BIOLOGICAL INFORMATION

FOR THE SLAVE GEOLOGICAL PROVINCE

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TABLE OF CONTENTS

INTRODUCTION

The Slave Geological Province (SGP) is a geological formation extending from Great Slave Lake to the Coronation Gulf (Figure 1). The area contains many rich mineral deposits. Because of the large amount of exploration proceeding in the SGP, many of the potential concerns for wildlife relate to the cumulative effects of many projects, rather than specific impacts from a single project. The Department of Renewable Resources would like to take a proactive approach by collating biological information and by increasing the amount of research and monitoring work in the SGP.

This report represents a first step in bringing together existing information on wildlife in the SGP. Information gaps can then be more thoroughly examined. The next step will be to identify potential impacts of development, as well as mitigative measures to ensure that development proceeds with as little impact as possible on wildlife.

The objectives of this report are:

1. To compile biological information known for wildlife species occurring in the Slave Geological Province (SGP), especially those species of primary concern to NWT Renewable Resources.
2. To indicate knowledge gaps by noting where biological information is lacking.
3. To list current, planned, and proposed studies on wildlife in the SGP.

This report addresses primarily those species which are the focus of programs in the Wildlife Management Division. It is intended to complement a more broadly focused draft report recently completed by J. Obst for the Department of Indian Affairs and Northern Development (DIAND) entitled Status and Vulnerability of Wildlife and Habitats in the Slave Geological Province. That report briefly summarizes general information on life history (distribution, abundance, habitat, food, population, reproduction, role in ecosystem) and ecological vulnerability, and provides a map showing distribution in the SGP, for each of 40 species of mammals and 154 species of birds known to occur in the development region. It also gives information on 29 species of fish; lists important arthropods and other invertebrates and their significance in food chains in the SGP; and lists vascular plant families and their use by wildlife. These two reports should be used together for the best picture of the biological information known for the SGP.

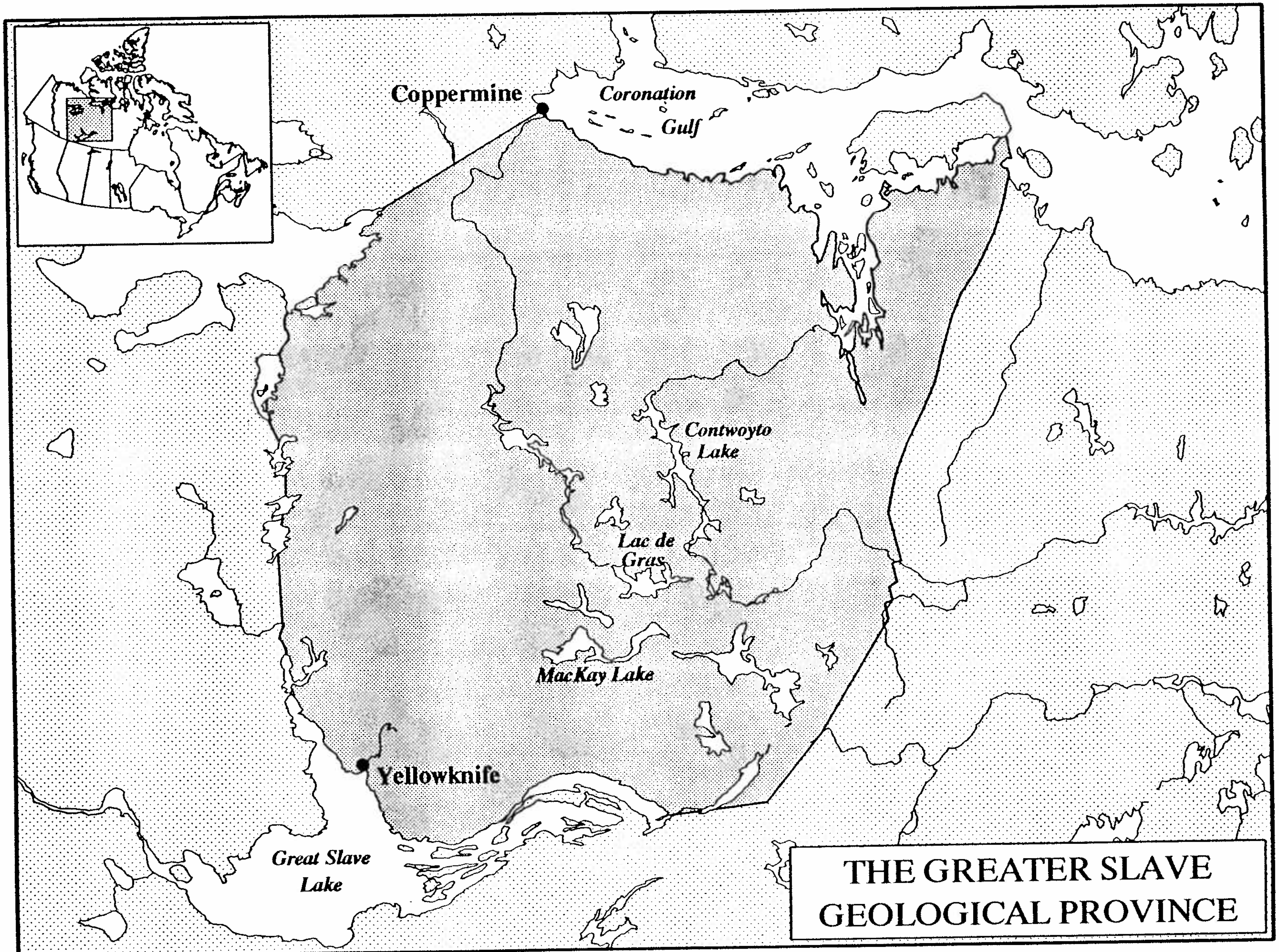

Figure 1. The Slave Geological Province

CARIBOU

The Bathurst herd is one of the five major barren-ground caribou herds found on the mainland NWT. Each herd is a relatively cohesive group of caribou which moves between a large winter range and a small, relatively discrete, calving ground. The Bathurst herd was named after Bathurst Inlet, the area traditionally used for calving. Its range (250,000 km^2) overlaps the North Slave Geological Province although not all that area is used in any one year. Its annual movements bring it, in most years, within the hunting area of 19 communities and thus its welfare concerns many people who use it.

The Bathurst herd's ecology is relatively little known compared to herds elsewhere (A. Gunn, pers. comm.). Its size and over winter survival of calves (a measure of the herd's potential to increase) have been regularly monitored.

Distribution and movements

The movements of caribou within their range are unpredictable. An annual mass movement along definable routes, which is often brought to mind by the term migration, is rarely observed. Only large scale movements such as the movement towards the calving ground in May and June and the movement southward in the fall are predictable but their timing and route annually vary. During the remainder of the year movements are unpredictable and an area where there were thousands of caribou one year may not have a single animal the next. With few barriers to their movement, except large lakes and rivers such as Contwoyto and Point lakes and the Western River, specific migration corridors have not been documented (Urquhart 1981).

The most predictably used part of the range is the traditional calving grounds. The location of the calving grounds is only known during the years when caribou numbers are surveyed. For the years with information, the cows use areas east and south of Bathurst Inlet (Urquhart 1981, Fleck and Gunn 1982). Most cows arrive on the calving ground by late May and early June. But when late springs or deep snow hinder migration, the cows do not reach the traditional areas but calve on their west and south edges around Bathurst Inlet. Within the traditional calving grounds we cannot yet predict the annual use of any one area but information from other calving grounds points to a relationship between use, snow melt patterns and forage availability. We do not fully understand why the cows return to a traditional area (Fleck and Gunn 1982, Gunn and Miller 1986) but the reasons may be a choice of habitats with greening and flowering plants at a time when the cows need high quality nutrition to support their calves. And wolf densities are lower on the calving grounds as many wolves have their pups in dens closer to the treeline (T.M. Williams, pers. comm.).

Most bulls, some yearlings, and non-pregnant females tend to lag behind the cows during the spring migration and generally do not migrate as far as the calving ground. They drift together in late June, early July. They usually join up with the cows and calves, once they have left the calving grounds. These mixed groups may form large post-calving aggregations in late June and July in order to reduce insect harassment. In summer, Bathurst caribou may be found throughout the tundra portions of their range, as the caribou forage on tundra vegetation. The precise movements of caribou are unpredictable from year to year. Nonetheless old hunting sites and local knowledge indicate that caribou do cross rivers and lakes at traditional sites (Urquhart 1981).

