THE CULTURAL ECOLOGY OF THE CHIPEWYAN

BY

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ABSTRACT

This study is concerned with the persistence of human life on the edge of the Canadian Barren Grounds. The Chipewyan make up the largest distinct linguistic and cultural group and are the most easterly among the Northern Athapaskan Indians, or Dene. Over many centuries, the Chipewyan have maintained a form of social life as an edge-of-the-forest people and people of the Barren Grounds to the west of Hudson Bay.

The particular aim of this thesis is to attempt, through a survey of the ecological and historical literature, to elucidate something of the traditional adaptive pattern of the Chipewyan in their exploitation of the subarctic environment.

Given the fragmentary nature of much of the historical evidence, our limited understanding of the subarctic environment, and the fact that the Chipewyan oecumene (way of looking at life) is largely denied to the modern observer, we acknowledge that this exercise in ecological and historical reconstruction is governed by serious hazards and limitations.

In substance, this analysis begins with a general consideration of the ecological perspective in anthropology and with the elaboration of a workable conceptual framework. There follows a consideration of the historical questions of Chipewyan territory, settlement pattern, and population. Continuing, the analysis deals with the natural

environment of the subarctic, giving particular attention to those features of the environment which bear on the ecological niche of the Chipewyan. Central to the thesis is the analysis of the local hunting unit or ecological population functioning in its ecological niche within the ecosystem. A final brief chapter is given to the issue of the acculturative influence of the fur trade on Chipewyan life.

In conclusion, it is asserted, after Geertz and in sympathy with the deliberations of the 1966 Ottawa Conference on Cultural Ecology, that the reconstructive task is well served by the adoption of a more thoroughgoing ecological perspective and that a clearer understanding of the traditional adaptive pattern of the Chipewyan can be realized only through the convergence of the analytic efforts of the disciplines of ecology, history, archaeology, linguistics, and anthroplogy.

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TABLE OF CONTENTS

CHAPTER		PAGE
1	Introduction	1
2	Territory, Nomenclature, Population	21
3	Natural Environment	55
4	Traditional Adaptation	161
5	Influence of the Developing Fur Trade	194
	Conclusion	204
	Bibliography	210

LIST OF FIGURES

Figure 1.	The Territory of the Chipewyan.	25
Figure 2.	Samuel Hearne's Coppermine Journey. 1770-1772.	46
Figure 3.	The Canadian Shield: exposed and bordering buried sector.	60
Figure 4.	The tree-line in Canada.	61
Figure 5.	Vegetation and permafrost relationships in Subarctic Canada (after Brown).	62
Figure 6.	A transect of permafrost conditions along a meridian in northwestern Canada.	63
Figure 7.	Soils.	70
Figure 8.	Permafrost.	73
Figure 9.	Relief Map.	78
Figure 10.	Vegetation Regions of Northern Canada.	84
Figure 11.	Forest Sections of the Boreal Forest Region.	85
Figure 12.	Population Estimates and Distribution of Barren Ground Caribou.	92
Figure 13.	Spring Migration Routes of Barren Ground Caribou.	94
Figure 14.	Mean date of last snow cover (1 inch or more) on barren ground caribou range.	102
Figure 15.	The two main areas of caribou distribution on May 1, 1967, and the spring migration routes to the calving grounds. (Parker, 1972)	113
Figure 16.	Approximate areas from which caribou were killed by Indian and Eskimo hunters within the winter range of the Kaminuriak population, August 1967 to July 1968 (Parker, 1972).	114

Figure 17. The mid-summer migration routes south from Baker Lake, by the Kaminuriak population, July 14 to August 15, 1967 (Parker, 1972). 117

Figure 18. Fall migration routes (November 1 to 17, 1966) and distribution of the Kaminuriak population on November 17, 1966 (Parker, 1972). 119

Figure 19. The relationship of some co-inhabitants of barren ground caribou range to caribou. Extent of classification in some instances is arbitrary (Kelsall, 1968). 124

Figure 20. Distribution of musk-oxen on the Canadian mainland. The relative density of this distribution is shown by various sizes of black dots (Clarke, 1940). 133

CHAPTER 1

INTRODUCTION

INTRODUCTION

This study is concerned with the persistence of human life on the edge of the Canadian Barren Grounds. The Chipewyan make up the largest distinct linguistic and cultural group and are the most easterly among the Northern Athapaskan Indians, or Dene. Over many centuries the Chipewyan have maintained a form of social life as an edge-of-the-forest people and people of the Barren Grounds to the west of Hudson Bay. It is in the context of the harsh and unyielding environment of the Canadian Shield that I approach their distinctive traditional economic and social organization.

The question of cultural identity has assumed new importance for the Dene with the proclaiming of the Dene Declaration[1] at Fort Simpson in July 1975. In its stated theme of "land and unity" and with the not infrequently heard expression "the land is the culture", the Dene have been giving renewed expression to the basic adaptive principle that it is in the process of exploiting and adapting to a particular environment that a human population generates a distinctive culture and a distinctive social organization.

The particular aim of this thesis is to attempt, through a survey of the ecological and the historical literature, to elucidate something of the traditional adaptive pattern of the Chipewyan in their exploitation of the subarctic environment. In substance, the

pattern of analysis is as follows. The introductory chapter is concerned with general considerations relating to the ecological approach in anthropology and with the elaboration of a workable conceptual framework. Chapter Two, more historical in nature, is essentially a consideration of the unresolved problems of Chipewyan territory, settlement pattern and population. Chapter Three seeks to outline the characteristic features of the subarctic environment. Particular attention is given to those features of the environment which bear on the traditional ecological niche of the Chipewyan. Chapter Four, which is the central chapter of the thesis, is concerned with the manner in which the Chipewyan functioned in their ecological niche within the ecosystem. It is concerned particularly with the manner in which they chose to exploit the resources of the region and with the ways in which resource fluctuations and uncertainties were reflected in their social organization. The final chapter offers a brief consideration of the acculturative impact of the developing fur trade on the traditional adaptive pattern of the Chipewyan.

As with all such attempts at ecological and historical reconstruction, the task of analyzing the traditional adaptive pattern of the Chipewyan is beset with serious hazards and limitations. Not the least of these is the fact that much of the traditional Chipewyan world view, or oecumene - what they perceived as their universe, the meanings and values they found in it, and how they defined their relations to it (to use Helm's (1962:634) statement) - is locked up in

a language and system of magic that is all but beyond the reach of the modern observer.[2]

In such circumstances, it can no doubt be argued that in ecological and historical reconstruction, one is simply projecting present and historical evidence back into the precontact period and thereby indulging in historical conjecture. My response to this view would be that the analytic hazards do not invalidate the exercise. Rather, it would seem, the legitimacy of proceeding with such an investigation lies in proceeding with due awareness of the hazards and with a considerably more modest expectation than that of understanding the traditional adaptive pattern as a whole. Indeed, the fact that the anthropological literature abounds with just such cultural salvage operations is indicative of the willingness of anthropologists to come to terms with a changing world.

With respect to the Chipewyan, there is unquestionably much of their traditional way of life that is lost beyond recall. Among the more serious limitations affecting such investigations as this are the limited amount of competent fieldwork that has been done among the Chipewyan over the years and the fragmentary nature of much of the historical evidence. Other limitations include the impossibility of working with large hunting groups and the fact that the fieldworker of today can have no assurance that even the more remote and conservative of existing groups are representative of the more distant past.

The hope of gaining a clearer understanding of the traditional adaptive pattern of the Chipewyan then would appear to lie in a multi-disciplinary approach - in a convergence of the analytic efforts of the ecologist, the historian, the archaeologist, the linguist, and the anthropologist. As far as the present study is concerned, it is conceived from an essentially ecological perspective, while at the same time drawing to a considerable extent on the historical literature. As a literary survey it represents a fairly extensive review of the ecological and the historical literature. It must be conceded, however, that in an area of study as dynamic as the Canadian subarctic has become in recent years, one cannot feel any secure sense of being in touch with the full range of the literature.

Along with the burgeoning scientific interest in the subarctic in recent years, there appears to have developed a sense of the inadequacy of existing perspectives An indication of the dissatisfaction with the prevailing cultural and historical orientation in the analysis of social organization can be seen in the Proceedings of the Conference on Cultural Ecology held in Ottawa in August 1966 under the chairmanship of David Damas. The same conference stressed the need for the development of a more secure ecological approach to the understanding of social phenomena.

The ecological approach in anthropology gained initial credence some eighty years ago with Otis Mason's (1895) pointing to the

formative influence of habitat in the elaboration of culture. There followed Wissler's (1926) work on the general notion of culture area and Kroeber's (1939) further development of the concept of culture area in relation to natural area.

Julian Steward (1955), in his influential book Theory of Culture Change, rejected Kroeber's insistence on the need to understand the whole society in its interaction with its environment as being beyond attainment, and recast the problem of perspective in terms of local environment or ecological niche and culture core and their discernible interactions. A similar analytic focus has been advocated by Vayda and Rappaport (1968:485) in their restatement of Clifford Geertz: "...this discrimination and specification of variables permit a replacement of the gross equations about the influence of environment upon culture with more incisive queries about how specific variables, both cultural and environmental, interact; how their functioning is regulated; how stable a system they constitute; and so forth." A good example of this approach is provided by Hallowell's (1949) attempt to analyze the dynamics of the Algonkian hunting-territory system in terms of such variables as the size of the hunting ground, the size and composition of the hunting groups, the density of the population, the ratio of active hunters to non-hunters, and the concentration and dispersal of game animals. The ecological approach to social phenomena then has required the development of a more refined conceptual framework.

It has become generally accepted that the focal point of this approach is adaptation to the environment. The concept of adaptation is here used in the accepted ecological sense of the processes by which and interactions through which an organism or population responds to its environment so as to ensure its own survival. It has to be recognized, however, that human behaviour, as with animal behaviour generally, can be either adaptive or maladaptive. Differential interspecies success in adapting to particular local environments is an essential dynamic of the structuring of ecological communities. Further, as Eggan (1972:82) emphasized in relation to social systems, an analytic distinction must be made between adaptation within the social system (intraspecies) and adaptation external to the social system (interspecies and environmental).

The ecological approach is succintly expressed by Helm (1962:630): "The anthropological view of ecology stresses the adaptive and exploitative relations, through the agency of technology, of the human group to its habitat, and the demographic and sociocultural consequences of those relations." This approach is given further emphasis by Rappaport (in Damas, 1969b:187) with his assertion that ecological anthropology can be made more operational by placing it within the framework of general ecology and that such a strategy would enhance rather than obscure our understanding of culture. The need to maintain a balanced perspective, however, is emphasized by Hewitt and Hare (1973:34), "few things could diminish the impact of

ecological ideas more than to ignore the power of artifice and culture in human affairs." While keeping in mind the longer-term need to understand the relative importance of ecological, ideological and historical forces in shaping culture and social organization, we would seem to be led in our ecological approach as Damas (1969b:10) points out, to an a priori conviction that "economic factors or features of the natural environment take precedence as determinants of social or cultural features."

At the risk of belaboring the point, we might take note also of Clifford Geertz' (1963) observations on the adoption of a more thoroughgoing ecological perspective in anthropology. Prefacing his ecological approach to fieldwork in Indonesia (1963:xviii), Geertz asserts: "I am convinced that an adequate understanding of the new countries of the "third world" demands that one pursue scientific quarry across any fenced-off academic fields into which it may happen to wander." In engaging in such "poaching expeditions", as he calls them, in the name of ecological anthropology, Geertz both asserts the merits of the ecological approach and points to the hazards of granting to ecology an unmerited position of preeminence among the various disciplines.

On the side of ecology, he asserts (1963:1): "The turn to ecology represents a search for a more penetrating frame of analysis within which to study the interaction of man with the rest of

nature...." Further, he asserts (1963:3): "The ecological approach attempts to achieve a more exact specification of the relations between selected human activities, biological transactions, and physical processes by including them within a single analytic system, an ecosystem." Among the hazards, Geertz warns against any reductionist use of ecology as an exclusive and comprehensive frame for the analysis of human culture and community organization. In sum, he expresses the view (1963:10) that: "Cultural ecology, like ecology generally, forms an explicitly delineated field of inquiry, not a comprehensive master science."

What has been developing then in the ecological approach, essentially a systems approach, is the view of culture and social organization as essentially adaptive mechanisms. Culture is usefully defined by Goldschmidt (1966:viii) as a "...patterned response to the character of human needs and each society is shaped by the insistent demands that life exerts on the living." In similar vein, Harris (1971:202) stresses the notion of system elaborated in terms of structure and process: "To help conceptualize the complicated interrelationships between culture and environment, it will be convenient to regard each human population, its repertory of behaviour patterns and its habitat, as part of a regulated system of life-sustaining interactions." Wilson (1975) perceives social behaviour and social organization as being fundamentally a set of devices for tracking and responding to changes in the environment.

Ecology, in its most general sense, is well defined by Allee et al (1949:1) as the "science of the interrelation between living organisms and their environments, and emphasizing interspecies as well as intraspecies relations."

Within this general orientation then we must establish a conceptual framework and attempt to elucidate a number of key analytic concepts. Central to the ecological orientation is the concept of ecosystem, which has been operationally defined by Rappaport (in Damas,1969b:184) as "a system of material exchanges among the populations of the several species and the non-living substances occurring within a demarcated area." An ecosystem is a dynamic, open system whose boundaries must be arbitrarily drawn. It is a system with both biotic and abiotic components and is constituted of physiography, climate, soils, bacteria, fungi, plants, and animals. The system is maintained by the adapative interaction of those components. Within the ecosystem, the fundamental processes include those of energy flow, the hydrologic cycle, nutrient cycling, and the growth and regulation of diverse species populations. The interaction of populations within the ecosystem can perhaps best be viewed as the ecological community. The dynamic character of the ecological community can be seen in the existence of successional and climax stages[3] of species distribution within the community. Changes in community structure can be seen in relation to such factors as long-term climatic changes and may be particularly dramatic in the

aftermath of forest fires or bush fires. Another indication of the dynamic nature of ecological communities is the gradient of complexity observed between adjoining communities. Such a gradient, termed an ecocline, can have both spatial and temporal variability.

On a somewhat larger geographic scale, a biome exists as an area of characteristic vegetation. A biome contains within it a variable number of discrete ecosystems. In the Canadian subarctic the two characteristic biomes are the boreal forest and the tundra. The transition zone between two biomes, termed an ecotone, is particularly interesting ecologically. The ecotone - the taiga, in the subarctic - is usually characterized by greater species diversity than either adjoining biome. Within the ecotone can generally be found species which are native to both biomes as well as other species which are more characteristic of the ecotone itself. This phenomenon is referred to as an "edge effect" or "edge community" (See Pianka, 1974:245).

Within an ecosystem the practical unit of analysis is the population. Rappaport (in Damas, 1969b:176) offers the definition of an ecological population as "an aggregate of organisms sharing distinctive means for maintaining trophic (i.e. feeding) relations in the ecosystem in which they participate together."

The central concept relating the ecological population to the ecosystem is that of ecological niche. (Here we come to the focal point of the ecological perspective in anthropology). As defined by Clapham (1973:103): "The niche comprises all the bonds between the population and the community and ecosystem in which it is found. These bonds include factors such as the tolerence ranges and optima for all abiotic environmental variables, the sorts of organisms that can be untilized for food by the population, as well as the organisms that feed on it, the areas in which the population can live, and the population structure of the species." From our anthropological perspective the focus of analysis then becomes one of understanding the functioning and survival of a human population in its ecological niche within the ecosystem.

The notion of niche is not a simple concept. As pointed out by Whittaker et al (in Whittaker and Levin, 1975:333), it is a construct, one of a class of concepts not subject to direct observation but postulated to explain a range of observations. It is in many ways analogous to the sociological concept of role. In essence, niche serves to define a population and to demarcate the place and functioning of that population within the ecological community. The principal difficulty in using the concept of niche is that of identifying within the multiplicity of niche characteristics those variables which are most important in regulating the population. Moreover, as with the population itself, the character of the niche changes over time.

Of crucial importance in developing the notion of niche is the concept of limiting factor. As discussed by McNaughton and Wolf (1973:30) and derived from Blackman (1905): "...an organism process that is dependent upon many distinct environmental factors for its operation will be limited by a single factor whose value is farthest from the process requirements." McNaughton and Wolf go on to emphasize that an understanding of the operation of limiting factors is imperative to the development of a predictive theory in ecology.

The concepts of niche and limiting factor then are central to an understanding of population dynamics. Rappaport stresses this (in Damas, 1969b:160) by pointing out that it is rare for a population to be actually limited by the resource base. Quoting Wynne-Edwards, he states that there will generally be mechanisms which will cut off population size well below the carrying capacity of the land.

In elaborating the concept of niche there are a number of other issues to be dealt with. Important among these is the distinction between niche and habitat. This distinction is given some clarification by Whittaker et al (in Whittaker and Levin, 1975:321) by restricting habitat to the physical and chemical aspects of the environment, and reserving niche for the intracommunity role of the species.

The ordering of niches in relation to each other and the regulation of overlapping niches occur in response to the selective pressures operating on the competing species. As Garret Hardin emphasizes in his paper "The Competitive Exclusion Principle" (1960), niche differentiation is the necessary condition for species coexistence. A large degree of niche overlap in the matter of resource utilization is unlikely to be sustained, and, in the extreme case, complete competitors cannot coexist. In another well-known paper, "The Tragedy of the Commons" (1968), Hardin deals with the issue of the overutilization of resources and with the proposition that in human behaviour there is a class of problems for which "there is no technical solution". That is to say, in a situation in which normal constraints on population size or on resource utilization are absent, a population's social organization tends to become extremely unstable. Such was the case during the intensely destructive competitive period of the fur trade in Canada.

An important clarification in the ecological perspective in anthropology came with Steward's (1955:37) notion of culture core - "the constellation of features which are most clearly related to subsistence activities and economic arrangements." Steward rejected the attempt to understand the whole society in its adaptive response to the environment in favour of the more clearly defined goal of understanding the adapative pattern of a human population, surviving within its niche in the ecosystem, in terms of the population's

culture core. In this way the problems of ecological analysis were rendered more manageable.

The problem of a workable analytic scheme became the central issue of the Ottawa Conference on Cultural Ecology. Out of this debate there emerged an analytic scheme which has gained rather wide acceptance. Based on the notions of culture core, and adaptation to the environment, it includes three components - the exploitative pattern, the settlement pattern and the community pattern. Adopting the ecological population as the basic unit of analysis; the exploitative pattern encompasses the habitat and the pattern of resource exploitation through the medium of technology. The settlement pattern involves the spatial and temporal aspects of society; that is to say, population distribution and population shifts through its annual cycle. The community pattern involves the social organization of the population.

The culture core of traditional Chipewyan life is centered on their survival as a relatively small-scale hunting society within the taiga ecotone. Their adaptive pattern and annual cycle were shaped fundamentally by their exploitation of the migratory caribou herds and by the harshness, the variability, and the uncertainty of their habitat. The early historical record leaves little doubt that most Chipewyan hunting groups faced at least one period of starvation in the course of their annual cycle. An understanding of their social

system, in Kroeber's terms, and an appreciation of the manner in which the Chipewyan lived their lives would require the etic perception[4] of the observer and the emic perception of the native, which as Steward conceded is more than we can reasonably expect to attain.

Nevertheless, a point of some conjecture with respect to the Dene concerns the basis for their philosophical acceptance of the frequently harsh conditions of survival or starvation which they faced. On the one hand there are the views expressed by Sahlins and Needham (in Lee and DeVore, 1972:89) with respect to hunters. Sahlins, viewing hunters as the "original affluent society", asserts: "Rather than anxiety, it would seem the hunters have a confidence born of affluence, of a condition in which all the people's wants (such as they are) are generally easily satisfied. This confidence does not desert them during hardship." And Needham speaks of "a confidence in the capacity of the environment to support them, and in their own ability to extract their livelihood from it." Helm, on the other hand, asserts: "I do not think the thesis of confidence in the yield of tomorrow holds for the boreal forest peoples. Rather, my reading of northern Indian equanimity is that it is fatalistic rather than optimistic. If either the day or the morrow does not provide for itself, there is little one can do about it."

Consider the observations of Samuel Hearne (1972:44) on his journey to the Coppermine River in 1770: "I have more than once seen

the Northern Indians (Chipewyan), at the end of three or four days fasting, as merry and jocose on the subject, as if they had voluntarily imposed it on themselves;..." Again, Hearne (1972:42), on discovering that a cache of provisions had been raided by another party: "This disappointment and loss was borne by the Indians with the greatest fortitude; and I did not hear one of them breathe the least hint of revenge in case they should ever discover the offenders; the only effect it had on them was, that of making them put the best foot foremost. This was thought so necessary, that for some time we walked every day from morning till night." Or, as described by Capt. George Back (1970:226),

> A Cree Indian of the name Pepper, who had long resided around Chipewyan as a hunter came to the Fort in November, 1832, after a temporary absence and, having smoked his pipe, gave a plausible account of severe calamities, which had befallen him in the preceding winter. After describing the horrors of starvation in the desolate forest, and his ineffectual efforts to ward it off, he said that, worn out, at length, by hunger and cold, his wife, the mother of his children sunk into a lethargy and died; his daughter soon followed; and two sons, just springing into manhood, who promised to be the support of his old age, - alas! they also perished; lastly, their younger children, though tended by him with unwearied solicitude, and fed for a time on the parings of their leather garments, sunk under their sufferings, and slept with their brethren.

Such scenes call to mind Goldschmidt's reference (quoted above) to "...the insistent demands that life exerts on the living," and Hardin's (1968) reference to the philosopher A.N. Whitehead: "The essence of dramatic tragedy is not unhappiness. It resides in the solemnity of the remorseless working of things."

The territory of the Chipewyan has been described by Downes (1943) as: "This forlorn world of rock and tundra... of lakes and rivers;" and by Farley Mowat (1971) in his book People of the Deer:

> On an evening when the sun hovered about the horizon's lip, I sat beside a man who was not of my race, and watched a spectacle so overwhelming in its magnitude that I had no words for it.
>
> Below us, on the undulating darkness of the barren plains, a tide of life flowed out of the dim south and engulfed the world, submerged it so that it sank beneath a living sea. The very air was heavy with the breath of life itself. There was a sound of breathing and of moving that was like a rising wind. It was as if the inanimate and brutal crust of rock had been imbued with the essential spark and had risen from its ageless rigidity to claim the rights of life.

And by Alexander Mackenzie's (Lamb, 1970:125) description of Lac Ile-a-la Crosse:

> The situation of this lake, the abundance of the finest fish in the world to be found in its waters, the richness of its surrounding banks and forests, in moose and fallow deer, with the vast numbers of the smaller tribes of animals, whose skins are precious, and the numerous flocks of wild fowl that frequent it in the spring and fall, make it a most desirable spot for the constant residence of some, and the occasional rendevouz of others of the inhabitants of country, particularly of the Knisteneaux (Cree).

Such environmental extremes are not uncommon in the lives of hunters and fishermen - at times a world of emptiness and solitude, at other times a world buzzing with life and activity. The Chipewyan existence - economic, social, and cosmological - rested to no small extent on the necessity of coming to terms with such environmental

contrasts and extremes, providing the necessities of food, clothing, shelter and fire, and of coping with the sheer physical hardship and discomfort of travel in inclement weather over difficult terrain.[5]

With the development of the fur trade and the establishment of trading posts on Hudson Bay, along the Saskatchewan River, and in the Athabasca Region, the analytic task becomes as much historical as ecological. The principal acculturative forces introduced by the fur trade and the impact of those forces on traditional Chipewyan life remain matters of dispute. From our ecological perspective the most significant effect would appear to be a shift in settlement pattern from the transition zone to the boreal forest, and with it a lessening attachment to the caribou herds and a shift from an essentially hunting economy to a mixed hunting and trapping economy. There is danger in overgeneralizing here, however. Many Chipewyan groups did not move into the boreal forest. They maintained their attachment to the taiga and to the Barren Grounds. Moreover, there is considerable environmental variability over the expanse of territory, from the Hudson Bay Lowlands to the east, to the more open, sandy-soiled forest to the south, and the more densely wooded region around Slave River. It is in my view a mistake to treat the Chipewyan as a homogeneous population. Rather, on the basis of both environmental diversity and early historical accounts, it seems reasonable to view traditional Chipewyan life as possessing some sense of regional identity and some degree of regional diversity.

FOOTNOTES

1. The Dene Declaration, proclaimed at Fort Simpson, N.W.T. in July 1975, gives expression to Dene land claims. It contains a statement of rights and a proposed agreement with the Government of Canada. It is published by the Dene of the Northwest Territories, Box 2338, Yellowknife, N.W.T.

2. The notion of oecumene, expressed by Helm, was previously used by Birket-Smith (1929:31) in his ethnographic study of the Caribou Eskimos.

3. With respect to community development, a successional stage is characterized by a shifting of the balance between interacting species populations. A climax stage is one in which the interspecies population balance is relatively stable over a period of time. This rather contentious issue is dealt with at some length by McNaughton and Wolf (1973:340-394).

4. This distinction between the detached perception of the outsider and the involved perception of the native was first clearly expressed by Malinowski (1922). It was given more recent expression in terms of etic and emic perception by the linguist Kenneth Pike (1967).

5. A fascinating picture of the subarctic environment is provided by Fuller and Holmes (1972) in their book The Life of the Far North.

CHAPTER 2

TERRITORY, NOMENCLATURE, POPULATION

TERRITORY, NOMENCLATURE, POPULATION

The problem of identifying and naming particular regional Chipewyan populations and establishing their settlement pattern has long interested historians, with at best dubious results. In the absence of an understanding of how the Chipewyan saw themselves and named themselves, the attempt to pin names on particular groups approaches being a fruitless academic exercise. In the absence of adequate ecological and historical data, historical reconstruction has been able to produce little more than a few generalizations based on fragmentary evidence.

The name "Chipewyan", it is generally agreed, comes from the Cree description of this Northern Athapaskan group as "pointed skins". There is, however, some difference of opinion about the exact meaning of the term. According to Pettitot (1884), and Curtis (1928:3), the term "pointed skins" refers to the characteristic shape of the shirts worn by the Chipewyan. Curtis derives the name from the Cree Wichipwayaniwuk (pointed fur people). Thompson (Tyrrell, 1916:128) and Jenness (1972:385), on the other hand, ascribe the term to the form in which the Chipewyan dried their beaver skins. There is also the observation of Richarson (1851, vol.1:357) with reference to the Eskimo-style pointed skirts: "The Kutchin also wear these pointed skirts but they have not been adopted by the Hare Indians or any of the Chipewyan tribes, who in common with the more southern Indians cut

their shirts or frocks evenly round at the top of the thigh". Richardson (1851, vol.2:5) further offers the view: "The name Chipewyan... has rather, I believe, its origin in the contempt felt by the warlike Crees for the less manly 'Tinne, whom they oppressed by their inroads, before commerce introduced peace between them. Chi-pai-ak'-tim (you dead dog) is a most opprobrious epithet. The appellation of "slave", given to the Dog-ribs by the same people, whose war-parties penetrated even to the banks of the Mackenzie has a similar origin." The Chipewyan refer to themselves as - 'Dene, or 'Tinne ("the people") (Richardson, 1851, vol.2:2), with a prefix identification of groups from particular geographic regions.

During the early historical period the name commonly given to the Chipewyan by the Hudson's Bay Company traders was Northern Indians - a name consistently used by Samuel Hearne in the journal of his (1769-1772) journey to the Coppermine River and the Arctic Coast. The North West Company traders from Montreal, such as Alexander Mackenzie, used the term Chepewyan. By the time of George Simpson's appointment as Governor of the Athabasca Department for the Bay Company in 1820, the name Chipewyan had come into general use by the fur traders of both companies (Simpson, 1938).

The Woods Cree to the south were referred to as the Southern Indians or Home Indians by the traders on Hudson Bay, and as the Knisteneaux by the early Montreal traders. Richardson (1851,

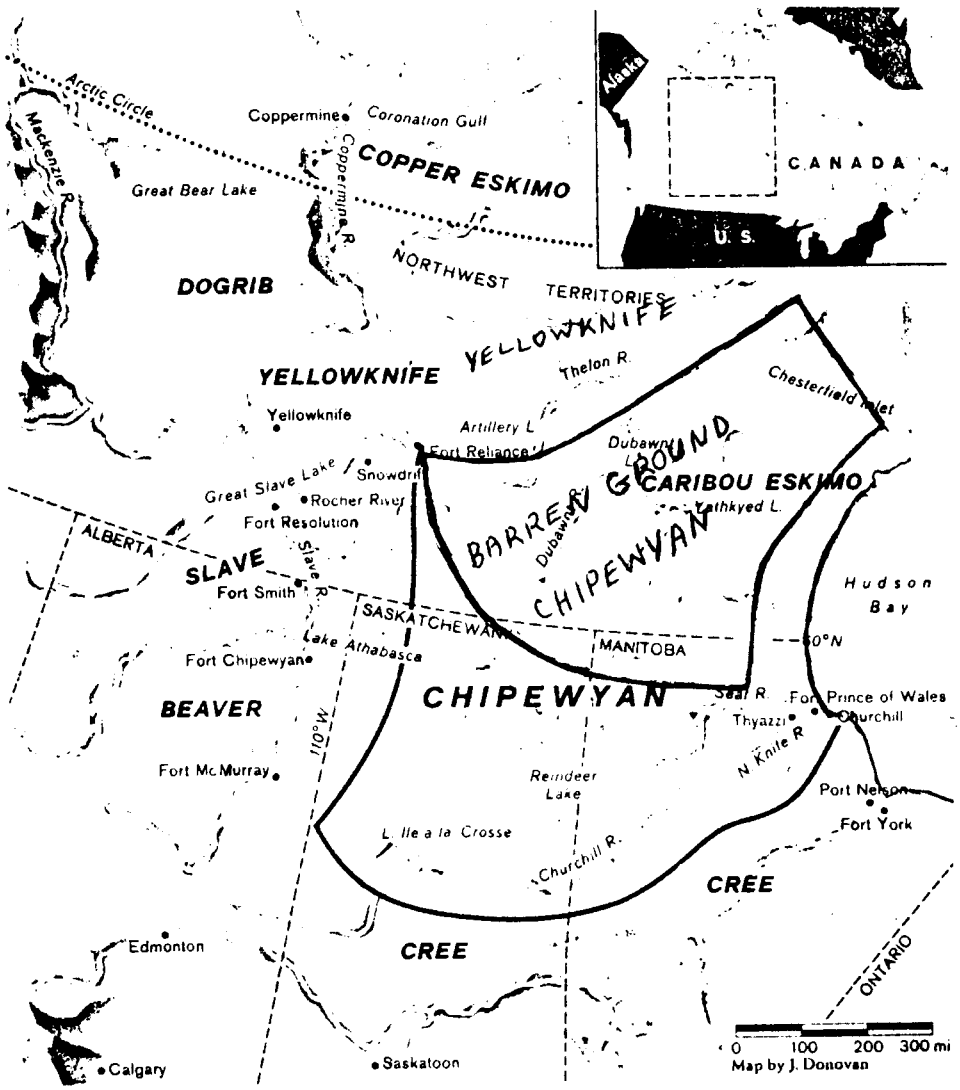
vol.2:33) refers to the Cree as the Eythinyuwuk. Thompson (Tyrrell 1969:104) speaks of the Cree as the Nahathaways. The third group of Indians trading into the forts on the Western shore of Hudson Bay, the Assiniboins from the plains and woodland around Lake Winnipeg were referred to by the Bay traders as the Half-Home Indians (Tyrrell, 1934:112, 167; Morton, 1973:153).

Despite these difficulties of nomenclature, a number of significant issues remain. What was the traditional territory of the Chipewyan? What were their relations with their neighbours? What degree of regional diversity characterized different Chipewyan groups? What of Cree territorial expansion in post-contact times? What of Chipewyan territorial expansion? What was the total Chipewyan population? And perhaps most significant, what degree of social disruption and population shift occurred with the Chipewyan during the furtrade period?

Territory (Figure 1)

The question of the traditional territory of the Chipewyan is perhaps needlessly complicated by our tendency to look for discrete boundaries between distinct tribal groupings. When we consider that the Chipewyan possessed no particular sense of tribal identity; that their ecological niche lay within the transition zone and the Barren Grounds; and that as relatively small-scale hunting groups they moved

Figure 1. The Territory of the Chipewyan.


