G.N.W.T. Manuscript Report No. 69.

Latour, P., N. Maclean and K. Poole.
1994: Movements of martens, *Martes americana*, in burned and unburned taiga in the Mackenzie Valley, Northwest Territories. Canadian Field-Naturalist 108(3):351-354.

Lee, J. and A. Niptanatiak.
1993: Ecology of the Wolverine on the Central Arctic Barrens: a Progress Report. Manuscript Report #75. Department of Renewable Resources. Government of Northwest Territories. Yellowknife. NWT, 29pp.

Lortie, G.M.
1982: The 1981-1982 winter distribution of woodland caribou in the Mackenzie Mountains, N.W.T. Yukon Renewable Resources, Whitehorse, Yukon.

Machmer, M., C. Steeger and M. McDonaugh.
ND: Use of Paper Birch by Cavity Nesters in the Southern Interior of British Columbia. BC Ministry of Forests, Nelson Forest Region. Technical Report TR-012. 20 pp.

MacKay, R.H.
1978: Status report on Trumpeter Swan, *Olor buccinator*, in Canada, 1978. Comm. Status Endangered Wildl. Can., Can. Wildl. Serv., Ottawa. 38 pp.

MacLean, N.
1994: Population size and composition of moose in the Fort Norman area, NWT, November 1993. Department of Renewable Resources, G.N.W.T. Norman Wells, NWT. Manuscript Report No. 80. 17 pp.

Machtans, C.S.
2000: Extra-limital observations of broad-winged hawk, *Buteo platypterus*, Connecticut Warbler, Oporornis agilis, and other bird observations from the Liard Valley, Northwest Territories. Canadian Field-Naturalist 114(4): 671-679.

Martin, M.
1978: Status report on Caspian Tern *Sterna caspia* in Canada 1978. Rep. Prepared for Can. Wildl. Serv./Comm. Status Endangered Wildl. Can. Ottawa, Ontario. 42 pp.

Matthews, Steve.
2003: Habitat/Environmental Assessment Biologist, Department of Resources, Wildlife and Economic Development. Fort Simpson, NWT. Personal Communication.

McCormick, K.J. and L.J. Shandruk.
1987: A survey of trumpeter swans and their habitat in southern Mackenzie District, Northwest Territories: 1986. Canadian Wildlife Service, Western and Northern Region. Technical Report No. 26. 44 pp.

McCormick, K.J., M.E. Adams, C.J. Stephenson and A.S. Goodman.
1984: Key migratory bird terrestrial habitat sites in the Northwest Territories. Canadian Wildlife Service, Western and Northern Region, Habitat Management Section. Technical Report No. 84 – 6. 175 pp.

McCormick, K.J. and M.E. Adams.
1984: Migratory bird terrestrial habitats – An NWT Overview. Canadian Wildlife Service, Western and Northern Region, Habitat Management Section. Technical Report No. 84 – 8. 138 pp.

McKelvey, R.W.
1975: Trumpeter swan – hinterland's whos who. Canadian Wildlife Service. Revised 1992. Minister of the Environment. Minister of Supply and Services Canada. Catalogue No. CW69-4/53-1992E, ISBN: 0-662-19413-6.

Mech, L.D.
1995: The challenge and opportunity of recovering wolf populations. Cons. Biol. 9: 270-278.

MELP (Ministry of Environment, Lands and Parks).
1999: British Columbia Wildlife Habitat Rating Standards. British Columbia Ministry of Environment, Lands and Parks. Victoria, BC. 97 pp. http://www.elp.gov.bc.ca/wld/pub/

MELP (Ministry of Environment, Lands and Parks).
1992: Elk in British Columbia. British Columbia Ministry of Environment, Lands and Parks. Victoria, BC. 4 pp. http://www.elp.gov.bc.ca/wld/pub/elk.htm

Moore, Steve.
2002: Wildlife Biologist, EBA Engineering Consultants Ltd., Yellowknife, Northwest Territories. Personal Observations.

Morgantini, L.E. and W.B. Russell.
1983: An assessment of three selected elk winter ranges in the Rocky Mountain Region. Prepared by Wildland Resource Consultants Ltd. for Alberta Fish and Wildlife Division. Edmonton, AB. 265 pp.

Mueller, F. P.
1995: Tundra esker systems and denning by grizzly bears, wolves, foxes, and ground squirrels in the central Arctic, Northwest Territories. File Rep. No. 115. Department Renewable Resources, G.N.W.T., Yellowknife. 68 pp.

Myers, J.P. and F.A. Pitelka.
1980: Seasonal abundance and habitat use patterns of shorebirds at two sites in Northern Alaska. Wader Sudey Group Bull. 29:28-30.

Nagorsen, D.
1990: The mammals of British Columbia, a taxonomic catalogue. Memoir No. 4, Royal British Columbia Museum, Victoria, B.C. 213 pp.

Northern Land Use Information Series.
1972: Indian and Northern Affairs. Land Use Planning Branch of Lands Directorate. Lands, Forest and Wildlife Service. Department of the Environment.

Olsen, B., M.
2001: Mountain caribou. *In*: Co-management of Woodland Caribou in the Sahtu Settlement Area: Workshop on Research, Traditional Knowledge, Conservation and Cumulative Impacts. Pages 14-15, Section 5. Special Publication No. 1, Sahtu Renewable Resource Board , Tulita, NWT. 22 pp.

Olsen, B., M. MacDonald and A. Zimmer.
2001: Co-management of woodland caribou in the Sahtu Settlement area: workshop on research, traditional knowledge, conservation and cumulative impacts. Special Publication No. 1, Sahtu Renewable Resource Board , Tulita, NWT. 22 pp.

Page, L.M. and B.M. Burr.
1991: A Field Guide to Freshwater Fishes of North America north of Mexico. Peterson Field Guide Series #42. 432 pp.

Parks Canada.
1984: Nahanni National Park Reserve Resource Description and Analysis. Natural Resource Conservation Section, Parks Canada, Prairie Region, Winnipeg, Manitoba.

2003: Parks Canada Agency Annual Report 2000-2001. http://www.parkscanada.gc.ca/docs/pc/rpts/ann00-01/annu00-01_33_e.asp

Peek, J.M.
1982: *Elk* (*Cervus elaphus*). Pages 851-861. *In:* Wild mammals of North America: biology, management, economics. J.A. Chapman and G.A. Feldhamer (eds.). John Hopkins Univ. Press. Baltimore. 1147 pp.

1998: Habitat relationships. Pages 351-375 *In:* A.W Franzmann and C.C. Schwartz, eds. Ecology and management of North American moose. Smithsonian Institution Press, Washington.

Pelton, M.R.
2000: Black bear. Pages 389-408 *In:* S. Demarais and P.R. Krausman, eds. Ecology and management of large mammals in North America. Prentice Hall. Upper Saddle River, NJ.

Penner, D. F.
1981: Fur-bearer Studies in the Liard River Valley British Columbia, 1980 Winter Survey. McCourt Management Ltd. B.C. Prepared for British Columbia Hydro and Power Authority.

Poole, K.G.
1992: Lynx research in the Northwest Territories, 1991-92. Department of Renewable Resources. Manuscript Report No. 68. 43 pp.

1994: Characteristics of an unharvested lynx population during a snowshoe hare decline. J. Wildl. Manage. 58(4): 608-618.

Poole, K.G., B.T. Elkin and R.W. Bethke.
1995: Environmental contaminants in wild mink in the Northwest Territories Canada. Science Of The Total Environment 161: 473-486.

Powell, R. A.
1982: The fisher: life history, ecology, and behaviour. University of Minnesota Press, Minneapolis, Minnesota. 217pp.

Rescan (Rescan Environmental Services Ltd.)
1996: Baseline study updates: ecological mapping; eskers, carnivores and dens. Prepared by Rescan Environmental Services Ltd., Vancouver BC for BHP Diamonds Inc., Vancouver BC and Yellowknife NT.

Resources Inventory Committee.
1999: Inventory methods for woodpeckers standards for components of British Columbia's Biodiversity No. 19. Ministry of Environment Lands, and Parks for the Terrestrial Ecosystem Task Force. Version 2.0. http://www.for.gov.bc.ca/ric/pubs/tebiodiv/woodpeckers/index.htm

Ross, P.I. and M.G. Jalkotzy.
1992: Characteristics of a hunted population of cougars in southwestern Alberta. J. Wildl. Manage. 56:417-426.

Ruggiero, L. F. K. B. Aubry, S. W. Buskirk, L. J. Lyon and W. J. Zielinski (eds.).
1994: The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States. General Technical Report RM-254. US Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Ft. Collins, Colorado.

RWED (Resources, Wildlife and Economic Development).
2001a: NWT species 2000. General status ranks of wild species in the Northwest Territories. Government of the Northwest Territories (GNWT), RWED, Yellowknife NT. 50pp. Also available at: http://nwtwildlife.rwed.gov.nt.ca/monitor.