Large groups of both sexes occur near treeline during the rut in October, after which the cows and bulls segregate. Most years, both sexes return to the boreal forest after the rut with bulls generally moving farther into the forest than cows and yearlings. Some caribou of the Bathurst herd winter on the tundra along the Arctic coast and around Bathurst Inlet. The most frequently recorded wintering areas include those around Hearne, Gordon, Indin, Hotta, and Dismal Lakes; Coppermine River; and Coronation Gulf and north Bathurst Inlet. This information is piecemeal as range-wide systematic surveys have been infrequent (Urquhart 1981). For herds whose winter range is better known, use of wintering areas is variable in that the areas are used for a few years and then abandoned for some time. Added to that variability is the effect of forest fires and that caribou use their range in proportion to herd size. As the herd increases, the range may be extended, and overall density of the herd tends to remain consistent.

The definition of the herd is based on the cows' annual return to their calving grounds (Fleck and Gunn 1982, Gunn and Miller 1986). The recovery of ear-tags from hunters in the 1960s, and continued monitoring by Renewable Resources in 1979, suggested that there was less than 5% interchange between herds despite some overlap in total ranges with the Bluenose and the Beverly herd (T.M. Williams, pers. comm.). Out of respect for the feelings of Aboriginal people, caribou have not been caught and marked on the Bathurst range since 1979. The range of the Bluenose caribou herd overlaps with the Bathurst caribou range but there is no thorough information on year-round movements of either herd (T.M. Williams, pers. comm.). In the 1990s, caribou that calve on Victoria Island have resumed their historic crossing to the mainland after the rut and are wintering along the coast in increasing numbers (tens of thousands), and returning to Victoria Island in April-June (Gunn 1990). The significance of the overlap in the tundra winter ranges of Bathurst and Victoria Island caribou is unknown.

Habitat use

Habitat selection by caribou is complex and not well understood for caribou in the NWT compared to the

Porcupine herd (Russel et al. 1993) or some Alaskan herds. Habitat use for the Beverly herd on the calving grounds (D. Thomas, pers. comm.) and the winter range is known in detail and at least some of that information is applicable to the Bathurst herd.

The selection of habitat by caribou depends on an array of factors affecting availability of food, ease of travel, relief from insects, and predation. For example, snow characteristics influence the selection of winter habitat. Wide open areas, such as lakes and burned areas, are used as escape terrain and resting sites. In summer, eskers and other high ground selected to provide relief from insects is in proximity to sedge meadows and other wet sites where the caribou can forage. An important point is that caribou need a variety of interspersed habitats so that they can make appropriate choices in terms of foraging, predator avoidance and minimising harassment by insects (Russel et al. 1993).

Diet

In winter, caribou select forage with high digestibility or high protein levels (eg. certain lichen species and the green parts of sedges), and avoid evergreen shrubs with waxy leaves (Kuropat and Bryant 1983) [eg. Labrador tea (*Ledum sp.*), Crowberry (*Empetrum nigrum*), blueberry (*Vaccinium sp.*), bearberry (*Arctostaphylos sp.*)], dead leaves, and woody tissues, because they are difficult to digest. Caribou in winter mostly eat lichens. However, because lichens alone cannot provide adequate protein, caribou supplement their diet with sedges (*Carex sp.*) and horsetails (*Equisetum sp.*) in early winter, and alder (*Alnus sp.*), birch (*Betula sp.*), and willow (*Salix sp.*) in late winter (Russell et al. 1993).

The diet of caribou in spring and on the calving grounds also depends on forage availability. Many lichen uplands are the first areas on the Beverly calving ground to lose snow cover, and fruticose lichens in these areas were important until new plant growth emerged (Gunn et al. 1985). On the Bathurst calving grounds, willows, dwarf birch, green alder (*Alnus crispa*), and cottongrass (*Eriophorum vaginatum*) are common and are likely utilized as new growth emerges (Fleck and Gunn 1982).

During the summer, caribou range widely over the tundra and feed mostly on grasses, sedges, forbs, and a variety of shrubs. Caribou tend to select new sprouts and buds as well as flowers; foods which are rich in minerals and protein. The consumption of grasses and sedges diminishes as these plants mature and become less digestible (Russell et al. 1993, Kuropat and Bryant 1983). By late summer the leaves of deciduous shrubs such as willows, dwarf birch, blueberry and bearberry form the bulk of the caribou's diet.

In the fall, caribou switch to grasses and sedges, because proteins are retained in the leaves longer than other plants. Birch and willow leaves are still important and caribou select mushrooms. The summer and fall diet results in dramatic weight gains unless insect harassment is severe.

Bathurst caribou were collected between 1988 and 1992 to determine annual changes in physical condition and diet (T.M. Williams, pers. comm., DRR 1991). Bulls and cows had the lowest reserves of fat and protein in July at the end of the period of severe insect harassment, and were not able to increase reserves until August. Both bulls and cows are able to maintain their condition over the winter, indicating sufficient quantities of forage on the winter range for current densities of caribou (T.M. Williams, pers. comm.).

Other factors influencing habitat selection

Other studies, especially those of caribou in the Porcupine and Beverly herd, explain much about the annual cycle of condition in caribou cows and its relevance to birth and survival of their calves (Russell et al. 1993, D. Thomas, pers. comm.). Barren ground caribou calve either just before or during the plant's spring burst of new growth. Cows bear the cost of lactation more from forage intake than their body reserves. Timing of the availability of high quality forage is then a key element in the growth of their calves. A cow has to reach a threshold level of condition to conceive during the October rut as well as to survive the winter. Then, her body reserves along with winter foraging conditions determine, especially in the last third of pregnancy, when the calf is born and its birth weight. Gestation is prolonged if a cow is in poor condition. In Newfoundland, variation in winter conditions caused a 30% difference in birth weights. Severely under-sized newborn calves have poorer chances of survival.

The two components of the relative forage availability are the absolute amount of forage and snow conditions. Weather during the previous plant growing season influences forage available in winter. For example, lichens tend to grow on drier sites and their productivity is less in dry summers. Those sites often are relatively exposed and have shallow snow cover where caribou prefer to feed. It is not just the depth of snow but its density and whether or not it is crusted that influences the energetic costs of cratering to reach forage and to move. Those costs are partly borne by body reserves but some three-quarters of the energy comes from the foraging itself. Caribou are energetically efficient at cratering through the snow to reach forage but those costs are some 30% higher than just walking on bare ground, and increase exponentially with sinking depth and dense or crusted snow drain even more energy (Fancy and White 1985). A crust on the snow that would almost support the caribou's weight before collapsing raised the cost of walking by about 570%. Deep snow and crusted snow also shift the relationship between wolves and caribou: if the caribou break through and flounder the wolves have the advantage if they can travel on the snow's surface.

Biting insects are an affliction for caribou in summer. Caribou lose foraging time and expend energy trying to escape the predation of mosquitoes (*Culicidae sp.*) and warble flies (*Hypoderma tarandi*). Summer temperatures and wind speed largely determine the level of harassment. If the harassment is severe, the caribou lose weight. Lighter calves are less likely to survive the winter especially if the snow is deeper than average.

A study at Lupin Mine in summer 1993 compared the activities of caribou on and off the mine site at different levels of insect abundance. Preliminary observations suggest that caribou, especially bulls, occurred on the mine property for insect relief and foraging but cows and calves were more likely to avoid the mine (Mueller in prep.).

Population dynamics

Herd size

Trend in the size of the Bathurst herd has been determined from 11 calving ground surveys conducted between 1970 and 1990 (Urquhart 1981, DRR 1994). Photography has been used since 1980 to increase the accuracy of the survey estimates. The number of breeding females on the calving grounds declined between 1970 and 1979, increased from 1980 to 1986, and has been relatively stable since 1986 (Urquhart 1981, DRR 1994). Herd size in 1990 was estimated at 352,000 caribou 1 year old and older (DRR 1994). Given the high recruitment rates and low mortality in recent years, there is some question why the herd is not larger. The factors limiting herd size are unknown.

Reproductive characteristics

Studies of Bathurst caribou in 1990 and 1991 found that females did not breed until 2.5 years of age, when approximately 38% of the cows became pregnant. Population estimates have typically assumed a mean pregnancy rate, for females older than one year, of 72%. This figure was derived from data describing age structure and pregnancy rates for Qamanirjuaq caribou in the late 1960s (T.M. Williams, pers. comm.).

A recruitment index has been obtained each year since 1985 from spring classification surveys that estimate over-winter calf survival. Those surveys have indicated consistently good over-winter calf survival since 1985 (T.M. Williams, pers. comm.). In 1990, 1991, and 1992, calves were 16%, 22%, and 15% of the herd, respectively. The herd increment was 19%, 28%, and 18% respectively (DRR 1991). There are no data on sex and age structure or fall composition of the Bathurst herd (T.M. Williams, pers. comm.).