Alaska
CANADA
U. S.
Arctic Circle
Coppermine
Coronation Gull
Mackenzie R.
Great Bear Lake
Coppermine R.
COPPER ESKIMO
NORTHWEST TERRITORIES
DOGRIB
YELLOWKNIFE
YELLOWKNIFE
Thelon R.
Chesterfield Inlet
Yellowknife
Artillery L.
Fort Reliance
Dubawnt L.
Great Slave Lake
Snowdrift
Rocher River
Fort Resolution
BARREN GROUND CARIBOU ESKIMO
Kathkyed L.
Dubawnt R.
ALBERTA
SLAVE
Slave R.
Fort Smith
CHIPEWYAN
Hudson Bay
SASKATCHEWAN
MANITOBA
60°N
Lake Athabasca
Fort Chipewyan
BEAVER
CHIPEWYAN
Seal R.
Fort Prince of Wales
Churchill
Thyazzi
N. Knife R.
110°W
Fort McMurray
Reindeer Lake
Port Nelson
Fort York
L. Ile a la Crosse
Churchill R.
CREE
CREE
ONTARIO
Edmonton
Calgary
Saskatoon
0 100 200 300 mi
Map by J. Donovan

through their annual cycle in pursuit of the migratory caribou herds, the picture looks rather different. Given the ecological richness of the taiga ecotone and the often commented upon vastness of the caribou herds, Burch (1972), adopting the concept of center of habitation, effectively makes the case for the ability of the transition zone to support a human population. Having such a distinctive habitat and adaptive pattern before the fur trade period, it would scarcely make sense for the Chipewyan to venture south of the winter range of the caribou into the full boreal forest. As relatively small, mobile hunting groups having no strong sense of territoriality (see Penard, 1929), in an area of some 150,000 square miles, the Chipewyan would only sporadically encounter hunting groups of their neighbours - the Cree to the south and the Caribou Eskimo to the north and east. In such circumstances it makes little sense to seek to establish firm territorial boundaries.

The earliest account[1] of the more easterly region of the territory is provided by Nicolas Jeremie (1926), written while he was stationed at Fort Bourbon during the years 1694 to 1714.[2] Jeremie provides the first description of the Barren Grounds as a country "very barren, without beaver", inhabited by a people who live on fish and caribou. These people, who lived beyond the "Danish River"[3] and the Seal River, and in whose country was a mine of pure copper, he refers to as Dogribs. This reference to the Dogrib relates to their coming on the tragic scene of the Danish explorer Jens Munck's ship the Unicorn at the mouth of the Churchill River in the year 1620.

Jenness (1972:427), however, casts doubt on Jeremie's use of the name Dogrib. Referring to the letters of Fathers Marest (1694) and La Potherie (1753), he concludes that the early fur traders in Hudson Bay often applied the name Dogrib to any Athapaskan-speaking people living west and northwest of the Cree. Jenness (1972:426) further asserts that by the end of the seventeenth century Seal River was certainly controlled by the Chipewyan.

The first recorded venture inland from Hudson Bay was that of Henry Kelsey in 1689. On June 17th of that year Kelsey, himself only nineteen years old at the time, set out from Churchill accompanied by an Indian boy by the name of Thomas Savage. Savage is described (Morton, 1973:110) as a Chipewyan who as a slave of the Cree had been taken to York Factory. Kelsey entitles his account of this journey A Journal of a voyage and Journey undertaken by Henry Kelsey to discover and endeavour to bring to a Commerce ye northern Indians Inhabiting to ye Northward of Churchill River and also ye dogside Nation. After venturing some 150 miles to the northwest of Churchill, on July 12th Savage out of his terror of meeting Eskimos, and with the expressed view that Kelsey was unaware of the dangers he faced, refused to go any further. At this point, Kelsey turned back, arriving at Churchill on July 28th to find that the newly built fort had burned to the ground. (I can find no record of the cause.) Although Kelsey had met no Indians on this journey, it is clear that by this time, 1689, a distinction had been made by the fur traders between the Dogribs and

the Northern Indians. Further, it was recognized that a third group - the Eskimo - also inhabited the area. The presence of the Eskimo was confirmed by Jens Munck's report of finding extensive remains of Eskimo habitation at the mouth of the Churchill River and by Joseph Robson's (1752) report of uncovering large quantities of Eskimo remains during the excavation for the stone Prince of Wales Fort. Further, Jeremie reports of the Eskimo coming regularly to Churchill River to obtain wood.[4]

The proximity of the Chipewyan to the region was confirmed by the appearance at York Factory of two Chipewyan women who had been slaves of the Cree and had escaped their captors. The first woman arrived at the Fort in the fall of 1714, just after Governor James Knight had reclaimed the fort from the French. She provided Knight with the first substantial information on the Chipewyan and their territory. Much to Knight's distress, however, the woman grew sick and on November 22, 1714, she died.

Two days later the other Chipewyan woman, the assertive Thanadelthur[5], arrived at the Fort. On hearing her account of the rich fur land and metal deposits of her people (suggesting to Knight both copper and gold), the Governor immediately decided to send William Stewart into the country of the Northern Indians (Chipewyan) with a two-fold purpose. He was to try to put an end to the fighting between the Cree and the Chipewyan and he was to encourage the

Chipewyan to come to trade at the Bay by telling them that the Company intended to establish a factory at Churchill the following year (1716). Knight moreover sent Thanadelthur with Stewart and indeed the success of the journey was due very largely to her perserverance and to the extraordinary influence and leadership that she exercised over both the Chipewyan and the Home Indians (Cree) who accompanied them.

As outlined by Morton (1973:133), Stewart's journey would seem to be confirmed by his report that they had crossed seventeen rivers beyond the Churchill, that after the third river they got out of the woods and returned to the woods at the thirteenth river. Beyond that to the seventeenth river the trees became progressively larger. This description and the time of the journey suggest that Stewart had travelled approximately 700 miles from York Factory to the region of the Slave River, to the south of Great Slave Lake.

There seems little doubt that Stewart had penetrated to the heart of Chipewyan territory, for on his return to York Fort he brought ten young Chipewyan men with him. Governor Knight's enthusiasm was such that in 1717 he sent Stewart to pick a site for a fort at Churchill River and at the same time sent a young apprentice, Richard Norton, to make "a great Sweep to the Southward of the West." Although there is no record of Norton's route, he did meet the Chipewyan (Rich, 1967:68), and established a peace between the Chipewyan and the Cree which for many years enabled the Indians of Great Slave Lake and

Athabasca to trade at Churchill and York Fort. According to Rich (1967:98) Governor Knight did establish a Fort at Churchill in 1717. and Indians from the north came to trade in the first year. Effectively, the middleman role of the Cree in the fur trade from the north had been broken. For Governor Knight the only disquieting note was that the ten young Chipewyan men, whom he had sent north to winter near Churchill so as to get them away from the Cree, were murdured by the Eskimo (Rich, 1967:98).

From the foregoing it would appear that in the region of Hudson Bay the Chipewyan occupied an uneasy position between the Cree and Eskimo. Historically there is no evidence that the Chipewyan had a secure hold on the Hudson Bay Lowlands. Moreover, ecologically, given the scarcity of caribou in this region, in precontact times the Chipewyan had little incentive to travel to the shore of Hudson Bay. This view would seem to be supported by Robson's (1752:63-4) observation that in the early contact period the Eskimo were driven north by the eastward movement of the Chipewyan. Certainly by the time of Hearne's journies in 1770 the Chipewyan were securely established in the region of Yathkyed Lake (White Snow Lake, in Hearne's journal, 1972:25) where they were well supplied with caribou, muskox, and fish. On August 19th, 1770, Hearne (1972:32) recorded the observation that: "In our way we frequently met with other Indians, so that scarcely a day passed without our seeing several smokes made by other strangers."[6]

With regard to the southern boundary, there is strong support for the view that traditionally the Churchill River separated the Chipewyan from the Cree. Hearne (1972:210), for example; Mackenzie, (Lamb, 1970:149): "It begins at Churchill, and runs along the line of separation between them and the Knisteneaux, up the Missinipi to the Ile-a-la-Crosse;" and Richardson (1851, vol.2:1): "'Tinne or "Dtinne, Athabascans, or Chepewyans. Under these national appellations I have to speak of a people whose southern border is the Churchill River, or the Missinipi, as it is termed by the Eythinyuwuk (Cree), to whom it is also a boundary line." Jenness (1972:424) assumes that in 1725 the Churchill River was the boundary between the Chipewyan and the Cree, and asserts that by 1750 it certainly was the case.

More recently, Gillespie and Smith (in Clark, 1975) have sought to establish that the Churchill River system was traditionally Cree country. Their case is to a great extent built on Wright's (1968) archeological evidence of Cree settlement in the region of Southern Indian Lake. Further support for their position might be gained from David Thompson's observations in the Muskrat Country[7] and in the regions around Reindeer Lake and Wollaston Lake in the years 1792 to 1797. Thompson states (Glover, 1962:72): "Having passed six years in different parts of this Region, exploring and surveying it, I may be allowed to know something of the natives, as well as the productions of the country. It's inhabitants are two distinct races of Indians; North of the latitude of fifty six degrees, the country is occupied by

a people who call themselves "Dinnie", by the Hudson Bay Traders "Northern Indians" and by their southern neighbours "Cheepawyans" whom I shall notice hereafter. Southward of the above latitude the country is in the possession of the Nahathaway Indians (Cree) their native name." And describing Reed Lake (1962:91), where he established a post for the Hudson Bay Company in 1794, he states: "This section of the Stony Region is called the Musk Rat Country and contains an area of about 22,360 square miles.... The Natives are Nahathaway Indians (Cree), whose fathers from time beyond any tradition, have hunted in these Lands." With reference to Reindeer lake, however Thompson (1962:125), speaks of: "My residence on Rein Deer's Lake which has become the country of the Chepawyans."

The suggestion raised here, of an earlier time when this region was occupied by the Cree is strengthened by Thompson's reference to the special significance which the Cree attached to Wollaston Lake and to the spectacular falls on the Black River. The special character of Wollaston Lake lay in the fact that it drains into both the Mackenzie and the Churchill drainage systems - to the west by Black River, or Fond du Lac River, into Lake Athabasca; to the east by Cochrane River to Reindeer lake at Brochet. On this account, states Thompson (Glover, 1962:111), it was called Manito Lake by the Cree. With regard to the falls on the Black River he states (1962:115): "The dashing of the water against the rocks, the deep roar of the torrent, the hollow sound of the fall, with the surrounding high, dark frowning

hills form a scenery grand and awful. and it is well named Manito Falls. While the Nahathaways possessed the country, they made offerings to it, and thought it the residence of a Manito[8]; they have retired to milder climates; and the Chepawyans have taken their place who make no offerings to anything; but my companions (two Chipewyan) were so awe struck, that the one gave a ring, and the other a bit of tobacco. They had heard of this Fall, but never saw it before."

Yerbury (1976), on the other hand, views the Cree in the early contact period (at least until Governor Knight's peace efforts in 1717) as having a much more aggressive and expansionary posture. He draws on the evidence of Knight (H.B.C. Arch. B 239/2:28) to the effect that a state of war existed between the Cree and the Chipewyan, and that the Cree, by this time equipped with rifles, had killed several thousand Chipewyan in the region of Churchill River.

The shifting boundary between the Chipewyan and the Cree, it appears, was also affected by the Westward push of the Cree. According to Jenness (1972:424), the Cree expansion westward and northward reached its greatest extent between 1750 and 1780. This view is supported by Mackenzie (Lamb, 1970:238): "When this country was formerly invaded by the Knisteneaux, they found the Beaver Indians inhabiting the land about Portage la Loche (Methy Portage)[9]; and the adjoining tribe were those whom they called slaves (Slaves, who at that time lived in the region of Lesser Slave Lake)." On his journey

to the Pacific Ocean in October 1792, Mackenzie observed the significance of the famous Peace Point on the Peace River: "On the 13th at noon we came to the Peace Point; from which, according to the report of my interpreter, the river dervies its name; it was the spot where the Knisteneaux and Beaver Indians settled their dispute." The date of this settlement is put by Jenness (1972:385) about the year 1760.

The westward advance of the Cree was followed within a very few years by the movement of the Chipewyan into the region around Lac Ile-a-la-Crosse and the headwaters of the Churchill River. From about the year 1775 onwards, with the proliferation of trading posts in the Saskatchewan and Athabascan regions, there seems to have been a progressive breakdown of territorial boundaries. Mackenzie (Lamb, 1970:73), for instance, relates Peter Pond's penetration to the Athabasca River, to the northwest of Lac Ile-a-la-Crosse, in 1778: "Here he passed the winter of 1778-9; saw a vast concourse of the Knisteneaux and Chepewyan tribes, who used to carry their furs annually to Churchill; the latter by the barren grounds, where they suffered innumerable hardships, and were sometimes even starved to death." David Thompson (Glover , 1962:397), records that, on June 6th, 1812, on his last journey to Montreal, he encountered between fifty and sixty small canoes of Chipewyan at Lac Ile-a-la-Crosse. The Chipewyan presence in the region of Berens House on the Athabasca River in the year 1820 is also recorded by Simpson (1938:46); "the

Chipewyans also frequently pass this place in the course of their winter hunt, both those belonging to Athabasca and Ile-a-la-Crosse."

To the west of Lake Athabasca the neighbours of the Chipewyan were the Beaver and the Slave - the Beaver occupying the territory between Athabasca River and Peace River to the western end of Lake Athabasca, and the Slave occupying the territory between Slave River and Hay River to the southern shore of Great Slave Lake. Until the early 1770's, and Samuel Hearne's return journey from the Coppermine River, the territory of the Chipewyan was confined on the west by Slave River and the eastern ends of Great Slave Lake and Lake Athabasca.

The changes which took place in the territory of the Beaver and Slave are outlined briefly by Goddard (1916:208-210). With the advance of the Cree along what Mackenzie referred to as the "war road of the Cree", from Lesser Slave Lake to Peace River Crossing, substantial territorial changes occurred. The Beaver became confined to the valley of the Peace River, the Slave to the lower Hay River and the Liard River, and the more westerly Sarcee were forced south onto the plains and became absorbed by the Blackfoot, Blood, and Piegan tribes (Lamb, 1970:117).

While these changes were occurring, Chipewyan expansion was also getting under way, led by Hearne's Chipewyan guide Matonabbee's

repeated ventures into the country of the "Athapuscow" Indians[10] to hunt moose and beaver (Hearne 1972:135. and 225-227). Other Chipewyan leaders were also engaged in this push to the westward. On one of his ventures into Athapuscow country around Great Slave Lake and Slave River Matonabbee came upon several tents in which he found one of his countrymen Captain Keelshies "who was then a prisoner (of the Athapuscows), with all his family and some of his friends (Hearne, 1972:225)." On another occasion (Hearne, 1972:175), on their return journey from the Coppermine River, on February 24, 1772, Hearne and Matonabbee encountered another Northern Indian leader Thlew-sa-nell-ie and several of his followers who were travelling westward. Thlew-sa-nell-ie gave them some tobacco and brandy which, according to Hearne, he had intended to be a present for the Southern Indians (Cree).

The westward expansion of the Chipewyan is confirmed by Simpson (1938:355) writing in 1821: "...they shook off their indolent habits, became expert Beaver hunters, and now penetrate in search of that valuable animal into the Cree and Beaver Indian hunting Grounds, making a circuit easterly by Carribeau Lake (Reindeer Lake), to the south by Ile-a-la-Crosse; and Westerly to the Banks of Peace River,... The greater proportion of them however remain on their own barren lands, where they procure sustenance with little exertion as the Country abounds with Rein Deer, and some years nearly the whole of them retire thither,..."

The Chipewyan presence to the east and Northeast of Great Slave Lake and their relationship with the Yellowknife and Dogrib Indians is discussed at some length by Gillespie (1969). The fact that the Chipewyan were no strangers to this region is clear from Hearne's account (1972:77): "Having arrived on the north side of this river (Conge-ca-tha-wha-chaga), we found that Matonabbee, and several others in our company, were personally acquainted with most of the Copper Indians (Yellowknives) whom we found there." The value of this region to the Chipewyan was to a great extent due to the role they were able to play as middlemen in the fur trade. An incident recorded by Hearne (1972:134) on October 23, 1771 tells the story:

> "On the twenty third of October, several Copper and a few Dogribbed Indians came to our tents laden with furs, which they sold to some of my crew for such iron-work as they had to give in exchange. This visit, I afterwards found, was by appointment of the Copper Indians whom we had seen at Congecathawhachaga, and who in their way to us, had met the Dog-ribbed Indians, who were also glad of so favourable an opportunity of purchasing some of those valuable articles, though at a very extravagant price: for one of the Indians in my company, though not properly of my party, got no less than forty beaver skins, and sixty martins, for one piece of iron which he had stole when he was last at the fort (Churchill)."

In summary, then, it appears that following the expansion westward and into the Peace River country of the Cree up to about the year 1770, the Chipewyan extended their territory considerably to the southward and westward. Undoubtedly two important factors in Chipewyan expansion were the pull of the fur trade into the boreal forest and the social and territorial breakdown of the Cree population

during the devastating smallpox epidemic of 1781-82. Other likely factors include the serious decline in the caribou population in the latter part of the 18th century, and the amalgamation of fragments of Chipewyan hunting groups with similarly decimated groups of Beaver, Slavey, and Yellowknife.

The relationship between the Chipewyan and the Caribou Eskimo would seem to have been one of mutual avoidance, coincidental to their differing annual cycles. When the Chipewyan went out into the Barrens during the summer in pursuit of the caribou herds, it was usual for the Caribou Eskimo to go to the coast of Hudson Bay to hunt sea mammals and to Churchill River or Baker Lake to collect wood. On the return of the Eskimo to the Barrens in the fall, most of the Chipewyan had retired to the edge of the boreal forest along with the main caribou herds.

The relationship seems to have been one of such hostility and distrust, though, that any encounter, whether deliberate or by chance, more often than not led to the stronger party massacring the weaker. Numerous such incidents have been recorded. Rich (1967:98) recounts the Eskimo massacre of the ten Chipewyans whom William Stewart had brought to York Fort. Hearne (1972:73-74) reports the singleminded intent of some 200 Chipewyan and Yellowknives who joined him at Clowey to murder the Eskimo on the Coppermine River. Peter Fidler (Tyrrell, 1934:532), just south of Great Slave Lake on December 20th, 1791,

reports: "...40 Tents of Chepewyans a little way to the Northward of us that they are returning from war with the Esquimeaux and had killed 5 Tents of those harmless inoffensive people." Yet another incident is noted by Glover (Williams, 1969:XLIV; Hearne, 1972:217n) where in the summer of 1756 at Knapps Bay on the Western shore of Hudson Bay, a party of Northern Indians had killed some forty Eskimos. Hearne, writing between 1782 and 1787, adds (1972:217) that although no Eskimo were seen at Knapp's Bay for several years after the incident: "For some time past, however, those Esquimaux who trade with our sloops at Knapp's Bay, Navel's Bay, and Whale Cove, are in perfect peace and friendship with the Northern Indians."

Nomenclature

A number of attempts have been made to locate particular Chipewyan groups within this expanse of territory. As suggested above (p.19), it is extremely difficult for the modern observer, excluded from the oecumene of the Chipewyan, with any assurance to identify local Chipewyan populations by name. About all that one can do, as emphasized by Sharp (personal communication), is to keep in mind that in such an exercise we are dealing with place names rather than the names of social groups, and that the common practice of the Chipewyan was to identify local populations by the territory over which they customarily roamed. With this reservation then, the settlement pattern which emerges is of the existence of two distinct groups in

pre-contact times, and, with the territorial expansion in the late eighteenth century, a splitting into four distinct groups.

In the early contact period the only distinction which was made was between the Northern Indians or Chipewyan, who roamed the edge of the forest and the Barren Grounds between Lake Athabasca and Hudson Bay, and the Yellowknife or T"atsanottine, in the region east and northeast of Great Slave Lake. There is however evidence to indicate that the Yellowknife were actually a branch of the Chipewyan. Franklin (1969:287), on his 1821 journey to the Arctic, states: "I shall now give a brief account of the Copper Indians (Yellowknives), termed by the Chipewyans, Tantsawhat-dinneh, or Birch-rind Indians. They were originally a tribe of the former people, and, according to their own account, inhabited the south side of Great Slave Lake, at no very distant period. Their language, traditions, and customs, are essentially the same with those of the Chipewyans, but in personal character they have greatly the advantage of that people." Jenness (1972:338) states much the same view, and adds that both were typically edge-of-the-woods people. Back (1970:457) states that the Yellowknives were practically wiped out by the Dogrib in 1823,and that at the time of his writing in 1833, they numbered no more than seventy families. A similar account is given by Richardson (1851, vol2:14).

With the territorial expansion of the Chipewyan in the late eighteenth century, four regional groupings emerged. In the

classification developed by Smith (in Clark, 1975:395-6), those who remained in their traditional territory and ranged across the Barren Grounds and down to Wollaston Lake and Reindeer Lake came to be known as the Etthen-eldeli-dene, or Caribou Eaters. Those who moved into the full boreal forest to the west of Lake Athabasca and Slave River came to be the Desnedekenade, "Great River People", or Athabascans. Those who moved into the lakes of the Upper Churchill River came to be known as the Thilanottine, "those who dwell at the head of the lakes." The other group was of course the few remaining T'atsanottine, or Yellowknives.

Another classification is provided by Curtis (1928:3) of regional groups which he claims to be recognized in the Cold Lake dialect. In Curtis' scheme, the Athabascans are referred to as Kai-theli-de-hotinne. The Thilanottine are the Kes-ye-hottine. The Ethhen-eldeli-dene are broken down into three groups:- Hathel-hottine ("people of the lowland") in the region of Reindeer lake; Gane-kuna-hotinne ("people of the jack-pine"), east of Lake Athabasca and centred at Fond du Lac; and the Sa-yisi-dene ("people of the rising-sun"), who roamed in the Barrens between Reindeer Lake, Hudson Bay, and Chesterfield Inlet. Also in Curtis' classification, the T'atsanottine, Yellowknife, are referred to as the Tandzan-hotinne.

An earlier classification by Richardson (1851, vol2:1-7) identifies three regional groups: the T-antsa-ut-'tdtinne

(Yellowknife), the Sa-i-sa-'dtinne (Caribou Eaters), and the group in the boreal forest whom he identifies simply as the Athabasca 'Tinne, or Chepewyans.

What has happened to the territorial distribution of the Chipewyan, then, is a shift into the boreal forest in the late eighteenth and early nineteenth centuries and a gradual abandonment of the Barren Grounds. This view is supported by Caspar Whitney's (1896) account of his journey to the Barren Grounds and by the brothers J.B. and J.W. Tyrrell. The Tyrrell brothers were the first Europeans to visit the Dubawnt and Kazan Rivers, in 1893 and 1894, since Samuel Hearne's visit 123 years earlier. J.B. Tyrrell (1911:5) states that: "Traces of old Indian encampments were seen in a few of the scattered groves that are growing along the banks of Dubawnt and Kazan Rivers, but these camps had evidently not been occupied for many years." Tyrrell's observations are recounted by Birket-Smith (1930:15).

A preliminary archaeological survey of this region is provided by Elmer Harp's (1962) paper "The Culture History of the Central Barren Grounds." From Harp's investigation, carried out in 1958, it is clear that there is much to be gained in understanding the chronology of Barren Ground settlement from more extensive archaeological investigation of the region to the west of Baker Lake and including the Thelon, Dubawnt and Kazan River systems. Harp postulates five cultural phases in the central Barren Grounds. Phase 1: beginning

some time after 3,000 B.C., an early Indian hunting culture adapted to the transitional zone but equipped for summer caribou hunting on the tundra. Phase 2: beginning around 1,000 B.C., the Pre-Dorset Eskimo culture, centered at the western end of Baker Lake. Phase 3: an archaic stage of Indian hunters, beginning in the first millennium A.D. and derived from the same basic interior tradition as phase one. Harp offers the view that it is this phase which constituted the origins of the Chipewyan presence in the region, in particular, the Etthen-eldeli or Caribou Easters. Phase 4: the Thule Eskimo tradition dated roughly from A.D. 1200-1400. Phase 5: the Caribou Eskimo tradition of the historical period, derived from the earlier Thule tradition. In this phase Harp draws support from the ethnographic work of Birket-Smith (1929).

Building on the pioneering work of such as MacNeish (1951) and Harp (1962), Noble (1971) addresses the basic archaeological problem of establishing an accurate chronological-cultural sequence of aboriginal occupation of the subarctic. In Noble's comprehensive survey there emerge three main traditions (tradition defined as "a distinct way of life reflected in the diagnostic material culture of a series of generically related complexes, which persist through appreciable time and across space", Noble 1971:104). According to Noble, the evidence establishes the existence of the Acasta Lake Complex (circa 5000 B.C.), some 80 miles southeast of Port Radium; the Canadian Tundra Tradition (1200 B.C.-200 B.C.); and the Taltheilei Shale Tradition (200 B.C.-1830 A.D.).

In Noble's interpretation of the evidence, the earliest settlement of the subarctic occurred through the northward migration of Plano peoples in the period 8000 B.C. to 5000 B.C. in the more westernly part of the region - a pattern which is in accord with the findings at Acasta Lake and also with the very recent retreat of the continental glacier. Noble further asserts the importance of Artillery Lake as one of the northernmost crossroads for southern Indian advance onto the Barren Grounds since about 3000 B.C. The earliest northward penetration of central Keewatin, Noble puts tentatively in the period from 7000 B.C. to 5000 B.C. While acknowledging the tentative nature of Noble's work, one senses that the general historical problem of Chipewyan settlement in the subarctic will be well served by the more extensive identification and analysis of archaeological complexes in the region.

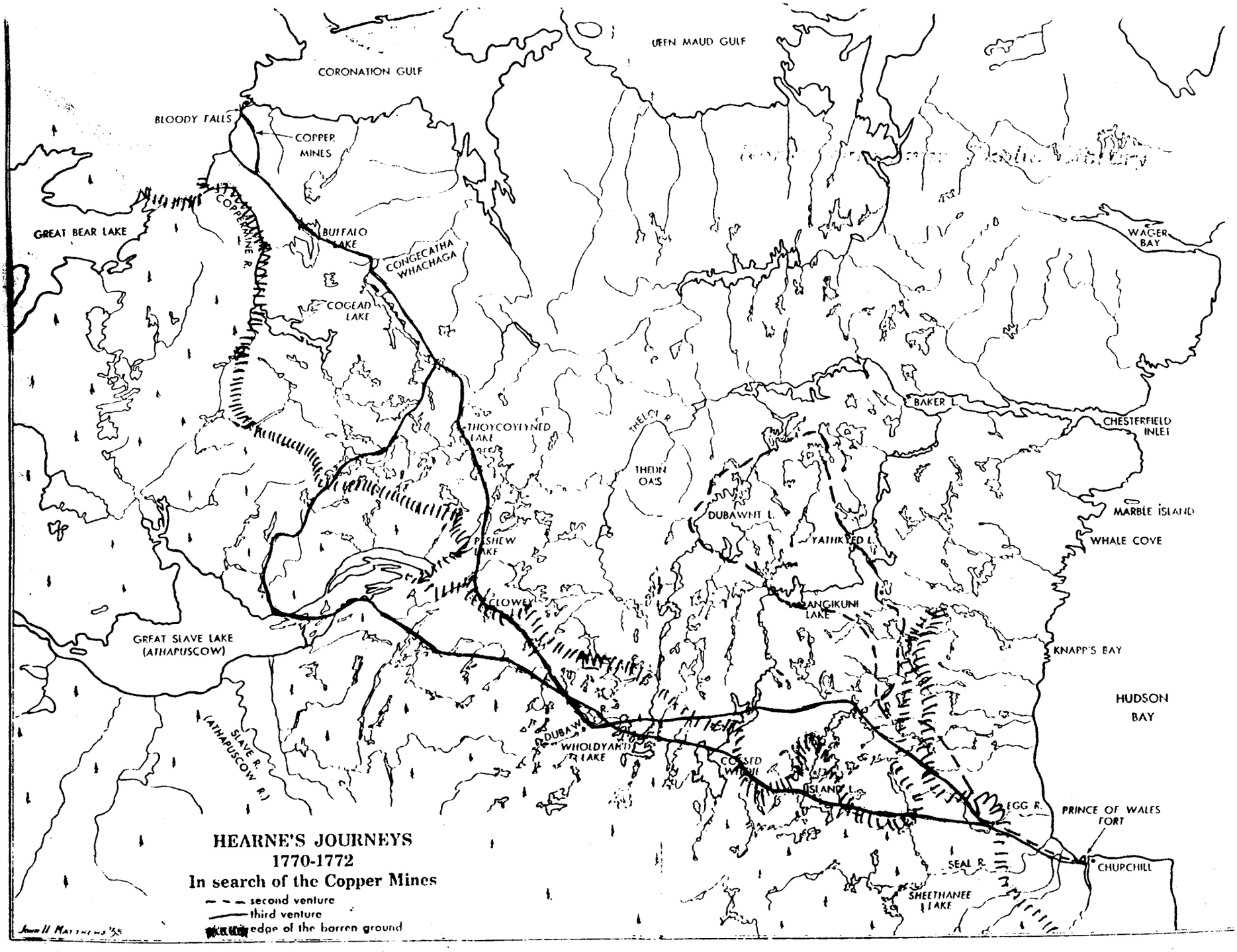
Population

In this general context of Chipewyan territory, and territorial shifts, we can try to make some assessment of population density and total population. Given the paucity of information from early contacts, such an assessment cannot be other than speculative, and it can be based on only two considerations - on the most reliable early observations, and on some general sense of the ability of the environment to support a human population.

The most valuable early accounts of Chipewyan life are provided by Samuel Hearne in the years 1869-1772, Alexander Mackenzie, 1789-1793, and David Thompson, 1792-1797. Hearne (Figure 2), since he lived with the Chipewyan during the two and a half years of his epic journey to the Northern Ocean, provides the clearest picture of Chipewyan life. Beginning on November, 1769, from Prince of Wales Fort (Churchill), and enduring at times extreme hardship and distress, Hearne succeeded in reaching the mouth of the Coppermine River only on the third attempt. He finally returned to Prince of Wales Fort on June 30th, 1772.[11]

From the picture of traditional Chipewyan life provided by those three early observers, it is clear that the basic subsistence unit of the Chipewyan was the "tent", to use Hearne's and Thompson's term, or the "lodge", to use Mackenzie's term. The tent, which consisted one or two hunters and all those immediately dependent on them, provides a clear means of indicating both the concentration and the dispersal of population. The tent, as the basic identifiable unit within the exploitative pattern of the Chipewyan, possessed the two characteristics most necessary to survival in a subsistence way of life - mobility, and the ability to coalesce into camps of variable size, usually in relation to resource concentration. It is this kind of flexibility of hunting group size and the intercommunication of numerous such groups which enabled a relatively small population to exploit caribou herds over a considerable expanse of territory. Sharp (1977) views

Figure 2. Samuel Hearne's Coppermine Journey, 1770-1772.


QUEEN MAUD GULF
CORONATION GULF
BLOODY FALLS
COPPER MINES
COPPERMINE R.
GREAT BEAR LAKE
BUFFALO LAKE
CONGECATHA WHACHAGA
COGEAD LAKE
WAGER BAY
BAKER L.
CHESTERFIELD INLET
THOYCOYLYNED LAKE
THELON R.
THELON OA'S
DUBAWNT L.
MARBLE ISLAND
WHALE COVE
YATHKYED L.
PISHEW LAKE
CLOWEY LAKE
ANGIKUNI LAKE
GREAT SLAVE LAKE (ATHAPUSCOW)
KNAPP'S BAY
HUDSON BAY
SLAVE R. (ATHAPUSCOW R.)
DUBAWNT R.
WHOLDYAH LAKE
ISLAND L.
EGG R.
PRINCE OF WALES FORT
SEAL R.
CHURCHILL
SHEETHANEE LAKE
HEARNE'S JOURNEYS
1770-1772
In search of the Copper Mines
second venture
third venture
edge of the barren ground

this basic adaptive pattern as a strategy of simultaneous concentration and dispersal of hunting units. The necessity of such a strategy is indicated in Burch's (1972:364) emphasis on the fact that in any particular locality the caribou population undergoes marked fluctuations, from season to season, from year to year, and also over longer periods of several human generations. It is such a general adaptive pattern that best serves the survival needs of a small population in an uncertain environment and that essentially characterized Chipewyan life in the transitional zone.

Hearne's repeated references to the number of tents he encountered within the transition zone give the picture of a sparsely inhabited territory with highly variable population density: (1972:5) "...we met a stranger, a Northern Indian, on a hunting excursion; ...there was only one man and three women at the tent;" (1972:32) "In our way we frequently met with other Indians, so that scarcely a day passed without our seeing several smokes made by other strangers"; (1972:63) "During our stay at Clowey we were joined by upward of two hundred Indians from different quarters"; and at Dubawnt River to the north of Cathawhachaga (Kazan River); (1972:25) "In a few days, many others joined us from different quarters; so that by the thirtieth of July we had in all above seventy tents, which did not contain less than six hundred persons."

David Thompson, within the boreal forest, on his journey from Reindeer Lake to Lake Athabasca by the Black River in 1796, was travelling through even more sparely-settled country than was Hearne. Thompson reports (Glover, 1962:117): "On the 25th June we came to three tents of Chepwayan Indians of five families, they were clean, comfortable, and everything in good order." Thompson also provides an indication of population density (Hopwood, 1971:122): "The Musk Rat Country, of which I have given the area, may have ninety-two families, each of seven souls, giving to each family an area of 248 square miles of hunting ground, or thirty-five square miles to each soul, a very thin population."