2001b: Moose Factsheet. Government of the Northwest Territories (GNWT), RWED, Yellowknife NT. Also available at: http://www.nwtwildlife.rwed.gov.nt.ca/NWTwildlife/bison/history.htm

2001c: NWT species at risk. Grizzly Bear. Government of the Northwest Territories (GNWT), RWED, Yellowknife NT. http://www.nwtwildlife.rwed.gov.nt.ca/Publications/speciesatriskweb/grizzlybear.htm

2001d: NWT species at risk. Shortjaw Cisco. Government of the Northwest Territories (GNWT), RWED, Yellowknife NT. http://www.nwtwildlife.rwed.gov.nt.ca/Publications/speciesatriskweb/shortjawcisco.htm

2002a: Population status reports. Government of the Northwest Territories (GNWT), RWED, Yellowknife NT. http://www.nwtwildlife.rwed.gov.nt.ca/Publications/populationstatusreports/populationrpts.htm

2002b: Wolves. http://www.nwtwildlife.rwed.gov.nt.ca/NWTwildlife/wolf/wolvestop.htm

Sadar, Dr. M.H.
1994: Information Requirements and Tools for Screening and Preliminary Assessment. Environmental Assessment Training Course. http://www.frameweb.org/powerpoint/InfoRequirementsandTools2000.ppt+Sadar+1994&hl=en&ie=UTF-8

Salter, R.
1974: Autumn migration of birds through the central and upper Mackenzie Valley region, 1972. Arctic Gas Biol. Rept. Series., Vol. 13(2):1-83.

Salter, R.E., W.J. Richardson and C. Holdsworth.
1974: Spring migration of birds through the Mackenzie Valley, NWT, April-May, 1973. Arct. Gas Biol. Rep. Ser. 28(2):1-168.

Scott, W.B. and E.J. Crossman.
1979: Freshwater Fishes of Canada. Bulletin 184. Fisheries Research Board of Canada, Ottawa. 966 pp.

Scotter, G.W., L.N. Carbyn, W.P. Neily and J.D. Henry.
1985: Birds of Nahanni National Park, Northwest Territories. Special Publication No. 15 of the Saskatchewan Natural History Society, Box 1121, Regina, Saskatchewan. 74 pp.

Shank, C.C.
1992: Fort Providence moose survey - November 1991. Wildlife Management Division, Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. File Report No. 55. 41 pp.

Sibley, D.A.
2000: The Sibley guide to birds. National Audubon Society. Alfred A. Knopf, New York. 545 pp.

Simmons, N.
1982: Seasonal distribution of Dall's Sheep in the Mackenzie Mountains, Northwest Territories. NWT Wildlife Service, Yellowknife, NWT. File Report No. 21 47 pp.

Sirois, J., M.A. Fournier and M.F. Kay.
1995: The colonial waterbirds of Great Slave Lake, Northwest Territories: an annotated atlas. Occasional Paper, Number 89. Can. Wildlife Service. Ottawa, Ontario. 59 pp.

Sirois, J., S.A. Alexander and S.E. Westover.
1991: Breeding sites of gulls, terns and jaegers at Iles du Large, Resolution Bay, and along the west shore of Great Slave Lake, Northwest Territories. Prog. Note No. 192, Can. Wildlife Service. Ottawa, Ontario.

Slough, B. G.
1985: Report on the status of fur-bearers in the Yukon Territory. Fish and Wildlife Branch, Yukon Department of Renewable Resources, Whitehorse, Yukon.

Steeger, C., J. Krebs and D. Crampton.
1993: A close look at wildlife trees. Extension Note 011. British Columbia Forestry Service, Nelson Forest Region. 7 pp.

Steeger C. and M. Machmer.
1996: Impacts of spring and summer logging on cavity-nesting vertebrates. Extension Note 025. British Columbia Forestry Service, Nelson Forest Region. 4 pp.

Terres, J.K.
1982: The Audubon Society encyclopedia of North American birds. Alfred A. Knopf, New York. 1109 pp.

Thompson, I.D.
1994: Marten populations in uncut and logged boreal forests in Ontario. Journal of Wildlife Management. 58:272-280.

Toweill, D.E.
1977: Food habits of cougars in Oregon. J. Wildl. Manage. 41:576-578.

Toweill, D.E. and J.E. Tabor.
1982: River otter. Chapter 36, pages 688 – 703. *In*: Wild mammals of North America: Biology, Management and Economics. Chapman, J.A. and G.A. Feldhamer. (Eds.). John Hopkins Univ. Press, Baltimore. 1147 pp.

Treseder, L. and R. Graf.
1985: Moose in the Northwest Territories – a discussion paper. Department of Renewable Resources, G.N.W.T. Yellowknife, NWT. Manuscript Report No. 13. 41 pp.

Troy, D.M.
2000: Shorebirds. Pages 277-303. In: J.C. Truett and S.R. Johnson (Eds). The natural history of an Arctic oil field. Academic Press. 422 pp.

Van Zyll de Jong, C.G.
1975: The distribution and abundance of the wolverine (*Gulo gulo*) in Canada. Can Field-Nat. 89:431-437

Veitch, A.M.
2001: Boreal caribou, Chapter 4, Pages 7 - 14. ***In:*** Olsen, B., M. MacDonald and A. Zimmer. 2001. Co-management of Woodland Caribou in the Sahtu Settlement Area: Workshop on Research, Traditional Knowledge, Conservation and Cumulative Impacts. Special Publication No. 1, Sahtu Renewable Resource Board , Tulita, NWT. 22 pp.

Veitch, A., R. Popko and N. Whiteman.
2000: Classification of woodland caribou in the central Mackenzie Mountains, Northwest Territories, August 1999. Department of Resources, Wildlife and Economic Development. G.N.W.T. Sahtu Region, Norman Wells, NWT. Manuscript Report No. 122. 16 pp.

Veitch, A.M., R.A. Popko and N. McDonald.
1996: Size, composition, and harvest of the Norman Wells area moose population, November 1995. Department of Resources, Wildlife and Economic Development. G.N.W.T. Norman Wells, NWT. Manuscript Report No. 93. 32 pp.

Weaver, J.L., P.C. Paquet and L.F. Ruggiero.
1996: Resilience and conservation of large carnivores in the Rocky Mountains. Cons. Biol. 10: 964-976.

Westman, W.E.
1985: Ecology Impact Assessment, and Environmental Planning. A Wiley-Interscience Publication, Jhon Wiley & Sons. Toronto, Ont. 532 pp.

Wigal, R.A. and V.L. Coggins.
1982: Mountain goat. In: wild mammals of North America: biology, management and economics. J.A. Chapman and G.A. Feldhamer, Eds., John Hopkins Univ. Press, Baltimore. 1008 – 1035 pp.

Wooley, D.
1974: Studies of furbearers associated with proposed pipeline routes in the Yukon and Northwest Territories. Chapter 3. A study of marten in the Mackenzie District, N.W.T. Arctic Gas , Biological Report Series Vol. 9.34pp.

Wright, W., J.A. Nagy and T. Slack.
2003: Animated movements of barren-ground caribou tracked by satellite. Computer generated animation. Department of Resources, Wildlife and Economic Development. G.N.W.T. Inuvik, NWT.

APPENDIX A

COSEWIC DESIGNATIONS AND SPECIES LISTING FOR THE NWT

APPENDIX A
COSEWIC DESIGNATIONS AND SPECIES LISTINGS FOR THE NWT

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wildlife in Canadian species, subspecies and separate populations suspected of being at risk. COSEWIC bases its decisions on the best up-to-date scientific information available. All native mammals, birds, reptiles, amphibians, fish, molluscs, lepidopterans (butterflies and moths), vascular plants, mosses and lichens are included in its current mandate (COSEWIC, 2002).

COSEWIC's definitions of terms & risk categories for wildlife are discussed below.

WILDLIFE SPECIES

Species, subspecies or biologically distinct population of animal, plant or other organism, other than a bacteria or virus, that is wild by nature and

a. is native to Canada; or
b. has extended its range into Canada without human intervention and has been present in Canada for at least 50 years

EXTINCT

A wildlife species that no longer exists.

EXTIRPATED

A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.

ENDANGERED

A wildlife species that is facing imminent extirpation or extinction.

THREATENED

A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

SPECIAL CONCERN

A wildlife species of special concern because it is particularly sensitive to human activities or natural events, but does not include an extirpated, endangered or threatened species.

NOT AT RISK

A wildlife species that has been evaluated and found to be not at risk.

DATA DEFICIENT

A species for which there is insufficient scientific information to support status designation.

COSEWIC Species listings for the Northwest Territories

SPECIES	COSEWIC LISTING	PRESENT IN DEH CHO [1]
Eskimo curlew	Endangered	N
Wood bison	Threatened	Y
Grizzly bear	Special Concern	Y
Polar bear	Special Concern	N
Woodland caribou (Northern Mountain population)	Special Concern	Y
Woodland caribou (Boreal population)	Threatened	Y
Wolverine	Special Concern	Y
Peregrine falcon (*Falco peregrinus tundrius*)	Special Concern	N
Peregrine falcon (*F. p. anatum*)	Threatened	Y
Ivory gull	Special Concern	N
Ross's gull	Threatened	N
Western Toad	Special Concern	Y

[1] Note: Y = yes; N = no.