Mortality

There are no estimates of natural mortality for the Bathurst herd (DRR 1994). The wolf is the only major predator. Based on radio-caesium analysis, it is suggested that wolves may be taking 21,000 - 90,000 Bathurst caribou annually (6% to 25% of the 1990 population estimate) (DRR 1994). A rough estimate of the harvest of Bathurst caribou in the late 1980s is 14,500 - 18,500 (DRR 1994). The Bathurst herd is used by 19 communities. Harvest data have been compiled for Coppermine, Cambridge Bay, and Bathurst Inlet/Bay Chimo for 1983-1989 (Gunn et al. 1986). Some information is available for Rae-Edzo, Rae Lakes, Snare Lake, and Lac La Martre, but the data have not been summarised and accuracy is questionable (A. D'Hont, pers. comm). The Bluenose herd is used by 10 - 12 communities. Data from check stations on the Lupin winter road and the winter road system running north to Indin Lake shows that much of the annual harvest is obtained along them (DRR 1994). Harvest information is being collected in the Inuvialuit settlement area, and is about to be initiated by the Gwich'in (J. Nagy, pers. comm.).

Collections of Bathurst caribou between 1988 and 1992 indicate a low incidence of disease (T.M. Williams, pers. comm.) and contaminants (Elkin and Bethke 1995).

Current and proposed studies

Monitoring of the Bathurst herd is ongoing, with photographic surveys of calving grounds to determine herd size conducted every 5 or 6 years. The next survey is scheduled for 1996. Annual spring classification surveys are also conducted to determine over-winter calf survival and to obtain an index of recruitment. Disease and contaminant studies include a baseline study of a range of heavy metal and organochlorine contaminants as part of an NWT-wide study of the lichen-wolf-caribou food chain, health surveillance of the Bathurst herd to provide baseline data on the types and prevalence of diseases and parasites, and site-specific monitoring of contaminant levels in the Lupin Mine tailings pond, which began in 1993-94 (T.M. Williams, pers. comm.). The latter project, which describes caribou at the tailings ponds and airstrip at Lupin mine, will be continued and expanded. The emphasis will be on testing methods to exclude caribou and those methods will include traditional approaches, in cooperation with Dogrib and Inuit elders.

Possible mine development on calving grounds have led communities and comanagement boards to frequently ask about protection measures. The level of flexibility for calving ground protection depends on knowing a cow's daily movements and that would also assist in designing calving ground surveys. A proposal to track the Bathurst herd's movements using satellite telemetry will be part of a project to describe caribou movements and distribution. The other part is longer term understanding and funding will be applied for to compile traditional knowledge on caribou seasonal distribution and movements.

A first step to predicting effects of climate change will be to measure the annual variation in ecological factors affecting caribou, such as plant phenology and insect harassment. A small scale project will be initiated at Yamba Lake and its expansion will depend on the success of the above proposed satellite telemetry project.

WOLVES

Distribution and movements

Wolves occur throughout the SGP, and are associated with the Bathurst caribou herd. During 1978-80, wolves were radio-collared on the winter range to determine their movements in relation to caribou as well as den locations. A second study in the SGP was conducted during 1990-93. Wolves were radio-collared at dens and tracked during the summer (T.M. Williams, pers. comm.).

Studies have shown that most wolves in the NWT or SGP (and parts of Alaska) are not territorial. They follow the caribou during most of the year, except in the summer, when most wolves den near treeline. Few wolves follow the caribou as far as the calving grounds. However, breeding wolves feeding pups may travel up to 400 km from their dens to find caribou. The size of wolf groups in the SGP varies seasonally. Pups are mobile in late August/early September (T.M. Williams, pers. comm.).

Habitat use

Diet

SGP wolves eat primarily caribou over the winter. Predation rate appears to be related to caribou density. Studies suggest that food is not limiting to wolves that remain associated with caribou throughout the winter (DRR 1992). Carcass composition studies on wolves purchased from hunters indicate that wolves are in good physical condition in the spring, with extensive fat and protein reserves. Most wolves increase or maintain fat reserves from November through the third week in February. Females continue to increase their condition through early March, but males rapidly lose their reserves (T.M. Williams, pers. comm.).

Studies conducted on SGP wolves during the summer show that, while the wolves may eat small mammals, birds, and fish, they continue to rely on caribou over the summer (T.M. Williams, pers. comm.). The rate at which wolves kill caribou increases significantly with caribou density in the vicinity of the den (DRR 1992). Breeding wolves may travel as far as 400 km from their dens to obtain caribou. However, when the caribou are this far from dens adults cannot return the meat to the dens and pups starve (T.M. Williams, pers. comm.). July seems to be the critical month for Bathurst wolves, especially those denning at treeline, as caribou are generally farthest from treeline during this period. The wolves' ability to feed pups during this time determines pup survival (T.M. Williams, pers. comm.). We estimate that a wolf consumes 15 - 30 caribou per year.

Den sites

A database on wolf den sightings has been compiled from a variety of sources. Analysis of the distribution of wolf dens confirms literature reports that a large percentage of wolves that associate with barren-ground caribou, den at treeline (T.M. Williams, pers. comm.). Den site location may be due to a combination of habitat characteristics and to minimize the amount of time wolves are away from caribou. North of treeline, habitat is more marginal. On the other hand, wolves denning further north (i.e. closer to the summer range of caribou) have greater pup survival (T.M. Williams, pers. comm., Kuyt 1972).

Most dens observed in the SGP were tunnelled under vegetation into eskers. Wolves often expand and use the burrows of foxes, which have similar den site requirements. Esker systems at treeline are the most important denning habitat; however, not all eskers. It appears that some eskers are suitable for denning and others are not. North of treeline, eskers become more important as denning habitat (T.M. Williams, pers. comm.).

There is frequent documentation of traditional den sites being used by wolves over many years, though not necessarily every year. Wolves may also use several alternate den sites over the course of a summer. All dens documented have been underground burrows, and are usually on elevated sites of glacial origin. Den site location appears to depend on a complex interrelationship of ecological factors, including relief, soil type, drainage, snow cover, and vegetation. The ultimate limiting factor appears to be frozen ground. Studies of wolf dens in Alaska found that depth to permafrost, thickness of the active layer, and drainage were the most important factors influencing den site location. Most dens were in sandy soil (Lawhead 1983).

A detailed, systematic study of wolf den site characteristics in the SGP has not been done. However, a study to examine the role of esker habitat in the denning ecology of various wildlife species, including wolves, was conducted in the Lac de Gras area in 1994. Wolves established dens almost exclusively on esker habitat rather than on rocky upland or meadow habitat. Results of this study suggest that it may be feasible to evaluate the suitability of habitat for denning prior to industrial acitvities that might include esker use (Mueller 1995).

Population dynamics

Numbers

There are no data on abundance of wolves in the NWT. We believe there are between 1400 and 3000 wolves on the Bathurst caribou range (T.M. Williams, pers. comm., DRR 1994). A crude index of wolf densities obtained from wolves observed/hour on spring caribou surveys indicates that wolf numbers declined in the early 1980s and have remained low since 1985 (T.M. Williams, pers. comm.). This is consistent with recent high recruitment rates for Bathurst caribou. Although wolves examined appear to be in good physical condition, and pregnancy rates are high, wolves on the Bathurst caribou range do not seem to be increasing. Factors limiting wolf numbers are unknown, although increased harvest may play a role (T.M. Williams, pers. comm.).

Reproductive characteristics

Examination of harvested wolves indicate that most female wolves older than one year are breeding. Average litter size is 5 pups. As SGP wolves are not territorial, several females in one pack may have young at the same time. Wolf studies in the SGP have documented very low recruitment. Pup survival to September averaged only about 16% at treeline dens (T.M. Williams, pers. comm.).

Mortality

Wolves are generally not hunted by communities below treeline. They are heavily hunted on the tundra, especially by the communities of Bathurst Inlet, Bay Chimo, and Coppermine (T.M. Williams, pers. comm.). The harvest of wolves on the Bathurst range has increased since 1970. This probably reflects an increase in the number of hunters and the value of pelts rather than an increase in the number of wolves. In the 1970s, fewer than 200 wolves were taken annually. The largest harvest occurred in 1980, when 682 wolves were taken. Between 1985 and 1991, the harvest has consistently been 300 - 400 wolves per year (DRR 1994). No work has been done on disease in the wolf population on the Bathurst range.

Current and proposed studies

Currently no studies are being conducted specifically on wolves in the SGP. Carcass collections have provided data on physical characteristics, pack structure, reproductive peformance, food habits and the annual cycle of fat depositon for wolves associated with migratory herds, including the Bathurst herd. Studies into the effects of caribou migration on the functional and numerical response of wolves on the Bathurst herd range were completed in 1993. Additional funding is being sought for 95/96 to continue the work on esker ecology.

LYNX

Distribution and movements

Lynx occur throughout the forested areas of the SGP, although lynx densities within the SGP do not appear to be as high as in other areas of the western NWT. Lynx are generally not found above treeline, where most of the mineral development is currently concentrated. There have been no studies conducted on lynx in the SGP. However a long-term live-trapping and radio-collaring program was begun in 1989 on lynx in the Mackenzie Bison Sanctuary, adjacent to the SGP (Poole 1992).