Although it scarcely makes sense to speculate on the "typical" camp size in such a variable subsistence pattern, the size of group which Thompson describes would appear to be well-suited to the kinds of exploitative techniques described by those early observers. It fits in well with Sharp's (1977) observation that an increase in the size of the hunting unit imposes a greater burden in terms of the number of persons to be fed, but it does not significantly increase the size of territory which the hunting unit can exploit. It also corresponds rather closely to Steward's idea of a minimum subsistence group and to Birdsell's model of 25 persons (Lee and Devore, 1972:331). In this optimizing of hunting group size, in Steward's view (Lee and Devore, 1972:330), lower limits on group size are set by the specialized functions of subsistence activity and by the demands

of child rearing; upper limits are governed by the problems of exploiting a wider environment and by the problems of transportation.

A number of attempts have been made to estimate the precontact Chipewyan population. The most widely accepted estimate is that provided by James Mooney in the context of his survey of the aboriginal population of North America. Mooney (1928:25-26), taking the year 1670 as a reference point, postulates a population for Central Canada (between the Ontario Border and the Rockies) of 51,000. Of this number, he estimates a Chipewyan population of 3,500, made up of 2,250 Chipewyan and 1,250 Caribou Eaters. He puts the Yellowknife population at 430. Mooney qualifies his figures by pointing out that, mainly due to warfare and disease, there was a drastic population decline in the late eighteenth and early nineteenth centuries.

Slightly higher is the estimate provided by Morice (1905) of 4000 Chipewyan, 1700 Caribou Eaters, and 500 Yellowknives. Figures compiled by Captain Lefroy in 1844 on the basis of Hudson's Bay Company trading post records, and quoted by Petitot (1884:53) are as follows: "The enumeration of the Tinney under various subdivisions comes to 1592 men, estimated to represent 7575 souls. To these were added, at Fort Chipewyan, Lesser Slave Lake, and Ile-a-la-Crosse, 209 families of the Crees, estimated at 1081 souls. The Indians have apparently, therefore, decreased in numbers since 1844." The

comparison which Petitot had in mind is with his own observations (1884:52): "There were 900 Chipewyans and 300 Crees at Fort Chipewyan in 1862, but in 1879 I could only find 537 Chipewyan and 86 Crees, even including those living on the River Athabasca." Petitot adds that due to an extraordinary drop in the water levels of rivers and lakes over a number of years, and consequent drastic decline in animal and bird populations, a great many Indians died of starvation in the years 1879 to 1881. Another factor, not taken into account by Petitot, is the likelihood that in this period many Chipewyan did not travel to the trading posts.

More recent attempts at estimating population have been based much more on the productive capacity of the natural environment. An indication of population density can be gained from the comparisons of Kroeber (1939) for North America as a whole. Kroeber's figures for the Northwest Coast, for example, are a total population of 129,200 and a population density of 28.30 per 100 km^2; for the Western subarctic, a total population of 33,930 and a density of 0.87 per 100 km^2; and (relying largely on Mooney) for the Chipewyan a total population of 3,500 (2,250 Chipewyan and 1,250 Caribou Eaters) and population densities of 0.36 per 100 km^2 and 0.32 per 100 km^2. According to these figures we are indeed looking at a land that was but sparsely inhabited.

More recent attempts to deal with the problem of estimating aboriginal populations include those of Birdsell (1958), Dobyns (1966), and Thompson (1966). Birdsell, in his theoretical paper "On Population Structure in Generalized Hunting and Collecting Populations", bases his approach on the assumption that populations of hunting and collecting peoples are essentially stable, and are in equilibrium with the carrying capacity of the country. He develops this approach in terms of what he perceives to be stabilizing factors - such factors as territoriality, population dynamics, and cultural cohesion. Dobyn's paper provides a comprehensive appraisal of current techniques of estimating population.

Of special interest for this thesis in that it deals specifically with the Chipewyan, is Thompson's paper entitled "A Technique Using Anthropological and Biological Data." Thompson states his approach thus: "The basic idea utilized by this paper is that of man contributing to the ecological population equilibrium of a resource which he utilizes. If the other non-human factors leading to equilibrium can be evaluated, then the remaining human factors will be ascertainable." On the basis of a utilization coefficient of 141 caribou per tent over the year,[12] Thompson projects an expected number of 756 tents, and a "maximum likelihood estimate" for the Chipewyan population of 6,426 with a lower bound of 4,670 and an upper bound of 10,652.

On balance then the most likely estimates of precontact Chipewyan population fall within the range of 3,500 to 7,000, with overwhelming evidence of a drastic decline in the post-contact period. A possibility which, in my view, cannot be discounted, however, is that in precontact times the caribou population of the region was indeed larger than recent estimates suggest. In such a circumstance, it would not be unreasonable to suppose a precontact Chipewyan population of 10,000 or more. To my knowledge, though, there had been no serious attempt to analyze Chipewyan population in terms of limiting factors operating within their ecological niche.

FOOTNOTES

1. Yerbury (1976), quoting Rich, notes an earlier attempt in 1680 by the Hudson Bay Company to establish contact with the Northern Indians.

2. Fort Bourbon was in fact the English York Fort during the period of its possession by the French. Jeremie's observations are recounted by Arthur Dobbs in his history of the Hudson's Bay Company's territories published in 1744, and by Morton (1973:121) and Jenness (1972:426).

3. The Danish explorer Jens Munck, with his two ships Unicorn and Lamprey, had wintered at the mouth of Churchill River in 1619-1620. They were so ill-prepared for the winter that over 100 men perished. Only Munck and 2 other crew members survived. The following summer the 3 survivors managed to sail the Lamprey back to Denmark.

4. Burch (1972:349) discusses the presence of the Caribou Eskimo in this region at a somewhat later date. Yerbury (1976:18 note 2) comments on the early references to Dogrib Indians in the region of York Fort before the year 1717.

5. An interesting sketch of Thanadelthur is provided by Sylvia van Kirk, The Beaver, Spring 1974, pp.40-45.

6. See also Simpson (1843:74) and Birket-Smith (1930:34).

7. The Muskrat country of the fur traders lay eastward of Sturgeon-weir River, and between the Churchill and Nelson Rivers.

8. The Cree believed in the existence of Manitos, as the super-natural guardians and guides of every species of bird or animal.

9. Portage la Loche, or Methy Portage, situated between Lac Ile-a-la-Crosse and the Clearwater River leading into Athabasca River, is significant in that, on the main trade route of Athabasca, it is the height-of-land between the Churchill drainage and the Mackenzie drainage.

10. The Athapuscow Indians of whom Hearne speaks lived at the southern end of Great Slave Lake and to the west of Slave River. Rich (1960, vol2:56; 1967:149) refers to these people as Slaves. Morton (1973:295), on the other hand, claims that they were Cree who were at that time taking possession of the region. Hearne is somewhat confusing on the matter. At one point (1972:84n) he speaks of "Most of the Southern Indians, as well as the Athapuscow, and Neheaway tribes..." On numerous other occasions, however, he appears to equate the Athapuscow Indians with the Southern Indians (Cree) - for example, (1972:115n, 171n), and

p.174) on their failing to meet up with the Athapuscows he refers to their being "disappointed in our expectations of meeting the Southern Indians." On balance the Athapuscows of Hearne's time would indeed appear to have been Cree. Yerbury (n.d. note 7) quotes Wright (1975:142) to the effect that there is no archaeological evidence of a prehistoric Cree presence in the region of Lake Athabasca.

11. Not on June 30, 1773, as stated by Rich (1967:149).

12. The question of the number of caribou required to support a hunting group is open to dispute. Burch (1972:362). for example, quoting Lawrie and Kelsall, suggests a basic requirement of 50 caribou per person per year.

CHAPTER 3

NATURAL ENVIRONMENT

NATURAL ENVIRONMENT

General Characteristics. In looking at the territory of the Chipewyan, it is necessary to keep in mind that it is a region characterized by indefinite and shifting boundaries, and a region that in its broad range contains considerable diversity. We can of course point to the dominant environmental features of the region as being characteristic of a transitional zone - of an "edge-of-the-forest" or taiga environment existing between two distinct biomes, the tundra or treeless rocky plain to the north and east, and the generally sandy-soiled full boreal forest to the south and west.

A succinct description of this taiga zone is provided by Rowe (1972:62): "The transitional zone between subarctic forest and tundra stretches across northern Canada from the Mackenzie Delta to James Bay, thence to Ungava Bay and the Atlantic Coast. Such a broad geographic range inevitably includes a great diversity of environments, but the overriding influence of climatic severity has produced a similarity of vegetational structure throughout. This consists of a pattern of tundra "barrens" and patches of stunted forest, the latter usually but not exclusively along the shores of lakes and rivers and the former on the upland interfluves. The pattern shows a gradient change from south to north as forests shrink and tundra expands."

A reasonable understanding of this environmental pattern requires essentially two things - the identification of the structural and dynamic forces which shape the environment and the delineation of the distribution patterns of flora and fauna in relation to their environmental preferences and tolerances. From the ecological perspective of this thesis we are essentially concerned with elucidating the dynamics of the natural environment. In this approach the natural environment is viewed as being constituted by the interactions of five principal elements - the topographic features of the region, the interaction of soil, permafrost, and vegetation, the climate, the length of the growing season, and the distribution of vegetation and wildlife.

Of fundamental importance for the understanding of northern ecosystems are the question of the degree of ecosystem instability and the question of whether or not environmental oscillations are mainly of longterm or of short term duration. No less important in evolutionary terms is the related question of whether selective pressures operating on populations favour adaptation towards coping with ecosystem oscillations or favour increased ecosystem stability. In this ecosystem context, such issues as adaptation to low temperature would seem to be less significant than the overall questions of ecosystem stability or instability. In shaping the subarctic environment, the factor of overwhelming importance would appear to be what Dunbar (1968) has termed the Pleistocene event - a

succession of profound climatic changes and periods of continental glaciation, the last of which has receded only within the past 5,000 to 7,000 years.

From the point of view of traditional Chipewyan adaptation within the transition zone, a central problem is whether or not the environment has undergone pronounced changes over the past few hundred years. Although a satisfactory resolution of this problem awaits a great deal more paleoclimatological and paleoarchaeological research, the limited availabe evidence would seem to point to substantial environmental changes.

One of the more notable characteristics of the environment is undoubtedly the subarctic limits of forestation, that is to say, the treeline. The generally accepted delineation of the treeline at the present time is that of J.S. Rowe (1972), of the Canadian Forestry Service. It is characteristic of the treeline, however, that it is lacking in definition and in many areas may deviate up to 50 miles on either side of a designated line. Moreover, there are indications that the position of the treeline has undergone pronounced changes. Bryson et al (1965), for instance, argue on the basis of radiocarbon dating that in the period from 1,500 B.C. to 1,000 A.D. the treeline had twice advanced some 280 kilometers north of Ennadai Lake and in the intervening period had retreated considerably south of Ennadai Lake. Such changes, if substantiated, would be strong evidence of rapid environmental change in the region.

There as yet appears to be no clear understanding of what combination of factors governs the position of the treeline. It can be noted, however, (Figures 4 and 8) that the present position of the treeline coincides rather closely with the southern limits of continuous permafrost. Bryson (1965:47) observes also that the treeline coincides with the summer interface between the arctic airmass and the continental air mass, and he points out that the position of the treeline in the past has been greatly affected by forest fires. With respect to climate, Irving (in Beals, 1968:52) indicates a cooling period from about 1,100 A.D. on and mentions the "Little Ice Age" in the 18th century.

Although a great deal more evidence is needed to substantiate the thesis of pronounced environmental change in the subarctic, Dunbar (1968:4) offers the view that northern ecosystems are best interpreted as being youthful and immature and of imperfect adaptation to recent environmental changes. One factor of particular importance in Dunbar's view is that the there has been little time since glacial retreat in the region for soil formation - an essential component of terrestrial ecosystem development. Further, in Dunbar's view (1968:90), despite the fact of low species diversity in northern latitudes, the relatively large number of morphs (i.e. intraspecific variants) present implies ecosystem immaturity and ecosystem development. The position of the treeline or transition zone within the Canadian Shield can be seen from a comparison of Figures 3 and 4. The interaction of soil, permafrost, and vegetation in the formation of the environment is illustrated in Figures 5 and 6.

Figure 3. The Canadian Shield: exposed and bordering buried sector.


0
1000
Miles
EXPOSED SHIELD
BURIED SHIELD

Figure 4. The tree-line in Canada.

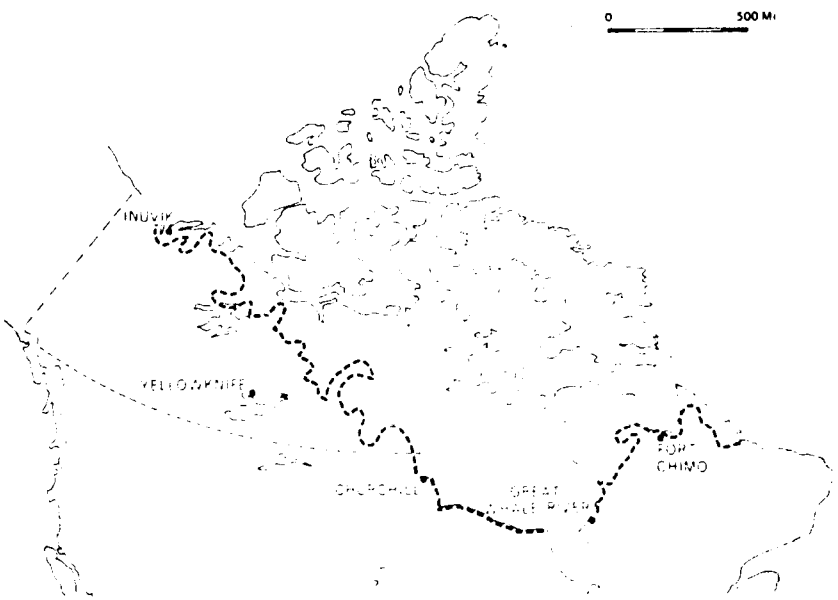

0
500 MI
INUVIK
YELLOWKNIFE
FORT
CHIMO

Figure 5. Vegetation and permafrost relationships in Subarctic Canada (after Brown).

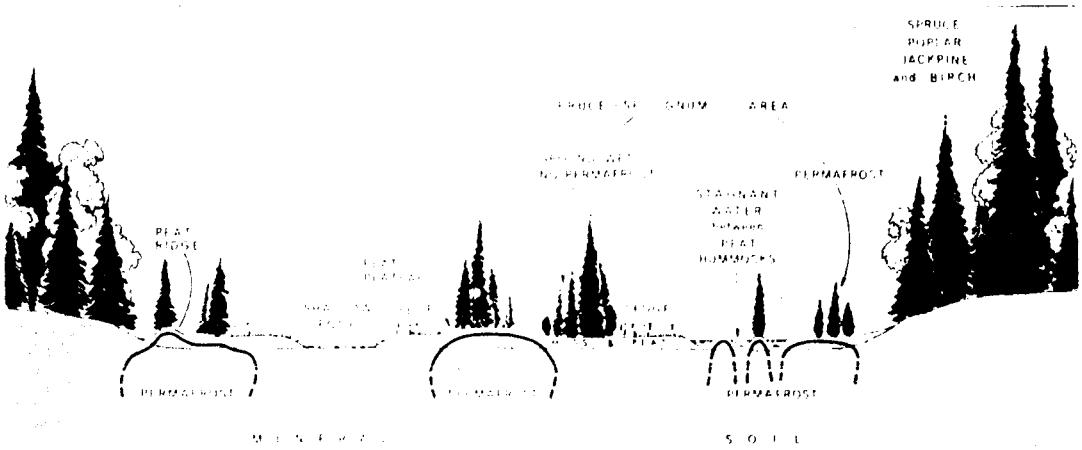
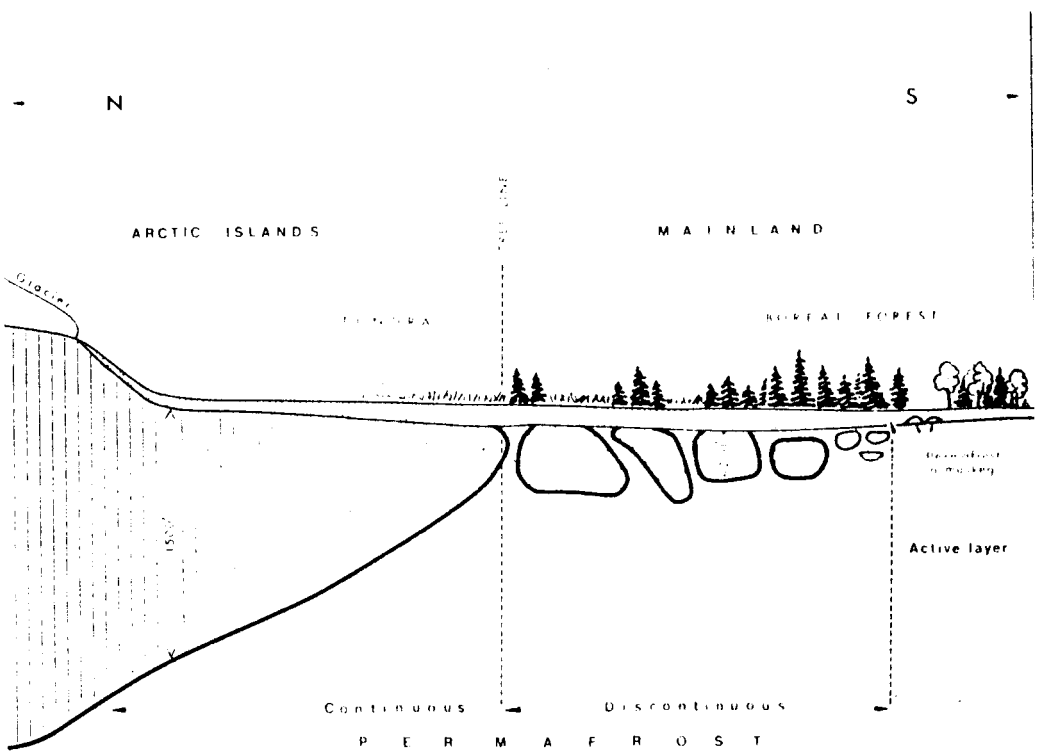

SPRUCE
POPLAR
JACKPINE
and BIRCH
PEAT
MOSS
PERMAFROST
PERMAFROST
PERMAFROST

Figure 6. A transect of permafrost conditions along a meridian in northwestern Canada.


N
S
ARCTIC ISLANDS
MAINLAND
Glacier
BOREAL FOREST
Active layer
Continuous
Discontinuous
P E R M A F R O S T

Geomorphology and Topography: The base on which the taiga environemnt has formed is, of course, the very extensive and very old Precambrian rock. It is essentially in the interaction of this rock base with the repeated processes of glaciation and deglaciation that the geomorphology and topography of the region have taken shape.

As R.B. Flint (1952) points out in his important summarizing paper "The Ice Age in the North American Arctic", relatively little work has been done in understanding the processes of glaciation in the Canadian north. The continental theory of glaciation, first proposed by the American geologist Louis Agassiz, gained some prominence in the 1890's and in the years since has met with general acceptance. Although a great deal of work remains to be done in this area, extensive geological exploration, mainly under the direction of the Canadian Geological Survey, has produced substantial evidence in support of the glaciation theory. The first extensive field work is that of Warren Upham's investigation of the Lake Agassiz Basin in Manitoba, published in 1890. At about the same time, further evidence came from the very extensive geological fieldwork (extending over five field seasons) of J.B. Tyrrell and his assistant D.B. Dowling. As J. Warkentin (1964:280) points out, one of Tyrrell's important contributions was to locate one of the last centres of glaciation in North America in the Barren Grounds of Keewatin, which he named Keewatin Centre.

The general picture of continental glaciation which has emerged is summarized by Flint (1952). It seems generally accepted that there have occurred a succession of four glacial ages and three interglacial ages throughout the Pleistocene epoch. The existing evidence suggests that the interglacial periods were of considerably longer duration than the glacial periods - of the order of 200,000 to 300,000 years for each interglacial period compared to some 100,000 years for each of the glacial periods, according to Flint. Although, if as is generally believed the most recent glacial retreat occurred over a period of 5,000 to 7,000 years, these timespans for glacial and interglacial periods would appear to be much too large. The possibility cannot be ruled out, however, that the processes of glaciation and deglaciation have been in fact much more dynamic than has been supposed. Indeed, Flint suggests further that throughout the Pleistocene epoch there is likely to have been a continual fluctuation in the mean annual temperature of the region of the order of $10^{o}C$. He favours the view that in glacial periods the mean annual temperature dropped some $8^{o}C$ below the present mean annual temperature for the region and that in interglacial periods the mean annual temperature rose some $2^{o}C$ above its present level.

Although this view requires substantial verification, it does suggest that there are reasonable grounds for indicating some correlation between long-term temperature fluctuations and glaciation processes. Indeed, the argument is made that such long-term

temperature changes constitute the driving force of the entire glaciation process. The probability of this is strengthened, it seems to me, by the fact that temperature is very clearly the main controlling factor in the distribution of flora and fauna. The evidence for long-term temperature fluctuations again as Flint points out, is very clear. There are three main factors which have a demonstrated effect on temperature. One factor is that temperature changes in response to changes in the elevation of land associated with changes in the earth's crust and changes in the pressure exerted by glacial ice. Another is that temperature changes in response to changes in the intensity of radiant energy emitted by the sun. Thirdly, temperature is influenced by the relative mass of glacial ice.

Considering then the indications of both long-term and short-term temperature fluctuations and the wide-ranging geological and biological effects of such fluctuations and considering the fact that the Canadian taiga is itself a transitional zone, I am of the view that the natural environment of the Chipewyan is and has been highly unstable, and that such environmental instability has required a high degree of adaptability in its inhabitants. Of crucial importance for this thesis of environmental instability is the fact, noted above, that the latest glaciation of the Canadian Shield has receded only very recently, and might in fact be still receding. This most recent continental ice sheet has been variously named the Laurentide Ice

Sheet (G.M. Dawson, 1890), the Keewatin Glacier (J.B. Tyrrell, 1896), and the Wisconsin Glacier (F.K. Hare, 1950 and others).

As the Danish ethnographer Kaj Birket-Smith (1933) has emphasized, the processes of glaciation and deglaciation have had a profound effect on the landscape of the Canadian Barren Grounds and taiga. This can perhaps be appreciated when it is considered that at its full extent the continental ice sheet covered some millions of square miles and is estimated to have attained a thickness of up to 10,000 feet. Little wonder then that the scouring action of the retreating glacier should have denuded vast areas of the Barren Grounds of its pre-glacial top soil, leaving little more than bare Precambrian rock. The sheer mechanical force exerted by the retreating ice sheet is seen in the gouging out of the large lakes and river systems which extend over the whole region.

It has also been noted by Flint (1952) and others that the surface elevation of the Shield above sea level has increased considerably since the pressure of ice was removed and that the elevation is expected to continue increasing to the extent of several hundred more feet. Related to this is the geological evidence that all of the large lakes in the region are in fact glacial lakes and that in earlier times they were very much larger than they are today. Most notable among these are Great Bear lake, Great Slave Lake, Lake Athabasca, Lesser Slave Lake, Wollaston Lake, Reindeer Lake and Lake

Winnipeg. There was also, of course, Lake Agassiz in Manitoba, which dried up completely. And apart from these, there is the fact that Hudson Bay is now very much smaller than in earlier times and is thought to be still shrinking.

We see then the topography of the region being formed in direct response to those protracted glacial forces. There have formed within the region five major drainage systems - the Back River, the Coppermine River, and the Mackenzie River, all flowing north into the Arctic Ocean; the Thelon, Kazan and Dubawnt Rivers draining into Baker Lake and Chesterfield Inlet; and the Churchill drainage system flowing east directly into Hudson Bay. The Mackenzie drainage system is fed by three very large lakes - Lake Athabasca, Great Slave Lake, and Great Bear Lake. In the Churchill drainage system there are three fairly large lakes - Wollaston Lake, Reindeer lake, and South Indian Lake. On the Barren Grounds, and draining into Baker Lake, are Dubawnt Lake, Kasba Lake, and Nueltin Lake. There are moreover a number of lakes which occupy the distinctive position of draining into two river systems. This is the case, as has been mentioned earlier, with Wollaston Lake which drains into both the Churchill system and the Mackenzie system. It is characteristic of most of the rivers in this region that their course includes innumerable rapids and small lakes. Indeed, the innumerable small lakes in the region, as seen, for example, in the aeronautical chart WAC D-13 (Department of Energy, Mines and Resources), are no less a consequence of glacial processes than are the major drainage systems.

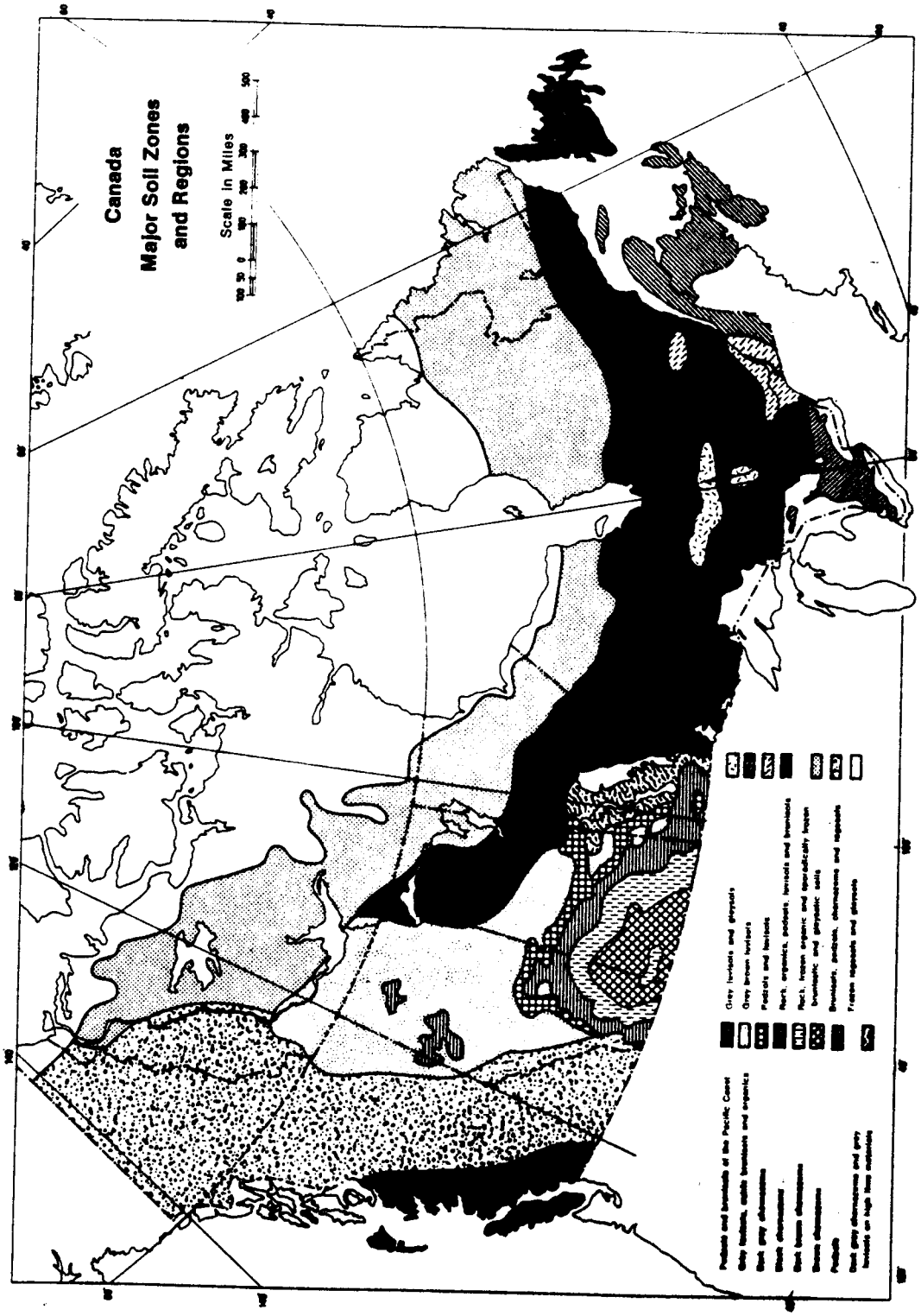
The difference in land forms between the Barren Grounds and the taiga is particularly striking in the region of Great Slave Lake and the north side of Lake Athabasca. The most careful early observation is recorded in the 1820 geological account of Dr. John Richardson. As a member of the Franklin Expedition, travelling from York Factory to Cumberland House, Fort Chipewyan, Fort Enterprise, the Coppermine River and to the Arctic Coast, Richardson (1851) makes the following observation:

> In Athabasca Lake we again came upon the edge of the primitive formation. The country around Fort Chipewyan is composed of roundish masses of naked rock, which heaped, as it were, on each other, and rising as they recede from the lake, attain, at the distance of a mile from the shore, an elevation of five or six hundred feet. The valleys are narrow, their sides often precipitous, and the general form of the hills may be termed short conical, but their outline is very uneven. The rocks also form many islands in the lake from two to three hundred feet high, and generally bounded on one or more sides by precipices. The Fort seems to stand upon a granite rock.

The attached soil map, Figure 7, confirms Richardson's observation, and gives a general picture of soil conditions in the region.

On the Barren Grounds the rugged, uneven character of the terrain at times makes travel extremely difficult. Over much of the region the landform is little more than a treeless plain of granitic rock covered by a moss and lichen carpet. Over large areas this plain is covered with endless ponds and small pools of water, at times making up 30 per cent to 60 percent of land surface area. It is a terrain which, when frozen in the winter is relatively easy to travel on, but which during the spring and summer thaw, turns into swamp and muskeg with scattered low hills.

Figure 7. Soils.


Canada
Major Soil Zones
and Regions
Scale in Miles

Southward and westward into the transition zone and the boreal forest, the Precambrian rock of the Barren Grounds gives way to the more recent Paleozoic limestone and sedimentary rocks and there is a gradual buildup of sandy and alluvial soil. Nevertheless, the landform in the transition zone shows considerable variability. In the Stony Rapids region of Northern Saskatchewan (Bone, Shannon and Raby, 1973:10), for instance, there is a marked change from the rugged, rocky terrain to the north of the Fond du Lac River to the more open lower relief country to the south of the river. This contrast is clearly shown in the aeronautical chart of the region (WAC D-13).

The soils and rocks of the subarctic are largely due to the glacial deposition. The form of this glacial deposition is seen to be mainly of three kinds - small whaleback-shaped hills, or drumlins; rocky moraines which formed along the margins of the retreating glacier; and very long sandy ridges, or eskers, which were deposited by rivers forming within the melting ice sheet. The high variability of this glacial deposition and the resulting poorly formed soils are to some extent reflected in the variability and patchiness of vegetation in the region.

Permafrost and Snow Conditions: Having considered briefly the topographic features and soil conditions which shape the subarctic environment we can now look at the two other important factors - permafrost and snow conditions.

As is the case with glaciation, no broad understanding has yet been developed of the dynamics and distribution of permafrost. The southern limits of permafrost are as difficult to delineate as the treeline, and indeed it has been found that there are islands of permafrost well south of what has been generally considered as the southern limit. An overall picture of the southern limits of both continuous and discontinuous permafrost can be gained from Figure 8.

As discussed by J.L. Jenness in his 1949 paper "Permafrost in Canada," there appear to be three main factors governing the formation of permafrost. The most important factor is the mean annual temperature of the region. On the basis of existing evidence, the southern limit of continuous permafrost is arbitrarily taken to be the 23°F (-5°C) isotherm of average annual sub-surface temperature, at a level just below the depth at which no seasonal change of temperature occurs (Figure 8, note 1). As also shown (Figure 8, note 4), the southern limit of permafrost coincides roughly with the 30°F average annual isotherm of air temperature.

Another important factor governing permafrost formation is the heat conductivity of the soil, although soil conductivity does not affect the temperature of freezing, it does have a pronounced effect on the rate of freezing. It is not surprising then, that given the variability of soil quality there should be variation in permafrost conditions. The third factor which has some bearing on permafrost

Figure 8. Permafrost.

PERMAFROST

ZONE OF CONTINUOUS PERMAFROST

Southern limit of continuous permafrost zone[1]

ZONE OF DISCONTINUOUS PERMAFROST

Widespread permafrost

Scattered permafrost

Southern limit of permafrost

Patches of permafrost observed in peat bogs south of permafrost limit

Permafrost areas in the Cordillera[2]

+ 50 Thickness of permafrost (in feet)

Localities in which pingos occur[3]

—15— Mean annual air temperature (°F)[4]

Glaciers

DEFINITION OF PERMAFROST

Permafrost is a term used to describe the thermal condition of earth materials, such as soil and rock, when their temperature remains below 32°F (0°C) continuously for more than one year. Between the permafrost or perenially frozen earth material, and the surface is an 'active layer' also composed of soil or rock, which thaws in summer and freezes in winter. Vegetation grows above permafrost throughout much of the permafrost region.