APPENDIX B

RANKING TABLES FOR VECs and NON-VECs

Rankings Table for Species

Species	Habitat Description	Season Description	Rank
Dall's Sheep	Range	Summer and Winter	1
Dall's Sheep	Range	Summer	1
Dall's Sheep	Approximate Range	Year-round Use	1
Dall's Sheep	Known Population	Year-round Use	2
Dall's Sheep	Known Lambing Range	Spring	4
Dall's Sheep	Known Sheep Mineral Lick	Year-round Use	4
Dall's Sheep	Sheep Nursing Area	Spring and Summer	4
Moose	All Habitat Functions	Late Fall	2
Moose	All Habitat Functions	Late Fall and Winter	2
Moose	All Habitat Functions	Winter	2
Moose	All Habitat Functions	Fall or Winter	2
Moose	All Habitat Functions	Spring or Summer	2
Moose	All Habitat Functions	Spring	2
Moose	Range	Year-round Use	1
Moose	All Habitat Functions	Wintering	2
Moose	All Habitat Functions	Early Wintering period only	2
Moose	Known Mineral Lick	Year-round Use	4
Wood Bison	Range	Year-round Use	1
Woodland Caribou	Range	Year-round Use	1
Woodland Caribou	Known Summering Area	Summer	1
Woodland Caribou	Known Wintering area	Winter	2
Woodland Caribou	Caribou Fall Rutting	Fall	2
Woodland Caribou	Suspected Calving Area	Spring	3
Woodland Caribou	Known Calving Area	Spring	4
Woodland Caribou	Caribou Mineral Lick	Year-round Use	4
Mountain Goat	Approximate Range	Year-round Use	1
Mountain Goat	Range	Summer	1
Grizzly Bear	Range	Year-round Use	1
Grizzly Bear	All Habitat Functions	Year-round Use	2
Grizzly Bear	Denning Area	Fall or Winter	4
Black Bear	Range	NA	1
Black Bear	Denning Area	Fall or Winter	4

Rankings Table for IBP Sites and Key Migratory Bird Sites

Site Number	Site Name	Designation Status	Ranking
2	Virginia Falls	Flora	2
75	Rabbitkettle Hotsprings	Geomorphology	1
49	Mills Lake	Critical Nesting Area	4
15	Liard River	Flora/fauna	1
25	Kakisa River	Waterfowl nesting area	4
49	Horn River	Waterfowl	1
32	Horn Plateau	Habitat for fishers and woodland caribou	2
79	Heart Lake	Flora	1
28	Glacier Lake	Geomorphology	1
35	Ebbutt Hills	Peat/palsa	1
22	Deep Bay Wood-Bison Sanctuary	Wildlife (wood bison and whooping crane)	2
34	Cartridge Lakes	Geomorphology	0
14	Alexandra and Louise Falls	Aesthetics	0
81	Coal River Springs	Geomorphology	0
29	Raven's Throat	Geomorphology	1
72	Carajou Lake	Important wintering range for Dall's Sheep	3
76	Caribou Flats	Important woodland caribou habitat	4
55	Cirque Lake Area	Wildlife	1
60	Lymnaea Springs	Geomorphology	1
58	Mackenzie Mountains Barrens	Calving area and high density of grizzlies	4
74	Mirror Lake	Geomorphology	1
57	Moosehorn Headwaters	Fauna/flora	2
26	Plains of Abraham	Plant refugia and unique fauna	3
70	Sculpin Springs	Unique flora and fauna	2
71	Toitye Hotsprings	Mineral licks by ungulates and unique flora	3
24	Willow Lake (Bracket Lake)	Wildlife	4
13	Whooping Crane Nesting Area	Nesting area	4
49	Mills Lake	Critical Nesting Area	4
NA	Beaver Lake	Critical Nesting Area	4
NA	Northwest Point	Critical Nesting Area	4
NA	Southeastern Mackenzie Mountains	Critical Nesting Area	4

Rankings Table for Karst Topography Sites

Name	Ranking
Fishtrap-Tetcela Glacial Spillway	4
Unnamed	4
Tungsten	4
Lened Creek	4
Meilleur	4
Old Pots	4
Wildmint	4
Hole in the Wall	4
Moore's	4
Kraus	4
Rabibitkettle	4

Note: Not all karst topography sites have been assigned names.

Rankings Table for Species

Species	Habitat Description	Season Description	Rank
Waterfowl	River/Stream	Spring, Summer and Fall	1
Waterfowl	Inland Water	Spring, Summer and Fall	1
Waterfowl	All Habitat Functions	Spring or Summer	2
Waterfowl	Migratory Route	Spring or Summer	3
Waterfowl	Migratory Route	Fall or Winter	3
Waterfowl	Nesting Area	Spring or Summer	4
Waterfowl	Breeding Area	Spring or Summer	4
Waterfowl	Staging Area	Fall or Winter	4
Trumpeter Swan	Nest Locations	Spring and Summer	4
Trumpeter Swan	Range	Spring, Summer and Fall	4
Whooping Crane	Range	Spring, Summer and Fall	4
Peregrine Falcon	Range	Year-round Use	1
Peregrine Falcon	Nesting Area	Year-round Use	4
Fish	Range	Year-round Use	1
Fish	Possible Spawning Area	Spring and Fall	1
Fish	Fish Migration Route	Spring and Fall	3
Fish	Fall Spawning Runs	Spring and Fall	3
Fish	Existing or Potential Fish Spawning Area	Spring and Fall	4
Furbearers	Range	Fall or Winter	1
Furbearers	All Habitat Functions	Year-round Use	2
Furbearers	All Habitat Functions	Fall or Winter	2

APPENDIX C

FIGURES

Figure 3:

Dall's Sheep Range Within the Study Area

Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Approximate Range
- Known Lambing Range
- Mineral Licks
- Sheep Nursing Areas

Prepared by: EBA Engineering Consultants Ltd.
Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic, 122° W Central Meridian, 60° N Reference Latitude, 60° N Standard Parallel 1, 65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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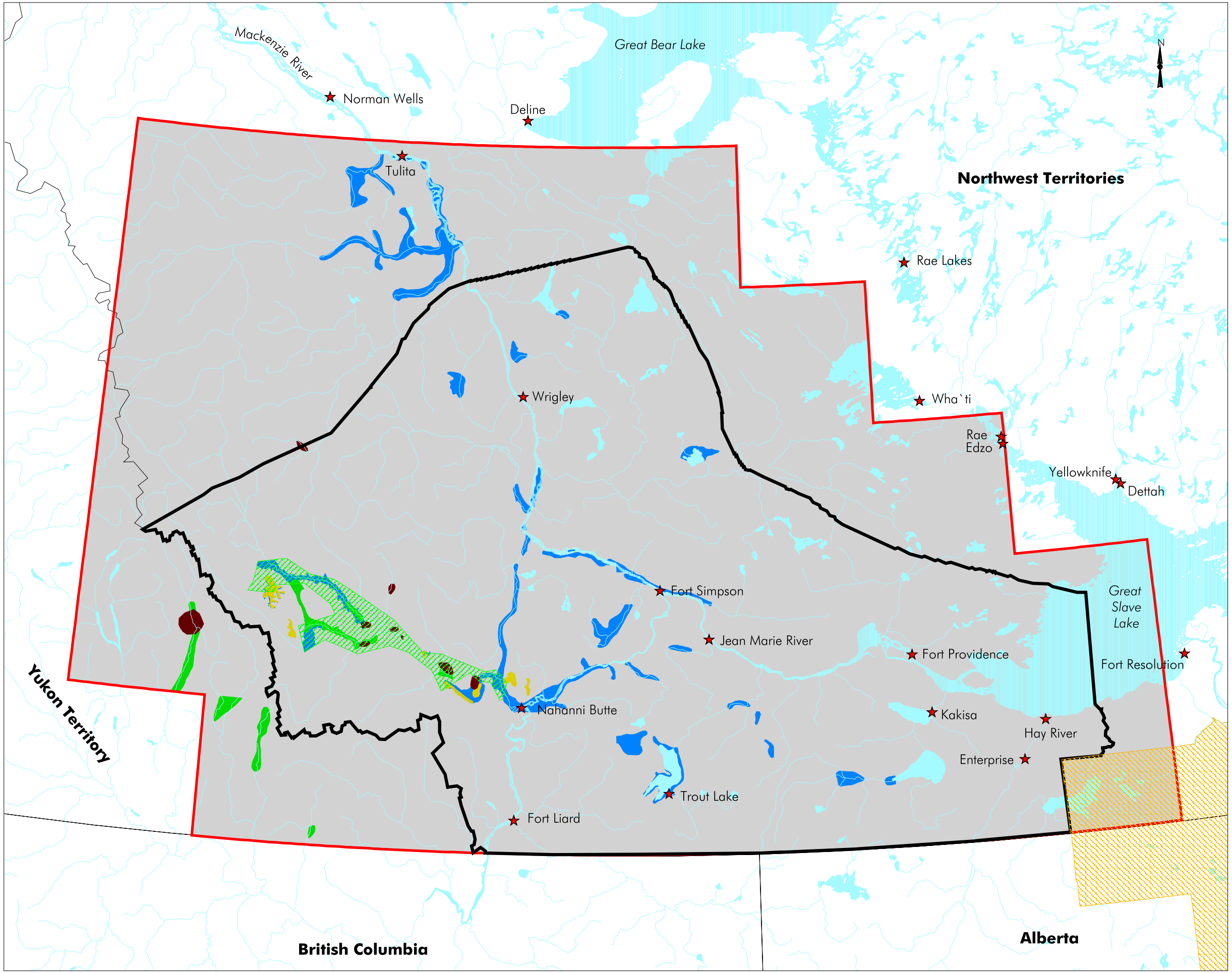
Figure 4:

Moose Range Within the Study Area



Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park

Moose Habitat - Season

- Fall
- Spring
- Winter
- Year Round Moose Range
- Mineral Licks

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Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic, 122° W Central Meridian, 60° N Reference Latitude, 60° N Standard Parallel 1, 65° N Standard Parallel 2
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Date: April 11, 2003

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Figure 5:

Wood Bison Range Within the Study Area

Mackenzie River
Great Bear Lake
Norman Wells
Deline
Tulita
Northwest Territories
Rae Lakes
Wrigley
Wha`ti
Rae Edzo
Yellowknife
Dettah
Horn Plateau
Mink Lake
Mackenzie Sanctuary
Great Slave Lake
Fort Simpson
Jean Marie River
Fort Providence
Fort Resolution
Kakisa
Hay River
Enterprise
Yukon Territory
Nahanni Butte
Liard River Bison Population
Trout Lake
Fort Liard
British Columbia
Alberta
N

Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Known Area of High Wood Bison Use, Winter
- Wood Bison Range
- Herd Expansion

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Client: Deh Cho Land Use Planning Committee
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60° N Standard Parallel 1
65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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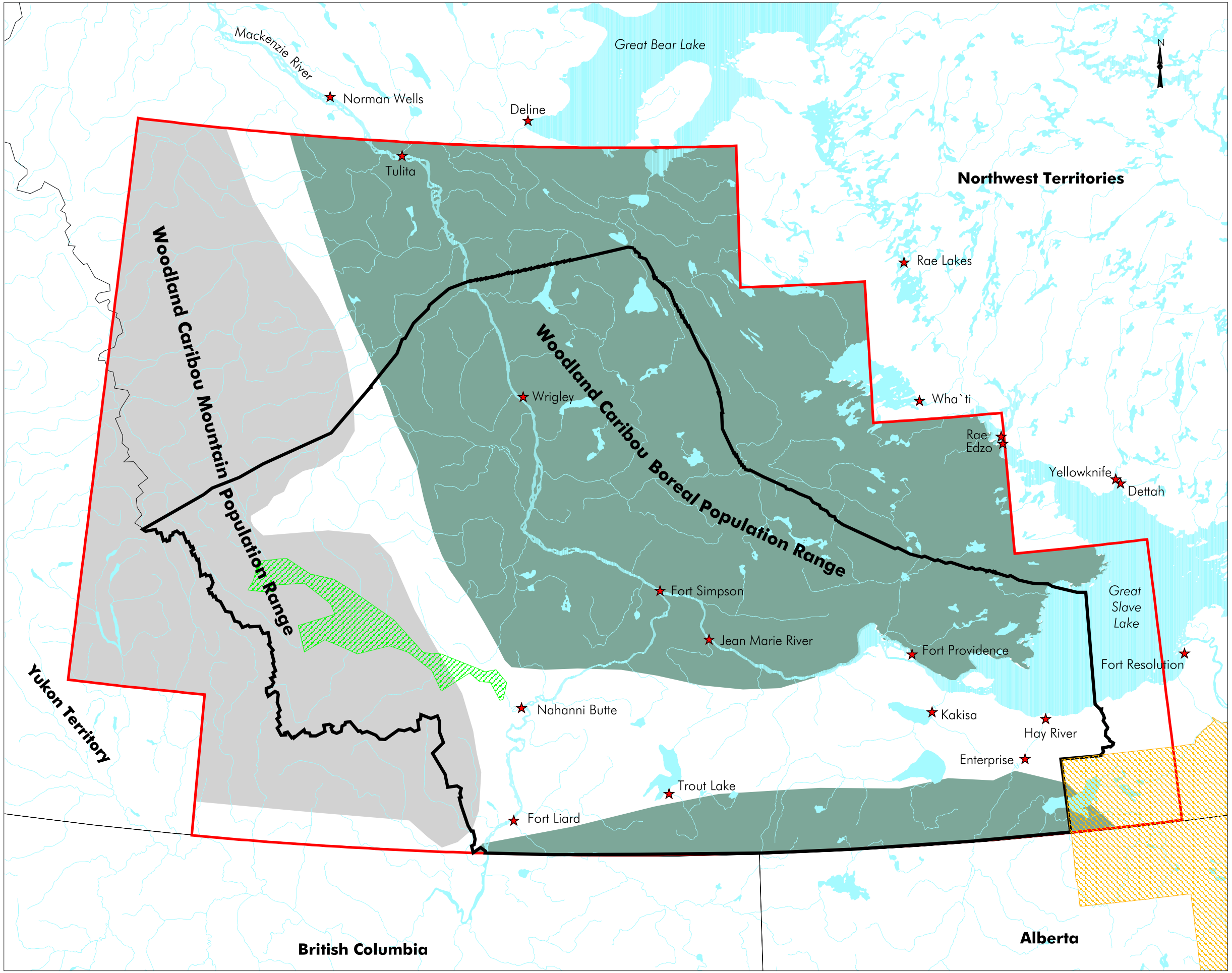
Figure 6:

Woodland Caribou Range Within the Study Area



Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Woodland Caribou Mountain Population Range
- Woodland Caribou Boreal Population Range

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Datum: NAD 83
Date: April 11, 2003

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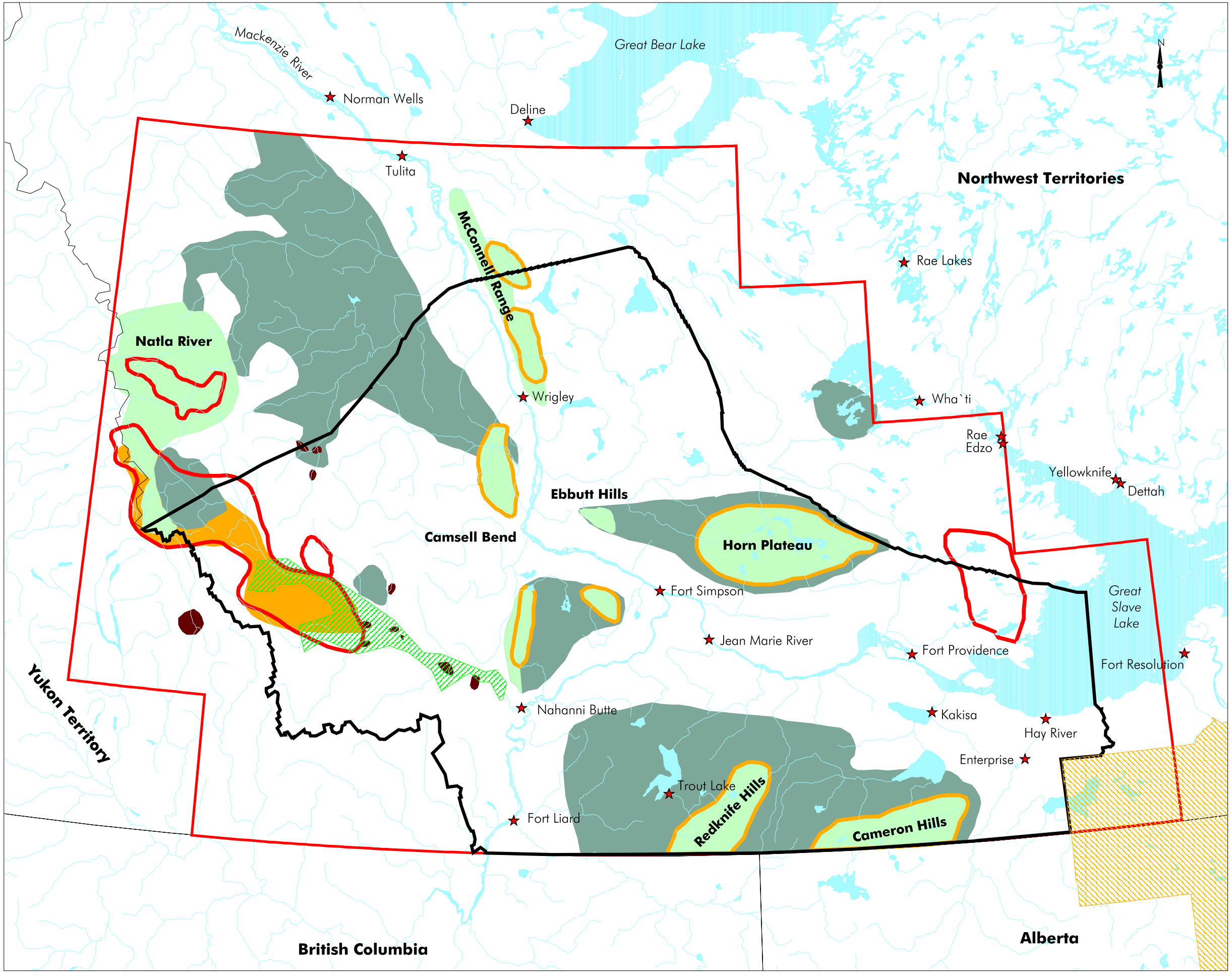
Figure 7:
Seasonal Areas Frequented by Woodland Caribou Within the Study Area



Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Caribou mineral licks
- Caribou calving areas
- Caribou suspected calving areas
- Caribou summering areas
- Caribou wintering areas
- Caribou fall rutting range

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60° N Standard Parallel 1
65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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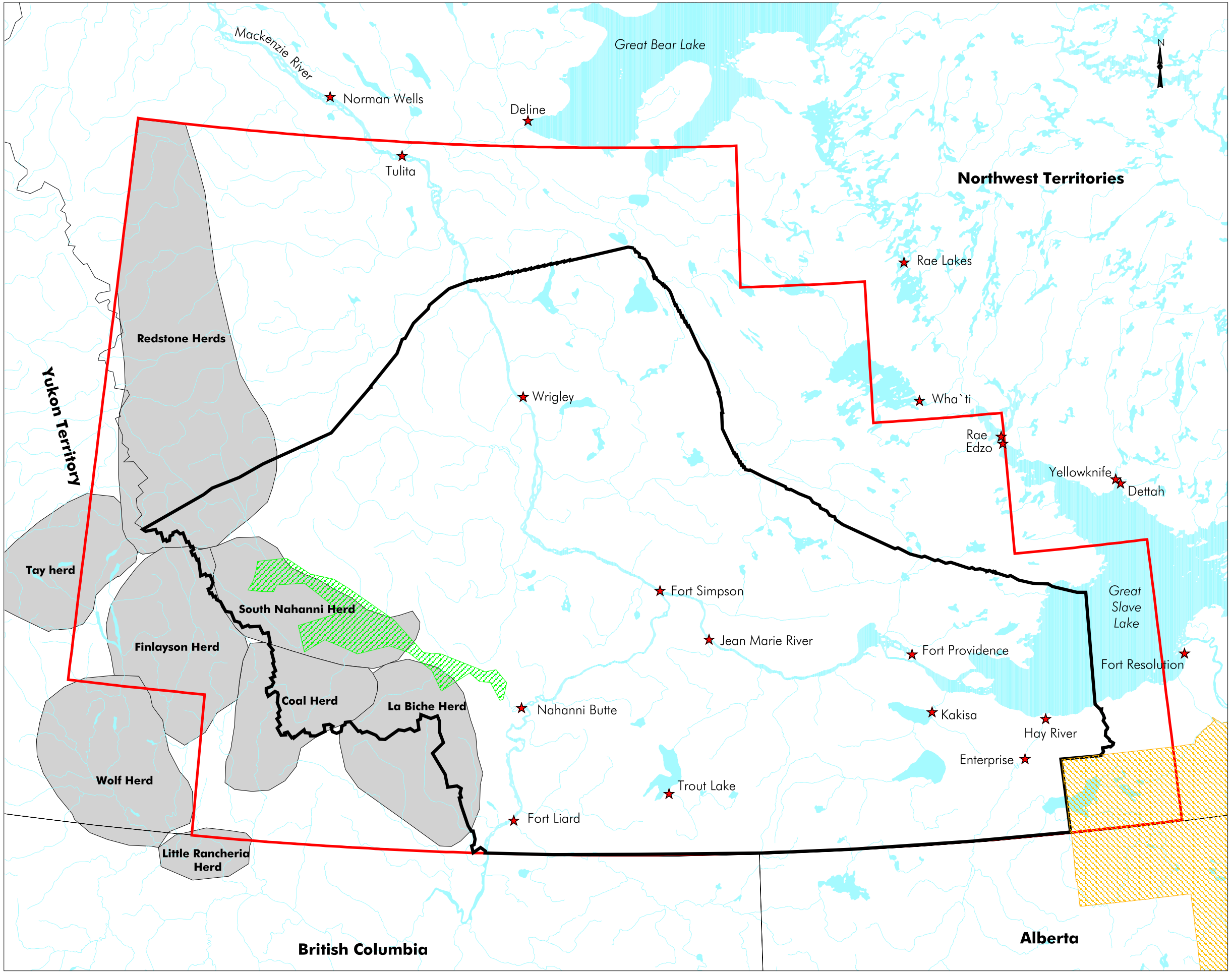
Figure 8:
Approximate Range of Mountain Caribou Sub Populations Within the Study Area



Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Sub Populations

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Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic, 122° W Central Meridian, 60° N Reference Latitude, 60° N Standard Parallel 1, 65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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Figure 9:

Mountain Goat Range Within the Study Area

Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Approximate Range
- Summer Range

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Datum: NAD 83
Date: April 11, 2003

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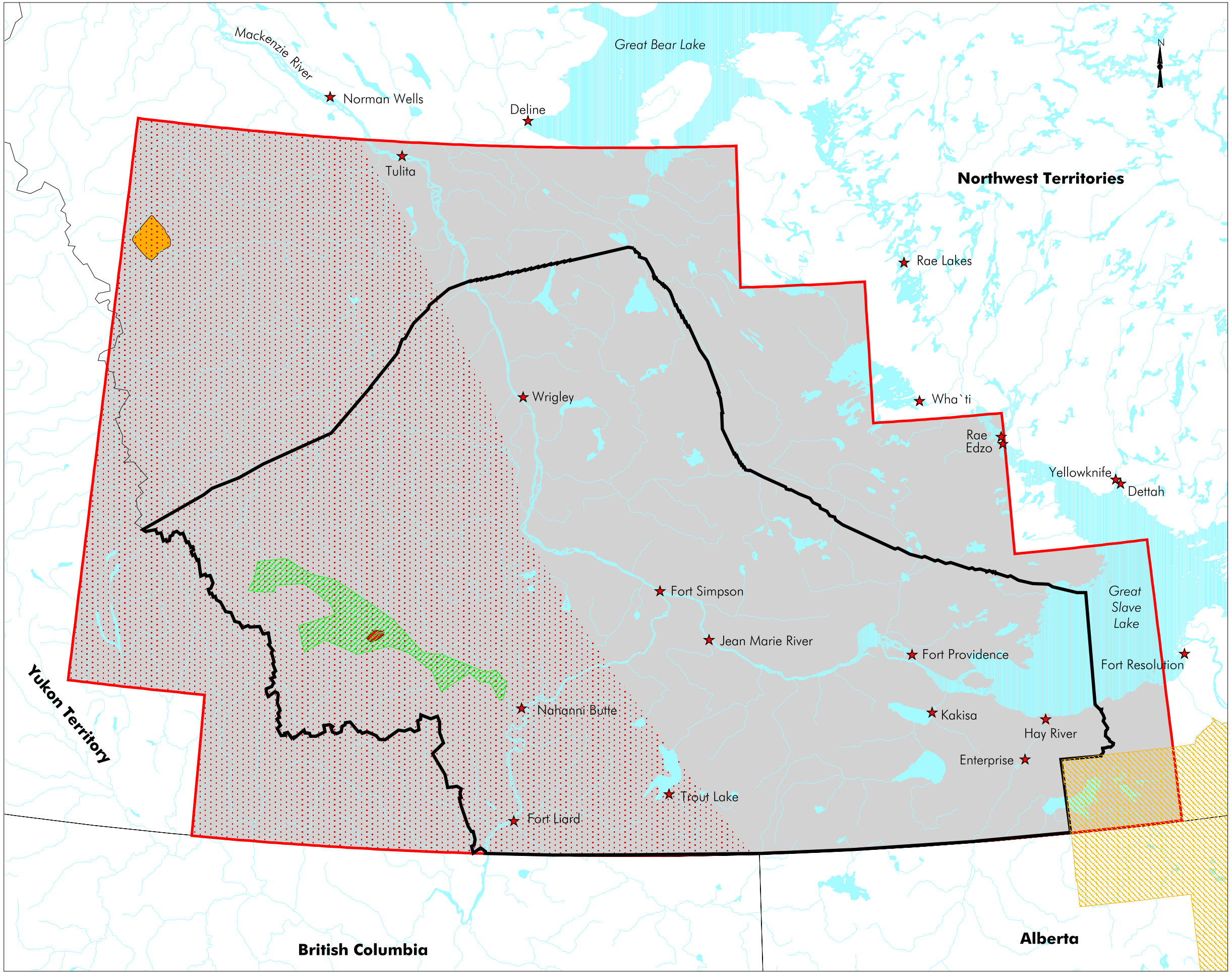
Figure 10:

Bear Range Within the Study Area



Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Grizzly Bear Denning Area
- Black Bear Denning Area
- Black Bear Range
- Grizzly Bear Range