Results to date show that 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, annual home-range size was smallest during the year of hare decline. After the number of hares dropped, i.e. during the period of hare scarcity, home-range size increased significantly, and dispersal of lynx intensified. Dispersal direction and distance was found to vary greatly, up to 900 km from the study area. By the second winter of hare scarcity, all radio-collared lynx previously resident on the study area had dispersed and/or died (Poole 1992, 1994).

Habitat use

Diet

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. Habitat use by lynx is currently being studied on the Mackenzie Bison Sanctuary as part of the study described above (Poole 1992).

Breeding habitat

There have been no studies conducted on the characteristics of breeding habitat for lynx in the NWT. Areas of deadfall and tangled bush appear to be used in the Mackenzie Bison Sanctuary (K. Poole, pers. comm.).

Population dynamics

Population size

There are no data available on numbers of lynx in the SGP. Densities have been determined for lynx in the Mackenzie Bison Sanctuary since 1989. Densities peaked, during the final year of hare population peak and during the winter of the hare decline, at about 30/100 km^2, and declined to about 3/100 km^2 the winter after a decline in hare numbers. Peak densities were among the highest recorded (Poole 1994).

Reproductive parameters

Kitten production and survival on the Mackenzie Bison Sanctuary were high during years of peak and declining hare densities, with kittens making up 43-49% of the population. Average litter size was 4. Kitten recruitment dropped to zero during winters of low hare abundance (Poole 1994).

Mortality

There is no information on mortality of lynx in the SGP. Mortality has been documented for lynx in the Mackenzie Bison Sanctuary study area, and fur return records are available for each community where lynx are trapped. Natural mortality of lynx on the Mackenzie Bison Sanctuary increased significantly during years of hare scarcity. Natural causes accounted for a death rate of 0.48 during the low in hare numbers. Primary cause of death was starvation, usually occurring during mid-winter and appearing to correspond with periods of severe cold (Poole 1994).

The number of lynx harvested annually in the NWT since the late 1950s has generally followed the 10-year population cycle. During 1991-92, 2230 lynx pelts were sold in the NWT, a slight increase over the previous year (Poole 1992). In 1993-94, harvests declined to about 474 lynx (K. Poole, pers. comm.). For 6 communities near the SGP (Lutsel K'e, Dettah, Yellowknife, Lac la Martre, Rae Lakes, Snare Lake) total fur returns between 1986/87 and 1993/94 ranged from a high of 278 in 89/90 to a low of 20 in 1993/94.

Current and proposed studies

There are no current or proposed studies on lynx in the SGP. The Mackenzie Bison Sanctuary studies are ongoing and will continue to provide information on lynx habitat use and movements, population densities, survival and dispersal patterns, and kitten production and survival in relation to hare density. Caution should be used in transferring the results of this study to other areas as lynx trapping does not occur in the Sanctuary study area, and trapping pressure is not heavy in areas surrounding the sanctuary.

WOLVERINES

Distribution and movements

Wolverines occur throughout the SGP and surrounding areas, in both boreal forest and tundra habitats. Details of their distribution are unknown. They are invariably associated with large tracts of undisturbed wilderness, however, the definition of "large" has not been determined.

Wolverines are believed to use large home ranges. Field research on wolverines was initiated in 1993 on a study area about 200 km southeast of Coppermine centered around Napaktolik Lake. This area is within the SGP. Based on one month of radio-tracking data and identification of tracks, the area occupied by two male wolverines was estimated to be 300-400 km^2 and 100-200 km^2 respectively. A multi-year study conducted in northern Alaska (Magoun 1985) determined a summer home range of 626 km^2 for adult males and a yearly home range of 104 km^2 for adult females. Adult females with young tend to restrict their movements between March and May (Magoun 1985). Young wolverines are born in March and April. Young dispersing wolverines leave their mothers during their first winter and are transient during the following year or two, covering greater distances than adults (Lee and Niptanatiak 1993).

Diet

Wolverines are both predators and scavengers. They kill and eat mammals up to the size of caribou as well as birds, particularly waterfowl, ptarmigan and grouse. Analysis of scats (n = 7) and wolverine carcasses (n = 300) indicate that caribou form the bulk of the wolverine winter diet in the SGP (Lee and Niptanatiak 1993, Gunn and Lee in prep., Lee 1994). The dynamics among caribou, wolves, and wolverines are likely an important factor in the ecology of all 3 species, but these dynamics are not understood.

The presence of high amounts of calcium and phosphorous in a limited sample of scats suggests that wolverines can digest bone, and appears to be consistent with reports that they can subsist on only bone for long periods (Lee and Niptanatiak 1993). Wolverines are known to cache food when there is a surplus and retrieve these stores during leaner times.

Denning habitat

The characteristics of wolverine denning habitat in the SGP have not been defined. There have been no systematic studies identifying the requirements for den sites or factors that might limit their distribution. Descriptive information on dens in the Napaktolik Lake area is available.

In the Napaktolik Lake study area dens were encountered frequently and appeared to be of three main types. A deep den with evidence of extensive use including tracks, day beds, and marking appeared to be associated with a denning female. There is evidence that adult females show fidelity to maternity den sites. Deep dens or holes with little sign of activity and only a few tracks in the vicinity may be one of several dens within a home range that are known to the animal and used for escape or during periods of inactivity. Shallow holes in the snow, 1 or 2 metres in length and often associated with food scraps, are likely eating dens where a wolverine can eat and rest without being exposed.

As well as holes or dens, shallow depressions in the snow were found, invariably located in slightly elevated positions on the side of a hill, snow bank, or ridge. These are probably day beds used by wolverines to rest and scan the surrounding area (Lee and Niptanatiak 1993).

Population dynamics

Numbers and density

The number or density of wolverines in the SGP is not known. The only density estimates are from track surveys in the Napaktolik Lake study area, which yielded a maximum estimate of 1/136 km^2 and a minimum estimate of 1/226 km^2. These densities are lower than those reported in northwest Alaska and Montana, and comparable to those reported in the Susitna River Basin in Alaska. The actual density may be higher, as 14 animals were harvested from the vicinity of the area surveyed in the months before the survey (Lee and Niptanatiak 1993).

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) classifies the wolverine west of Hudson Bay as vulnerable, and east of Hudson Bay as endangered. The wolverine has all but disappeared from the barrens of Labrador and northern Quebec, likely due to hunting and previously low caribou populations (Dauphine 1987).

Reproductive characteristics

There are no data on recruitment. Based on harvest collections from the Central Arctic (Gunn and Lee in prep., Lee 1994) female wolverines are not sexually mature until some time after 1 year of age. Ninety seven percent (n = 41) of adult (2+ yr) females and 57% (n = 26) of yearling (1-2 yr) females were pregnant. This is a higher pregnancy rate than reported elsewhere. Females with detectable fetuses were harvested in February and March. Mean fetal litter size was 3.75 (n = 16). Although related to the number of young produced, the number of fetuses overestimates production because of *in utero* and neonatal mortality. Field studies in other areas have shown the actual litter size to be closer to 2. Reproductive success is reported to be closely linked to food supply (Magoun 1985).

Mortality

There are no data on natural mortality. Human harvest is likely the most significant cause of mortality for wolverines in the NWT. The wolverine is a desirable and sought-after furbearer. Harvest studies in the Central Arctic indicate that data based on fur return records alone underestimate the harvest by 50% or more, as many pelts are used locally and never reach the market. Mainland Kitikmeot communities annually harvest 50 - 100 animals, the major portion of the harvest occurring in the areas of Coppermine and Bathurst Inlet (Gunn and Lee in prep., Lee and Niptanatiak 1993).

Fourteen wolverines were harvested from the Napaktolik Lake area in 1992-93, compared with an average of 3 per season between 1986-87 and 1988-89. The increased harvest was likely a result of increased caribou hunting activity in the area by the residents of Coppermine (Lee and Niptanatiak 1993). Similarly, the harvest of wolverines by Yellowknife hunters increases dramatically once the Lupin winter road is open (J. Lee and K. Poole, pers. comm.). Factors affecting harvest levels and age/sex ratios of the harvest are not understood.

Currently, the NWT has no management program for wolverines, no idea of sustainable harvest, and an unrestricted and unregulated kill which is not consistently documented.

Current and proposed studies

No research is currently being conducted in the SGP. A harvest collection program is continuing in Coppermine, Bathurst Inlet and Bay Chimo to document sex/age composition and chronology of the harvest, and to obtain data on productivity and recruitment (J. Lee, pers. comm.). A study has been proposed to examine home range requirements and movement patterns of wolverines, identify maternal dens, and establish recruitment rates, using a combination of conventional and satellite telemetry. A 3 to 5-year study is needed to obtain such baseline data that will help evaluate the impacts of development in the SGP on wolverines (J. Lee and K. Poole, pers. comm.).