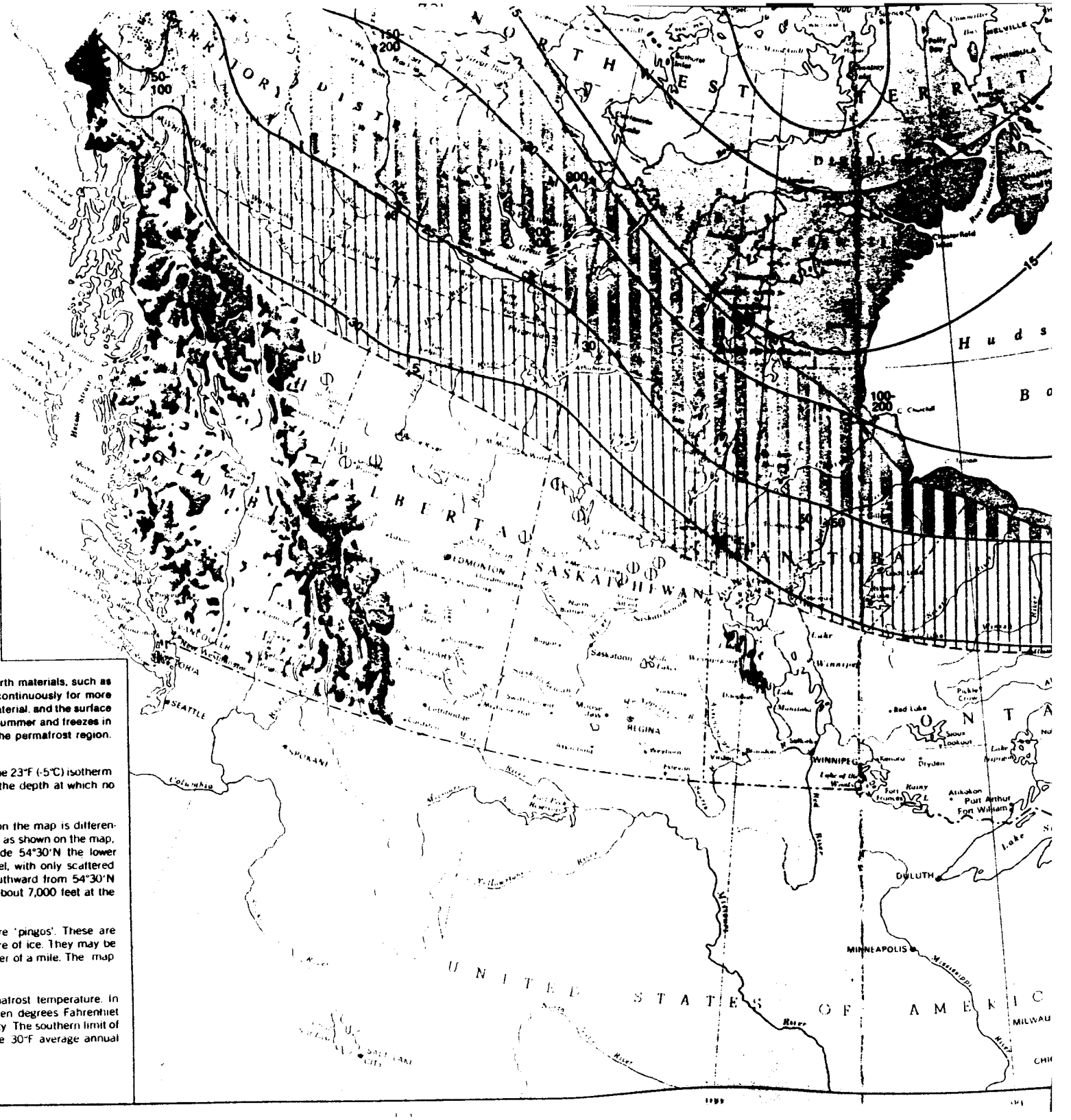
[1] The southern limit of continuous permafrost is arbitrarily taken as the 23°F (-5°C) isotherm of average annual sub-surface temperature, at a level just below the depth at which no seasonal change of temperature occurs.

[2] Permafrost in the Cordillera is part of the permafrost region but on the map is differentiated by colour. At the northern limit of the Cordilleran permafrost, as shown on the map, permafrost occurs in valley bottoms. Southward to about latitude 54°30'N the lower altitudinal limit of permafrost is about 4,000 feet above sea level, with only scattered occurences in particular types of terrain at lower elevations. Southward from 54°30'N the lower altitudinal limit has been estimated to rise steadily to about 7,000 feet at the forty ninth parallel.

[3] The most spectacular landforms associated with permafrost are 'pingos'. These are typically symmetrical hills composed of material uplifted by a core of ice. They may be more than 100 feet high with a base diameter of up to one quarter of a mile. The map shows their known distribution in generalized form.

[4] A broad relationship exists between air temperature and permafrost temperature. In general the temperature of the permafrost ranges from two to ten degrees Fahrenheit warmer than the average annual air temperature at a given locality. The southern limit of permafrost shown on the map coincides approximately with the 30°F average annual isotherm of air temperature.

$$°C = \frac{5}{9}(°F - 32)$$



formation and regression is the insulating properties of the surface of the soil. Bare ground is directly influenced by air temperature, whereas ground that has a covering of snow, or ice, or water, or dense vegetation can be considerably insulated from the air temperature.

There now seems to be general agreement, according to Jenness (1949), that permafrost first appeared during the refrigeration of the earth's surface at the beginning of the Pleistocene epoch or so called Ice Age. Moreover there seems little doubt that permafrost does not form under huge masses of snow or ice. It is reasoned that the friction and pressure resulting from the snow or ice mass keeps a thin layer of ice at ground level at its melting point, thereby serving as an insulator.

Again, with respect to the formation and regression of permafrost, we can see that long-term temperature change is the principle dynamic factor, that the rate of change in permafrost conditions is governed by soil conductivity and surface cover insulation.

Despite the fact that there is a vast area of permafrost in the Canadian arctic and subarctic, and that permafrost has been measured to depths of more than 1,500 feet, there is considerable evidence to suggest the instability of permafrost conditions (see Jenness, 1949). In support of the view of environmental instability in northern

latitudes Jenness cites the Russian claim that in the Archangel region of northern Russian the southern boundary of permafrost has moved almost 100 kilometers (60 miles) farther north during th past 96 years. Although no such evidence has been produced for the Canadian north, the possibility of such sudden shifts in permafrost conditions cannot be ruled out. Other evidence (Price 1972:14) indicates that whereas in some areas permafrost is retreating, in other areas it is forming. At any rate the dynamic nature of permafrost is indicated in the fact that very little change is required in mean annual temperature for very significant changes to occur in permafrost conditions. It is also indicated in the active role played by taliks (areas of unfrozen ground) found within continuous permafrost (Price, 1972:10).

One of the more interesting landscape features associated with permafrost is the existence of pingos. These are small symmetrical hills up to about 150 feet in height and about a quarter of a mile in diameter at the base. Pingos are formed in effect by a blistering of the surface of the permafrost. Although they have a soil and vegetation covering, they have an ice core.

With regard to the influence of permafrost on vegetation, there are two important factors that must be considered. One factor is the depth of the "active layer" of permafrost - that is, the surface layer that freezes in winter and thaws in summer. It is the shallowness of

the "active layer" coupled with the scarcity of soil that limits vegetation to those species which have shallow roots. The other important factor is that the sub-surface permafrost very severly limits the drainage and absorption of surface water, resulting in the persistent and widespread muskeg that is characteristic of much of the region. In such conditions vegetation is limited to those species which have anaffinity for very wet soil conditions. In rather striking contrast to the areas described is the distinctly different vegetation pattern found in the drier, more sandy soil of eskers - somewhat removed from the direct influence of permafrost.

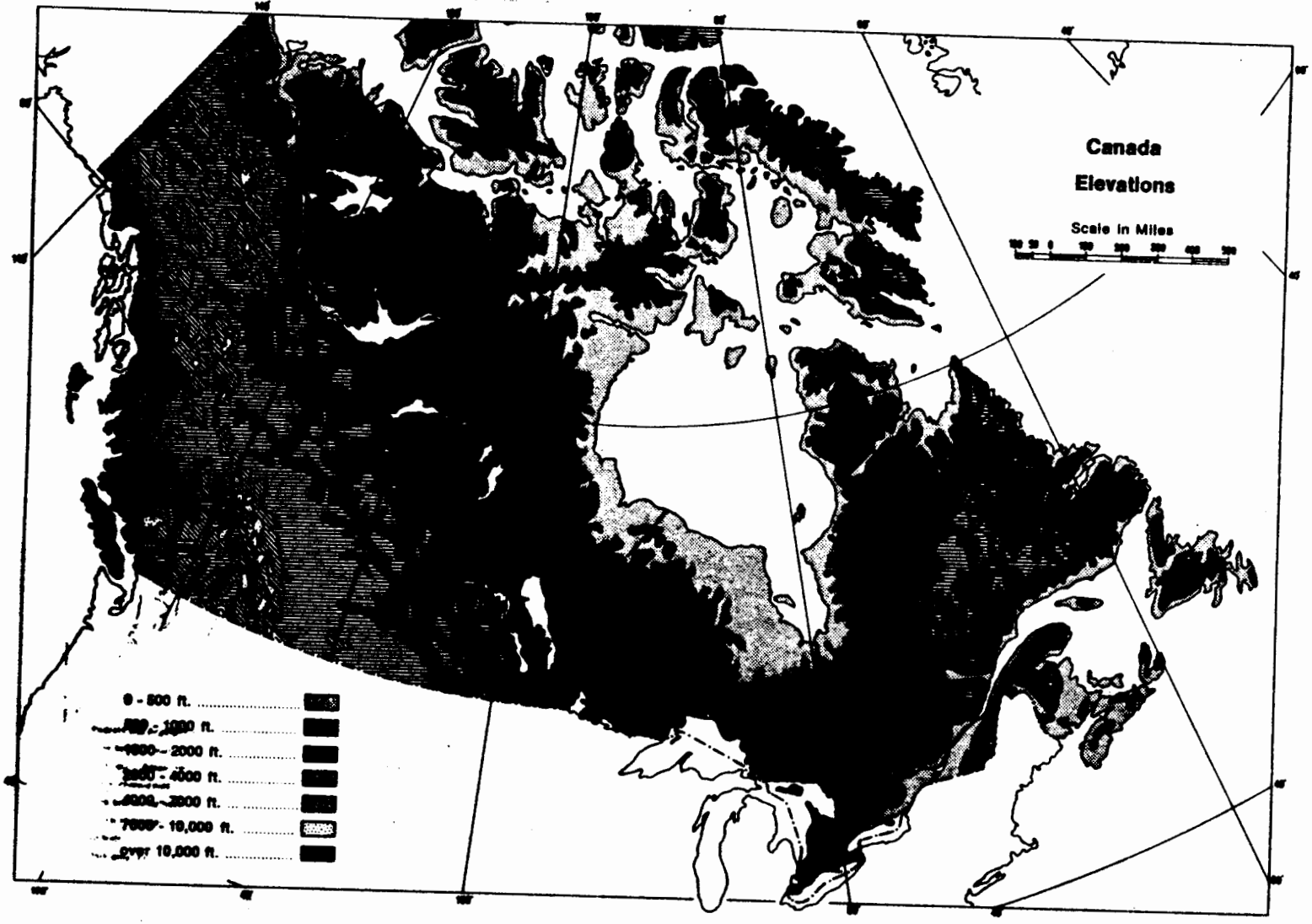
Climate: Although soil conditions and permafrost conditions do indeed set limits to vegetation and biological range in the subarctic, one finds it asserted again and again in the literature that climate is the ultimate ecological control. The case is well put by F.K. Hare in his 1951 paper "Some Climatological Problems of the Arctic and Subarctic". Hare (1951) stresses the crucial importance of what he aptly calls ecological climatology - that is, the investigation of the relation of climate to natural vegetation. It is, as Hare points out, an area of investigation in which a great deal of work remains to be done, and it remains an area which is hampered by the acute lack of observation data throughout the arctic and subarctic.

Before proceeding with a consideration of the influence of climate on the natural environment, we might note two structural

features of the landscape which have a direct bearing on climate. These features are shown on the relief map, Figure 9. One is the fairly large body of water afforded by the Mackenzie River and three principal lakes which drain into it (Great Bear Lake, Great Slave Lake, and Lake Athabasca), a factor which has some moderating effect on climate. The other feature perhaps more significant, is the elevation gradient. Whereas the elevation around the lakes mentioned and in the region of Hudson Bay is less than 1,000 feet, the elevation on the central Barren Grounds is in the range of 1,000 to 2,000 feet.

A comparison of the relief map (Figure 9) and the aeronautical chart (WAC D-13) shows the significance of elevation and water mass as factors affecting air temperature. The effect of altitude is indicated in the general observation (Kendrew and Currie, 1955:35) that mean temperature decreases about $1^{o}F$ for every 330 feet of altitude. The effect of water mass on mean temperature is indicated in the fact that freeze up and break up occur later in the year for large water masses than for small water masses. As discussed by Larnder (in Beals, 1968:337-338) with reference to Hudson Bay, the main effect of a large mass of ice at break up time is to hold down the air temperature and thereby retard the onset of summer. Approaching freeze up, on the other hand, the general effect of a large water mass, to a greater extent it would seem than many small bodies of water, is to maintain air temperature and moderate climate. It is to be expected then that the climate of the central Barren Grounds would be more extreme than that of the surrounding regions.

Figure 9. Relief Map.


Canada
Elevations
Scale in Miles
0 - 500 ft.
2000 ft.
4000 ft.
10,000 ft.

Of the climatic factors which have some direct effect on vegetation, we can consider the following - temperature, length of the growing season, precipitation, wind and snow blast, snow shelter, and fire. Again, temperature is seen to be the controlling factor. But in these northern latitudes, the crucial limitation is temperature as a factor limiting the length of the growing season. Thus it is that the dominant factor of climatic control of the environment has come to be expressed as the mean temperature for the growing season, which is to say the mean temperature for the month of July. It has been widely observed, for example, that the July isotherm for 10°C (50°F) corresponds rather closely to the treeline, and this climatic equivalent of the treeline has met with wide acceptance. Although this is exactly the kind of climatic-ecological correlation that Hare is seeking, he takes the view nevertheless that the 10°C isotherm has enjoyed a prestige among biologists and geographers far exceeding its merits. The inadequacy of this correlation of course can indicate two things: one is that the formulae used to correlate climatic conditions with ecological conditions are not yet sophisticated enough; the other probability is that the tree-line is still shifting. Indeed J.W. Marr (1948) showed that to the east of Hudson Bay there is an active northward migration of the tree-line. With regard to the tree-line, Hare goes so far as to state the following:

> "It seems quite evident that the tree-line has not yet attained its equilibrium position in many areas; futhermore the rapid fluctuation characteristic of recent sub-arctic climates makes it doubtful whether any such equilibrium can be struck at all."

A more acceptable definition of the growing season which is coming into use is provided by Rowe (1972:153): "The length of a growing season is based on the average number of days between the date the mean daily temperature exceeds 42°F in the spring and falls below 42°F in the autumn."

Of the other factors mentioned with respect to climatic control of the environment, there is not much that needs to be said. Precipitation is very low in the arctic and subarctic, the Barren Grounds receiving some 8 to 10 inches of rain per year and the taiga some 10 to 15 inches of rain per year. In more temperate climates with a longer growing season the area would be virtually a desert. But in these northern latitudes, precipitation can be discounted as a significant factor in vegetation growth - this for two reasons, that the growing seaon is very short (4 to 6 weeks) and that the permafrost maintains the water content of the soil at a level more than adequate to sustain growth. A notable exception, of course, is those areas, particularly along ridges and eskers, where the soil is well-drained. Wind and snow blast are significant factors insofar as they tend to limit growth or cause stunted growth on exposed ridges and hills. Snow shelter is significant in that it protects a great deal of vegetation in winter from cold and wind.

Fire is a serious factor in that fires (caused either by human agency or more frequently by lightning) pose a very serious threat to

caribou winter range. The most damaging effect of fire is that it destroys the slow-growing lichen cover which is the principal food of caribou during the winter months. While fire destroys the climax spruce-lichen forest of the caribou winter range, it serves to generate the successional community stage of poplar, birch, willow and alder which is the favoured range of moose.

Vegetation: To this point we have considered the principal forces which shape the subarctic environment. Most important among those forces we have indicated are temperature, length of the growing season, soil conditions and permafrost conditions. On the basis of the interaction of those forces, we can now to some extent fill out the picture of the natural environment by considering the distribution patterns of flora and fauna in relation to their particular adaptations and in relation to their environmental tolerances. It should be kept in mind that at this level, no less than at the longer-term level of geological and glacial forces, the subarctic environment is unstable and irregular. It is a harsh environment, extending over a vast area, and it is characteristic of the area that both vegetation and animal populations are distributed unevenly.

Botanists and ecologists have long been preoccupied with the problems of definition, classification, and geographical differentiation in dealing with the vegetation patterns of the subarctic. One of the most useful statements of the scope of the

problem is provided by Raup (1941) in his classic paper "Botanical Problems in Boreal America." A more limited consideration of the problem is offered by Griggs (1946) in his paper "The Timberlines of Northern America and their Interpretation." A major effort to pull those problems into some kind of focus was attempted at the 1966 Helsinki symposium (UNESCO, 1970) on the Ecology of the Subarctic Regions.

The task facing ecologists in acquiring an understanding of the environment of the subarctic is clearly stated by Ritchie (1960): "Investigation must begin with extensive work to establish the general configuration of vegetation zones and community types and be followed by detailed intensive study of the composition, structure, dynamics and ultimately the ecology of the vegetation." With respect to the Western sub-arctic of Canada and the Barren Grounds in particular, such systematic investigation has scarcely begun.

There are really two fundamental analytic problems involved in this kind of ecological investigation. One is the broad problem of classification, or vegetational mapping. The other, and perhaps more difficult, is the problem of understanding vegetational distribution in relation to such environmental forces as physiographic, climatic edaphic, and cultural conditions. The trend of investigation would seem to be in the direction of accepting climate as the most dynamic environmental force. In consequence, these two basic analytic

problems are being approached by a number of investigators in terms of a long-range goal of comprehensive climatic mapping and vegetational mapping, and of identifying correlations between the two maps. The possibilities of the approach are discussed by Mather and Yoshioka (1968) in their paper, "The Role of Climate in the Distribution of Vegetation."

The first broad classification of forests was provided by W.E.D. Halliday (1937) with the publication of A Forest Classification for Canada. The classification was refined by Rowe (1959 and 1972) with the publication of Forest Regions of Canada. The Boreal Forest Region of Rowe's classification, a broad band of mainly coniferous forest, stretches across central and northern Canada from Newfoundland to the Mackenzie Delta and into Alaska.

In Rowe's Classification, the Boreal Forest Region is broken down into 33 major sections. With regard to the territory of the Chipewyan, two of those sections are of major importance and five others are of peripheral importance. Of major importance are the Forest-Tundra section and the Northwestern Transition section. Of lesser importance are the Hudson Bay Lowlands, the Upper Churchill, the Northern Coniferous, Athabasca South, and Upper Mackenzie sections. A general picture of this vegetation pattern can be gained from the vegetation map Figure 10, and the boreal forest sections map Figure 11.

Figure 10. Vegetation Regions of Northern Canada.

VEGETATION REGIONS

PHYSIOGNOMY	FORMATION TYPE	CHARACTERISTIC DOMINANT SPECIES
	AREAS WITH ALMOST NO VEGETATION	
Glaciers and permanent snowfields etc		
	TUNDRA	
Rock-desert or fell-field		Lichen - Avens - Saxifrages
Arctic stoney lichen-heath		Lichens - Labrador Tea - Arctic Bell-heather
Arctic dwarf shrubs - sedges - lichen-heath		Shrubby Birch and Willows - Sedges - Blueberry - Crowberry - Labrador Tea
Arctic mature sedges - grasses and shrubs		Sedges - Labrador Tea - Bluejoint - Shrubby Willows and Birches
Alpine sedges - grasses and shrubs		Arctic Bell-heather - Sedges - Bluegrass - Mountain Avens - Dwarf Willows
	TUNDRA-OPEN WOODLAND	
Lichen-heath - shrubs - patches of needle-leaf trees		Lichens - Caribou - Dwarf Birches and Willows - Black Spruce - Tamarack
	OPEN WOODLAND	
Lichen floor with scattered needleleaf trees		Lichens - Black Spruce
Lichen floor with scattered needleleaf trees		Lichens - Spruce - Tamarack
Shrub floor with scattered needleleaf trees		Labrador Tea - Black Spruce
Shrubby needleleaf trees with patches of heath and barrens		Spruce - Fir - Sheep Laurel
Scattered needleleaf trees with broadleaf shrubs		Spruce - Shrubby Alder - Mountain Ash - Birches
Shrubs or grass with patches of needleleaf trees		Dwarf Birches and Willows - Fir - White Spruce
	BOGS-ORGANIC TERRAIN	
Small lakes - moss and sedge covered floor and strings of needleleaf trees		Sphagnum Moss - Sedges - Black Spruce - Tamarack
	BOREAL FOREST	
Needleleaf trees		Spruce - Balsam Fir
Needleleaf trees		Spruce - Jack Pine - Tamarack
Needleleaf trees		Black Spruce
Needleleaf trees with some boreal broadleaf trees		Aspen - Spruce
Needleleaf trees with some boreal broadleaf trees		Black Spruce - Aspen
Needleleaf trees with some boreal broadleaf trees		White Spruce - Poplar - Jack Pine
Needleleaf trees with broadleaf and barren patches		Jack Pine - Black Spruce

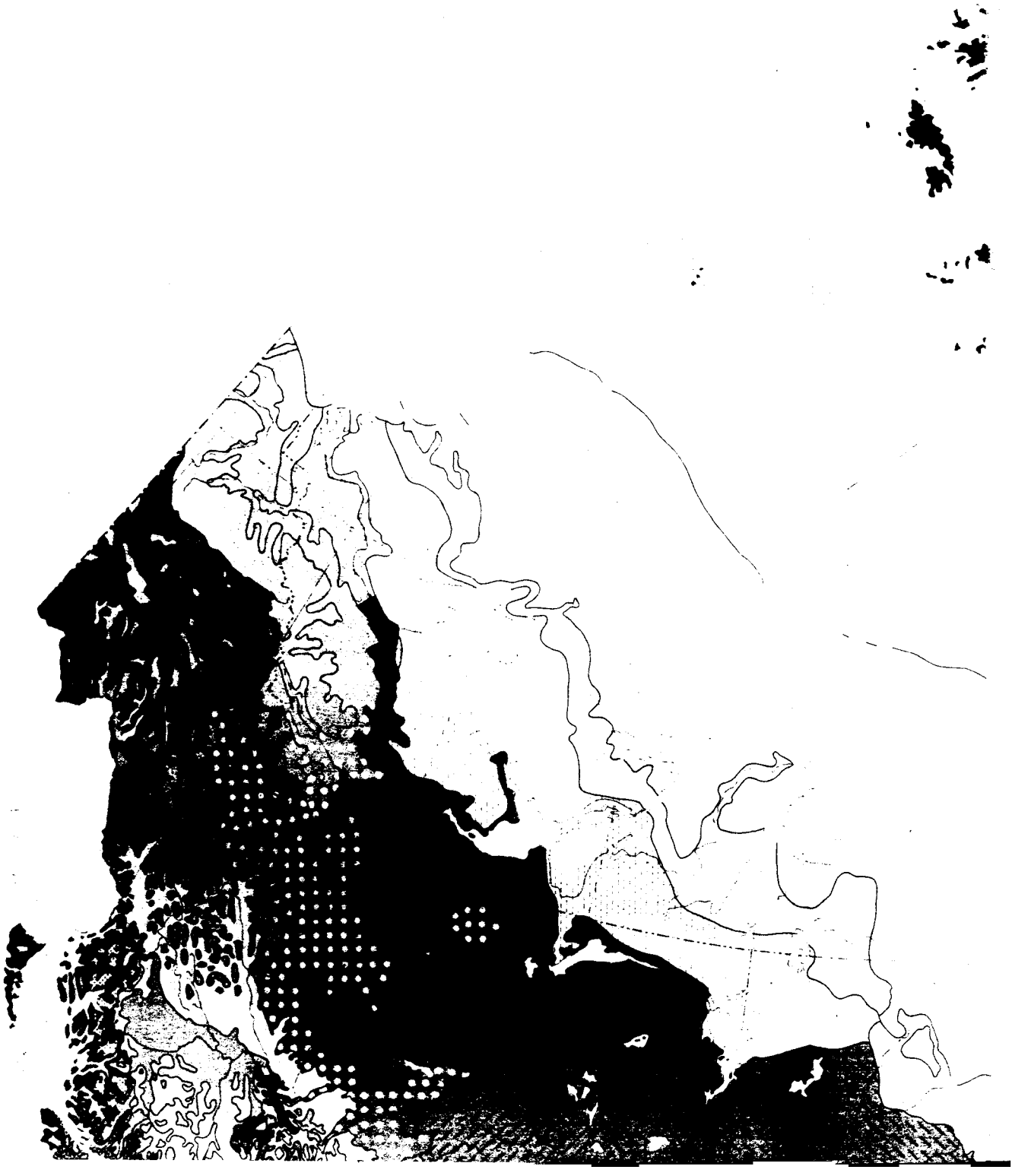
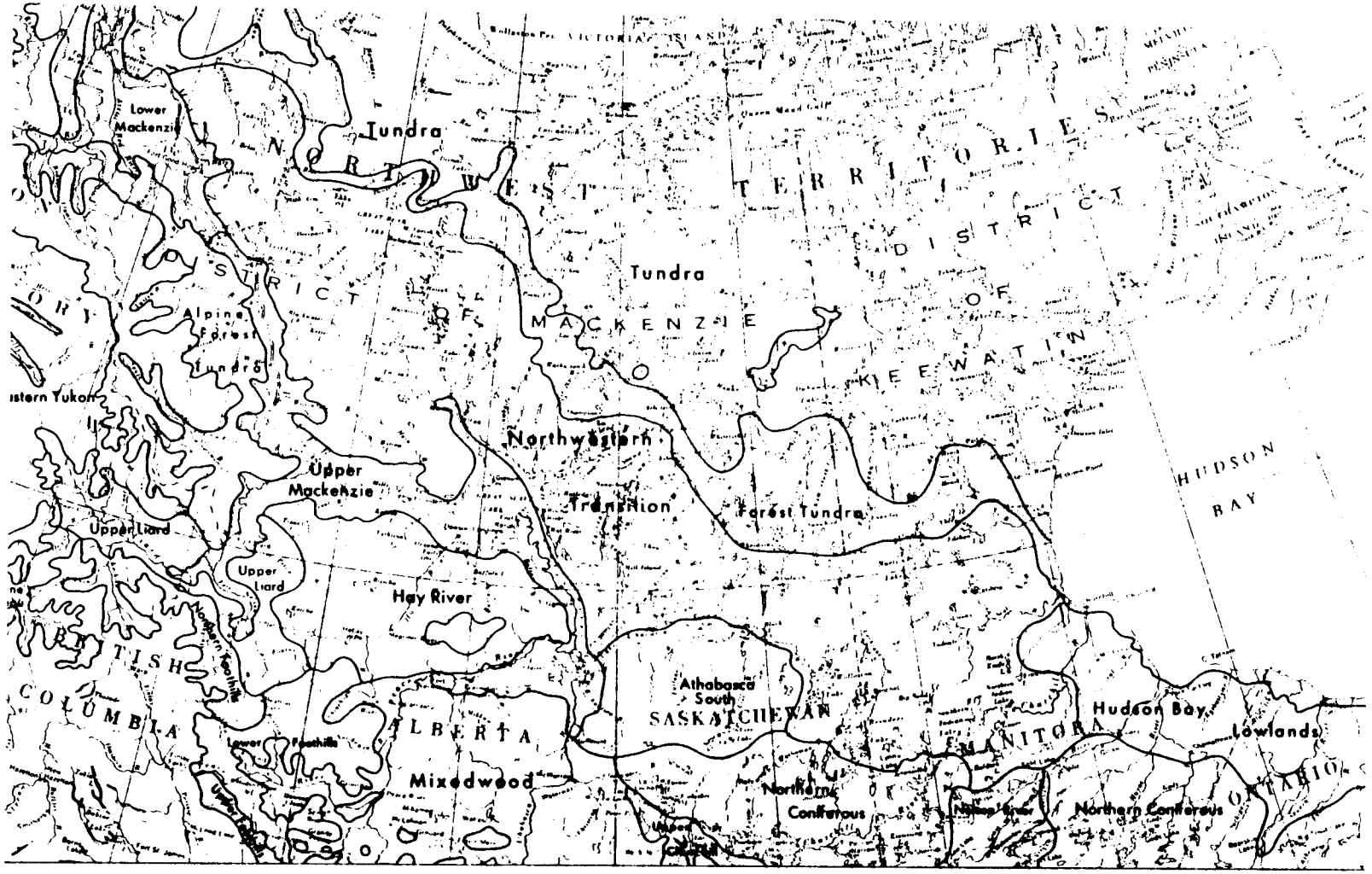


Figure 11. Forest Sections of the Boreal Forest Region.



Produced by the Surveys and Mapping Branch,
Department of Mines and Technical Surveys, Ottawa, 1966

The Forest-Tundra ecotone, which is central to the traditional territory of the Chipewyan, encompasses the northern limits of forestation - the treeline. It is the transitional zone between the boreal forest and the tundra - the land of lichen-woodland, the "land of the little sticks." As indicated earlier, it exhibits a gradient change from south to north as forests shrink and tundra expands. The transition is well-described by Savile (1968:399-400): "Northward from the continuous forest, the hilltops first become treeless. The treeless areas become larger and start to coalesce, so that the cover changes to tundra with islands of spruce, which quickly become small and widely spaced... When the trees are left behind moderately tall willows and alders are found at first; but the latter soon drop out, and the shrubby willows and dwarf birches quickly become more depressed and more widely scattered."

From the limited amount of vegetational mapping that has to this time been carried out, a generalized picture of floral adaptation is emerging. The preliminary conclusions, which I draw from Hare (1950, 1954), Hustich (1953), Ritchie (1960), Dagon (1966), La Roi (1967), and Rowe (1972), are that, in the main, vegetational communities in the Canadian subarctic exhibit a broad range of environmental tolerance and that the environmental dominance of particular plant species is closely governed by their adaptability to particular climatic, edaphic, physiographic, and cultural conditions. The irregularity of these environmental conditions over the whole subarctic region is clearly seen in the patchiness of the vegetaion.

Within the Forest-Tundra Section and the Northwestern Transition Section, the more extreme hydric sites afforded by sphagnum bogs and poorly drained soils tend to be dominated by Black Spruce (Picea mariana) and Tamarack (Larix laricina), species which although of broad environmental tolerance are adapted to extremes of cold and wetness. Less widespread but also common to such sites are stunted Willow (Salix L.), Speckled Alder (Alnus rugosa), Alaska Birch (Betula neoalaskana), and Water Birch or Black Birch (Betula occidentalis). The more mesic sites afforded by well-drained, but moist, silty soils, tend to be favoured by White Spruce (Picea glauca), Balsam Fir (Abies balsamea), Balsam Popular (Populus balsamifera) and Trembling Aspen (Populus tremuloides). Less widespread, but fairly common along streams and on clear land and burned-over areas, are Choke Cherry (Prunus virginiana), and Pin Cherry (Prunus pensylvanica). The more xeric sites afforded by dry sandy soils and burned-over areas are more favourable to such species as Jack Pine (Pinus banksiana), and White Birch (Betula papyrifera).

As with the variable dominance pattern of trees, the ground cover varies in response to physiographic, climatic, edaphic and cultural conditions. The open tundra is very largely a treeless, rocky plain covered with a carpet of moss and lichen, with innumerable bogs, small ponds and pools of water. In higher and drier areas vegetation is sparse and poorly developed. In lower and wetter regions, where there is an accumulation of organic debris, vegetation is lush and dense.

In the taiga and the more open boreal forest the ground cover is more highly developed and consists of diverse plant communities of shrubs sedges, grasses, lichens, mosses, and a great variety of woody plants and herbaceous plants.

The dominant shrubs include dwarf Spruce (Picea), Birch (Betula glandulosa), Alder (Alnus crispa), Willow (Salix anglorum), and Juniper (Juniperus communis). Smaller shrubs and heaths include Blueberry (Vaccinium uliginosum), Bearberry (Vaccinium vitis-idaea), Crowberry (Empetrum hermaphroditum), Cloudberry (Rubus chamaemorus), and Labrador tea (Ledum groenlandicum and Ledum decumbeus). Sedges include many species of Carex and several species of the cotton sedges Eriophorum. Although usually stunted and scattered, numerous species of grasses are found including the turf-forming Blue Grass (Poa). Of the many species of lichen, the dominant fruticose or shrub-type include Caribou Lichen or Reindeer Moss (Cladonia), Cladina, Cetraria, and Stereocaulon. The most abundant arboreal lichens include Alectoria jubata, Evernia mesomorpha, and Usnea hirta. A species common to more barren sites is the familiar Rock Tripe (Umbilicaria). The more abundant bryophytes or mosses are Sphagnum in bogs and muskeg and in the boreal forest such species as Hylocomium splendens, Anlacomnium palustre, and Camptothecium nitens - the so-called feather-mosses. The great number of species of flowering herbs and plants which lend brilliant colour to the tundra and taiga landscape need not be considered here.