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Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic,
122° W Central Meridian,
60° N Reference Latitude,
60° N Standard Parallel 1
65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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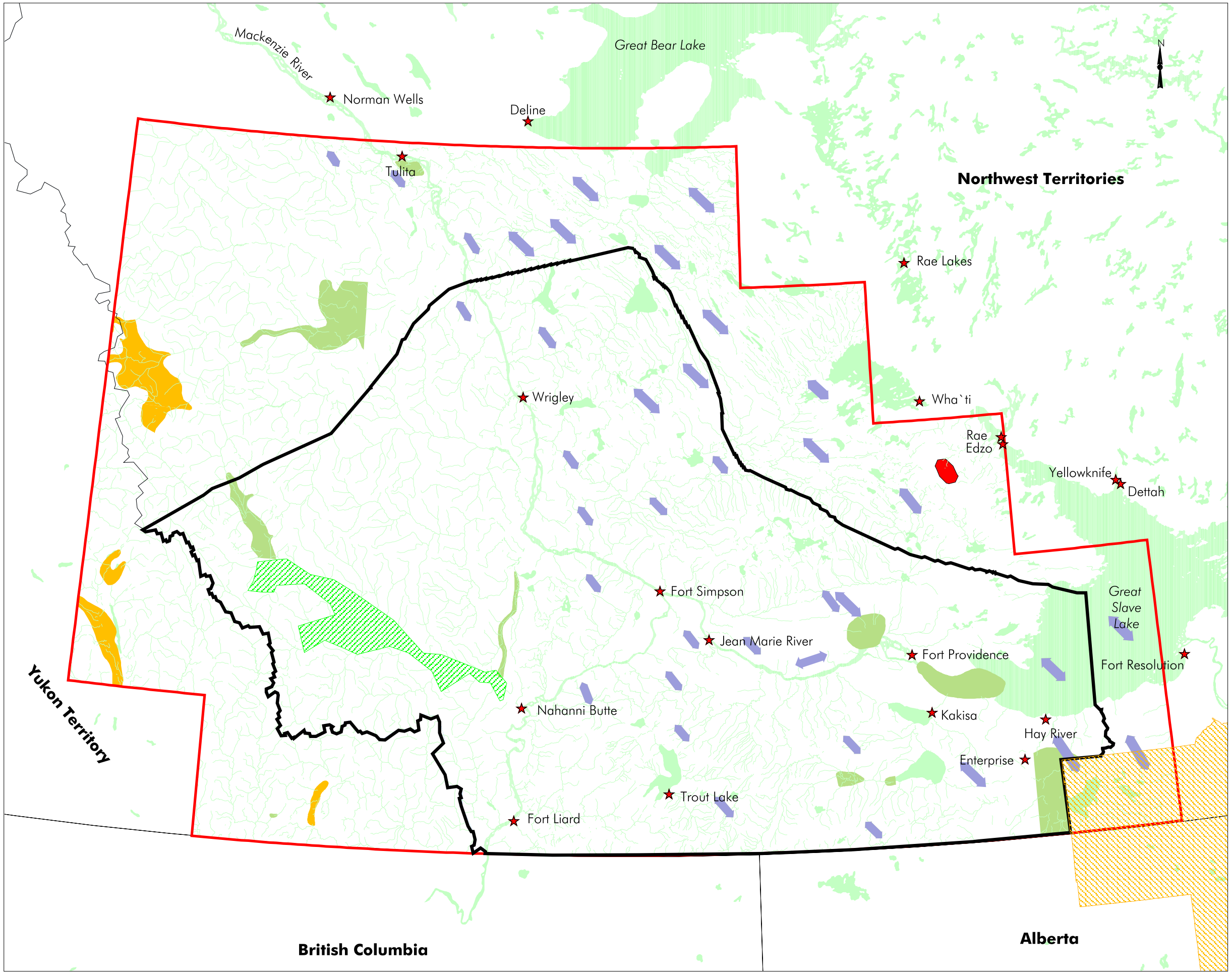

Figure 11:

Waterfowl Range Within the Study Area

Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Territory
- Nahanni National Park
- Wood Buffalo National Park
- Waterfowl Migratory Route
- Common Waterfowl Migratory Route
- Waterfowl Staging Area
- Known Breeding Area
- Potential Waterfowl Habitat
- Potential Waterfowl Habitat

Prepared by: EBA Engineering Consultants Ltd.
Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic,
122° W Central Meridian,
60° N Reference Latitude,
60° N Standard Parallel 1
65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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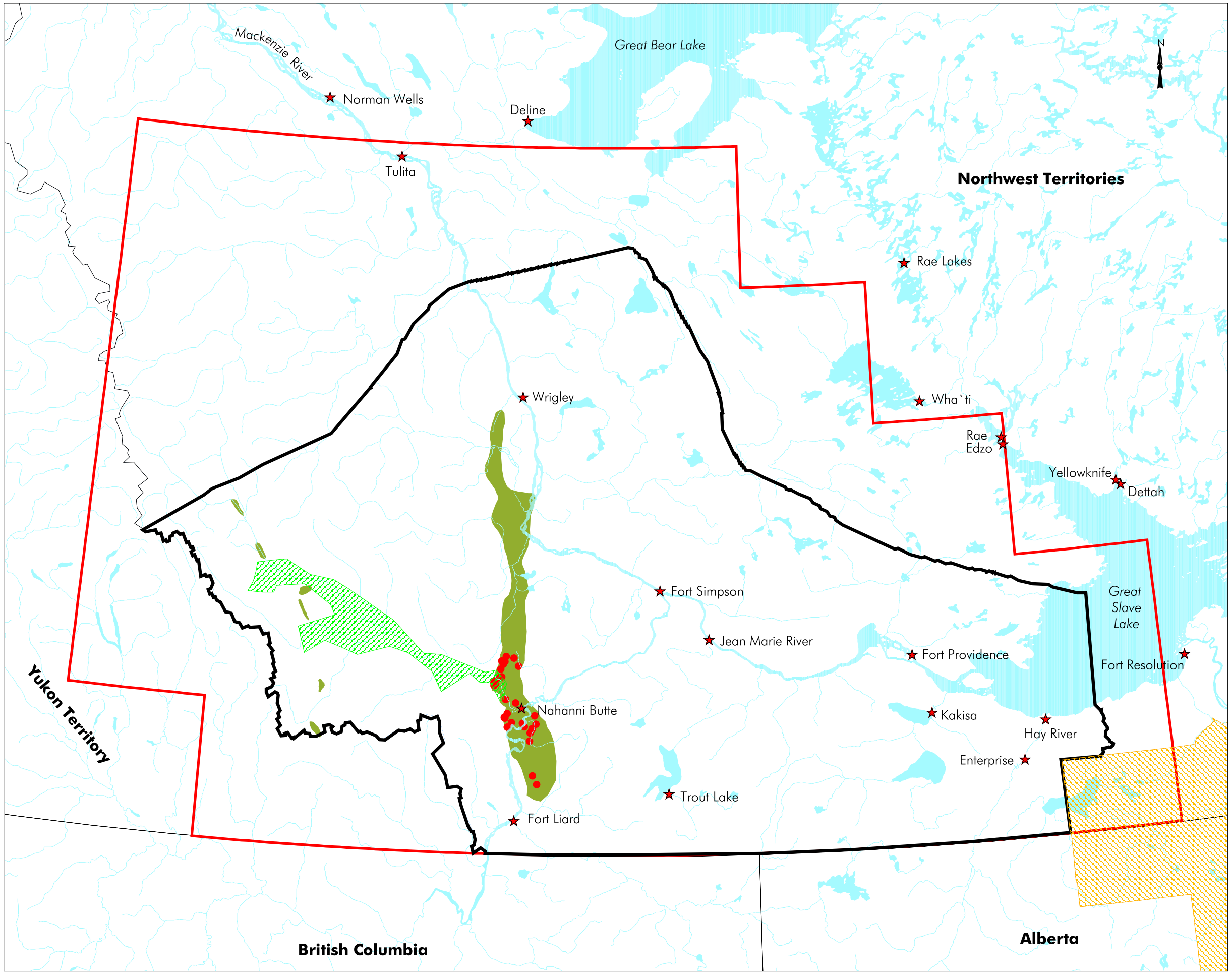

Figure 12:

Trumpeter Swan Range Within the Study Area

Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Trumpeter Swan Nesting Area -- RWS 1983
- Trumpeter Swan Habitat -- OWS 1991

Prepared by: EBA Engineering Consultants Ltd.
Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic,
122° W Central Meridian,
60° N Reference Latitude,
60° N Standard Parallel 1
65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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Figure 13:

Whooping Crane Range Within the Study Area

Mackenzie River
Great Bear Lake
N
Norman Wells
Deline
Tulita
Northwest Territories
Rae Lakes
Wrigley
Wha`ti
Rae
Edzo
Yellowknife
Dettah
Fort Simpson
Great Slave Lake
Jean Marie River
Fort Providence
Fort Resolution
Yukon Territory
Nahanni Butte
Kakisa
Hay River
Enterprise
Trout Lake
Fort Liard
British Columbia
Alberta

Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Whooping Crane Habitat

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Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic,
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60° N Standard Parallel 1
65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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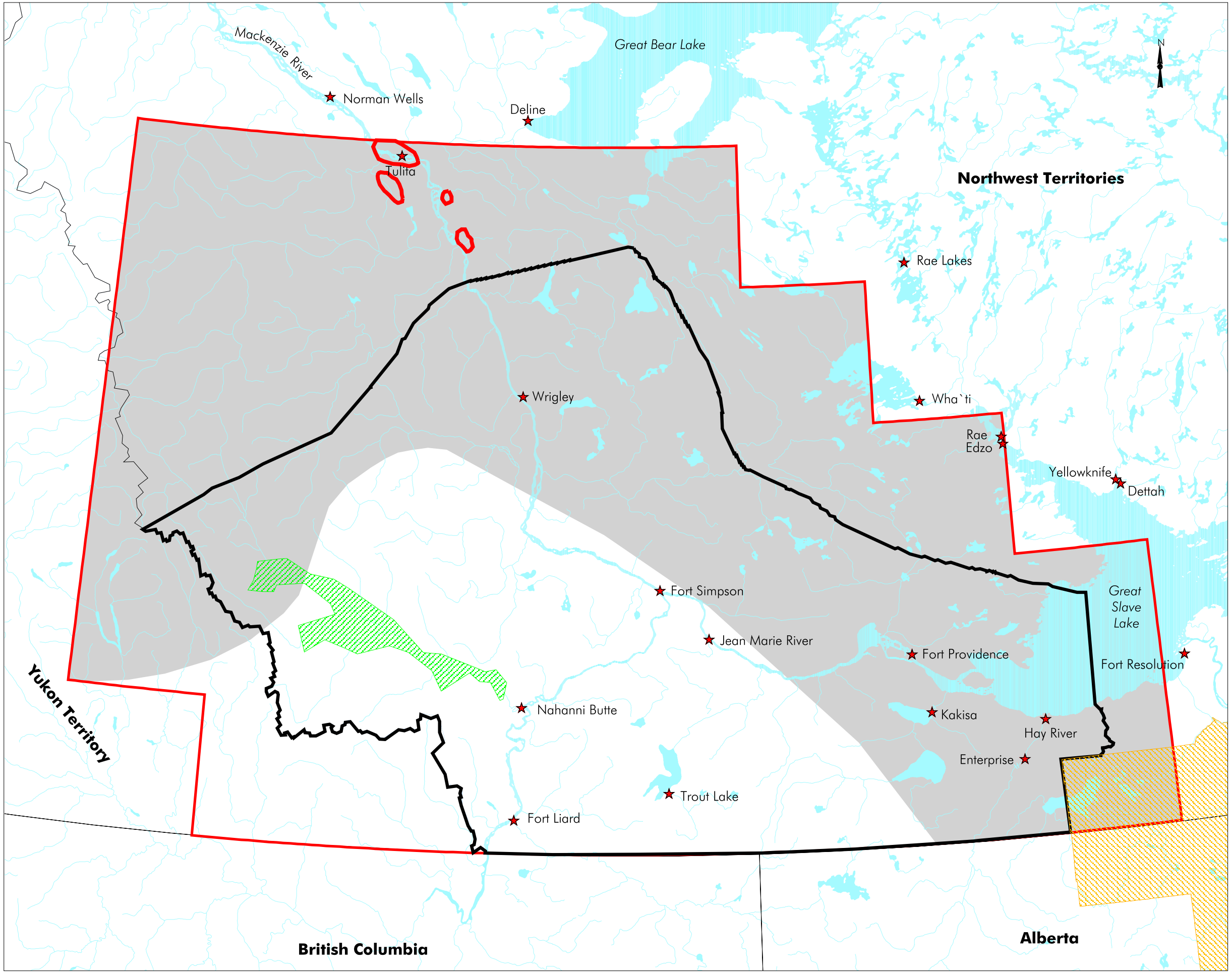
Figure 14:
Peregrine Falcon (Anatum) Range Within the Study Area



Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Peregrine Falcon Range
- Known Nesting Areas

Prepared by: EBA Engineering Consultants Ltd.
Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic,
122° W Central Meridian,
60° N Reference Latitude,
60° N Standard Parallel 1
65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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Figure 15:

Known Fish Migration and Spawning Sites Within the Study Area

Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Known Migration Sites
- Known Spawning Sites

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Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic, 122° W Central Meridian, 60° N Reference Latitude, 60° N Standard Parallel 1, 65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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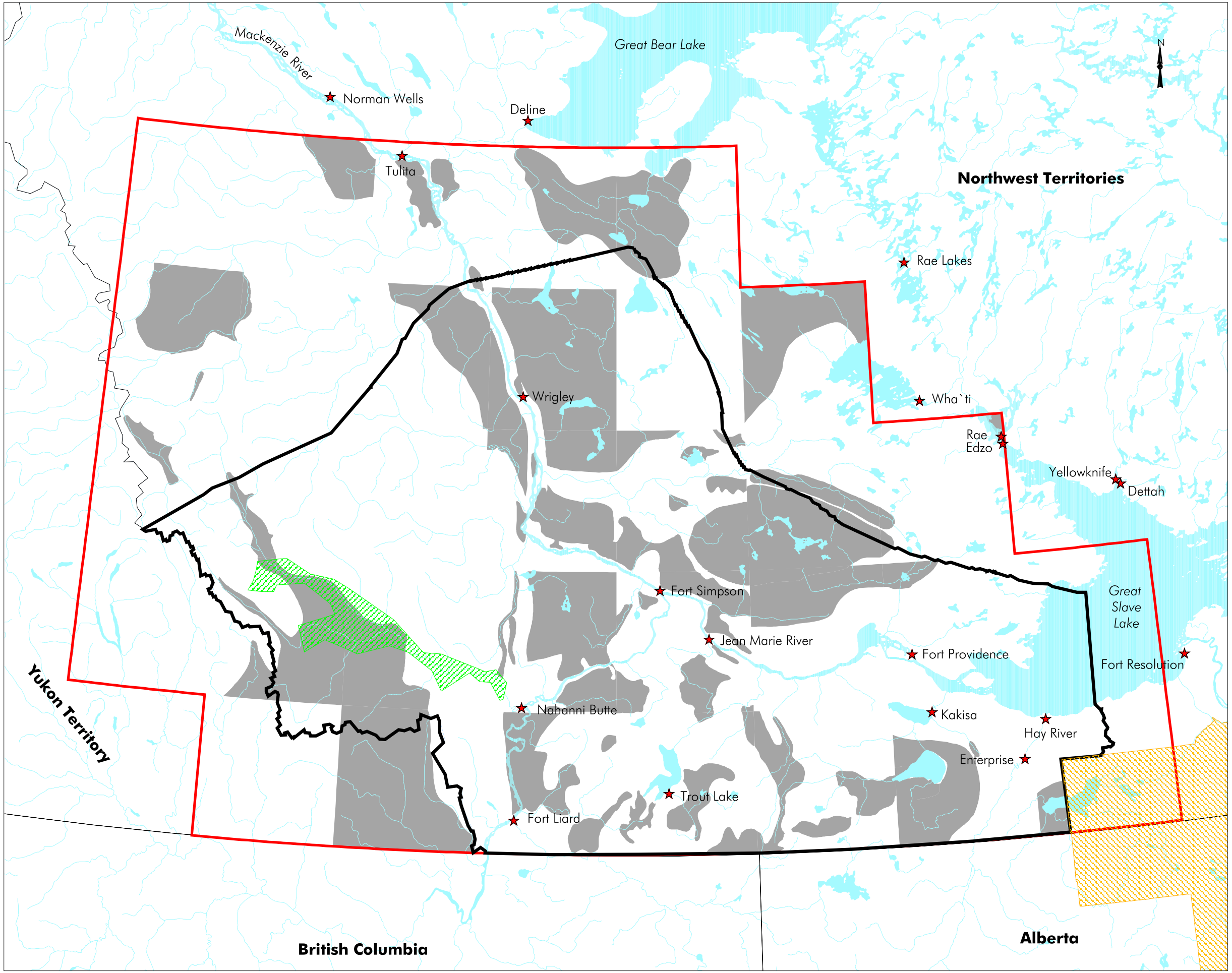
Figure 16:

Known Furbearer Habitat Within the Study Area



Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Furbearer Habitat

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Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic,
122° W Central Meridian,
60° N Reference Latitude,
60° N Standard Parallel 1
65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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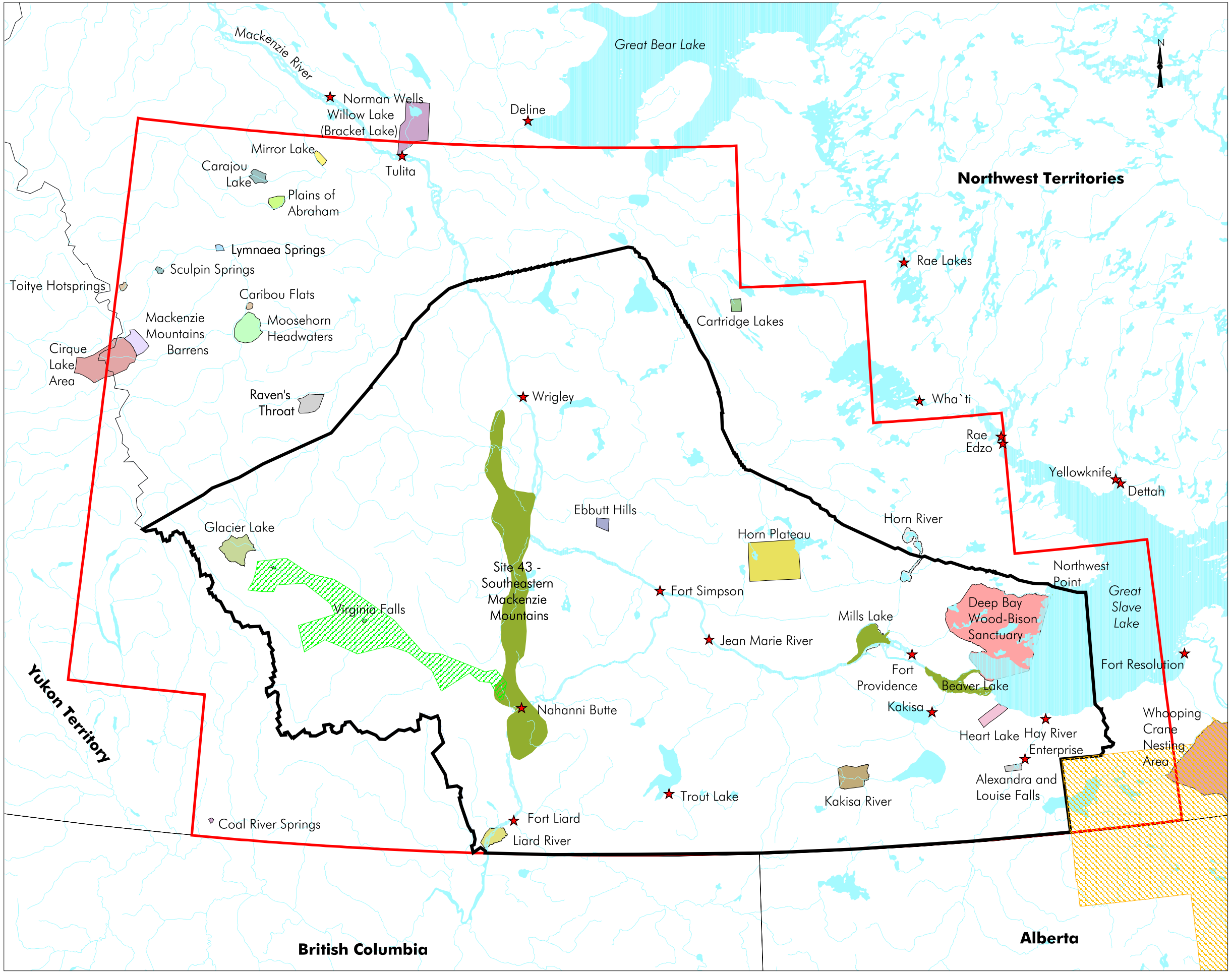
Figure 17:

IBP Sites and Key Migratory Bird Sites Within the Study Area



Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Alexandra and Louise Falls
- Carajou Lake
- Caribou Flats
- Cartridge Lakes
- Cirque Lake Area
- Coal River Springs
- Deep Bay Wood-Bison Sanctuary
- Ebbutt Hills
- Glacier Lake
- Heart Lake
- Horn Plateau
- Horn River
- Kakisa River
- Liard River
- Lymnaea Springs
- Mackenzie Mountains Barrens
- Mills Lake
- Mirror Lake
- Moosehorn Headwaters
- Plains of Abraham
- Rabbitkettle Hotsprings
- Raven's Throat
- Sculpin Springs
- Toitye Hotsprings
- Virginia Falls
- Whooping Crane Nesting Area
- Willow Lake (Bracket Lake)

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Client: Deh Cho Land Use Planning Committee
Projection: Lambert Conformal Conic,
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60° N Standard Parallel 1
65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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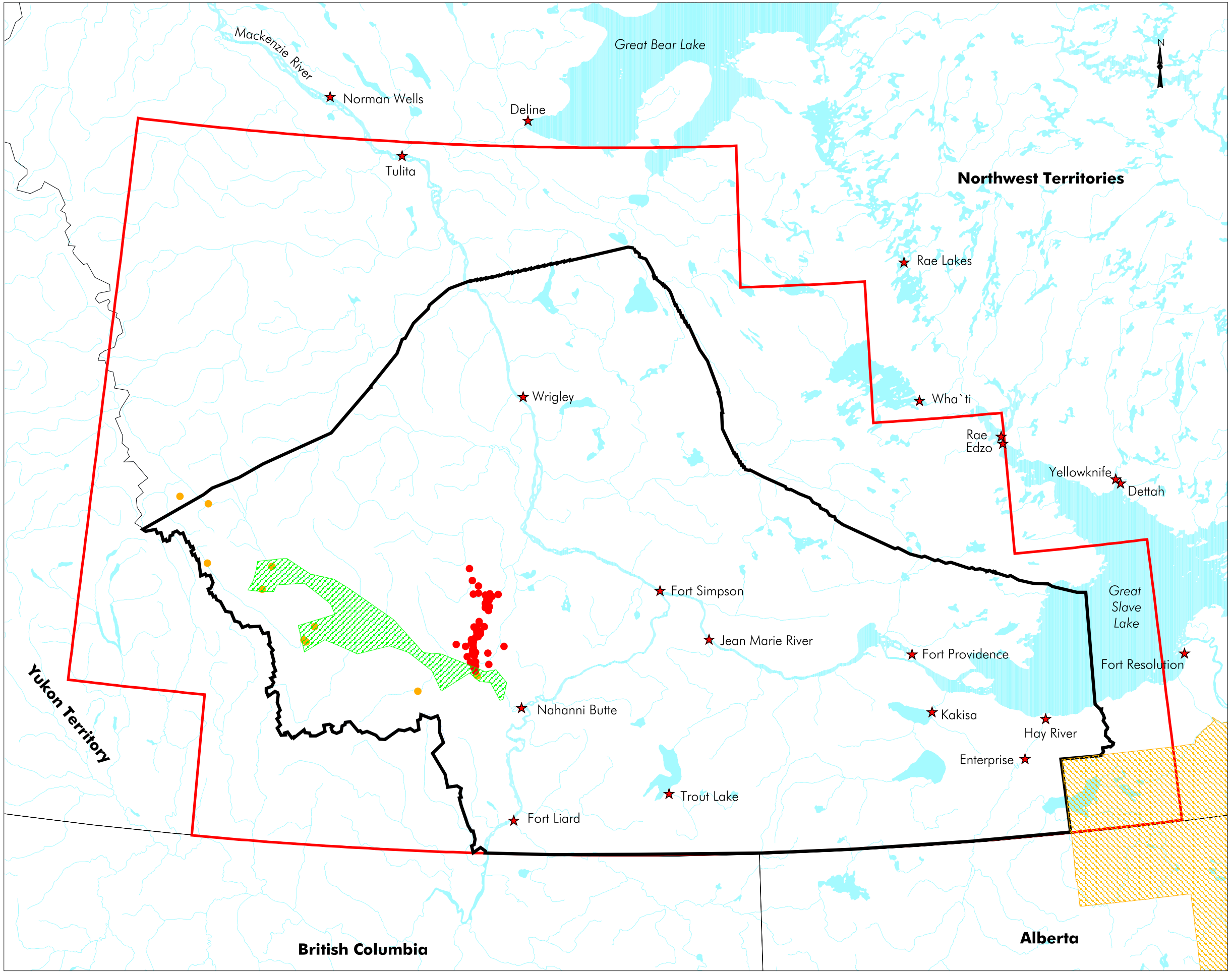
Figure 18:

Known Karst Topography and Hotsprings Within the Study Area



Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Location of Karst Topography
- Location of Hotspring

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Client: Deh Cho Land Use Planning Committee
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122° W Central Meridian,
60° N Reference Latitude,
60° N Standard Parallel 1
65° N Standard Parallel 2
Datum: NAD 83
Date: April 11, 2003

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Figure 19:

Areas of High Conservation Within the Study Area

Scale 1:3,000,000

50 0 50 100 Kilometers

Legend

- Communities at or near study area boundary
- Deh Cho Study Area
- Deh Cho Region
- Nahanni National Park
- Wood Buffalo National Park
- Rank = 4
- Rank = 3
- Rank = 2
- Rank = 1
- Migratory Routes

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Client: Deh Cho Land Use Planning Committee
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Mackenzie River
Great Bear Lake
Norman Wells
Deline
Tulita
Northwest Territories
Rae Lakes
Wrigley
Wha`ti
Rae Edzo
Yellowknife
Dettah
Fort Simpson
Jean Marie River
Great Slave Lake
Fort Providence
Fort Resolution
Kakisa
Hay River
Enterprise
Nahanni Butte
Trout Lake
Fort Liard
Yukon Territory
British Columbia
Alberta