WATERFOWL

Distribution and movements

There has been no work done on waterfowl in the SGP, especially in the central area where most activity is occurring, and nothing definitive is known about the distribution or activities of any waterfowl species in that area (R. Bromley, pers. comm., P. Latour, pers. comm., J. Sirois, pers. comm.).

Snow, Ross', Canada, and white-fronted geese which nest in the central arctic leave their prairie staging ground in late April and early May, and arrive on nesting grounds a month later. It is likely that these substantial populations spend much of their time staging in the SGP (R. Bromley, pers. comm.). It is suspected that large numbers of central arctic geese stage in the eastern part (at least) of the SGP enroute north in the spring, perhaps spending 2 weeks before moving to the coast to nest (R. Bromley, pers. comm.). However, nothing has been documented as the area is large and remote, and few efforts have been made to survey it. The distribution of spring migrant waterfowl in northern areas in general is poorly understood, and staging areas for waterfowl nesting in the central Canadian arctic are relatively unknown north of the 60th parallel (Sirois 1993). The distribution of fall staging areas in the SGP is likewise unknown.

Several preliminary surveys have been conducted along the edges of the SGP (Arctic coast and Great Slave Lake), and long-term research programs are ongoing in important waterfowl breeding areas adjacent to the SGP (Kent Peninsula and Queen Maud Gulf by NWT Department of Renewable Resources and Canadian Wildlife Service, respectively). Otherwise, the only information available is casual observations by people working or travelling in the area, or accounts in early explorers' journals (R. Bromley, pers. comm.).

The lake system from Lac la Martre north to Great Bear Lake, on the western edge of the SGP, is suspected to be important to migrating waterfowl and may be a migration corridor. There have been unconfirmed reports of trumpeter swans using that area (P. Latour, pers. comm.).

Between 1989 and 1991 aerial surveys were conducted for Canada geese, white-fronted geese, and tundra swans in coastal areas of the Kitikmeot Region to identify and delineate important brood-rearing and moulting areas. Three of the areas surveyed (60 km north of Coppermine, Kent Peninsula, and Tingmeak River) border the SGP. Extensive investigation of these areas, suggested by local residents and researchers based on their observations of geese, yielded important and previously unknown information about waterfowl distribution. Four new Key Migratory Bird Terrestrial Habitat Sites (believed to support at least 1% of the national population of a species) were identified, including the area north of Coppermine and the Kent Peninsula. The Tingmeak River is already classified as a Key Site (Bromley and Stenhouse 1994).

Spring aerial surveys have been conducted for migrant waterfowl in the eastern Great Slave Lake region, adjacent to the southern boundary of the SGP. The area from Walmsley Lake to Artillery Lake, on the edge of the SGP, was included in the survey. During spring 1990 and 1991, approximately 39,000 - 49,000 birds were counted (7-8 birds/km flown). Seventy percent of all waterfowl observed were geese. Large numbers of tundra swans and several species of ducks were also seen. Areas important to spring migrant waterfowl were identified, including upper Artillery Lake (others were south of the East Arm, outside of the SGP) (Stenhouse and Bromley, unpublished report, n.d.).

Spring aerial surveys in the North Arm of Great Slave Lake (1986 - 1990) have shown that tens of thousands of spring migrant water birds regularly use the shoreleads and ice-free wetlands and rivers along the east shore, which forms a boundary of the SGP. More than 90,000 water birds of 29 species were estimated during the peak of migration in late May 1990, a late spring. The majority of birds were distributed along the east shore. Boundary Bay, lower Yellowknife River, Matonabbee Bay, and lower Beaulieu River supported bird densities higher than average. Canada geese, scaup, and northern pintails were especially abundant. The east side of the North Arm is a Key Habitat Site for Canada geese and tundra swans (Sirois 1993).

Habitat use

Food habits

There is no information on the food habits or habitat use of spring staging geese or other waterfowl suspected to occur in the SGP. It is likely the birds are foraging on overwintered berries (R. Bromley, pers. comm.). Berry-stained geese have been observed arriving on nesting grounds in the central arctic (R. Bromley, pers. comm.). During late staging, birds probably feed on early green shoots of sedges. Important food plants have not been documented.

Nesting habitat

Nothing is known about nesting waterfowl or their habitat in the SGP. It is not likely that the SGP is an important nesting area for waterfowl, with the possible exception of oldsquaw ducks. However, this cannot be concluded definitely as no breeding surveys have been conducted (R. Bromley, pers. comm.). Several areas adjacent to the SGP are important nesting areas for geese and swans (see **Distribution and movements** above), and these species may extend southward into the SGP.

Staging habitat

As discussed above, preliminary surveys suggest that substantial numbers of waterfowl may use the SGP during spring and fall staging. However, the numbers and distribution of birds, the activities and duration of their stay, and the characteristics of important staging habitat remain undocumented.

Based on spring surveys in the eastern Great Slave Lake region, spring staging habitat north of treeline appears to be hilltops and south-facing slopes where snowmelt has begun and geese can feed on overwintered berries (R. Bromley, pers. comm., Stenhouse and Bromley, unpublished report, n.d.).

South of treeline, many of the important staging areas identified during spring surveys at the edge of the SGP were riverine habitats or large shallow bays and associated wetlands, often at the mouth of a river (Sirois 1993, Stenhouse and Bromley, unpublished report, n.d.). An important characteristic of spring staging habitat appears to be early break-up and the availability of ice-free water, especially during late springs when surrounding areas remain icebound. The particular conditions contributing to early break-up in these areas have not been examined. The factor that most influenced the abundance of spring migrants using the east shore of the North Arm appeared to be late spring conditions. Birds were concentrated in the North Arm as the ponds and lakes adjacent to it were icebound until late May (Sirois 1993). During springs when break-up is earlier, more birds may use these "inland" lakes and ponds, which are situated in the SGP.

Population dynamics

No data exist on population sizes, densities, reproductive characteristics or mortality for any waterfowl species in the SGP. It is known that the central arctic populations of Ross', white-fronted, Canada, and lesser snow geese, and tundra swans have increased substantially since the 1960s to early 1980s (Bromley and Stenhouse 1994).

Current and proposed studies

There are no current studies on waterfowl in the SGP. However, 2 ongoing projects would be relevant to any coastal development or marine shipping (R. Bromley, pers. comm.):

a) Coppermine banding: 1994 was the last year of a banding program in the Locker Point area (50 km north of Coppermine) to delineate populations of Canada and white-fronted geese and determine survival rates.
b) Walker Bay research station: a long-term research program to determine factors affecting production of Canada and white-fronted geese, and to determine their survival rates and population delineation.

Recognizing the high potential for mineral development in the SGP, the waterfowl biologist has assisted BHP to develop surveys for migratory bird spring staging and nesting use in the BHP claims, a 1500 km^2 block of low arctic tundra. The project may include searches for transmittered geese from the Walker Bay study area. The potential exists for a more regional project to be developed with similar objectives, pending review and support by entities involved in the Slave Province Regional study. If such a project develops, the study would use a combination of ground-based observations and aerial surveys to determine the location and amount of use by different species of important staging habitat, the chronology of arrival, staging and departure from staging grounds, and how staging habitat is used.

GRIZZLY BEARS

Little information is available on the distribution, movements, habitat use, or population dynamics of grizzly bears in the SGP, and harvest data for the southern portion are incomplete. However, studies from the Coppermine area and in the Inuvialuit Settlement Region suggest that grizzly bears in the SGP will most likely have a low reproductive rate, and occur at low densities. It is likely however, that some areas within the SGP will have higher productivity and densities while other areas will support few, if any, bears. Current productivity and density information suggests that the grizzly bear population in the SGP will, at best, sustain a very low kill rate. Determining the sustainabilty of current quotas and the consequences of problem kills will require a better understanding of reproductive characteristics, natural mortality, density, population discreteness, exchange with surrounding areas, and the sex and age composition of the kill. Determining the effect of development activities will require further information on habitat use and relationships between habitats and productivity (R. Case, pers. comm.).

Distribution and movements

There is currently no documented information on the distribution and movements of grizzly bears in the SGP. Grizzly bears are known to occur throughout the tundra portion of the SGP. However, there have been no surveys or studies of grizzly bears in the central Arctic to document relative densities. Sighting information from people working or travelling in the area suggest that bears occur at low densities throughout the SGP (A. McMullen, pers. comm.).

Observations and harvests of marked bears from the Coppermine and Anderson-Horton River studies indicate that subadult males may travel large distances. A subadult male tagged in the Anderson-Horton area was relocated in the Dismal Lakes area 2 years later; a straight line distance of 460 km. Another subadult male moved 333 km from the Richardson River to Point Lake in a year. A third subadult male moved from the Hornaday River area to Cape Kendall near Coppermine over 2 years; a straight line distance of 360 km (R. Case, pers. comm, Case in prep.).