As indicated above, such cataloging of dominant vegetational types is but a preliminary to the identification of plant communities and to the understanding of the ecological dynamics of these communities. An understanding of both the structure and the dynamics of plant communities and of climate would enable us to better employ the notion of ecological niche, as advocated by Steward and by Helm, in analyzing the adaptive and exploitative patterns of animal populations and of human settlement.

Fauna: Traditional Chipewyan subsistence was centred on the exploitation of the vast herds of migratory barren-ground caribou - the only large ungulate apart from the muskox adapted to life in both the barrens and the woodlands. Indeed, as Kelsall (1968:46) asserts: " A knowledge of both biomes (the tundra and the taiga) is mandatory to an understanding of the ecology of caribou." It might equally be asserted that a knowledge of caribou behaviour is mandatory to an understanding of traditional Chipewyan subsistence. The Chipewyan subsistence pattern, however, was sufficiently diversified to exploit various smaller animals, birds, and fish at certain times of the year and at times when faced with the failure of the caribou herds. Of increasing importance to the Chipewyan with the development of the fur trade was the exploitation of fur-bearing animals and a lessening exploitation of game animals.

Game animals: Barren-ground Caribou (Rangifer tarandus groenlandicus, (Linnaeus); R.T. Arcticus (Richardson)): Of the five subspecies of caribou recognized in Canada, the barren-ground caribou occupied a central position in the social and economic organization of the Chipewyan. Early European accounts offer many reports of the vastness of the migrating caribou herds. Among the more graphic is that provided by David Thompson (Glover, 1962:87) in May, 1792, in the region of Hayes River, while he was still employed by the Hudson's Bay Company. Thompson describes a herd of caribou which came on him and his companion William Cook with a sound of thunder and which they watched for two days.

> We attempted to estimate the number of Deer that passed in this great herd but the Natives pointed out their method, which was thought the best; this was to allow the Deer a full hour and a half (by the Sun) in the morning to feed, and the same before sunset; this would give ten full hours of running, of what we thought twenty miles an hour, which they reduced to twelve miles, observing that large herds appear to run faster than they really do. By this means they extended the herd of the first day to one hundred and twenty miles in length and the herd of the second day to half as much more, making the whole length of the herd to be one hundred and eighty miles in length, by one hundred yards in breadth. The Natives do not understand high numbers, but they readily comprehend space, though they cannot define it by miles and acres; and their Clock is the path of the Sun. By the above space, allowing to each deer, ten feet by eight feet; an area of eighty square feet: the number of Rein Deer that passed was 3,564,000 an immense number, without including the many small herds.

A similar experience is reported by the naturalist E.T. Seton (1911:220) accompanied by fellow naturalist E.A. Preble on August 7, 1907, while camped on the Kasba River. So impressed was Seton with the extent of caribou herds that he placed the total caribou population of the Canadian subarctic at over 30,000,000.

In the light of more recent knowledge, such estimates of caribou population in earlier times are generally considered to be much too high. A more likely estimate of pre-contact caribou population is offered by Kelsall (1968:146). Having in mind the variability of caribou range and using an average range-carrying capacity of five caribou per square mile, Kelsall estimates an aboriginal population of about 2,395,000 animals.

Given this variability in the distribution and concentration of the caribou population, recent studies have sought to identify discrete herds and to analyze population structure and population dynamics in relation to the seasonal migrations and nomadic wanderings of the caribou.

The first comprehensive study, that of Banfield (1954), conducted in 1948, identified nineteen distinct caribou herds over the whole range. As indicated by Thomas (1969:7), the difficulty in classification is in the fact that herds are continually changing in number, size, and geographic location. On the basis of tagging studies (Miller and Robertson, 1967) and field observations it became evident that, whereas winter ranges showed considerable variability, the summer calving grounds of the caribou showed a high degree of regularity. It is on the basis of calving grounds then that Thomas (1969) incorporated Banfield's classification into four major caribou populations. As shown in Figure 12, Thomas identifies the Bluenose

Appendix I

Figure 12. Population Estimates and Distribution of Barren Ground Caribou.

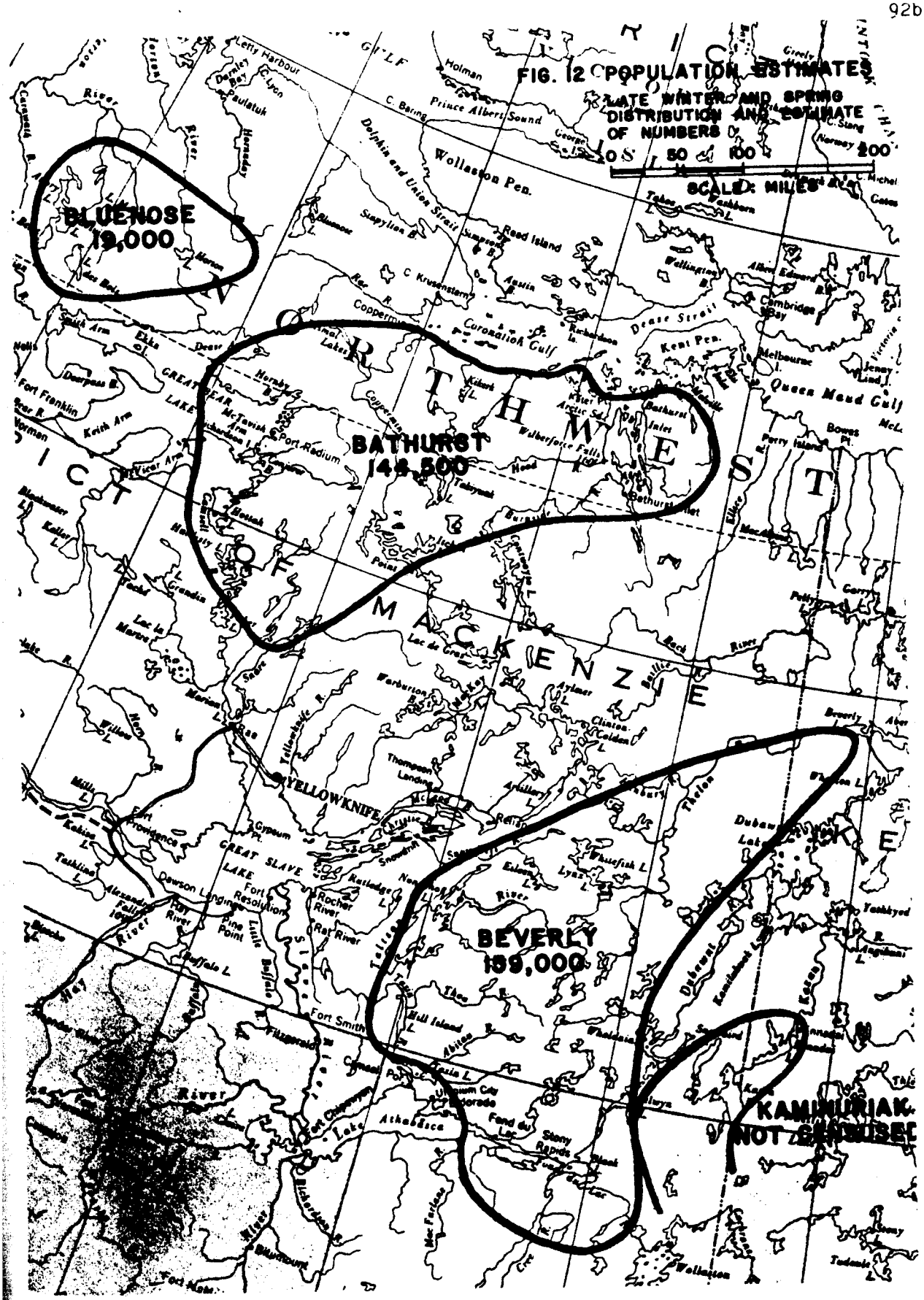


FIG. 12 POPULATION ESTIMATES
LATE WINTER AND SPRING
DISTRIBUTION AND ESTIMATE
OF NUMBERS

population (Banfield's Great Bear Lake and Colville Lake herds), the Bathurst population (Banfield's Radium, Rae, and Yellowknife herds), the Beverly population (Banfield's Saskatchewan, Athabaska and Hanbury herds), and the Kaminuriak population (Banfield's Brochet, Duck Lake, and Churchill herds). These four populations, named after lakes which are central to their calving grounds, appear to have gained general acceptance as a classification of the overall caribou population. It can be seen (Figure 13), that in relation to the traditional territory of the Chipewyan, the Beverly and Kaminuriak populations are of central importance.

As elaborated by Kelsall (1968) for the Barren Ground caribou (R. t. groenlandicus) and by Skoog (1968) for the Alaska caribou (R. t. granti), the caribou displays extensive morphological and behavioural adaptations to the subarctic environment. Of its behavioural adaptations, one of the more important from the point of view of exploitation by the Chipewyan, is the annual cycle of migratory and nomadic behaviour. The caribou are continually on the move. Pruitt (1959:159) and Kelsall (1968:48) emphasize the fact of snow as an integral part of the environment of the caribou for at least eight months of the year. The caribou has therefore had to adapt to the ecological effects of a permanent winter snow cover in the boreal forest and the taiga and of a changing summer environment on the Barrens. The question of what biological, environmental, climatic, and topographical factors govern the annual cycle of the

Figure 13. Spring Migration Routes of Barren Ground Caribou.

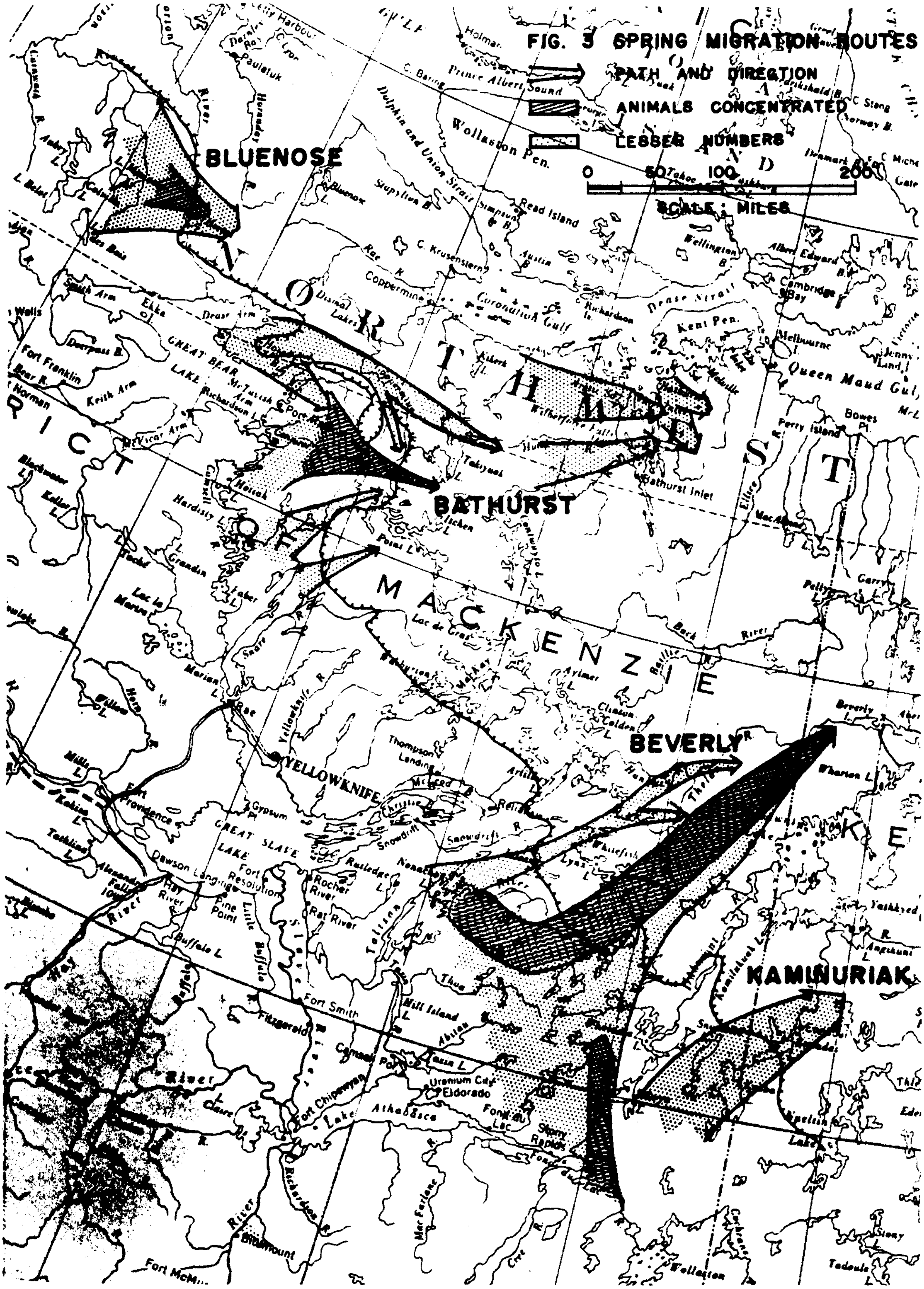


FIG. 3 SPRING MIGRATION ROUTES
PATH AND DIRECTION
ANIMALS CONCENTRATED
LESSER NUMBERS
0 50 100 200
SCALE: MILES
BLUENOSE
BATHURST
BEVERLY
KAMINURIAK
YELLOWKNIFE
MACKENZIE
GREAT BEAR LAKE
GREAT SLAVE LAKE
Lake Athabasca
Coronation Gulf
Queen Maud Gulf
Bathurst Inlet
Wollaston Pen.
Fort Smith
Fort Chipewyan
Uranium City
Eldorado
Fort Resolution
Fort Providence
Hay River
Fort Franklin
Port Radium

caribou is of central importance to understanding its ecological adaptation, and is at the present time very much open to debate. It would seem that both the winter and the summer environment impose physiologicl stresses on the caribou which, coupled with morphological and physiological predispositions, have the effect of keeping the animals on the move. It would seem further that the pattern of movement throughout the year is in as yet undetermined ways constrained by topographical features of the environment.

The spring migration to the calving grounds normally begins in mid-March with animals, mainly pregnant cows and yearlings, gradually moving out of the boreal forest towards the treeline (see Loughrey and Kelsall in UNESCO. 1970. pp.275-280). By mid-April the drive to the calving grounds has gained full momentum, with the leading animals moving beyond the tree line in bands of up to 200 animals. These bands, with animals travelling in single file in long parallel lines, move across the terrain of least resistance, usually chains of frozen, snow-covered lakes, eskers, and glacial ridges, towards the calving grounds some 200 to 500 miles out on the Barrens. The general southwest-northeast orientation of the drainage systems of the Thelon, Dubawnt and Kazan Rivers, favours the development of regular spring migration routes by the Beverly and Kaminuriak populations. Travelling under favourable conditions the herds cover thirty to forty miles a day. Often though travel is impeded and at times diverted by deep, soft, or wet snow, and by ice-free rivers and thin lake-ice.

The calving grounds of the caribou are characterized by high elevation, dry climate, and generally rugged, rock-strewn ground. Usually, the leading bands are on the calving grounds by the first week of June, with parturition occupying the month of June. About 70% of calves are born during the week of June 9th to June 15th, with June 12th taken to be the peak of the calving period (Kelsall, 1968:177). Caribou calves are remarkably precocious. Within hours of birth they are able to walk and in two or three days are able to travel with the herd. Within a week or two of calving, the cows and calves move to lower elevations in search of the better quality grazing afforded by new growth of grasses and sedges.

Throughout the month of July the caribou remain in fairly large aggregations, mainly concentrated in good quality pastures, at times confined by topographical barriers, and often in close groups as a protection against continual insect harassment. With the first sudden drop in temperature in early August, the insects abruptly disappear from the tundra. The caribou at this time, with pelage in very poor condition and no fat reserves, are physiologically at their lowest ebb. Thus released from harassment by black flies and mosquitoes the animals disperse and for a month or so spend a more leisurely period feeding and resting (see Kelsall's 1968:127 reference to the August dispersal of the caribou).

As the physical condition of the animals improves in late August and early September, they again tend to form herds and begin a leisurely drift southward and westward towards the treeline. Often at this time the herds penetrate well into the boreal forest, then to reverse direction and move back onto the Barrens prior to the October rut.

The rut occurs on the tundra throughout October and early November. In the latter part of November, coinciding with the onset of winter, the migrational drive reasserts itself and the herds head directly into the taiga and the boreal forest. Although a few small herds might winter on the Barrens, by mid-December the main caribou populations have located winter range within the boreal forest.

The more nomadic movement of caribou throughout the winter varies considerably from year to year, mainly, according to Pruitt (1959), in response to changing snow conditions and the accessibility of food. With lengthening daylight and the onset of spring thaw by about mid-March, the caribou again move towards the treeline and the annual cycle begins anew.

The annual cycle of the caribou would seem to be best viewed as an adaptive response to a complex and continually changing environment. The adaptive pattern is characterized by two pronounced migratory periods - the spring drive to the calving grounds and the

more leisurely fall movement back into the boreal forest - and two more nomadic periods - during the late summer disperal on the Barrens and throughout the winter in the boreal forest. It must be kept in mind though, as Burch (1972) emphasizes, that there is a considerable degree of variability and unpredictability in the migratory pattern of the caribou. Within the annual cycle, periods of high population density tend to occur in late winter prior to the spring migration, immediately after the calving period, and during the autumn migration and rutting period. Other sporadic periods of concentration occur at the main crossing points on lakes and rivers during the spring and fall migrations.

As indicated above, the question of what biological, environmental, climatic, and topographical factors govern the annual cycle of the caribou is one of continuing investigation and debate. The most predictable features of the annual cycle in both time and place are the June calving period well out in the Barrens and the October-November rut located just beyond the treeline. Although the factors involved in the migratory pattern are undoubtedly complex, principal among them, as argued by Banfield (1974:386), would seem to be seasonal rutting and calving requirements, changes in diet associated with seasonal growth and availability of vegetation, changing snow conditions, weather, wind direction, insect harassment, and the destruction of range by forest fires.

Kelsall (1968:111) and Parker (1972b:24) point out that there is as yet no firm evidence for the particular mechanisms which govern caribou movement and caribou population dynamics throughout the annual cycle. There are, however, a number of correlations and hypotheses which offer some promise. Of these, three would seem to merit particular consideration - Formozov's (1946) investigation of the relationship between snow cover and animal movements and feeding habits, Pruitt's hypothesis of caribou movement during the winter being governed by a snow condition gradient, and Kelsall's (1968:111) assertion of Zugdisposition as a precondition for extensive caribou movement. Although no one of these offers an adequate explanation of caribou movement, Kelsall (1968:111) acknowledges the likelihood of a complex interaction of the animal with the environment involving two basic factors - Zugdisposition, a physiological readiness or precondition within the animal, and environmental stress or stimulus.

In developing the idea of physiological readiness for migration, Kelsall (1968:111) offers the anology of Farner's (1955) work on bird migration, and quotes Farner thus: "Zugdisposition may be characterized by the accumulation of substantial fat reserves, a remarkable ability to restore these reserves when depleted, a tendency to sleep more lightly, and a tendency to develop nocturnal restlessness. Either the continued persistence of Zugdisposition per se, or the influence of environmental stimuli, or a combination of both, result in the migratory behaviour and the beginning of migration."

The issue of environmental stimulus in relation to snow cover is dealt with by Pruitt (1959). Pruitt's hpothesis, based on his field work in northern Saskatchewan, rests on two basic propositions - one that snow undergoes a maturation process as winter progresses characterized by increased depth, hardness, density and granulation; the other that caribou have a threshold of tolerance which appears to increase as winter progresses. The increasing threshold of snow cover, in Pruitt's view, acts as a kind of snow fence marking off areas of impenetrable snow cover from more accessible areas of snow cover, and tends to confine caribou within areas of more hospitable snow cover. Pruitt (1959:165) offers specific correlations between snow cover characteristics and caribou concentration. He also points to the common occurrence of barchans[4] resulting from storm activity in areas devoid of caribou and the presence of gali[5] in areas of higher caribou concentration. As Pruitt suggests, the relationship between the condition of the snow cover and distribution of caribou would seem to merit further investigation.

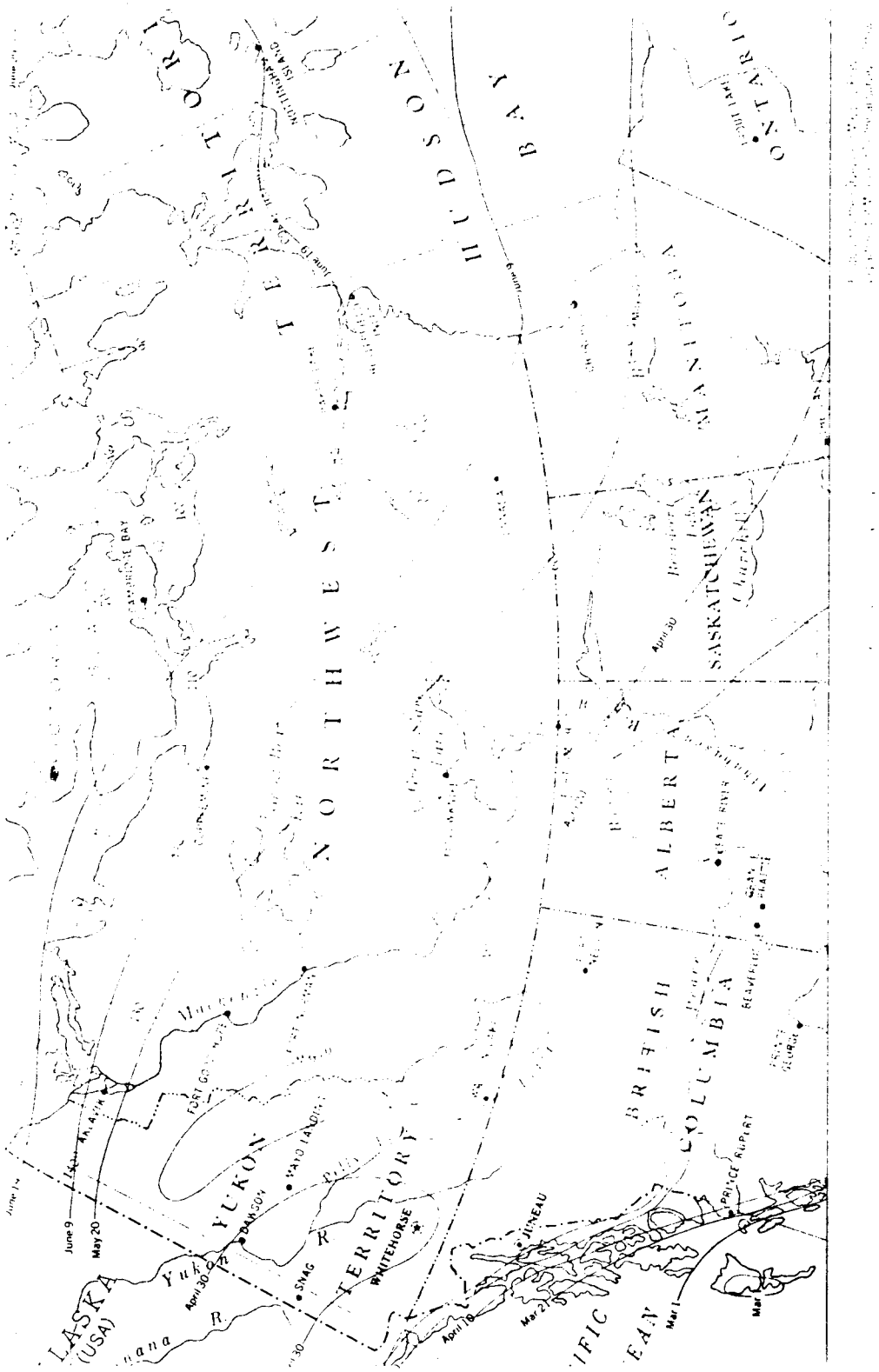
To return to the question then of what mechanism triggers migratory behaviour in caribou herds, the available evidence would seeem to point to a complex interaction of physiological readiness and changing environmental stresses and stimuli. Kelsall (1968:112) discounts the importance of a particular photoperiod because of the considerable differences in latitude and consequent amount of daylight of different winter ranges. He does however suggest the importance of

temperature and its effect on snow conditions, the formation of "sun crust", and spring thaw as an important migratory stimulus. The spring rise in temperature would seem to correlate with shifts in the threshold of snow conditions (after Pruitt) and the caribou's continual search for better travelling and feeding conditions. Temperature change also correlates with the springtime recession of snow cover northward and eastward onto the Barrens.

Figure 14 gives mean dates of last springtime snow cover on the caribou ranges. As Kelsall (1968:48) points out, the dates of snow cover recession correlate well with the dates of caribou migration to the calving grounds. The line for May 20 corresponds approximately to the treeline. The line for June 19 falls roughly on the location of most of the main calving grounds. The caribou, during their spring migration normally arrive at each of the lines approximately 2 1/2 to 3 weeks before the date given. Thus, with the onset of spring thaw, but before the snow has completely melted, the caribou are on the move to their calving grounds and summer ranges.

Apart from the problem of what factors act as stimuli to caribou migration, there is the scarcely less difficult problem of what factors govern the orientation or direction of migration. The common view, expressed above, is that the roughly southwest-northeast orientation of the Thelon, Dubawnt and Kazan River systems, coupled with the caribou travelling along the line of least resistance,

Figure 14. Mean date of last snow cover (1 inch or more) on barren ground caribou range.


NORTHWEST TERRITORIES
YUKON TERRITORY
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
BRITISH COLUMBIA
BAFFIN ISLAND
NORTHAMPTON ISLAND
CAMBRIDGE BAY
FORT GOOD HOPE
MAYO
DAWSON
WHITEHORSE
WATSON LAKE
FORT NELSON
FORT ST. JOHN
PRINCE RUPERT
JUNEAU
SNAG
Yukon R.
Liard R.
Mackenzie R.
Peace R.
ALASKA (USA)
June 9
May 20
April 30
April 10
Mar 21
Mar 1
Mar

favours, for the southernmost Beverly and Kaminuriak herds, migration to the regions of Beverly Lake and Kaminuriak Lake. Again though, the mechanisms governing direction of migration are undoubtedly more complex than this.

It would seem reasonable that, in addition to the influence of the drainage system with its chains of frozen lakes and rivers in the springtime, more localized features of topography and vegetation would also have some influence. This view is expresed by Pruitt (1959:160). After Alcock (1936), he points to two distinctive topographic regions within which the migration routes fall. One is the region of rough exposed bedrock which extends north and north-east from Lake Athabasca, Fond du Lac, and Black Lake. It is a region of long and deep lakes with generally very steep and rugged banks and of rivers flowing to the northeast. This is the terrain over which much of the Beverly population must travel in its spring and fall migrations. The other region more to the south and east is characterized by a more rolling and sandy terrain with only occasional outcroppings of bedrock. It is a region of extensive chains of drumlins and a number of prominent eskers. This is the terrain over which the more westerly segment of the Kaminuriak population must travel.

A third region with distinctive topographical and vegetational features is the Hudson Bay Lowlands to the east (Ritchie, 1962). This is a region of low relief, with extensive clay and silt deposits and

large expanses of poorly drained peat mantle. It is a region in which the drainage system is more fragmented and assumes more of a west-east orientation - cutting across the migration routes of the more easterly segment of the Kaminuriak population. It is also a region of significantly different climate than the other two regions.

Two fundamentally important questions emerge from this fact of topographically, vegetationally, and climatically differentiated regions. One is that of what effect these distinctive features have on the direction of caribou migration. The other question is that of whether or not these distinctive features have led to more specialized morphological and behavioural adaptations in more localized caribou herds. The answers to these questions require a great deal more work on vegetational mapping within the regions and on a much better understanding than is presently available of the morphology and population structure and dynamics of particular herds of caribou.

Associated with the annual cycle of the caribou are the animals' diet and seasonal food preferences. There are distinct differences between the diet of caribou on the summer range and on the winter range, with the summer diet showing considerably more variety.

With new grwoth in the spring the caribou seek out areas of fresh green vegetation. Concurrently, (Kelsall, 1968:73) caribou feces change from the hard dry pellets of the winter months to the soft

shapeless droppings of the growing season. The availability of fresh green vegetation extends out into the Barrens as the herds move onto the summer range (Figure 14). The phenological progression of new growth of preferred foods is as follows (Kelsall, 1968:73 and Loughrey and Kelsall, 1970:276); mid June, green shoots of cotton-grass (Briophorum spp.); early July, other sedges (Carex spp.) and grasses, new leaves of glandular birch (Betula glandulosa); from about July 10th, new growth of stunted willows (Salix spp.). Along with the preferred new growth the caribou consume the staple fruiticose lichens such as Cladonia, Cetraria, and Stereocaulon, the leaves of many woody perennials, such as Arctostaphylos, Empetrum, Ledum, Rhododendron, and Vaccinium, numerous forbs, louseworts (Pedicularis sp.), and a variety of other winter-killed vegetation. Dryas integrifolia, a dominant plant on much of the tundra, is consumed in quantity. Some species of fungi, particularly mushrooms, and some varieties of berries are consumed. As new growth of sedges, grasses, willow, and birch become more mature and tougher, their consumption diminishes.

During winter, the diet of caribou is somewhat more restricted, partly due to the more limited range of vegetation, partly due to its more limited accessibility under the snow cover. The common fruiticose lichens form the bulk of the winter diet, with a substantial part of the diet made up of the varieties of sedges, grasses, and woody plants mentioned above. Horsetail (Equisetum spp.)

is a preferred winter food. Rock tripe (Umbilicaria hyperborea) and such arboreal lichens as Alectoria jubata, Evernia mesomorpha, and Usnea hirta, are consumed in quantity when the preferred fruticose lichens are not available.

Given the caribou's dependence on lichen, a very great threat to the winter range of the caribou is posed by forest fires. Scotter (1964) estimates that lichen cover destroyed by fire requires nearly 100 years to be restored to its former condition. Miller (1976:6), however, argues that forest fires are beneficial to caribou winter range in the sense that they increase the heterogeneity of plant cover and favour the growth of lichen species which occur in early successional stages.

Shed caribou antlers are chewed by caribou at any time of the year. The bulls shed their antlers in fall and early winter while in the taiga or boreal forest, the cows, during early summer on the tundra. According to Kelsall (1968:82) the spike antlers of young caribou which are shed when still in velvet, are ignored, but any others are chewed avidly. Also according to Kelsall (1968:3) some shrubs and small trees, notably larch, willow, spruce, and birch are chewed, though infrequently. Caribou are rarely seen drinking water. The explanation offered by Kelsall (1968:83) is that water requirements are probably met in the summer by the moisture content of green plants, and in winter by ingested snow.

With regard to the general behaviour of the caribou, a number of characteristics have been widely described. Most notable are that the barren ground caribou are gregarious, at times forming very large herds, and that they are restless animals and are continually on the move. They are diurnal in their behaviour, and have successfully adapted to a wide range of environmental conditions, including permament winter snow cover, the varied terrain and summer vegetation of the tundra, and an annual temperature range exceeding 150°F. Along with their adaptive range they display varying degrees of wariness and curiostiy at different times of the year. Although the caribou follow a generally predictable annual migratory pattern, as emphasized by Burch (1972:364), they exhibit extensive lateral movement within this migratory pattern. Further, herd size and concentration exhibit considerable variation in different settings.

As grazing animals caribou exhibit extensive rather than intensive feeding habits. That is to say, they crop lightly the new growth of the vegetation, taking a few bites, moving on a few paces, and then cropping some more. Thus even while grazing they are on the move. Among the more remarkable adaptations of the caribou is their ability to locate and extract food under the winter snow cover. Using their keen sense of smell, they first locate vegetation under the snow and then, digging craters with their forelegs, they are able to graze. Their adaptation extends even to their hoofs being longer in winter than in summer (Pruitt, 1959:175).

The ability of the caribou to get sufficient food in winter is governed by the characteristics of the snow cover and by the bioenergetics of extracting food from underneath the snow cover. Caribou can function quite well in snow depths of up to 23 or 24 inches, depending of course on the hardness of the crust and the density of the snow. With greater snow depths of the order of 25 to 30 inches, commonly encountered in late winter, however, extracting sufficient food becomes much more difficult and exhausting. Further difficulty is caused by increasing granulation of the snow in late winter, which results in the walls of the feeding craters continually collapsing. The greatest difficulty which caribou face in winter is a sudden thaw and subsequent freeze up which effectively puts an impenetrable crust over large areas of winter range. Thus although superbly adapted to their winter environment, the caribou are not free from the threat of disaster in the form of starvation.