Relocation data from radio-collared adult females in the Coppermine study area suggest that adult females concentrate their activity in a core area of 500-700 km^2. Annual home range data are not available as only 3 locations were available per year. Six bears were observed to make long movements away from the area of concentrated use, up to 100 km (1-way). These movements occurred between May and late June and the animals had returned to their usual range by fall (Case in prep.).

Habitat use

Habitat use and identification of important grizzly bear habitat have not been documented anywhere in the SGP or surrounding areas.

Food habits

No systematic analysis of food selection, relative importance of different foods, or seasonal habitat use has been conducted in the SGP or anywhere else on the barrenlands of the NWT.

In general, grizzly bears are known to eat a wide variety of foods, including vegetation (sedges, forbs, roots, berries), caribou and muskoxen, fish, waterfowl eggs, and small mammals, in particular arctic ground squirrels (Bromley 1988). The timing and importance of these food sources is not known. Predation on adult and calf muskoxen has been recorded in the Coppermine area. Observations on caribou calving grounds suggest that grizzly bears will prey on newborn calves. Anecdotal reports from outfitters and hunters suggest that grizzly bears kill and scavenge caribou extensively in the fall (R. Case pers. comm.). Studies in other areas indicate that bears typically use different habitats at different times of the year, often establishing general movement patterns to take advantage of food supplies which are only available for short periods (Bromley 1988). Food supply appears to be the primary factor determining grizzly bear distribution and habitat use. Reproductive potential is dependent on the nutritional state of the female, which reflects habitat quality and availability of food (R. Case, pers. comm., Bromley 1988, Bunnell and Tait 1981).

Denning habitat

A systematic study of den site characteristics and denning habitat has not been conducted in the SGP, however, a 1994 study of the ecology of esker ecosystems in the SGP suggests that grizzly bears establish dens almost exclusively on sandy eskers rather than the other available habitat types, and that bear dens tended to be on southern slopes with a relatively high percentage of shrub cover. Den site characteristics have only been recorded for 4 bears in the Coppermine area during recent research. This sample size is too small to allow any conclusions (R. Case, pers. comm.). A denning survey in the Coppermine area in 1984 documented den sites in open, flat, sparsely vegetated tundra interspersed with eskers (Gunn 1984).

A study by NWT Renewable Resources in the 1970's found that denning habitat in the Mackenzie Delta area was characterized by strong to very strong slopes, southerly exposure, shrubs, and unfrozen substrate that easily crumbled. This study also concluded that suitable denning habitat could not be classified solely by regional biophysical properties, thus mapping of denning habitat using LANDSAT imagery would likely be unsuccessful. It suggested that denning activity may be better explained in relation to the food resources and seasonal activity centers of a bear's range, such as proximity to foraging areas, rather than in terms of environmental factors (Mychasiw and Moore1984).

As grizzlies spend 7 to 8 months in dens, suitable denning sites are an important habitat requirement. Site suitability is influenced by a variety of factors including soil type, terrain, aspect and vegetation. Site selection may be influenced by ease of digging -- which is partly dependent on the depth, moisture content, and stability of the soil -- and by site characteristics influencing energy conservation, such as southerly exposure and snow accumulation (Bromley 1988, Schoen et al. 1987).

Population dynamics

Density and distribution

The status of barren-ground grizzly populations in the central Arctic is unknown. The nearest area with a density estimate is the Anderson/Horton River area where the density of grizzly bears was estimated to be 1 bear/113 km^2 (Clarkson and Liepins 1993a). In the Inuvialuit Settlement Region, the overall density is estimated to be approximately 1 bear/141 km^2. A very rough and low-precision estimate made for the Coppermine area, based on limited mark-recapture data, is 1 bear/154 km^2 including cubs, and 1 bear/202 km^2 for bears 2 years old and older (R. Case, pers. comm.).

We assume that grizzly bear distribution is not uniform (R. Case, pers. comm., Clarkson and Liepins 1993a), and caution must be used in extrapolating population information from one area to another. The terrain in the Coppermine and Inuvialuit study areas is different from that of the central SGP. These Coppermine and Inuvialuit areas include major river valleys, coastal plains and more topographical relief, and generally have a greater diversity of habitats. Density of grizzly bears is primarily dependent on the availability and quality of food. Access to diverse habitats, and especially to high-protein food sources such as fish runs and caribou, can result in localized high bear densities. Studies in the Anderson-Horton river area found that river valleys and tributaries had much higher densities of bears, while flat tundra plains had lower densities than the overall average (Clarkson and Liepins 1993a). Within the SGP we could also expect that some areas would support higher densities than others. There also appears to be a trend toward decreasing densities of barren-ground grizzly bears from west to east across the tundra. Although this trend has not been quantified, it is consistent with vegetation patterns and possible forage availability. We would therefore expect that the overall density and productivity of grizzlies in the SGP would be less than that of Coppermine and the Anderson-Horton area.

Reproductive characteristics

There is no information on the productivity of grizzly bears in the SGP. Grizzly bears have very low reproductive and recruitment rates compared to other large arctic animals. Habitat quality may be an important factor influencing geographic variation in reproduction and recruitment in grizzly bears.

A study of the reproductive potential of grizzly bears was conducted in the Coppermine study area between 1988 and 1994. The mean age of first breeding was 7.33 years (n=6), and the average birth interval 3.18 years (n=11). Average litter size was 2.26. Survival of cubs to 1.5 years was 81.4%. Overall cub survival to age 2.5 was 62% (R. Case, pers. comm.). This study will be completed in 1995.

Productivity of grizzly bears in the Anderson-Horton area was studied between 1987 and 1991. Age of first breeding was 6 years, although the average age of first successful reproduction (to weaning) was 10-11 years. Mean breeding interval was 4.87 years as many females lost litters before they successfully weaned one. Average litter size was 2.27, with an overall cub survival rate of 54% (Clarkson and Liepins 1993b).

Natural mortality

The primary cause of natural mortality for cubs and adult females appears to be predation by adult male grizzlies. Two collared adult females in the Coppermine study area were killed by other bears (R. Case pers. comm.). One of the bears had been pulled from her den. During the Anderson-Horton River study, 5 adult females were killed by other bears, presumably large adult males. The females were likely killed attempting to protect their cubs. Cubs were eaten by the male bears, and some females were partially eaten (Clarkson and Liepins 1993b).

Harvest

Grizzly bears are killed in the SGP for one of three reasons:

1) Subsistence use: Within the SGP, native people can legally harvest barren-ground grizzly bears (except females with cubs and bears in dens) for food. There is no requirement to report subsistence kills, although hunters are being encouraged to do so. Reporting of kills is excellent in the Kitikmeot Region while grizzly bears are not often harvested for food by the Dene (Bromley 1988. Although subsistence harvest is potentially unlimited, a low demand for bear meat along with the difficulty and danger in harvesting bears has kept the subsistence harvest low (DRR 1991).

2) Defence of life or property: Any person may kill a bear that is endangering life or property. The kill must be reported to Renewable Resources as soon as possible, and the hide and jaw turned in. Reporting relies on voluntary compliance, so it is difficult to ensure the complete and accurate recording of all defence kills. Educational programs such as the Safety in Bear Country program, posters, pamphlets and advertisements along with camp inspection patrols increase awareness of the reporting requirements and increase the chance of people not reporting being caught.

3) Sale of hunts or hides: Two Barren-Ground Grizzly Bear Management Areas fall entirely (F/2-1, Bay Chimo and Bathurst Inlet) or partially (C/1-2, Coppermine) within the SGP. In each area there is an annual harvest quota of 5 bears. Tags issued under these quotas can be used to sell hides of bears killed by GHL holders, or to sell guided sport hunts to non-GHL holders, including non-residents. While subsistence and defence kills currently do not have to be taken off the quota, a tag is necessary if the hides are to be sold. Support for establishing all inclusive quotas is being sought from the communities and the Nunavut Wildlife Management Board. The season for grizzly bear hunting is from

1 July to 30 June for native hunters. While non-native hunts are restricted to 15 August to 31 October and 15 April to 31 May. The fact that a summer overlaps two seasons can result in more than 10 tags being used in one summer.

Harvest data are considered complete for the Coppermine, Bay Chimo, and Bathurst Inlet areas since quotas were established in 1985. The Coppermine harvest declined from a high of 13 in 1986 to a low of 5 in 1990. The total harvest was 6 in 1991 and 1992, and increased to 10 in 1993, including 5 quota kills, 2 defence, and 3 subsistence kills (R. Case pers. comm.). In 1994, 7 bears were killed in the Coppermine Area; 3 were sport hunts, 2 were problem kills and 1 was a subsistence kill.

In Bay Chimo/Bathurst Inlet the harvest peaked at 6 in 1987 and remained at or below the quota of 5 since then. In 1993, the harvest consisted of 2 sport hunts, 2 defence, and 1 subsistence kill. In 1994, only 4 bears were killed; all were sport hunts.