The concentration and mobility of caribou herds during winter seem to be governed by snow conditions and the accessibility of adequate food. Pruitt's (1959) hypothesis of caribou moving in response to the stresses imposed by a gradient of snow conditions is supported by the observations of Kelsall (1968), Skoog (1968), and Parker (1972). If such is indeed the case, then the ability to predict caribou distribution and to anticipate caribou movements during the winter months on the basis of such environmental factors as a gradient of snow conditions must have been tremendously important for

traditional Chipewyan hunting. The usual pattern of winter grazing is for the animals to rest offshore on lakes during the day and to graze on the nearest accessible vegetation in the morning and late afternoon. Caribou rarely graze over an area more than twice during a single winter, due to the fact that in areas of extensive feeding craters impenetrable crusts tend to form on the snow cover. Likewise, large concentrations of caribou are rarely found in the same area in succeeding winters. On the other hand, in winters of less than average snow depth, with minimal restrictions on movement and feeding, the caribou tend to disperse over a wider area (Parker, 1972:52).

An important adaptive consequence of this extensive rather than intensive feeding pattern of the caribou is the conservation of winter range. The summer range of the caribou presents no such problems of finding adequate grazing. During the summer the animals are even more on the move than during the winter and with the bursting forth of new growth of vegetation in late June and early July there is a great range and abundance of good quality grazing.

The general behavioural pattern of the caribou is markedly influenced by environmental circumstances. During periods of rapid migration and at times when the herd is concentrated, the animals are not unduly disturbed by the presence of predators. During winter, on the other hand, when the herd is more dispersed, the animals are much more wary. Although extremely good swimmers, the caribou are most

vulnerable to human predation while in the water, particularly at major crossing points on rivers and lakes when the herd is more concentrated.

The behaviour of the caribou is also affected to a considerable extent by the physical condition of the animals, which changes considerably in the course of the year. The most distressing period for the animals is undoubtedly the month of July and early August when they are in moult and are subjected to relentless harassment by blackflies, mosquitoes and warble flies. In an attempt to escape this torment the animals tend to bunch up in groups, and move about in a frenzy. They also seek out any wind which tends to disperse the insects and any areas of cooler temperature such as areas of remaining snow cover and the cooler north slopes of any hilly region. Consequently, although this varies somewhat by sex, as indicated above, by early August the caribou are in the poorest physical condition of any time in their annual cycle. On the other hand, the animals are in the peak of condition in late August and September. In this period the pelage of the caribou is in top condition from the point of view of the Chipewyan. By late September, however, the caribou fur becomes too dense to be used in clothing. In peak condition, with a pronounced buildup of back fat, at this time the bucks weigh on an average about 225 pounds and the cows 150 pounds.

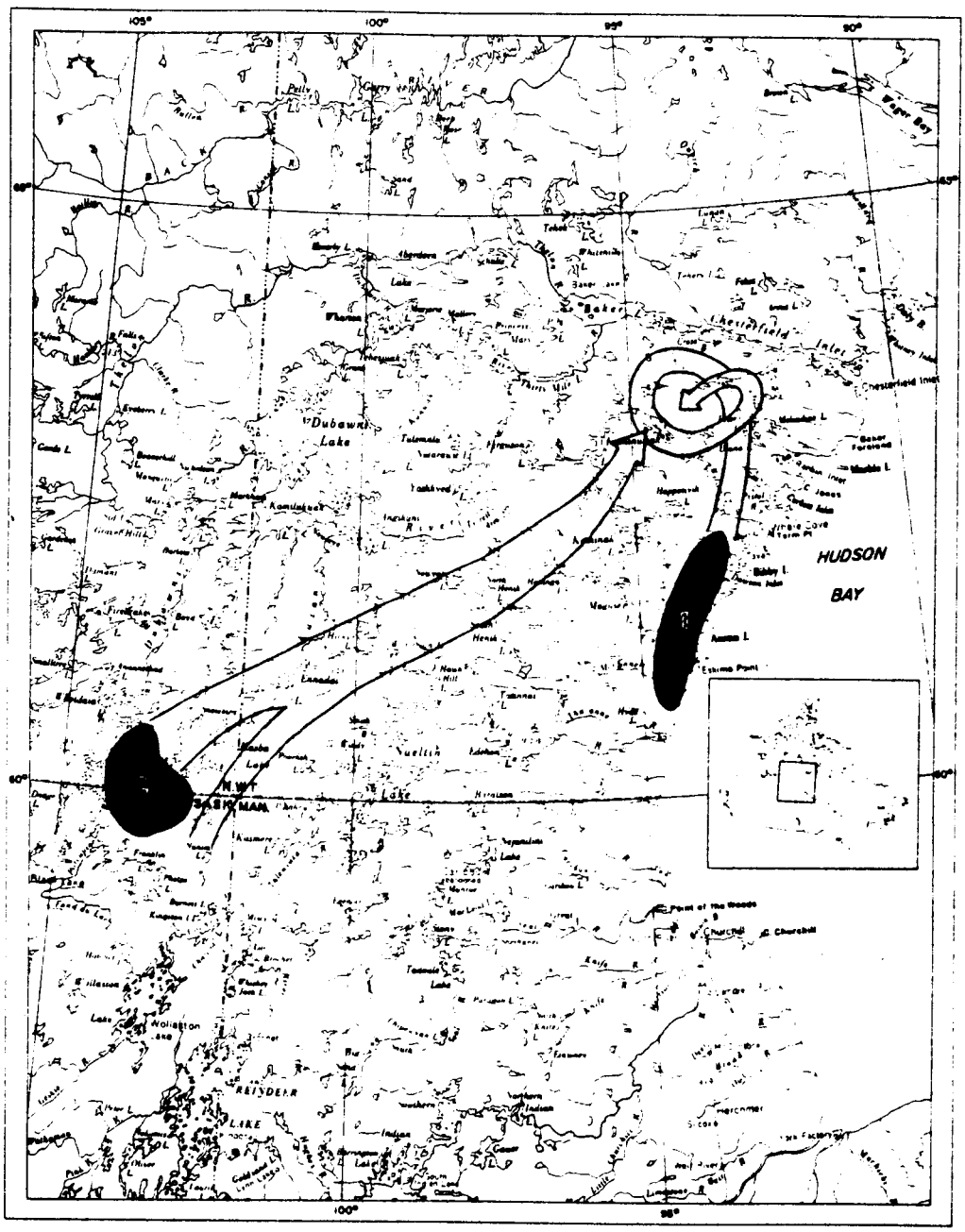
Within a caribou herd there is substantial age and sex segregation at certain periods of the year. Sexual segregation is greatest just before and during the calving period. The drive to the calving grounds is led by groups of pregnant cows and yearlings with groups of older bulls following up to 100 miles or more behind. During summer and the August dispersal there is considerable intermingling of these groups until the rutting period in October and early November, when age and sex segregation is at a minimum. With the first substantial snowfall of the winter, anywhere from September to early November, the drive to the winter range is triggered, led this time by the reconstituted groups of old bulls. On the winter range those groups of older bulls tend to move deeper into the boreal forest than do the groups of cows with calves and yearlings. Within a caribou herd the sex ratio of the adult population has been estimated at 40 to 60 males per 100 females (Loughrey & Kelsall, 1970:278). Although the age structure of a herd has not been so extensively investigated, Banfield (1955) has constructed a preliminary life-table for caribou which indicates an average life expectancy for caribou of 4.1 years.

With regard to the distribution of caribou on winter range, Thomas (1969:7) differentiates three distinct herds wtihin the Beverly Population. Referring back to Figure 12, these can be located as the Beverly 1 herd, located east of Great Slave Lake; the Beverly 2 herd, north of Lake Athabasca; the Beverly 3 herd, south east of Black Lake.

Of particular importance from the point of view of Chipewyan exploitation and hunting practices, would be the Beverly 3 herd. Rather less important would be the Beverly 2 herd, due mainly to the more rugged and inaccessible terrain to the north of Lake Athabasca. The Beverly 1 herd has constituted the principal resource of the more northerly Chipewyan hunting groups. The Beverly 3 herd as distinct from the other two is characterized by a larger proportion of older bulls. In the course of the annual cycle there is a convergence of these three herds during the summer in the calving region around Beverly Lake followed by a fall and winter dispersal in the region of the treeline and the boreal forest.

The distribution of the Kaminuriak population would seem to be considerably more complex than that of the Beverly population, perhaps in response to significantly greater variations in topography, vegetation, and climate within its territory. Some idea of the winter distribution can be gained from the maps in Figures 15 and 16 showing three main areas of concentration - one around the northern end of Wollaston Lake and Reindeer Lake and in the region of Cochrane River, which joins the two lakes; another to the north of Southern Indian Lake; and the third along the coastal plain on the west coast of Hudson Bay north from about Eskimo Point. As acknowledged by Parker (1972), these three concentrations correlate in the order given with Banfield's Brochet or Windy Bay herd, Duck Lake herd, and Churchil or Eskimo Point herd.

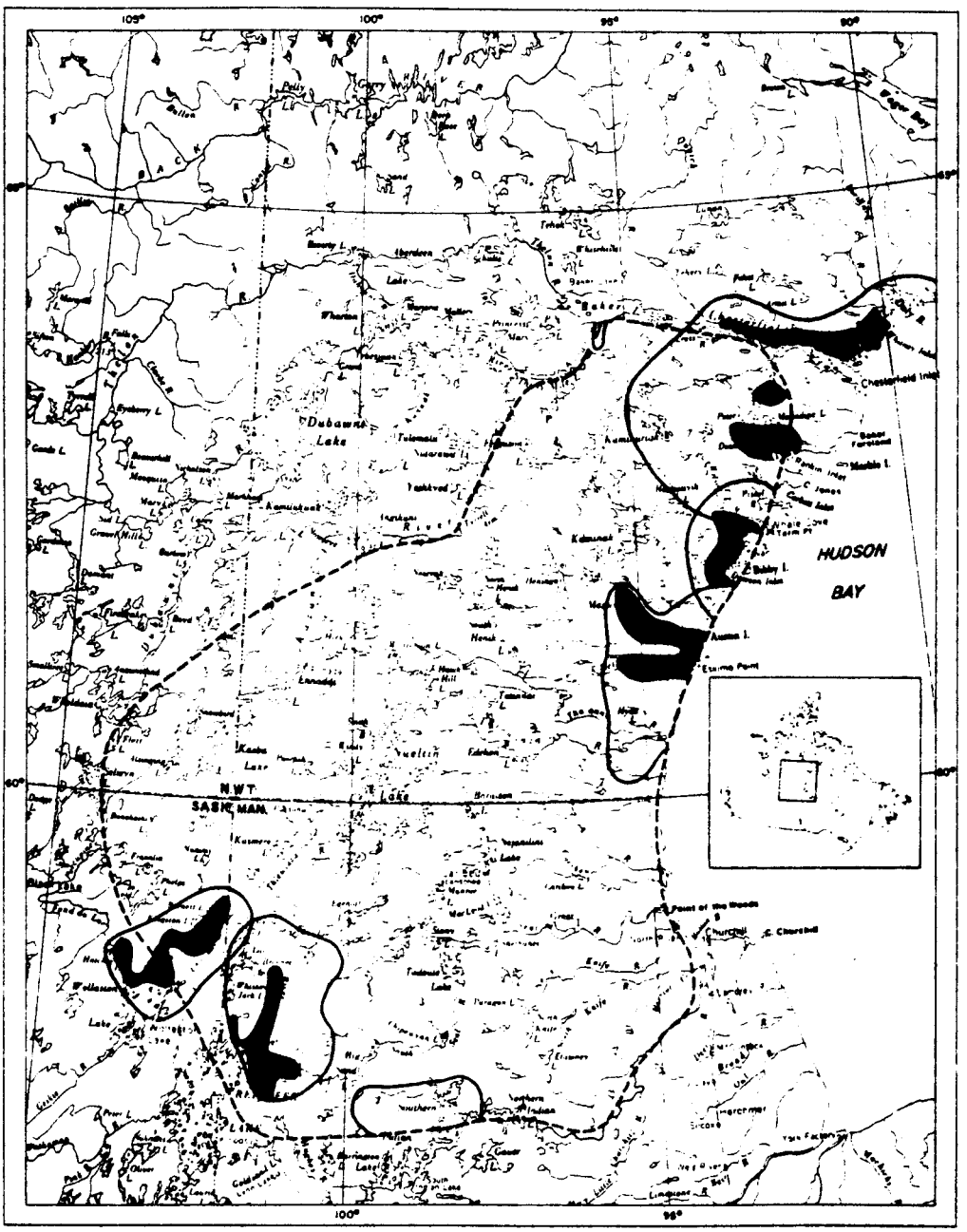
Figure 15. The two main areas of caribou distribution on May 1, 1967, and the spring migration routes to the calving grounds. (Parker, 1972)



1 Tundra-wintering caribou

2 Taiga-wintering caribou

Figure 16. Approximate areas from which caribou were killed by Indian and Eskimo hunters within the winter range of the Kaminuriak population, August 1967 to July 1968 (Parker, 1972).


HUDSON
BAY
NWT
SASK
MAN
Total range limits
Areas from which caribou killed
Areas of heavy hunting pressure
Miles 0 50 100 150

As suggested above, the focal points for understanding the seasonal dispersion of caribou are the calving grounds and the area of the rut. For the Kaminuriak population the evidence indicates that calving is concentrated in the high ground between Kaminuriak Lake and Rankin Inlet and south to Kaminak Lake and the northern end of Maguse Lake. The selection of such rugged terrain for calving ground would seem to offer the most favourable conditions for calf survival. As Parker (1972:28) points out: "During spring breakup, when calving is in progress, elevated, rocky terrain provides the driest possible conditions and also the maximum shelter available from high winds and sudden rain and snow storms." Also of some consequence is the fact that this region is beyond the reach of predators at this time of year. Travel to the calving grounds is facilitated by the fact that on the larger lakes the ice usually remains solid until late June. For the Kaminuriak population the coastal-wintering animals (Eskimo Point herd) usually move inland to the calving grounds in late May, arriving there some two weeks before the main body of the taiga-wintering caribou. Calving in this region is completed by June 20th.

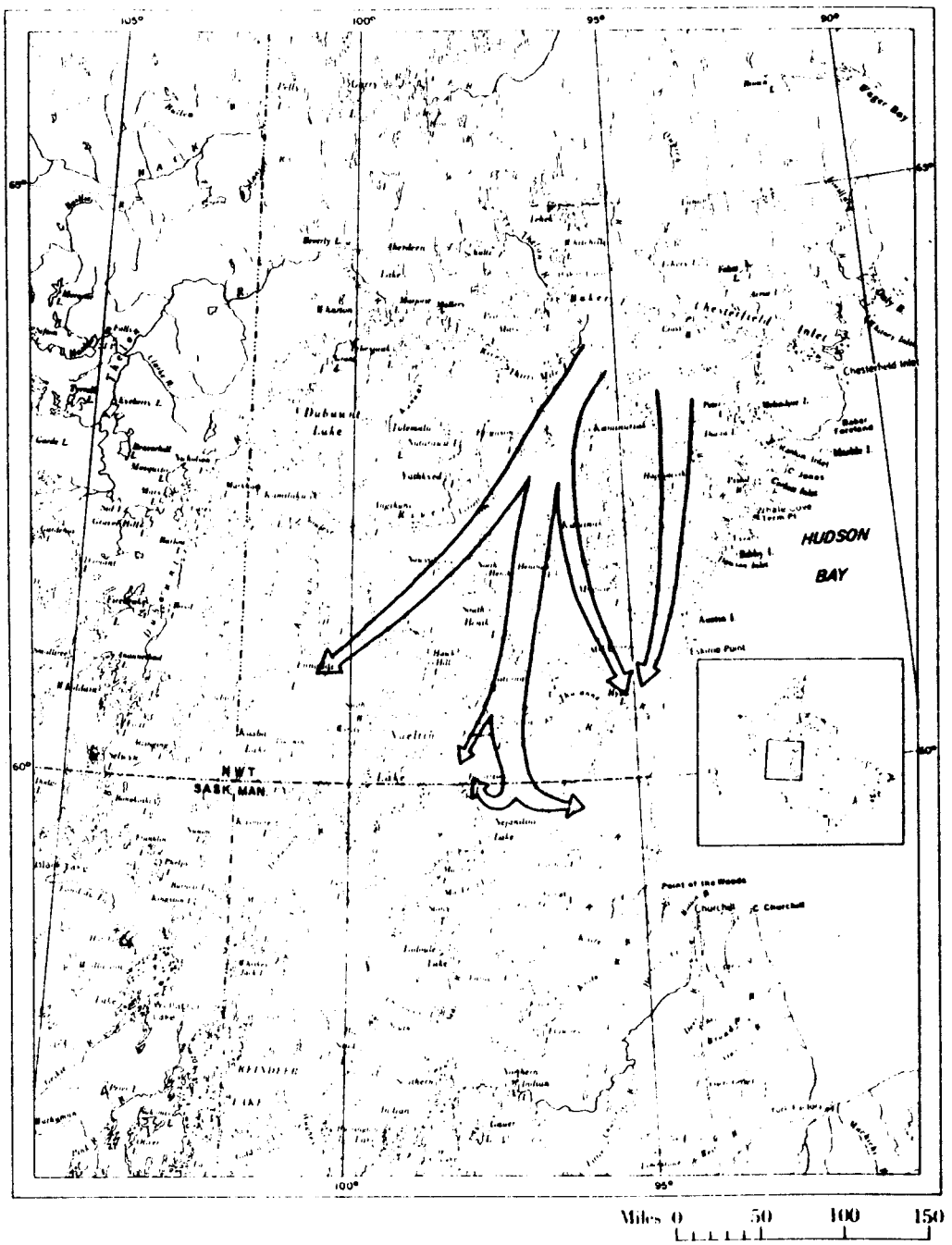
The characteristic post-calving pattern, according to Parker (1972:30) is for the many small nursery bands to drift northward from the calving grounds until early July when they form larger aggregations situated south of Baker Lake between lower Kazan River and Cross Bay on Chesterfield Inlet. In early July these aggregations

are joined by bands of older bulls which normally do not leave the treeline until mid-June.

The migratory pattern continues with a mid-summer migration south from Baker Lake. This movement begins in the period of July 14th to July 22nd, and, according to Parker, proceeds at a rate of 10 to 15 miles a day. Although this migration is more diffused than the spring migration north, Figure 17 indicates three discernible routes leading to mid-summer concentrations in the regions of Ennadai Lake, Baralzon Lake, and Hyde Lake. Parker (1972:34) offers the view that this pattern might be due to the low carrying capacity of the late summer range. He suggests further that the flat, sedge and grass terrain along the coast is more favourable range than the more rugged interior for nursing cows and calves, and that the cool winds off Hudson Bay give the animals some relief from insect harassment. This southerly movement, which comes to an end about August 15th, coincides with Kelsall's reports of the August dispersal of the Beverly population.

The pattern described by Parker indicates a coalescing in late September of the central and eastern concentrations in the region of South Henik Lake and a movement of the western concentration to the west side of Nueltin Lake. The latter concentration was observed by Parker (1972) and by Lawrie (1948) to have a greater proprtion of bulls than the other two concentrations. With the onset of the rut in October, (peaking about October 24th) the greatest caribou

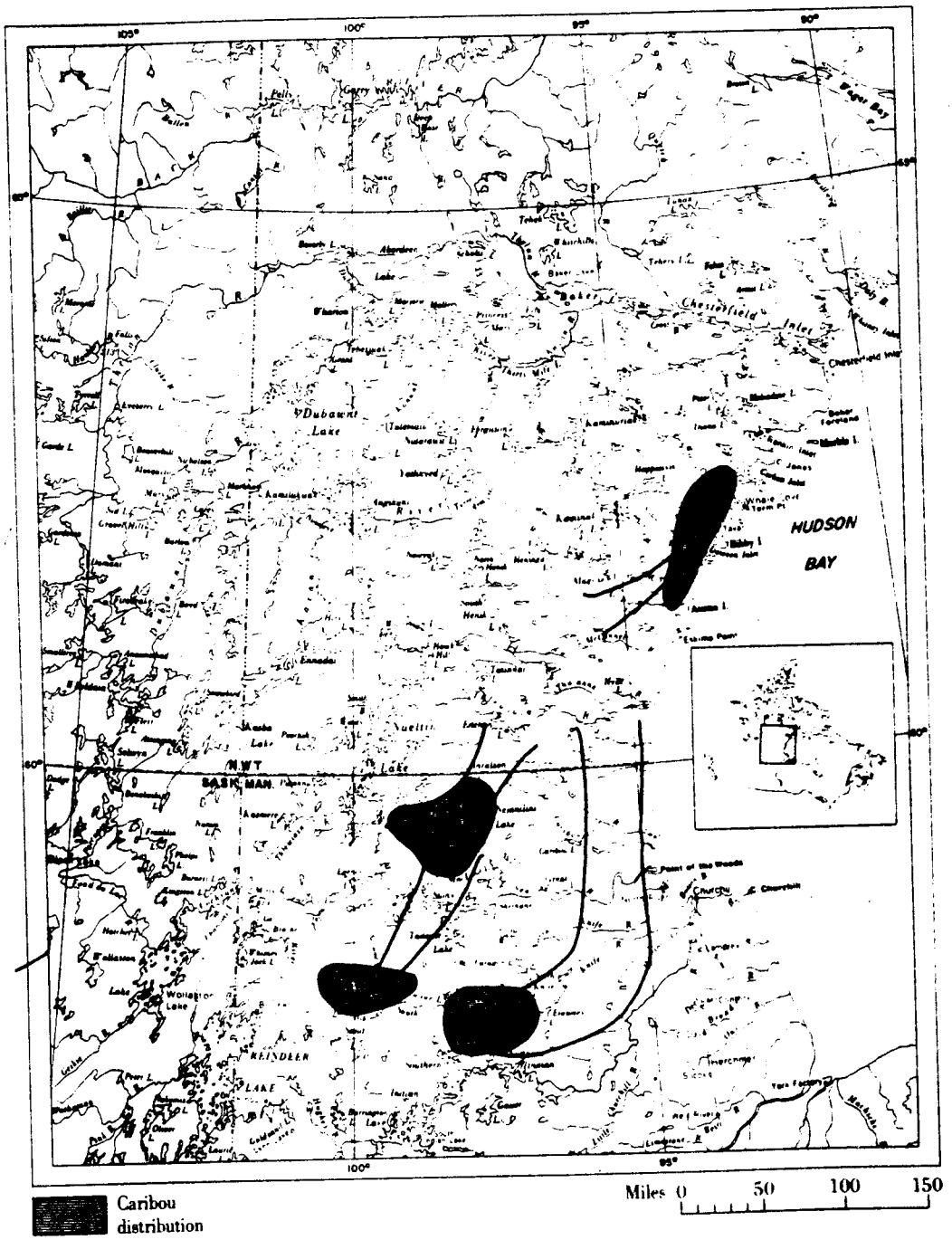
Figure 17. The mid-summer migration routes south from Baker Lake, by the Kaminuriak population, July 14 to August 15, 1967 (Parker, 1972).


105°
100°
95°
90°
60°
65°
Dubawnt Lake
HUDSON BAY
NWT
SASK. MAN.
Miles 0 50 100 150

concentration is found in the region between South Henik Lake and Edehon Lake. In Parker's (1972:44) observation, the three main concentrations approach a common area as the rut increases in intensity. Although Parker appears to accept the view that there is interbreeding between the three herds, it has not yet been shown conclusively that the concentration to the west of Nueltin Lake does in fact substantially meet up with the concentration between South Henik and Edehon Lakes. The question of a common area of rut and random interbreeding of the three late-summer concentrations is crucial to resolving the issue of whether or not the Kaminuriak population is actually a single population or is rather made up of a number of discrete local populations.

By late October and early November the fall migration into the taiga and boreal forest is underway. As shown in Figure 18, the pattern of three distinct herds within the Kaminuriak population tends to be reestablished with the migration of different concentrations in the direction of Eskimo Point, Southern Indian Lake, and Reindeer Lake. Coincidental with this migration into the boreal forest is a general movement to the west to the region of Cochrane River. By January the smaller bands of older bulls are segregated from the main concentration of cows, calves and yearlings, usually in the region of Southern Indian Lake. Parker (1972:23) accepts the reports of Hearne (1775), Richardson (1829) and Preble (1900) that barren-ground caribou were rarely found to the south of Churchilll River and rejects Banfield's contrary view.

Figure 18. Fall migration routes (November 1 to 17, 1966) and distribution of the Kaminuriak population on November 17, 1966 (Parker, 1972).


HUDSON
BAY
NWT
SASK. MAN.
Dubawnt
Lake
Baker
Lake
Chesterfield
Inlet
Wollaston
Lake
REINDEER
LAKE
Caribou
distribution
Miles 0
50
100
150

Echoing the views of Pruitt (1959), Parker relates the caribou distribution on the winter range to the snow condiitons and weather encountered in late January. As snow depths increase to a normal late January snow cover of 25 to 30 inches, movement becomes restricted and the population more concentrated, usually in the region of Cochrane River. Such was the case in the spring of 1968. In contrast, a late winter snow cover of 16 inches in 1969, with consequent minimal restrictions on movement and feeding, found the caribou population dispersed over a wide area. In 1967, on the other hand, with a late winter snow cover somewhat deeper than normal, the main caribou population (exclusive of the smaller bull bands) migrated some 100 miles farther to the northwest than in 1968. This resulted in a large spring concentration to the east of Selwyn Lake and south of Wholdaia Lake - well within the winter range of the Beverly population. On the basis of these correlations, Parker (1972:90) offers the view that extremely deep snow cover in late winter tends to keep the herds on the move, usually in a northerly or northwesterly direction, in search of more favourable feeding conditions. In such conditions there would appear to have been considerable mid-winter intermingling of the Beverly and Kaminuriak populations. Moreover, as indicated above, the winter mobility of the caribou in response to difficult snow and feeding conditions would force the Chipewyan hunting groups to the east of Lake Athabasca into a more mobile pattern of hunting activity.

A crucial variable in the structure and dynamics of caribou herds is that of calf survival. As mentioned above, the sex ratio of adult caribou has been found to be from 40-60 males per 100 females. the sex ratio of new-borm calves, on the other hand. has been found to be 106 males per 100 females (Loughrey and Kelsall, 1970:278). Observations of normal calf mortality during the first year range from 50 to 70 per cent, and on occasion even higher.. Parker (1972:90) gives an estimate of 78 percent annual mortality rate for calves from 1966 to 1968. The principal causes of this extraordinarily high mortality rate have been taken to be weather, accidents, disease and predation. Two facts of particular note are reported by Hart (1961) and Loughrey and Kelsall (1970); one that the greatest calf mortality occurs during the first week of life; the other, that male calves suffer a much higher mortality rate than do female calves.

The principal cuase of death during the first week according to Hart, is cumulative stress (heat loss), due to a combination of low temperatures, high winds, and precipitation. Similar conclusions are drawn by Kelsall (1972:238). Loughrey and Kelsall (1970:278) suggest the possibility that the increased vulnerability of male calves might be due to a higher metabolic rate and consequent accelerated heat loss. Another significant factor (Kelsall, 1972:240) is the separation of the calf from its mother in bad weather, before it is able to fend for itself.

In any caribou herd the younger animals appear to have a greater susceptibility to accidental death. Most commonly cited causes are crippling injuries sustained through falling in precipitous terrain drowning while swimming in open water, falling through unsafe ice, and starvation due to excessive depth or hardness of snow cover on the winter range.

As pointed out by Kelsall (1970:269), diseases of viral or bacterial origin are uncommon in wild animal populations, and in this the barren ground caribou is no exception. Parasitism, however, is very extensive and significantly affects both the behaviour and the physical conditions of caribou. The two most widespread parasites of caribou are the warble fly (Oedemagena tarandi L.) and the nostril fly (Cephenemyia trampe L.). Much the more prevalent is warble fly infection, with male caribou more susceptible than female caribou. Warble flies are on the wing from from late June to September. Eggs laid on caribou underhair penetrate the hide and exist in a larval state along the back of the animal throughout the fall and winter. In late May and June the larvae leave the animals through breathing holes in the hide and pupate on the ground. The most visible effect of this larval infection is that from Janurary to July caribou hides are riddled with holes, making them worthless for human utilization. By the end of July, the holes have in the main healed over. A similar cycle is described for the nostril fly (Kelsall 1970:270). In this case the effect on the caribou appears to be one of extreme irritation

rather than of physical damage, and persists throughout the spring migration.

Although the physiological effects of these parasites and of black fly and mosquito harassment on caribou have not been extensively studied, the overall effect would appear to be that of contributing to the exhaustion and weakened physical condition of the animals. Particular consequences of this harassment, it is suggested, might be disruption of feeding and perhaps a lessening of milk production in lactating females. It has been shown (Kelsall, 1970:273) that during the insect season caribou suffer a 20 per cent loss of weight. Although the time is variable, it is usually only with the end of the fly season in early August that the physical condition of the animals begins to improve.

To complete the consideration of the adaptation of the barren-ground caribou to its environment, it is necessary to take accuont of the extremely important factor of the caribou's interaction with other animal species. Without attempting to catalogue all the birds and animals of the caribou range, we can however form a general picture of those species which have frequent, direct relationships with caribou. As discussed at some length by Kelsall (1968) and as outlined provisionally in Figure 19, these other species can be considered in relation to the caribou as predators, as competitors for food, and as scavengers.

Figure 19. The relationship of some co-inhabitants of barren ground caribou range to caribou. Extent of classification in some instances in arbitrary (Kelsall, 1968).

BARREN-GROUND CARIBOU

PREDATORS

Minor or theoretical	Major
Grizzly bear*	Man**
Polar bear*	Wolf**
Coyote	
Wolverine**	
Lynx	
Golden eagle*	
Raven**	

COMPETITORS

Major	Minor or theoretical
Arctic hare*	Woodchuck
Snowshoe hare	Moose
Ground squirrel*	Whistling swan*
Voles (some)**	Geese*
Lemmings*	Grouse
Woodland caribou	Ptarmigan*
Muskox	A few passerine birds**

SCAVENGERS

Shrews	Fisher	Hawks (some)**
Black bear	Weasels**	Golden eagle*
Grizzly bear*	Mink	Bald eagle
Polar bear*	Wolverine**	Jaegers*
Red Fox*	Lynx	Gulls
Arctic fox*	Ground squirrel	Canada jay
Coyote	Voles (some)**	Crow
Wolf**	Lemmings*	Raven**
Marten	Porcupines	Arctic hare
		A few passerine birds

*Primarily tundra forms
**Forest and tundra forms

There seems to be little argument with the view that man and the wolf constitute the only two major predators of the barren-ground caribou. A great deal of attention has been paid to man's exploitation of the caribou herds. Very little attempt, apart from the work of Kuyt begun in 1960, has been made to investigate the predator-prey relationship between wolf and caribou, or even to come to an accurate estimate of the wolf population of the caribou ragne. Kelsall (1968:251), on the basis of one animal per 60 square miles of land surface, estimates a total wolf population of 8000 animals for the whole caribou range. Robertson, (quoted by Parker, 1972:83) estimates a wolf population of 600 for the Brochet section of the Kaminuriak range. Banfield (1954) estimates a 5 per cent annual caribou mortality due to wolf predation. Kuyt (1972:33) estimates that a single wolf would eat about 23 average caribou per year. Kuyt also observes that, although wolves may migrate hundreds of miles with the caribou herds, wolves found on the caribou calving grounds in summer are non-breeding animals. Denning wolves are generally found nearer to the treeline.

Whereas during the winter wolves depend almost entirely on caribou for food, during spring and summer their diet is supplemented by small rodents, passerine birds, eggs and fish. Wolves generally prey on caribou calves and on the older animals in the herd, and they kill at least four times as many female caribou as males (Kuyt, 1972:7). Kuyt also observes that many more wolf cubs die in areas

where caribou are absent than in areas occupied by caribou. Althoough this evidence is sketchy, it can perhaps be viewed in relation to what has been asserted as a general ecological rule (Odum, 1959, and Kelsall, 1968:243) that in predator-prey relationships, "the limiting effect of the predator tends to be quantitatively small when the interacting populations have a common evolutionary history in a relatively stable ecosystem." Parker (1972:85) supports the view that wolf predation is a necessary element in the maintainance of a healthy caribou population. Human predation, on the other hand, since it is more selectively oriented to taking pregnant cows and animals in prime condition, he views as detrimental to the caribou population.

With reference to Figure 19, the available evidence suggests that, apart from human exploitation, caribou herds are little affected by other animal species. The nine species suggested by Kelsall as minor predators, (grizzly bear, polar bear, coyote, wolverine, lynx, golden eagle, and raven), might better be viewed as scavengers feeding on caribou. The reports of these species killing caribou are no more than suggestions or inferences. On the question of competition for food, the abundance of new growth of grasses and sedges in spring and summer ensures a plentiful food supply for all those species of birds and mammals which depend on it. The basic caribou winter diet of lichens is not consumed on any scale by other species. There are a great many other species, birds and mammals, which live as scavengers on caribou remains.