Male bears make up a large portion of the harvest, especially in the Coppermine area. Of the 65 bears killed in that area since 1985, 12 (18%) were females; only 3 were adult females. In Bay Chimo, adult females made up a large portion of the harvest between 1987 and 1989. In 1990, the sport hunts were switched to the spring. Since then the success of the sport hunts has increased and primarily male bears have been killed (R. Case pers. comm.). The majority of defence kills are subadult bears.

Kill data for the southern portion of the SGP are incomplete. There are no quota kills outside the Management Areas, and few subsistence kills. Table 1 summarizes the total reported harvest in the SGP and the Coppermine area since 1985.

The potential for unreported kills must be considered along with the reported kill. The number of unreported kills is a matter for speculation, however it is likely that some bear kills are not reported. Minimizing the number of unreported kills is essential to evaluating the impact of the harvest on the population.

Current and proposed studies

Research on grizzlies is currently being conducted adjacent to the SGP in the Rae-Richardson valley and Dismal Lakes area west of Coppermine. Long-term research has also been conducted on bears in the Anderson-Horton River area (Clarkson and Liepins 1993a, 1993b) and in other locations further west (Richards Island, Tuktoyaktuk Peninsula, Brock-Hornaday Rivers). The study of grizzly bear reproductive parameters being conducted in the Coppermine area will be completed in 1995. A long term management strategy will be developed in cooperation with the Hunters' and Trappers' Association.

The emphasis of the grizzly bear program in the Slave Geological Province will be on collection of data needed for impact and harvest assessments. A cooperative study is being initiated in 1995/96. Confirmed partners in this project include BHP Ltd., Rescan Environmental Services Ltd., DIAND, the University of Saskatchewan and the Department of Renewable Resources. Other partners are being sought. This project will identify grizzly bear population units based on long-term movements, define critical habitats, determine the geographical extent of impacts of resource extraction activities, describe seasonal ranges and denning habits, and document seasonal food habits of barren-ground grizzly bears.

It is proposed that the Department of Renewable Resources maintains a response capability to deal with problem bear incidents in the SGP, including taking deterrent actions and the capture and removal of problem bears. The anual cost of maintaining this capability would depend upon the number and the nature of problem bear incidents and the availability of in-kind support from the companies affected. A study is proposed to evaluate recent innovations in bear deterrent equipment for their applicability to problem bear detection and deterrent in the SGP and to investigate methods for grey water disposal in camps on the tundra which will reduce or eliminate grey water as a bear attractant.

A traditional knowledge study is proposed to record Dene and Inuit information on the seasonal habits, distribution, denning requirement and cultural importance of grizzly bears in the SGP. This study would involve interviews of elders and other hunters familiar with the study area and grizzly bears.

As a tropic level species, the barren-ground grizzly is exposed to a wide range of environmental contaminants found in the terrestrial ecosystem. The potential for biological effects of contaminants may be greater in grizzly bears than in other species because of their low reproductive potential and seasonal ecology which affects contaminant exposure and seasonal redistribution amoung body tissues. A study is proposed to evaluate current exposure to contaminants and potential effects, and provide a benchmark to monitor changes that may arise from regional developments.

Table 1. Reported grizzly bear kills in the Coppermine and Slave Geological Province area, 1985 - 1994.

YEAR	QUOTA/ SUBSIST	PROBLEM			TOTAL
		INUIT/DENE	INDUSTRY	OUTFITTING	
1985	3	5	0	0	8
1986	11	0	3	2	16
1987	13	6	1	5	25
1988	10	4	1	0	15
1989	6	1	0	0	7
1990	4	0	0	1	5
1991	7	0	4	1	12
1992	9	1	1	2	13
1993	11	4	1	5	21
1994	8	4	3	3	18

* Data from before 1992 is still considered incomplete.

DIURNAL RAPTORS

Distribution and movements

A number of raptor species occur in the SGP. Species distributed below treeline include osprey, northern goshawk, sharp-shinned hawk, and red-tailed hawk. Species occurring throughout the forested region and the forest-tundra transition zone include bald eagle, northern harrier, merlin, and American kestrel. Golden eagles and peregrine falcons are distributed throughout the SGP. Gyrfalcons and rough-legged hawks also occur throughout the SGP but nest on the tundra and forest-tundra transition zone. Most species are thought to be fairly common with the exception of sharp-shinned hawk, northern goshawk, and red-tailed hawk, which are considered "occasional". The gyrfalcon and the goshawk are the only diurnal raptors that regularly winter in the NWT.

There is little detailed information on the distribution and movements of raptors in the SGP. Systematic surveys have been conducted only along the arctic coast. Nest locations are known mainly for falcons and eagles, primarily along the major rivers and the arctic coast. However, for the most part records of raptor nests in the SGP are dependent on incidental reports from people working and travelling in the area.

Gyrfalcons have been studied since 1983 in an area near Coppermine, and since 1982 at Hope Bay on the mainland coast just east of Bathurst Inlet. Surveys in these areas have documented nest site locations for nesting raptors, in particular gyrfalcons, peregrine falcons, and golden eagles.

Habitat use

Food habits

The primary prey for northern raptors are small mammals (including arctic ground squirrels), small birds, ducks, ptarmigan, and fish. Food habits of gyrfalcons have been documented in the Hope Bay area, where the primary prey were ptarmigan and arctic ground squirrels (Poole and Boag 1988). Some food habit information is available from collections of pellets at the nests of gyrfalcons, peregrine falcons, rough-legged hawks, and golden eagles (C. Shank, pers. comm.). No other information exists on food habits of raptors in the SGP.

Availability of prey is likely most important in a regional context (C. Shank, pers. comm.). Research at Hope Bay showed that the number of successfully breeding gyrfalcons in that area was apparently unaffected by the density of ptarmigan, their primary prey (Shank and Poole 1994). However, this conclusion is currently being questioned (C. Shank,. pers. comm.). In Rankin Inlet, microtines were found to be important prey for tundra peregrine falcons, even during years of low microtine abundance. Rodents appeared to be a significant source of food for Rankin Inlet peregrines especially during the period after falcons arrived on the breeding grounds and before the arrival of most migratory bird prey (Bradley 1988).

Nesting habitat

Tundra-nesting raptors usually nest on cliffs, which are generally concentrated along rivers and coastlines. However, low rock outcrops in upland tundra, often near lakes, may also provide suitable nest sites. Forest-nesting species primarily use trees; each species has different requirements. Northern harriers nest on the ground. Bald eagles, which usually nest in large trees, have been found nesting on the ground on islands in Great Slave Lake. Raptors often use tall human-made structures for nesting. There are many exceptions to the "rules"; the nesting requirements of raptors are not well understood. Many raptors use traditional nest territories year after year. The location of the actual nest may vary to some degree as a nest territory often includes several alternate nests sites.

In the SGP, raptor nest site requirements have been documented only in the Hope Bay study area (Poole and Bromley 1988a, 1988b). For gyrfalcons in that area, data are available on nesting density and internest distance, and nest site characteristics (Poole and Bromley 1988a). Further studies identified the relationships among several species of raptors nesting in the Hope Bay area, including nest site requirements, nesting chronology, sharing of the prey base, and the effects of internest distance on reproductive success (Poole and Bromley 1988b).

Population dynamics

<u>Numerical trends and reproductive characteristics</u>

There is little information on population numbers or densities, breeding patterns, or reproductive success, for raptors in the SGP, except in the study areas already mentioned. Since 1982, annual surveys have monitored the number of young produced and the percent of territorial pairs breeding for raptors nesting along the coast between Coppermine and Bay Chimo (C. Shank, pers. comm.).

Population trends have been monitored for raptors in the Hope Bay study area (2000 km^2) since 1983, and in the Coppermine area (4000 km^2) since 1982. Between 1983 and 1991, the number of productive gyrfalcon nests at Hope Bay ranged from 9 to 12. During the same period in Coppermine, the numbers ranged from 4 to 13. Although there is considerable variability in reproductive success from year to year, there is no evidence of long-term trend in these areas, indicating long-term stability of the breeding population (Shank and Poole 1994).

For gyrfalcons, we assume that highest densities will occur along a 20-km wide strip of habitat along the coastline. At best, densities of gyrfalcons along the coast may approach 1 pair/175 km^2 (Shank and Poole 1994).

The number of occupied peregrine falcon territories at Hope Bay and Coppermine increased significantly between 1982 and 1991. The growth rate appears to be exponential, with doubling times of 6-7 years for the Hope Bay population and 5-6 years for Coppermine. Increasing populations of tundra peregrines have been documented across the arctic, and likely reflect a recovery from earlier pesticide-related declines in peregrine populations (Shank et al. 1993). Between 1982 and 1991, the number of occupied peregrine territories ranged from 18 (1986) to 61 (1990) at Coppermine, and from 17 (1982,'83,'85) to 51 (1991) at Hope Bay (Shank et al. 1993).