Woodland Caribou (R.t. caribou): The woodland caribou differs both physically and behaviourally from the barren ground caribou. Both bulls and cows are considerably larger than the barren-ground subspecies. The woodland caribou is confined mainly to the boreal forest in the regions to the west of Slave River and to the south of Churchill River. Unlike the barren-ground subspecies, the woodland caribou does not form large herds. It is more dispersed and the total population is very much smaller. Although nomadic in behaviour, it does not exhibit the migratory pattern of the barren-ground caribou. In contrast to the promiscuous rutting behaviour of the barren-ground caribou, the bulls of the woodland caribou collect and defend harems of twelve to fifteen cows. The winter diet of the woodland caribou consists much more of arboreal lichens than the fruticose lichens favoured by the barren-ground caribou. This subspecies, although much fewer in number than the barren-ground caribou, has traditionally been of considerable importance in the economy of the Chipewyan.

Moose (Alces alces aldersoni): The moose found in the northern taiga and boreal forest is one of four subspecies recognized in Canada. The moose is the largest member of the deer family, with bulls of this subspecies averaging about 1,000 pounds and cows 768 pounds (Banfield, 1974:395). The habitat of the moose differs significantly from that of the caribou. Whereas caribou winter range is mainly in climax spruce-lichen forest, moose prefer the browse found in more open poplar and birch succession areas and in lakeshore

willow and alder thickets. Although moose are found througout the caribou winter range, the region to the west of Slave River and along the Mackenzie River, affording an abundance of excellent winter browse, is the main area of moose concentration.

The moose generally is a solitary animal, with, according to Banfield (1974:396), an average of 2 animals to a square mile and up to 10 animals to a square mile on the more restricted winter range. The animals tend to migrate seasonally, spending the summers on higher ground and moving down to the valleys during the winters. On the more restricted winter range the moose is frequently in severe competition with other species of deer. The moose is primarily a browser, during the winter feeding mainly on the foliage and twigs of a variety of trees. As with the caribou, its summer diet is more varied and includes, in addition to the foliage of trees, many aquatic plants, forbs and grasses. A favoured summer habitat is along lakeshores and shallow bays where the animal can feed on the leaves and submerged tubers of water lilies. The usual feeding times are morning and late afternoon with most of the summer day spent in the forest shade, chewing the cud. When it encounters deep snow in winter the moose tends to restrict its movements to well-worn trails along river banks.

The cows are seasonally polyoestrous, with the rutting season extending from mid-September to late November. Calves are born in late May or early June, and are very awkward and unsteady for the

first two or three weeks of life. After that the calves gain weight steadily and are usually weaned and come into moult by September. The calves stay with their mothers throughout the first winter.

The moose is a timid animal and reacts quickly to man's presence. Its alertness seems to be based mainly on its acute hearing and sense of smell. Although its eyesight does not appear to be so acute, the animal reacts quickly to movement. Spending much time in summer wading in bays and along lakeshore, the moose is also a very strong swimmer. Although it seldom breaks into a gallop the moose can attain speeds of about 35 miles per hour in an awkward running gait. The lifespan of the moose ranges up to about 20 years. During the rutting season, the bulls tend to be truculent and dangerous, and healthy adults easily fight off wolves. Wolves do however prey on the older and weaker animals, and on the younger animals. Black bears and grizzly bears also appear to be of some consequence as predators. The moose is important in human exploitation both as a source of food and for the fact that the tough moose hide provides leather for clothing, gloves, leggings and moccasins.

American Bison or Buffalo (Bison bison L.): There are two recognized subspecies of bison - the larger, more northerly form (B. b. athabascae), generally referred to as the wood buffalo, and the traditionally much more numerous plains buffalo (B. b. bison); both subspecies are reported in the region to the west of Slave River.

Seasonal migrations of up to 150 miles are reported (Banfield, 1974:406) between the wooded hills of Wood Buffalo Park and the valley of the Peace River. Much as the elk and the mule deer, then, the bison is confined to the westerly and southerly fringes of the Chipewyan territory and is in consequence of only marginal importance to the Chipewyan economy. In the overall economy of the fur trade, however, the plains buffalo as the main constituent of pemmican was enormously important, as it was also to the economy of the plains Indians. Among early historical accounts, Henry Kelsey, the young explorer for the Hudson's Bay Company, first observed the plains buffalo on August 20, 1691 when he reached the prairie in Manitoba. Samuel Hearne first observed the wood buffalo in the region of Great Slave Lake, on January 9, 1772, on his return journey from the Coppermine River.

Bison are gregarious animals, nearly always found in cohesive herds, which range in size from small bands of up to 20 animals to large herds numbering many thousands of animals. They are adapted to a wide range of habitat, including arid plains, aspen parkland and meadows, river valleys and coniferous forest. Primarily grazing animals, they feed mainly on a wide variety of grasses, sedges and forbs. Total population estimates for the bison before the advent of Europeans range up to 40 to 60 million animals. Apart from the decimation of herds wrought by human exploitation, the only other significant predators of the bison are thought to be the wolf and the grizzly bear and perhaps the mountain lion or cougar.

The bison is the largest of terrestrial mammals in North America. with adult bulls averaging 1,200 to 1,300 pounds in weight and adult cows 930 pounds, and large bulls weighing up to a ton (Banfield. 1974:405). Bison are mainly diurnal in habits. feeding intermittently throughout the day, with prolonged rest periods throughout the afternoon. They have keen eyesight and a keen sense of smell. and, when alarmed, are easily stampeded. The cows are seasonally polyoestrous with rutting extending from early July to late September. and parturition from mid-April to early June. The animals are remarkably long-lived with some reported living up to 40 years.

Muskox (Ovibos moschatus): The muskox is the only ungulate adapted entirely to life beyond the treeline. In this unique position, the muskox has traditionally been a resource of some importance to the economy of both the Indians and the Eskimos of the Barren Grounds. This is especially so at times and in places where caribou were absent.

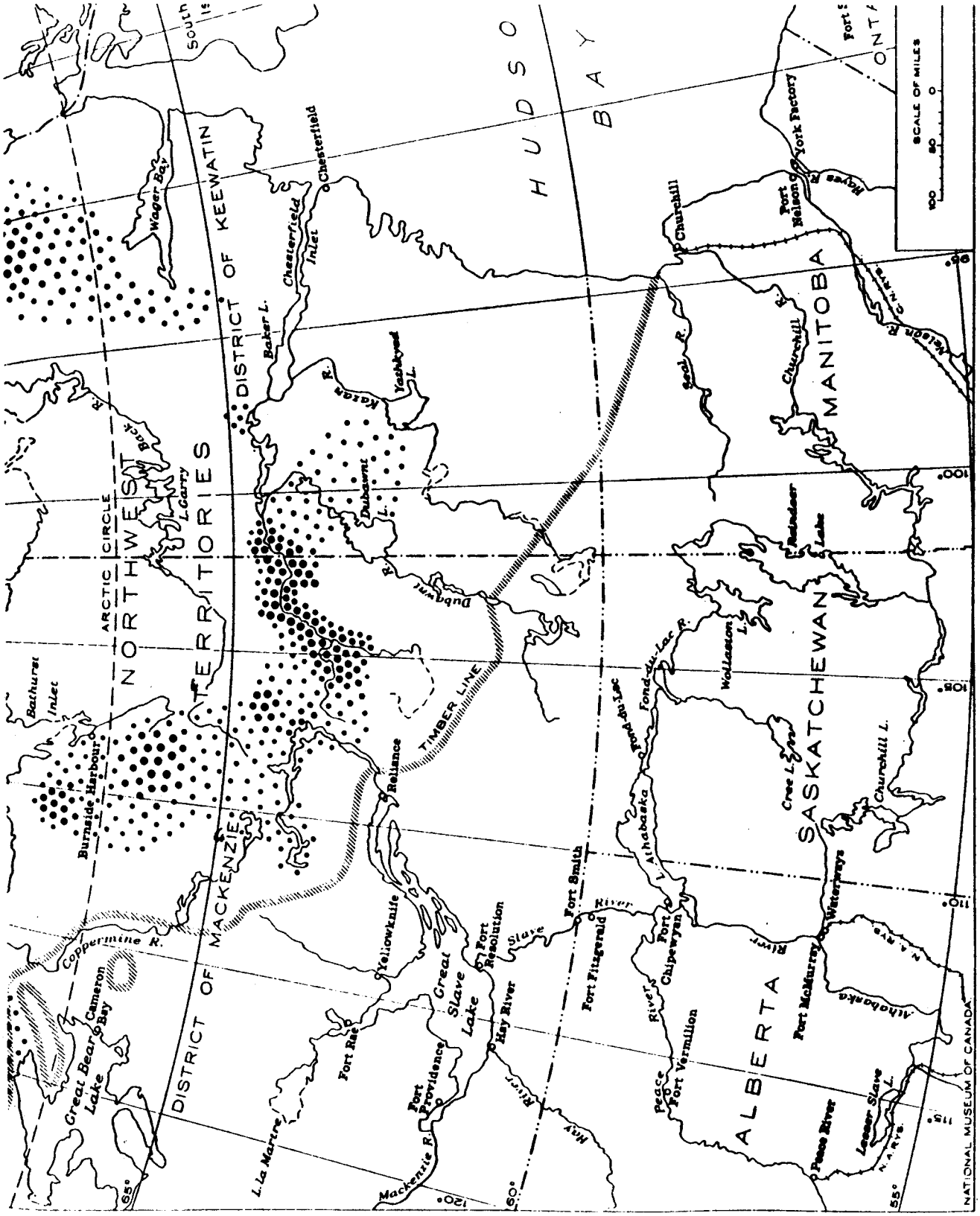
A major problem in understanding the distribution and adaptive pattern of the muskox lies in the fact that a species of so limited a population was decimated by greatly increased hunting pressure in historical times. The increased use of dogs and rifles made the muskox an easy mark for human predation and led to the systematic wiping out of whole herds. According to Banfield (1974:413), over 15,000 muskox hides were shipped from the Canadian north between 1864 and 1916 to satisfy the demand for carriage robes.

Although not much can be said about the pre-contact muskox population, there are a number of significant general observations that can be made about the species (see Clarke, 1940:80). It seems clear that the total muskox population was never very large, and that it varied greatly at different times. Moreover, the available evidence suggests that there has been great variation in both the distribution and density of the muskox population.

On the basis of accumulated evidence Clarke (1940) arrived at the probable distribution shown in Figure 20. Burch (1972), on the other hand, claims a more extensive distribution of muskox, extending at least as far south as Selwyn Lake.

In as much as the Chipewyan made extensive use of the Barren Grounds, there can be no doubt that the muskox was extremely important to their economy. Of particular importance to the Chipewyan would be the concentration of muskox in the region of the upper Thelon River on the central Barrens. Of rather less importance would be the more scattered distribution of muskox between Dubawnt and Yathkyed Lakes and in the region of Beverly Lake. Also of some significance, but more in the territory of the Yellowknives, was the presence of muskox in the region of Clinton-Colden, Aylmer, and Muskox Lakes, to the northeast of Great Slave Lake. Having in mind the decimation of herds since about 1850, Clarke (1940:84) estimates a total muskox population on the Canadian mainland in 1937 of about 1,200 animals, of which some 300 were located within the Thelon Game Sanctuary.

Figure 20. Distribution of musk-oxen on the Canadian mainland. The relative density of this distribution is shown by various sizes of black dots (Clarke, 1940).


HUDSON BAY
NORTHWEST TERRITORIES
DISTRICT OF KEEWATIN
DISTRICT OF MACKENZIE
ALBERTA
SASKATCHEWAN
MANITOBA
ARCTIC CIRCLE
TIMBER LINE
SCALE OF MILES
Wager Bay
Chesterfield Inlet
Baker L.
Churchill
York Factory
Port Nelson
Hayes R.
Seal R.
Churchill R.
Nelson R.
Reindeer Lake
Wollaston L.
Fond du Lac
Fond du Lac R.
Athabaska L.
Cree L.
Churchill L.
Waterways
Fort McMurray
Athabaska River
Fort Chipewyan
Peace River
Fort Vermilion
Lesser Slave L.
Peace River
Fort Smith
Fort Fitzgerald
Slave River
Fort Resolution
Great Slave Lake
Hay River
Fort Providence
Mackenzie R.
Fort Rae
L. La Martre
Yellowknife
Great Bear Lake
Cameron Bay
Coppermine R.
Bathurst Inlet
Burnside Harbour
Larry
Kazan R.
Yathkyed L.
Dubawnt L.
Dubawnt R.
Reliance
100°
105°
110°
115°
120°
60°
65°
55°
N.W.T.
N.W.T.
NATIONAL MUSEUM OF CANADA

The muskox is a gregarious animal existing in herds which function as close-knit units. Herd size varies from 3 to about 100 animals, with herds of about 15 animals commonly found. The muskox also appears to follow a limited migratory pattern over a range of about 50 miles. The animals are both browsers and grazers and the feeding pattern is leisurely and intermittent. The summer range is mainly within the fairly dense vegetation of river valleys and lakeshore, in protected meadows, marshes and willow and alder thickets. In this kind of cover the muskox is fairly well concealed. By the end of August or early September the muskox leave the summer range for the higher elevations of the exposed and wind-blown central Barrens where they spend the winter. The herds appear to be more dispersed in winter than in summer. The summer diet of the muskox includes willow, alder, and a wide range of sedges, grasses, and forbs. In winter the diet is more restricted, consisting mainly of stunted willow and birch, Labrador tea, crowberry, cowberry, and bilberry.

For most of the year the muskox herds are made up of cows with calves, yearlings, two-year-old heifers and young bulls. The mature bulls either wander about alone or in small groups. They come together with the main herd in late July, however, for the duration of the rutting season which extends to the third week in August. Parturition occurs in late April and early May. Usually the cows calve only every second year. The animals appear to maintain a daily

pattern of activity throughout the year, including the long periods of winter darkness.

Prior to the demands of the fur trade, the Chipewyan appear to have exploited the muskox herds mainly as a food source when there were no caribou to be had. They appear to have had little use for muskox hides. During the spring caribou migration there is a substantial overlapping of caribou herds and muskox winter range. A report cited by Clarke (1940:78) indicates that in the early spring the Chipewyan expected to encounter muskox in the region to the west of the Thelon River and south of the Hanbury River, on the main route to the Beverly Lake calving grounds. With the development of the fur trade, the main trading depots for muskox hides were Fort Rae and Fort Resolution on Great Slave Lake. According to MacFarlane (1908), there are no records of muskox hides being traded at Fort Smith onthe Slave River or at any of the forts on Lake Athabasca. In the region of Dubawnt Lake, an area of no Eskimo settlement in recent times, the scattered muskox may have been infrequently encountered by Chipewyan. In the region of Kazan River, an area of regular Eskimo habitation, there have been no recent reports of muskox.

Apart from human exploitation, the only significant predatory threat to muskox would appear to be the wolf and barren-ground grizzly. From all accounts though it appears that, on going into their customary defensive circle, the muskox have little difficulty in thwarting such predatory attacks.

Fur-bearing animals and rodents: Of the great variety of smaller mammals inhabiting the boreal forest and the Barren Grounds, mention will be made of only those species which have a significant place in the economy of the Chipewyan.

Wolf (Canis lupus): There are two subspecies of wolf found in the territory of the Chipewyan: C. l. griseoalbus inhabiting the boreal forest and central Barrens, and C. l. hudsonicus in the more easterly region and adjacent Hudson Bay Lowlands. The wolf is primarily a hunter of big game, preying mainly on the various species of the deer family. The significance of the predator-prey relationship between wolf and caribou is indicated in the observation by Kuyt (1972:6,8) that a greater proportion of wolf cubs die in areas with no caribou than in areas occupied by caribou, and that areas were no caribou winter are devoid of wolves.

Remarkable features of the wolf adaptation are that wolves display complex social behaviour and that the family wolf pack reveals a complex social organization. Wolf packs follow a migratory pattern that is closely tied to the migrations of the barren-ground caribou. The breeding season for wolves is from late February to mid March, with pups being born in early May. During the breeding season and the summer, denning wolves are confined to the region of the treeline. Those wolves which follow the caribou to the calving grounds, according to Kuyt, are non-breeding wolves. In fall and winter the

wolf packs move with the caribou herds into the boreal forest, often with several packs uniting to pursue the hunt. The wolf population density would appear to bear some relation to caribou concentration, reaching as high as one wolf per 6.9 square miles in areas of maximum winter caribou concentrations (Kuyt, 1972:33).

Wolf dens are usually located on a promontory near water, and usually occupy caves, overhanging rock shelves, abandoned beaver lodges, or hollow logs. Above the den are lairs from which the wolves can survey the surrounding terrain. The usual size of a wolf pack, according to Kuyt (1972), is from 4 to 7 animals, but at times ranges up to 14 individuals. According to Banfield (1974:291), a wolf pack maintains a fixed home range around the den, and the pack maintains fixed runways within its territory and makes regular patrols over those runways. Others, however, suggest a more irregular hunting pattern.

The wolf is almost entirely dependent on caribou in winter, and with the caribou is among the few species that will cross large frozen lakes in winter. In summer, the wolf diet is much more varied and in addition to caribou includes small rodents, ground-nesting birds, eggs, fish, and to a lesser extent berries, fruit, and insects. In hunting caribou, wolves generally prey on calves, on older and weaker animals, and they are known to cache meat. The wolf is not a particularly fast animal, and can often be outrun by its prey. In

hunting it relies rather on cunning and the usual hunting pattern is for the pack to stalk and encircle prey. Starvation and disease, rather than natural predation appear to be the main controls on the wolf population.

Dog (Canis familiaris): According to Clarke (1940:36), there are two distinct strains of domesticated dog found in the north - the long-legged Indian dog adapted to travel in the bush and the short-legged Eskimo dog adapted to travel on the tundra. In recent times, however, there have been extensive interbreeding between the two as well as with other breeds and also with the wolf.

Arctic fox (Alopex lagopus innuitus): The arctic fox is found throughout the tundra and in winter south to the margin of the boreal forest. For much of the year it is a solitary animal. Foxes are found in pairs from the beginning of the breeding season in mid-February, and in families with the birth of the young between mid-May and mid-June. They remain together throughout the denning season until about mid-August, when the young foxes are abandoned by their parents.

The arctic fox population undergoes great fluctuations with peaks every 3 to 5 years. The fluctuations appear to correlate with fluctuations in the lemming population, with crashes usually coming a year after crashes in the lemming population. The litter size for the

arctic fox ranges up to 25 whelps and is related to the food supply. When food is abundant, litters tend to be large, and when food is scarce litters are smaller and there is a marked reduction in breeding animals.

Arctic fox dens are usually located in light, sandy soil in river banks or eskers. Apart from the denning season, the animals tend to migrate over considerable distances. They are resourceful in acquiring food, and are notorious camp thieves. Their main winter diet consists of lemmings and other arctic voles, supplemented by arctic hares, and ptarmigan. Their acute sense of smell enables them to readily locate prey under the snow. In summer the diet is more varied and includes ground squirrels, young hares, eggs, fledgling birds and fish. They are in the habit of establishing food caches during the summer months, and frequently trail wolves to scavenge on their caribou kills. They are mainly nocturnal in their behaviour. The wolf and man are the only serious predatory threats to the arctic fox. The rich white or blue winter pelt has long been a prized article of trade. Since the animal is not particularly wary of man, it is relatively easy to trap.

Red Fox (Vulpes vulpes regalis): The adaptive pattern of the red fox shows marked similarities to that of the arctic fox. The favoured habitat extends over the southern tundra and the more open regions of the boreal forest. The animal is rarely found in the more dense

forest regions. For about half the year it maintains the same kind of family social unit as the arctic fox. The litter size ranges up to 10 whelps. During the fall and winter the red fox is more solitary and travels over considerable distances. The red fox is omniverous in its eating habits, with its diet including microtine rodents, muskrats, cottontails, snowshoe hares, birds, eggs, fish, insects, grasses, acorns, berries, and fruits. It establishes extensive food caches during the late summer.

Black bear (Ursus americanus americanus): The favoured habitat of the black bear includes both coniferous and deciduous forest regions, swamps and berry patches. Black bears are solitary animals for most of the year, pairing up only briefly during the mating season. From October to April the animal exists in a state of hibernation in a safe shelter such as a cave, rock crevice, or hollow log. Cubs are born between mid-January and early February, while the sow is in hibernation. The litter size is from 1 to 5 cubs. The black bear is omnivorous with a diet consisting of about 75 per cent vegetable matter - spruce needles, grasses, sedges, browse, fruit, berries, and nuts. The remainder of the diet consists of carrion, insects, various small mammals, and fish. The grizzly bear is one of the few natural enemies of the black bear.

Barren-Ground Grizzly Bear (Ursus arctos): The barren-ground grizzly is confined to the tundra and the more open forest regions.

As with the black bear, it is a solitary animal for all of the year, apart from the brief mating period in late June and early July. The hibernation period is considerably shorter for the grizzly, extending from mid-November or early December till April. Although mainly nocturnal, it is also active during the evening and early morning hours. Its onmivorous feeding pattern is very similar to that of the black bear. The sows breed every second year, and the litter size ranges from 1 to 4 cubs. The grizzly is an excellent swimmer and at times displays extraordinary speed and stamina.

Wolverine (Gulo gulo luscus): The wolverine is the fabled animal of the north, the quiquehatch encountered in the writing of Samuel Hearne. It has a reputation for being pugnacious, bold, and very strong. On account of its scavenging habit of raiding traplines, food caches, and camps, it is generally regarded as a nuisance. The wolverine is a solitary wanderer for the great part of the year. The breeding season extends from late April to early September with parturition occurring between late March ad mid April. The litter size ranges from 2 to 5 cubs. The only wolverine pack is that of the mother and cubs which lasts through the first winter.

Although primarily a scavenger, following caribou herds and cleaning up the kills of wolves and bear, the wolverine is omnivorous. In addition to large game, its diet includes a variety of small game, fledgling birds, eggs, fish, roots and berries. The wolverine ranges

over both the tundra and forest regions, but is less frequently encountered within the forest. The animal is active both day and night and throughout the winter. It is an excellent climber and swimmer and possesses scent glands with which it "marks" its food to prevent the raids of other animals. The wolverine exhibits a strong sense of territoriality and, in keeping with its aggressive nature, utters a variety of barks, growls, and hisses. On account of its resistance to frosting, wolverine fur is of some value as trim for clothing.

Beaver (Castor canadensis canadensis): The beaver is adapted to living in water and favours a habitat of slow-flowing streams, lakes, rivers and marshes located close to groves of trembling aspen, willow birch, or alder. Frequently characterized as the "engineer of the wild," the beaver maintains a complex social organization based on the family and engages in the extensive cooperative work of building and maintaining dams and lodges. The beaver colony is variable in size, frequently ranging up to 10 or 12 members in autumn, with the mother occupying the central position in the family. The mating season extends through January and February, with kittens being born between late April and late June. The litter size ranges from 1 to 8. During this period the female drives the male from the main lodge. The young stay with the colony through the first year and the second winter, but are driven out of the colony before the birth of the second year's litter.

The beaver is mainly nocturnal in its activity, but is often about in late afternoon and on dull days. It remains active throughout the winter within the lodge and in the pond under the ice. Late summer and fall is the period of greatest activity. The kittens have developed to the point where they are extremely active and the adults and year-old members of the colony are occupied with repairing the lodge and hauling in a food supply for the winter. Freshly plastered lodges and feed piles are the most obvious signs of an active colony. The diet of the beaver includes leaves, twigs, buds and bark of trees and herbaceous pond vegetation. Trembling aspen is the favoured tree species, followed by willow and white birch. Spruce bark is eaten only when the animals are threatened with starvation. The pattern of food gathering consists of felling trees within a range of about 100 to 150 yards of the lodge, cutting off the branches, and dragging them to the dam. As the food pile increases in size and weight it reaches a point sometime before freeze up when the pile sinks into the pond above the dam. This sunken pile of branches constitutes the colony's food supply for the winter.

The main predatory threat to the beaver is posed by the wolf, wolverine, bear, coyote, lynx, fisher, and otter. Of these the otter poses the greatest threat, on account of its ability to attack the beaver in the water and inside the lodge. With the development of the fur trade, of which the beaver became the main resource, human exploitation reached the point of wiping out the beaver populations of large areas.

River Otter (Lentra canadensis preblei): The otter is an extremely adaptable animal and appears to be equally at home on land and in the water. Its favoured habitat is along the shores of rivers, marshes and deep, clear lakes. This animal does not excavate its own burrow. Rather it either constructs a bed in a hollow log or stump, or takes over the burrow of a beaver or muskrat. Although the otter maintains a strong family unit, the male departs from the burrow for the first few months after the birth of a litter. The mating season extends through late winter and early spring, with young being born the following winter. From 1 to 4 is the usual litter size. It is common to see otter "slides" on snowbanks along well-used otter trails, and on grassy or muddy slopes during the summer.

The otter is mainly nocturnal in activity, but at times is active in early morning or late afternoon. It forages widely along river banks and lakeshores, and lives mainly on a diet of fish, amphibians, insects, and small rodents. Most of its food is captured under water. The relationship between the otter and the beaver is little understood. Although the otter may pose some predatory threat to the beaver, the two species seem to co-exist in the same general environment. Apart from human predation, the otter would appear to be fairly secure from the predatory threat of other species. It is an extremely wary animal, very alert to human scent, and is difficult to trap.

Muskrat (Ondatra zibethicus spatulatus): The muskrat is an amphibious rodent, which seems somewhat better adapted to living in water than to living on land. Although they maintain family units, muskrats undergo rather extensive population shifts in autumn and early spring. Moreover, as is the case with numerous other species of rodent in the north, they are subject to marked long-term fluctuations in population. Their habitat in winter is along river banks, lakeshores, and ponds with access to water which does not freeze to the bottom. In summer their habitat is extended to include cattail marshes. Usually muskrat houses are washed out by spring flooding, and are consequently abandoned and rebuilt in the autumn. In addition to house building, the muskrat is occupied at freeze-up with building its familiar "push-ups" - plunge holes in the ice covered with a dome of frozen vegetation. The animal is continually active through the winter, both in its den and under the ice, and endeavours to keep the plunge holes open. The summer diet consists of a wide range of emergent vegetation - cattails, bulrushes, sedges and pond weeds. The winter diet is restricted to submerged vegetation.

Muskrats are generally nocturnal in behaviour. They are excellent swimmers. They are very quarrelsome among themselves and are fighters when cornered. Although quick and alert, they face a considerable predatory threat. If isolated on land they are easy prey for wolves, foxes, coyotes, and the larger raptorial birds. In the water, the young are vulnerable to attack by mink and pike. In winter

the muskrat "push-ups" are very often destroyed by foraging caribou or deer.

Mink (Mustela vison lacustris): The mink is a solitary animal, except for a brief period during the mating season in February and March. An excellent swimmer, it is well-adapted to both water and land. Mink dens are usually located under tree roots along river banks and lakeshores. Males range much more widely than do females. Kittens remain with the mother through the first summer, but by autumn are on their own. Mainly nocturnal in behaviour, mink are active throughout the year. The diet consists of small rodents, fish, amphibians, and some birds and insects. Although not particularly menaced by predators, the mink is vulnerable to attack by the wolf, fox, black bear, coyote, and great horned owl, and has long been a prime target of human exploitation.

Lynx (Lynx lynx canadensis): The lynx is a solitary hunter, confined mainly to dense climax boreal forest with undercover of thickets and windfalls. It is mainly nocturnal in behaviour and remains active throughout the winter. It is an excellent climber and in its wandering frequently swims rivers. The diet of the lynx consists mainly of snowshoe hares, voles, birds, and moose and caribou carrion. Of its few predators, the wolf is the most threatening. Lynx populations show marked fluctuations related to long-term fluctuations in snowshoe hare populations. When threatened with

starvation, the lynx ventures far onto the barrens in search of hares, lemmings, and ptarmigan.

Snowshoe hare (Lepus americanus macfarlani): The snowshoe hare is found throughout the forested region and at times out onto the tundra. Since it is a main part of the diet of a good number of predators, the snowshoe hare is an extremely important link in the foodchain of the north. It is also a species subject to dramatic fluctuations in population and density, due more to epizootic diseases than to predation.

The snowshoe hare is mainly nocturnal in activity and is active throughout the year. It is able to swim rivers and small lakes. It is a social animal, and constructs well-used runways. The female produces up to 4 litters a year. Its diet consists mainly of green grasses, forbs, and the tender leaves of trembling aspen, birch, and willow. In winter it will eat the carcasses of its own species. The snowshoe hare's fur is greyish-brown during the summer and turns white in winter, Its protective coloring is some defense against predators, but the animal is easily snared on its runways.

Arctic hare (Lepus arcticus andersoni): In contrast to the smaller snowshoe hare, which weighs an average of 4 pounds, the arctic hare is considerably larger, weighing from 7 to 12 pounds. The habitat of the arctic hare is entirely beyond the tree line. Its

pattern of activity is much like that of the snowshoe hare. It is a gregarious animal, mainly nocturnal, and active throughout the year. It also maintains well-used runways. The diet consists of grasses, sedges, a variety of other tundra vegetation, and any meat that can be scavenged. As with the snowshoe hare, the arctic hare faces a predatory threat from many other species, and is in consequence an important link in the foodchains in the north. Its pure white winter fur, with black-tipped ears, offers some protection from predators. The summer coat is a bluish-grey color.

Marten (Martes americana actuosa): The marten is an arboreal weasel, confined largely to climax coniferous forest. For most of the year it is a solitary animal. It is a good climber and swimmer, mainly nocturnal, and is active throughout the winter. Its rather wide food preferences include mice, voles, squirrels, snowshoe hares, birds, fruit, insects and carrion. The marten is relatively free from natural predators. However it faces a considerable threat in the destruction of its habitat by forest fires.

Fisher (Martes pennanti): The fisher is a solitary unobtrusive animal usually confined to climax coniferous forest, but, unlike the marten, is able to adapt to old burns and successional mixed forest. The fisher is a good swimmer, is both nocturnal and diurnal in its behaviour and remains active throughout the winter. Much like the wolf, it maintains lengthy regular hunting circuits. Its diet is very

similar to that of the marten. Along with the wolverine, it is one of the few serious predators of the porcupine. Apart from human exploitation, the fisher is relatively free from predators.

Ermine (Mustela erminea richardsonii): The ermine occupies a wide range of habitat, including coniferous corest, mixed forest, and tundra. It is exceedingly agile and quick. Although mainly terrestrial, it is a good climber and swimmer. Its diet includes a wide range of small rodents, shrews, birds and fish. It is mainly nocturnal in behaviour. During the winter it feeds on a food store of mice which is built up during the autumn. The ermine is subject to drastic fluctuations in population which follow closely similar fluctuations in the mouse population.

Porcupine (Erethizon dorsatum dorsatum): The porcupine is of some significance to the people of the north both as a food source and for the decorative use that is made of the animal's quills. The porcupine is a large, solitary, slow-moving rodent. It is an excellent climber and swimmer, is mainly nocturnal and remains active throughout the winter. Its summer diet consists mainly of the green leaves of trees, shrubs and forbs. It has a particular fondness for yellow pond lilies, aspen, and white birch. In winter it survives on the cambium layer and inner bark of trees. Apart from man, the wolverine and the fisher pose the main threats to the porcupine.

Within the natural environment of the Chipewyan there are a great many small mammals which are of little or no direct economic value, but which are of great importance as prey of the large carnivores in the food chains of the north. Among these are many species of squirrels, lemmings, mice, voles, and shrews. In the squirrel family (Sciuridae), the most prominent species are the red squirrel (Tamiascuirus hudsonicus), the northern flying squirrel (Glaucomys sabrinus), the chipmunk (Eutamias minimus) and the woodchuck (Marmota monax). Among the microtine rodent family (Muridae), which includes the muskrat, there are a great many species of lemmings, voles, and mice. Of shrews, which are among the smallest living mammals, there are several species of the genus Sorex and Microsorex. Many of these species of small mammals are found throughout the boreal forest and the tundra and all are well adapted to surviving the winter under the snow. As indicated earlier, many are subject to drastic fluctuations in population as a result of starvation or epizootic diseases.

Among species which are of peripheral significance to the environment of the Chipewyan might be considered the coyote (Canis latrans incolatus), the striped skunk (Mephitis) and the least weasel (Mustela nivalis). This weasel is quite rare and was taken as a good omen by many natives when caught in a trap.

Birds: Bird life constitutes an extremely important element in the northern environment. As with the many mammalian species

discussed above. the adaptive pattern of bird life in the subarctic must be viewed in the context of highly variable physiographic, climatic, edaphic, vegetational and cultural conditions. There are two particularly striking features of bird life in the subarctic that should be noted. One is that the three main vegetational zones - the closed boreal forest, the open boreal forest, and the open tundra - serve as a vast continental nesting ground for a great many species of birds. The other is that, in contrast to most mammalian adaptation in the region, almost all of the bird species have developed a migratory adaptation, and in consequence are seasonal visitors to the north.