High densities of peregrine falcons have been recorded in some areas of the NWT. It is likely that the high densities in these local situations are a result of concentrations of unlimited nest sites (e.g. cliffs) in a region otherwise poor in nest sites. Studies caution against extrapolating densities of peregrines over large areas (Bromley 1992).

Nest sites and food are the main resources that naturally limit breeding populations of peregrine falcons (Bromley 1992). The same is likely true for other raptors. Gyrfalcon densities are governed by the simultaneous presence of suitable nesting locations and a sufficient prey base (Shank and Poole 1994). There is also evidence that gyrfalcon densities are higher in more productive habitat (indexed by higher mean July temperature and taller willows) (Shank and Poole 1994). Rough-legged hawks, which are nomadic breeders, build nests and raise their young in areas where small mammal populations are highest (Shank 1993).

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 where prey are scarce (Bromley 1992). In Rankin Inlet, the size of nesting territories, not availability of nest sites (i.e. ledges and stick nests), apparently limited the number of peregrine pairs breeding in a given year. Size of territories was determined by territorial behaviour of the birds in early spring, ultimately influenced by the food supply during pre-laying. With an abundant food supply, for example when small mammal populations are high, peregrines may require smaller territories, be less aggressive, and allow extra pairs to nest between regular territories (Bradley 1988).

Numbers of rough-legged hawks appear to be closely related to small mammal abundance (Shank 1993). In the Coppermine study area, 75 rough-legged hawk nests were found in 1990, which was thought to be a peak year in the population cycle of voles. The number of nests dropped to 18 in 1991, reflecting the low population of small mammals. Nests increased to 55 in 1992 as microtine populations began to recover (DRR 1991).

<u>Mortality</u>
There is no information on raptor mortality.

Current and proposed studies

There is no research being conducted on raptors in the SGP, other than annual nest surveys in the Coppermine and Hope Bay areas. The Coppermine survey will be maintained in order to provide a baseline set of data for raptors in the SGP. To learn more about the migration patterns of gyrfalcons, we propose to place 3 satellite transmitters on gyrfalcons in the Hope Bay area in summer 1996 and remove them in 1997.

MOOSE

Distribution and movements

In the SGP moose are found in all forested areas south of treeline. On the tundra, scattered individuals may be found in areas of lush willow growth (Britton 1983). In 1994, a moose was observed on the south shore of Daring Lake. Moose are regularly seen and hunted near Coppermine and occasionally in the Tree River area.

It is not known if moose observed on the tundra remain on the tundra all year round or make regular movements onto the tundra. It is likely, however, that any movements would follow rivers where both forage and cover are available.

Habitat

Moose prefer early successional forests, and fire has been responsible for sustaining much of the present moose range in the southern SGP. A survey conducted in November 1989 observed 75% (31 of 41) of moose in 1973 and 1979 burns (Case and Graf 1992). No evaluation of the quality of moose habitat in the SGP has been conducted, however, given the rocky terrain, predominantly open coniferous forests and few riparian areas, habitat is of general low quality (Jacobson 1979).

Population dynamics

Moose densities in the NWT are low compared to those in other parts of North America. Average densities in the NWT range from 0.02 to 0.09 moose/km^2. Densities in the southern SGP fall into the low end of this range. A survey in the Gordon Lake area documented an average density of 0.02 moose/km^2 (Case and Graf 1992). Similar densities were found earlier by Lines (1968), Baker (1974) and Jacobsen (1982).

No information is available on productivity, calf survival, or mortality. Sample size in the November 1989 survey was too small to evaluate productivity (Case and Graf 1992). Wolves associated with the Bathurst caribou herd may prey on moose in the winter. There are also resident wolves and black bears which may prey on moose.

Harvest

Moose harvests in the south SGP are high relative to the density of moose in the area. Moose are harvested by both native and non-native NWT residents. Little data are available on native harvests. Harvests by non-native hunters from Yellowknife have steadily increased since 1984. In 1992/93 an estimated 125 moose were harvested by Yellowknife non-native hunters; an unknown portion of these were from the SGP (DRR files).

Current and proposed studies

There are no ongoing or proposed moose studies in the SGP.

BLACK BEARS

Black bears occur throughout the forested regions of the NWT. Densities are estimated to be low along the treeline, higher in forested areas, and highest along the Mackenzie River and Great Slave Lake (Clarkson 1985, DRR 1990). There is very little information on black bears in the SGP other than observations which indicate that they occur at low densities within treeline and are occasionally observed on the tundra.

There have been no surveys and no formal attempts to estimate population size for black bears 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 harvest of black bears is thought to be low. It is primarily incidental and associated with communities and camps. The greatest likely cause of mortality is problem bear kills (Clarkson 1985, DRR 1990).

Current and proposed studies

No research on black bears is currently proposed, anywhere in the NWT.

SMALL MAMMALS

Small mammals are important as they are keystone species in arctic 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 (foxes, weasel, marten). Arctic fox cycles and movements are driven by fluctuations in lemming numbers. Nomadic raptors (rough-legged hawks, snowy owls) choose areas of high microtine abundance for breeding. "Prey switching" by generalized predators affects the breeding success of waterfowl.

Ground squirrels were among several species studied as part of a study of esker ecosystems in the Lac de Gras area in the summer of 1994. Mueller (1995) found that ground squirrels established dens almost exclusively on sandy eskers. Den sites were relatively large complexes, usually with numerous burrows, and tended to face southwards. Disturbed soil indicated that 11 of the 18 squirrel dens (61%) had at some time been partially dug up by grizzly bears. Several abandoned fox dens had more recently been used by ground squirrels. More than 1/3 of abandoned bear dens were found with active ground squirrel dens inside them. In one case, a grizzly appeared to have denned in the middle of a ground squirrel den complex. 13 of 22 wolf dens (59%) also had ground squirrel dens within the same complex. Six ground squirrel den complexes were known to have been used concurrently with denning wolves, as determined from fresh tracks and visual sightings.

Current and proposed studies

Small mammal traplines were established and surveys conducted since 1990 at several locations throughout the NWT, including Coppermine and Yellowknife (Shank 1993). The only study area in the SGP was Daring Lake, first trapped in 1994. The purpose of the surveys is to establish a record of population fluctuations over a broad area, which will ultimately allow prediction of relative abundance and the geographic extent of synchrony in fluctuations. Currently, it is not possible to predict small mammal populations with any degree of certainty, nor is it known over how large an area populations are synchronized.

MUSKOX

Muskoxen usually occur at low densities on the mainland. They occur in the eastern tundra portion of the SGP, but their distribution is clumped. They tend to be concentrated along rivers, especially the Back River, and Contwoyto Lake (A. Gunn, pers. comm.). In summer, muskoxen feed on sedges and willows along rivers. In winter, they disperse away from rivers and feed in windswept areas where the snow is not too deep. There have been only two systematic surveys of muskoxen in the SGP. In 1991, the area northeast from Contwoyto Lake to the coast west of Bathurst Inlet was surveyed and 1400 muskoxen were estimated (Gunn 1991). The low proportion of calves in the population is consistent with observations of other mainland muskoxen and suggests that calf survival in the area is low. The spread of muskoxen west from Bathurst Inlet is slow as few were counted there compared to other areas. The area around Aylmer, Clinton-Colden, and Artillery Lakes was surveyed in 1991. Muskoxen were scattered throughout the area. No muskoxen were seen west of Aylmer Lake (Shank and Graf 1992), and only a few muskoxen have been observed south of Contwoyto Lake. Recent observations of muskoxen just north of Yamba Lake suggest that muskoxen may move into the Lac de Gras area. In the summer of 1994, a survey of muskoxen was conducted in the Thelon Game Sanctuary, adjacent to the SGP. The survey concluded that there are at least 1100 muskoxen in the Sanctuary.

Muskox range on the mainland has been expanding since the 1970's. Historical information suggests that muskoxen once occupied most of the tundra portion of the SGP so it is possible that muskoxen may recolonize the area.

Current and proposed studies

There are currently no ongoing studies of muskoxen in the SGP. A survey of muskoxen in the Bathurst Inlet area will be conducted in 1997/98. Observations of muskoxen in the southern portion of the SGP will be recorded to monitor recolonization of the area.

CONCLUSIONS

The Wildlife Management Division believes that cumulative impacts resulting from regional development and infrastructure are the major threat to wildlife populations in the SGP. For many species, the impacts of major concern are those associated with increased access from the construction of roads. Impacts of development should be reviewed in a regional context.

In general, there is little known about the ecology and numbers of wildlife species in the SGP. Research and surveys to date have not been concentrated in this area. Therefore there is currently very little information on which to base the assessment of impacts and the development of mitigative measures.

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