Bird life provides perhaps the most animated element of the northern summer. The sound and movement of bird life contributes greatly to the bursting out of the Northern summer in early June. No less, the gradual settling in of the quietness and stillness of the Northern winter coincides with the southerly departure of flocks of birds throughout September and October. Again, as is the case with mammals, bird species are adapted to an ecological niche, or a particular set of environmental conditions.

From the point of view of Chipewyan survival, bird life is particularly important. The arrival of flocks of geese and ducks has been on many occasions the means of averting starvation in the late spring. For both the Chipewyan and the trading posts the snaring and shooting of fat birds in the autumn has provided a significant part of

the winter's food supply. During summer, a time of relative abundance with no threat of starvation, birds and eggs provide a ready food source. During winter, in the absence of caribou, the very few species of birds which winter in the region have been on many occasions the means of averting starvation. Even more than with mammals, however, the availability of bird life is fortuitous. Although most species are wideranging with well-known breeding grounds, their distribution and movements are uneven, and difficult to predict from year to year.

As a food source, flocks of geese, ducks, and swans of the order Anseriformes have been most plentiful. The common species of geese in the region are Canada Goose (Branta canadensis), Ross's Goose (Chen rossii), Snow Goose (Chen caerulescens), and White-fronted Goose (Anser albifrons). Among surface-feeding ducks the common species are Mallard (Anas playrhynchos), Pintail (Anas acuta), Shoveler (Spatula clypeata), Blue-winged Teal (Anas discors), Green-winged Teal (Anas carolinensis), and Widgeon (Mareca americana). The common species of diving ducks are Bufflehead (Bucephala albeola), Canvasback (Aythy valisineria), Goldeneye (Bucelphala clangula), Greater Scaup (Aythya marila), Lesser Scaup (Aythya affinis), Oldsquaw (Clangula hyemalis), Redhead (Aythya americana), Ring-necked (Aythya collaris), Surf Scoter (Melanitta perspicillata), White-winged Scoter (Melanitta deglandi). Two other species of duck, the Common Merganser (Mergus merganser), and Red-breasted Merganser (Mergus serrator), and two species of swan,

the Whistling Swan (Olor columbianus), and Trumpeter Swan (Olor buccinator) are found across the subarctic. For all of those species, the sedge meadows, bogs, sloughs, marshes, and margins of ponds and lakes of the tundra provide an extremely rich breeding ground.

More adapted to the drier grasslands and to the boreal forest are grouse and ptarmigan of the order Galliformes. Principal among these are Spruce Grouse (Canachites canadensis), Ruffed Grouse (Bonasa umbellus), Sharp-tailed Grouse (Pedio ecetes phasianellus), Rock Ptarmigan (Lagopus mutus), and Willow Ptarmigan (Lagopus lagopus). The great importance of these species to the Chipewyan is that they are nomadic rather than migratory and are common to the winter range of the caribou herds.

The marshy, watery environment of the summer tundra is also the breeding ground for a great many species of shore birds, gulls, and terns, of the order Charadriiformes; several species of grebe (order Podicipediformes); White Pelican (Pelecamis erythrorhynchos); American Bittern (Botaurus lentiginosus); and several species of cranes, rails, and coots of the order Gruiformes. In larger ponds and lakes are found several species of the more solitary loon (order Gaviiformes).

Also ranging over the tundra but more adapted to the transition zone and the boreal forest are many species of raptorial birds which prey on the many small mammals in the region. Mainly nocturnal in

behaviour are several species of owl of the order Strigiformes. Diurnal birds of prey include a good many species of hawks, eagles, and falcons of the order Falconiformes. A significant characterstic of all those raptorial species is the fact that they are subject to population fluctuations in relation to the very large population swings of the birds and mammals on which they prey. As with the grouse and ptarmigan mentioned above, many of these species winter in the vicinity of the treeline and in the boreal forest. The two other groups of birds adapted to the drier grasslands and the boreal forest are several species of woodpecker of the order Piciformes, and a great many species of small passerine song birds (order Passeriformes). Among those, two of the most prominent are the Raven (Corvus corax) and the Common Crow (Corvus brachyrhynchos). The Raven is among the few species of birds which winter in the region.

Fish: Even more than is the case with mammals and birds, the number of species of fish and the degree of species differentiation decreases in the more northerly latitudes. Moreover, the abundance of all species is relatively low, the rate of growth is slow, and fish populations tend to be dispersed. Coincident with the slow growth rate for a number of species is increased longevity. Although most species are adapted entirely to fresh water, there are a number of anadromous species. Although an important food source for the Chipewyan, the fish stocks of the region have had a limited and frequently unreliable potential. As a winter food source, lake trout and lake whitefish have been most heavily exploited.

Lake Trout (Salvelinus namaycush): The lake trout is in fact a char rather than a trout and is of all species of char the least tolerant of salt water. Its distribution is general across the Canadian subarctic. There is, however, some unexplained clustering in certain areas and an absence of the species from other environmentally similar areas. The general habitat of the lake trout is in deep lakes in the southern part of the region and in shallower lakes and rivers in the north. It is fairly abundant in shallow tundra lakes and in large, clear rivers. In size it reaches an average length of 15 to 20 inches and a weight of about 10 pounds. A good number, however, may reach 50 pounds or more. The maximum age appears to be about 25 years. As with all northern fish, spawning is governed primarily by water temperature and light conditions. The lake trout spawns in the months of September and October, mainly in rocky shallows along lakeshores. As with most other species, the depth-distribution of lake trout varies with the seasons. After the spring break-up the fish are close to the surface, but during the warmer summer months they are usually found below the thermocline. During the winter months the depth-distribution is more variable. The lake trout has long been subject to heavy winter net fishing under the ice.

Lake Whitefish (Coregonus clupeaformis): The lake whitefish has faced the same winter net fishing pressure as has the lake trout. The distribution pattern is similar to that of the lake trout. Average size is of the order of 2 to 3 pounds, but ranges up to about 20

pounds. Spawning occurs in late September and October. As a species favouring a cooler water environment, in the more southerly lakes the whitefish favours the cooler waters of the hypolimnion during the summer months. The appeal of whitefish for human consumption is affirmed by Richardson (1836):

> "Though it is a rich, fat fish, instead of producing satiety it becomes daily more agreeable to the palate; and I know from experience, that though deprived of bread and vegetables, one may live wholly upon this fish for months, or even years, without tiring. The stomach, when cleaned and boiled with the rest of the fish, is a favourite morsel with the voyageurs."

There is the suggestion here that whitefish was regarded as affording some defense against scurvy.

Cisco, or Lake Herring (Coregonus artedii): Cisco, or lake herring, or tullibee, is a smaller species of whitefish. It is found throughout the subarctic, frequently in larger schools than is the case with lake trout and lake whitefish. Again, spawning occurs in the autumn in a time of declining water temperature, usually a week or two after the lake whitefish. Spawning is usually underway in shallow water with the first ice formation around the lakeshores. During the warmer summer months, cisco are usually found below the thermocline. Although somewhat less favoured for human consumption, cisco has been fished extensively for dog food.

Arctic Grayling (Thymallus arcticus): Grayling is found in lakes and streams across the north, usually in schools along rocky lakeshores and at stream mouths. It has been fished fairly heavily in the past, mainly for dog food but for human consumption when lake trout and whitefish were unavailable. Grayling spawn through April, May and June, during the ice breakup in smaller streams. They are commonly taken in weights up to about 5 pounds, and are relatively easy to catch.

Northern Pike (Esox lucius): The pike or jack fish is a species found across the subarctic and in weight ranges up to about 40 pounds. Its favoured habitat is clear, warm, slow-moving water, weed-filled bays, and rivers with abundant over-hanging vegetation. Although mostly confined to fresh water, it is at times found in the brackish water of river mouths. During the summer months it is frequently found in cooler, deeper water. The spawning season is in April and early May, immediately after the ice breakup. The pike is a voracious feeder and preys on a wide range of other lake and river species. It has been fished extensively both for human consumption and for dog food.

Goldeye (Hiodon alosoides): The goldeye is a species which has traditionally not been fished very extensively. Common throughout the Churchill and Mackenzie drainage systems, its favoured habitat is the quiet, turbid water of small lakes, rivers, ponds, and marshes. It is

mainly a surface feeder and grows to weights of 2 to 3 pounds. The spawning season is from May to early July. An unusual characteristic of the goldeye is its cat-like eyes which reflect light in the dark. In its adaptation to turbid water, it is a species which is both diurnal and nocturnal in its activity.

Walleye (Stizostedion vitreum): The walleye is adapted to a wide range of environmental conditions, but appears to thrive in the warmer waters of large, shallow, turbid lakes. It is a dominant species in waters within the boreal forest zone, and is commonly taken in weights up to 10 or 11 pounds. The spawning season is in spring and early summer. The more northerly populations may not spawn in years when the temperature is unfavourable.

Lake Sturgeon (Acipenser fulvescens): The lake sturgeon is confined to the warmer, more southerly waters of the Churchill drainage. It is infrequently found as far north as the Seal River. Its favoured habitat is the shoal areas of large lakes and rivers. The spawning season extends from early May to late June, and is preceded by extensive upstream migration. The lake sturgeon is primarily a freshwater fish and a bottom feeder. It is commonly taken in sizes of 3 to 5 feet and in weight from 10 to 80 pounds. In age, males range up to about 55 years and females up to 80 years. The sturgeon is a species of relatively small population and is of no great importance as a food fish.

Arctic Char (Salvelinus alpinus): The arctic char is the most northerly freshwater fish. It is not commonly found in the territory of the Chipewyan. Whether freshwater or anadromous in adaptation, it is mainly confined to the Arctic coast and to lakes and rivers along the shore of Hudson Bay. There is usually a seaward migration in the spring and a return to the rivers and lakes in late summer and autumn. They seldom penetrate more than 50 miles inland. The spawning season extends through September and October. The weight of sea-run char ranges from 2 to 10 pounds, with a few individuals up to 20 pounds or more. Although growth rates vary considerably, the arctic char is a good example of the slow growth rate characteristic of northern species. Available data (McPhail and Lindsey, 1970:145) indicate that it takes 10 to 15 years for anadromous arctic char to reach a weight of 5 pounds and that full size is attained at about 20 years.

Burbot (Lota lota): The burbot is the only truly freshwater species of the codfamily (Gadidae). It is a species widely distributed throughout the subarctic, and one of the few freshwater species to spawn in midwinter under the ice. It is commonly found in lake shallows and streams, but during the warmer summer months descends to the hypolimnion with the lake trout and whitefish. Burbot has traditionally been regarded as a coarse fish and used for dog feed. The liver and roe have been thought fit for human consumption but the meat only in times of great scarcity (Richardson, 1836).

Overall, the flora and fauna of the subarctic - the vegetation, mammals, birds, and fish - provide resources of relative abundance but of high seasonal variability. From the perspective of human exploitation and human survival in the subarctic, these resources constitute a habitat that requires a particular kind of adaptation and social organization. Throughout their existence in the subarctic, the Chipewyan have developed an adaptive pattern shaped by the resources and the limitations of the taiga, the tundra and the boreal forest. They have been able to adapt to the abundance, the deprivation, and the uncertainty of the environment.

CHAPTER 4

TRADITIONAL ADAPTATION

TRADITIONAL ADAPTATION

The early literature offers many accounts of the manner in which the Chipewyan exploited their environment and coped with its uncertainties. David Thompson (Tyrrell, 1916:148), for instance, on the Black River in the year 1796 recounts: "On the 25th June we came to three tents of Chepawyan Indians of five families; they were clean, comfortable, and everything in good order." On another occasion on Reindeer Lake, Thompson (Tyrrell, 1916:158) reports: "One day as usual, I had pierced the ice with new holes, or cleaned out the old holes with an ice racket, when an old Chepawyan Indian came to me, I told him I had five holes in the ice, and for these two days had caught nothing. He shook his head, left me and went about one hundred yards westward of me, we were about five miles from land, he then looked at all the land within sight, shifted his place until all his marks coincided, he then pierced a hole thro' the ice, put down his angling tackle, and in about an hours time brought up a fine trout of full thirty pounds. By one P.M. he caught another, rather larger, soon after which he gave over, put up his tackle and came to me, I had caught nothing."

Alexander Mackenzie, in describing the Chipewyan (Lamb, 1970:151), states: "A robe, made of several deer or fawn skins sewed together, covers the whole. This dress is worn single or double, but always in the winter, with hair within and without. Thus arrayed, a

Chepawyan will lay himself down on the ice in the middle of a lake, and repose in comfort, though he will sometimes find a difficulty in the morning to disencumber himself from the snow drifted on him during the night."

Samuel Hearne (1972:21) makes the following observations: "To record in detail each day's fare since the commencement of this journey, would be little more than a dull repetition of the same occurrences. A sufficient idea of it may be given in a few words, by observing that it may justly be said to have been either all feasting, or all famine; sometimes we had too much, seldom just enough, frequently too little, and often none at all. It will be only necessary to say that we have fasted many times two whole days and nights; twice upwards of three days; and once, while at She-than-nee, near seven days, during which we tasted not a mouthful of anything, except a few cranberries, water, scraps of old leather, and burnt bones."

The threat of hunger and starvation as a fact of life for the Chipewyan, as for their neighbours, is made clear by George Back's account (p.17 above) of the tragedy which befell Pepper, a Cree living in the region of Fort Chipewyan. Burch (1972:350), with reference to the Caribou Eskimo, accepts the view that, for a population primarily committed to hunting caribou, at least one period of hunger or starvation is part of the normal annual cycle.

From the above and other accounts, two qualities emerge which would seem to be of fundamental importance to survival in the subarctic. One is the skill and confidence with which the Chipewyan engaged in the primary subsistence activity of hunting and fishing. The other is their capacity to endure adversity and deprivation with a considerable degree of equanimity. As is clearly expressed in the journal of Samuel Hearne, it is the uneven and often unpredictable distribution of resources, both in space and in time, that poses the greatest difficulty to survival in the subarctic. The traditional adaptive pattern of the Chipewyan would of necessity have to cope with such problems as the irregular availability of resources.

From an ecological viewpoint there are sound reasons why the Chipewyan traditionally held to the transition zone and why they chose to make the pursuit of caribou the focal point of their social organization. Although it is generally true that there is a gradual decrease in species diversity in more northerly latitudes, transition zones, or ecotones typically are characterized by greater species diversity and concentration. As discussed above, an ecotone generally contains species representatives of both adjoining biomes and in addition other species native to the ecotone itself (see Pianka 1974:245). The edge of the boreal forest in the Canadian subarctic demonstrates this well known "edge effect" or "edge community". With respect to the exploitation of the migrating caribou herds, the

transition zone is strategically located between the summer and winter ranges. This factor is noted by Burch (1972:351) in his assertion that: "The only human populations who can even consider depending on tarandus (caribou) for the bulk of their needs on a year-round basis are those who live along the boundary between the animals' winter and summer ranges."

Within the ecosystem or ecological community of the taiga, the Chipewyan have occupied a distinctive ecological niche - in the sense of a particular set of trophic relations and distinctive means for maintaining those trophic relations (Rappaport in Damas 1969:176). Within this econiche the unit of survival and the key analytic unit is the local hunting band; the primary subsistence band, to use Steward's term; or the ecological population (Damas et al 1969b). The analytic problem then becomes that of understanding how the local hunting band demonstrates its ecological competence and survives within the ecosystem. For the Chipewyan, the local hunting band commonly consisted of from two to about seven tents, numbering in total up to about fifty individuals.

The adaptive pattern of the local hunting band can perhaps best be viewed as the result of the cumulative experience of the band in coping with the uneven resource distribution and in survivng within its particular econiche. There would seem to be two aspects to this adaptive pattern - one, that of the organizing principles which govern

ecological relationships and shape the social organization of the band; the other, the particular forms which the social organization has taken. With respect to organizing principles, we might consider three. First, of fundamental importance to social cohesion and social continuity, is what has been termed by Sharp (n.d.:1) a moral commitment to the hunting of caribou. The significance of this as an organizing principle is apparent in Hearne's repeated references to the preoccupation with caribou in both the thought and the conversation of his companions. A second principle is that of the skill and mobility of the hunter as the basis for survival. This is clearly evident in the organization of the local band and in the role differentiation within the band. Thirdly, there is the principle of the interaction and interdependence of numberous local bands in exploiting particular caribou herds and in coping with the uneven distribution of the herd and its unpredictable movement within its range. The necessity for this is clear in the fact, emphasized by Burch (1972), that it is impossible for the local band to stay with a migrating caribou herd, and the fact that migrating caribou herds do not follow the same migratory routes year after year. The necessity for such reciprocal relationships between local bands is also emphasized in Sharp's (n.d.:4) discussion of a pattern of simultaneous concentration and dispersal of social groups.

As shown in the proceedings of the Ottawa Conference on Band Organization (Damas 1969a), the notion of hunting band presents

unresolved problems of definition and typology. In the face of such difficulties, and having in mind the desirability of developing a more refined comparative method, Steward makes a strong case for an essentially functional approach to band organization and activity. A further basic point relating to band organization was made at the Ottawa Conference on Cultural Ecology (Damas 1969b) to the effect that the elaboration of social organization into corporate and institutional forms is to a great extent a function of population size. Conversely, Bicchieri (In Damas 1969b:161) asserts: "population down, rules down, because alternative solutions must be available." Such is the case with traditional Chipewyan social organization.

In keeping with this ecological and functional approach, the same conference on cultural ecology developed at some length the view that the subsistence pattern of the local hunting band be approached in terms of three main components - the exploitative pattern, the community pattern, and the settlement pattern. The soundness of this approach to social organization is indicated in its increasing acceptance as a pattern of inquiry.

With respect to population size and population survival, Wynne-Edwards (1962, 1965) among others raises an issue of basic theoretical importance. This issue concerns the existence of group selection processes or internal regulatory mechanisms governing population structure and population dynamics. Rappaport (Damas

1969b:161), quoting Wynne-Edwards, asserts that it is rare for a population to be actually limited by its resource base. There will, he asserts, generally be internal mechanisms which cut off population size considerably below the carrying capacity of the land. Such claims for the existence of group selection processes are, however, strongly disputed by a number of other ecologists. McNaughton and Wolf (1973:58), for example, are of the view that most phenomena attributed to group selection can just as readily be explained on the basis of classical natural selection acting on the individual. Similarly, Pianka (1974:12,250) argues that the fundamental units of natural selection are individuals and that group selection processes, if they do exist, are of limited and infrequent occurrence. This theoretical issue, although unresolved, emphasizes both the importance and the difficulty of understanding the dynamic character of social organization and social adaptation.

Although, as indicated above, the ecological population or local hunting group is the practical unit of analysis, it is the food-production process which is at the heart of the exploitative pattern. For the Chipewyan, the exploitative pattern was centered on a commitment to the hunting of caribou, and was organized around the skill and mobility of the hunter. This pattern traditionally followed an annual cycle which was closely bound to the migratory and nomadic behaviour of the caribou herds.

With regard to the production of food, the Chipewyan faced a number of general conditions of survival. Their ecological niche, shaped by this predator-prey relationship and by the various environmental forces existing over the annual cycle, would appear to have been governed more than any other by the limiting factors of space and time. The uneven and unpredictable distribution of the resource over the year was the fundamental problem of survival. The hunting group faced the problem not only of being aware of the resource distribution at particular times of the year, but also of being on the spot to exploit the resource. For a hunting group with children and old people, and having to carry its few material possessions, it is physically impossible to keep up with a caribou herd on the move. Burch (1972:345) points out that the caribou is able to go just about anywhere it wants and that a migrating herd has a tremendous capacity for sustained movement. Skoog (1968:89) estimates that a herd of caribou on the move is well able to maintain a steady pace of 10 kilometers per hour. In such circumstances, the strategy of the hunting group could only be to attempt to maintain contact with the herd as long as possible.

When in presence of a large herd or of a fairly extensive distribution of smaller herds, the hunting group faced no great problem. In other circumstances, however, the hunting group was faced with the difficult problem of anticipating the movements of herds and either seeking them out or laying in wait for them. In such times of

uncertainty, needless to say, survival might well depend on the most experienced hunter making the correct choice.

About the only certainty in caribou movement is the spring migration to the calving grounds and the fall migration to the edge of the forest. Within this general pattern a great range of movement is possible. As Burch (1972:364) points out, caribou herds are subject to extensive lateral movement within their migratory path, and it is uncommon for herds to follow the same migratory routes year after year. Kelsall (1968) points out that it is rare for large concentrations of caribou to be found in the same location in succeeding winters. Moreover, apart from the unpredictability of caribou movement wthin the annual cycle, there is the added problem of longer-term changes in caribou population and distribution, extending perhaps over several human generations. Although Clarke (1940:65) has suggested a 35 year cycle in caribou numbers, this is a matter of speculation and has received little study.

Apart from the limiting factor of space and uneven resource distribution, the hunting group also had to cope with the limiting factor of time. It was rarely possible for the hunting group to make more than one or two large kills of caribou in the course of the year. During the summer, a large kill presented the group with the problem of preserving the meat. This could be accomplished only by cutting the meat into strips and drying it in the sun - a time-consuming

process which severely impaired the mobility of the group. Moreover, since such a kill often coincided with the fly season or with cool and overcast weather, the chances of the meat becoming fly-blown or rotten were considerable. The acquisition of prime quality caribou hides for clothing and tents was possible only during a four or five week period in August and early September. A large kill at this time almost inevitably resulted in much of the meat rotting. The crucial factor in the production and preservation of food was a large kill during the frost season (from early October on). More than anything else, this was counted on to ensure the hunting group's survival over the winter.

In order to maximize the chances for such a successful kill, it was the practice of the hunting group to position its base camp in a strategic location from which the hunters were able to move extensively in any direction. In this way, the hunting group was able to cover the most favourable part of the range - the "centre of habitation" of the caribou, to use the term of Banfield (1954:18) and Skoog (1968:202). Both the location of the base camp and the success of the hunters were the product of the accumulated hunting experience of the band. Although, as indicated above, caribou movements were difficult to pedict, certain locations within the caribou range acquired the reputation of being good hunting spots. With respect to the more recent Chipewyan exploitation of the boreal forest, remote from the main caribou herds, the alertness and judicious timing of the hunter is equally crucial to the production of food - a fact well illustrated in Jarvenpa's (1976) analysis of the annual cycle of the present-day English River Band of Chipewyan.

The experienced hunter, in his efforts to maximize food production, was highly selective in the animals he killed. The reason for such selectiveness was the seasonal variation in the condition of the animals. Principally, caribou bulls show considerable seasonal accumulation or loss of back fat and visceral fat - accounting for up to 20% of body weight in mature bulls (Kelsall 1968:29.40; Burch 1972:342). Consequently, since bulls were in prime condition in the early fall, they were the preferred animals. In the period during and after the rut, selection was more for cows. Hunting success, as Hearne emphasized (1972, passim), depended not only on the skill and experience of the hunter, but was thoroughly bound up with hunting magic and taboos - the neglect of which, in the view of the hunter, would render the hunting effort ineffective. Some indication of the richness of symbolism surrounding the Chipewyan relationship with different animals can be gained from Birket-Smith's (1930:80-81) discussion of the notion that "All hunting is hunting for souls."

Hunting selectivity extended to the techniques used. Traditionally, large kills were secured once or twice a year either at caribou water crossings or in large pounds constructed at the edge of the forest. During the fall caribou migration it was the practice of the Chipewyan in canoes to intercept herds swimming across open stretches of water and kill the animals with spears. At its most effective, this technique would throw the herd into confusion, enabling the hunters to slaughter the entire herd (Birket-Smith,

1930:22-23). No less effecive in fall and winter was the pound or surround into which the animals were herded by long converging rows of bushes or sticks stuck in the ground. Once trapped in the pound, the animals were caught in snares and easily killed with daggers or with bows and arrows. A similar hunting technique employed on the Barren Grounds used one or two rows of sticks in the ground as a means of herding the animals past a promontory from which the hunters were able to kill the animals with bows and arrows. These hunting methods were employed both by small hunting groups and by the larger-scale cooperative effort of several distinct hunting groups. During winter when the caribou herds were frequently more dispersed and the animals more wary, hunting tended to become more of an individual activity with one or two hunters on snowshoes trailing animals, running them down, and killing them with bow and arrow. This pattern of hunting activity illustrates very well the skill and resourcefullness with which the Chipewyan exploited their major resource.

Apart from caribou, a resource vital to the exploitative pattern of the Chipewyan was wood. Both as firewood and as a construction material, it was one of life's necessities. Apart from the uneven distribution of caribou, the availability of the right kind of wood appears to have been one of the most significant limiting factors affecting the ecological niche of the Chipeywan. At any rate, there can be little doubt that their requirement for the right kind of wood traditionally held the Chipewyan to the transition zone or

"land-of-little-sticks" and to some extent shaped their annual cycle. A major use of wood was in the methods of transportation used to transverse this difficult terrain - principally for the construction of canoes, snowshoes, and sledges at particular times of the year. A more specialized requirement was the bark of larger birch trees as a covering material for canoes. Other important uses of wood included tent poles and weapons.

(It is one of the paradoxes of survival in the subarctic, a land of relative abundance but of uneven distribution of resources, that the Chipewyan were able to function pretty much as a "throw away" society. Indeed, it might well be that the seemingly careless ways of the Chipewyan were in fact a necessary part of their survival strategy. With the freeze-up, canoes were abandoned; with a heavy snowfall, tent poles were used to make snowshoes; with the spring thaw, snowshoes were abandoned. With their enforced mobility, the Chipewyan traditionally followed a pattern of utility. Travelling over difficult terrain required that material encumbrances be held to a minimum. The combination of specialized skills, a carefully timed annual cycle, and few material wants would appear to have enabled the Chipewyan to relocate their base camps with maximum efficiency, leaving behind those goods which could be replaced when needed at a later date.)

As has been frequently mentioned in the literature, (for example, Hearne 1972:passim, Birket-Smith 1930:passim; Burch 1972:362-364) nearly all of the material needs of the Chipewyan could be satisfied by caribou - caribou meat as their principal food; skins for tents, clothing, carrying bags, and improvised sledges; caribou rawhide or "babiche" for fishing nets, fishing lines, nets for catching beaver and ptarmigan, snares, lashings and the like; sinews for sewing hides and bones and antlers for implements, weapons and fish hooks. It is little wonder then that caribou and wood should have been the focus of traditional Chipewyan material culture and technology and that the transition zone between the boreal forest and the tundra should have been central to their ecological niche.

Inasmuch as the social organization of the Chipewyan was structured to harvest caribou, the work pattern, the social roles and relationships and the community pattern generally display an economy of function and a flexibility which serve to strengthen the local hunting group and to enhance the self-sufficiency of the group. As indicated above, the social order was built around the skill and mobility of the hunter and on the continuity of the base camp. The work pattern was essentially simple and straightforward. Since the men had to be free to hunt, much of the burden of routine work in the camp fell to the women. The preservation and cooking of food, the dressing of skins, making of clothes, moving the base camp, supervision of young children and caring for the old people - all of

these tasks were routinely undertaken by women. It was not however an inflexible pattern. In many situations, work was done by whoever was available. Young children, for example, were frequently in the care of older children or of grandparents. While the literature is full of references to the wretched lot of Chipewyan women (Hearne 1972:215, for example), life was no less arduous for the hunters, particularly in times of deprivation when despite hunger and fatigue they still had to pursue the hunt. In fact, men and women were very much dependent on each other and individuals could not expect to survive indefinitely apart from a hunting group.

Due to the paucity of data in the early literature and to the fact that any real sense of the oecumene of the Chipewyan is denied to the modern observer, it is extremely difficult to arrive at a satisfactory understanding of the dynamics of the ecological population or the local hunting group. Indeed, as Sharp (n.d.:54) has pointed out, the local hunting unit is not an emic category with the Chipewyan. Nevertheless, as an analytic category the notion of hunting unit has proved fruitful - this with the qualification that the hunting unit be viewed in functional and process terms rather than in fixed structural terms.

In our ecological perspective then, our aim must be to try to understand the community pattern and the settlement pattern (one cannot be understood without reference to the other) of the Chipewyan

as being adaptive responses to their ecological niche and to the limiting factors operating within their econiche. The commitment to hunting caribou had forced on the Chipewyan a pattern of social organization possessing both cohesiveness and flexibility - cohesiveness in the sense of the ability of the hunting group to survive in isolation for extended periods, flexibility in the sense of being able to cope with an anticipated turnover in group membership, and being able to maintain rather close working and social relationships with other hunting groups. Such requirements would seem to indicate a considerable complexity and subtlety of organization and a certain tenuousness and instability in the hunting group's existence. What held the local hunting group together and enabled it to survive as an effective means of exploiting caribou herds?

In Sharp's analysis of the Caribou Eaters in the region of Black Lake, the adaptive pattern which emerges shows cohesiveness and flexibility of organization to have been achieved by the functioning of the hunting unit and of extended kindred relationships. Apart from the persistent need to produce food, it is essentially the obligations and stresses within each of these components of the social order and the tensions between the two which provided the dynamic of the whole social system. Moreover, group cohesiveness and flexibility were secured and validated for the Chipewyan, in their world of uncertainty and privation, by the powerful system of myth and magic which permeated their oecumene.

The hunting unit is viewed as essentially a restricted cognatic descent group. It was a subsistence group, and a residence group fundamentally held together by ties of kinship. Leadership within the group rested with one individual - the most experienced and successful hunter. The placing of individuals in appropriate social categories and the organizing of relationships in relation to leadership and authority within the group were governed by the two principles of genealogical position and relative age. According to Sharp, little emphasis was placed upon genealogical knowledge. Age-ranking of siblings, on the other hand, was crucially important to the community pattern. It was central to the control of relations between siblings and it provided a structural basis for the splitting of the sibling group, especially the separation of brothers. The whole kinship system and therefore the local hunting group, acquired a necessary flexibility from the fact that the combined use of genealogical position and age-ranking did not allow a clear definition of generation. This fact accords well with the dictum of Bicchieri (above): "population down, rules down - because alternative solutions must be available." Within such a broadly defined kinship classification, a rather wide range of behaviour became socially acceptable.

Although strict age-ranking of siblings served to strengthen the cohesiveness of the local hunting unit, the overall flexibility of

kinship classification served to strengthen economic and social bonds between different hunting groups. The crucial factor here was that age-ranking was absent from cousin terms and from in-law terms. The consequence of this was that it established two sets of structured relationships between social equals. In childhood, cousin relationships tended to be close. With marriage, in-law relationships between different hunting units became extremely important. Particularly so was the seri relationship, the like-sex to like-sex in-law relationship. Both brother-in-law relationships and father-in-law-son-in-law relationships tended to acquire great economic and social significance and to be characterized by closeness, trust, respect, and cooperation between equals.

Within the local hunting unit, then, social cohesiveness was achieved primarily by the general division of labour in accordance with the requirements of subsistence activities and by the functioning of kinship relationships. This community pattern served to give a predictability to daily life and to give members of the hunting group a sense of comfort and security. Such group characteristics served well and indeed may have been reinforced by prolonged periods of isolation from other hunting groups.

The stress which inevitably developed within the local hunting unit tended to focus on relations between brothers. As brothers matured physically and became competent hunters in their own right, a

sense of competitiveness was generated between them. Under normal circumstances this competition and conflict was kept in check by the moral authority of the father or leader of the hunting group. With the aging of the father, however, and his consequent loss of effectiveness as a hunter and loss of magical power, conflict between brothers tended to become much more serious. In such circumstances, leadership of the hunting group usually fell to the oldest son and younger sons tended through marriage to join other hunting units, with the result that the stability of the local hunting group was restored.

Marriage, then, provided the most powerful link between different local hunting groups. Its importance can be gauged from the fact that parents were anxious to arrange marriages while their children were very young. It was common practice among the Chipewyan for young girls to be betrothed to men considerably older than themselves (Lamb, 1970:152). The value of this practice was two-fold. On the one hand, it served the interests of the girl to be married to a man who was a successful hunter. Further, it served the interests of the girl's father to have a son-in-law who could be counted on to provide for him in old age. Although an admission of failing powers, it was common practice with advancing years for a man to move into the hunting unit of his married daughter. The fundamental structural importance of marriage is also evident in the exogamous nature of the local hunting group, in a preference for cross-cousin marriage, and in the prohibition against more than a single marriage uniting any two

hunting units (Sharp, n.d.:102-107). The functional consequence of such structured affinal relationships was the creation and maintainance of a network of independent hunting units held together by ties of common need, kinship and reciprocal obligation.

As has been indicated above, it was common practice when the opportunity presented itself for the local hunting group to kill numbers of caribou far in excess of its needs. Through the pattern of simultaneous concentration and dispersal of hunting units (described by Sharp) in response to the probability of finding caribou, coupled with the existence of kinship-based reciprocal obligation, the network of local hunting units served to maximize food production for the regional population.

The occasion of an extremely large kill of caribou became also the occasion for a temporary greatly enlarged residence group. Such gatherings, in addition to serving an essential economic function - the distribution of food, also served a vital social function. Such gatherings of several local hunting groups periodically provided an occasion for socializing, affirming intergroup kinship ties, and an opportunity for some realignment of group membership. Although in such larger residential groups the local hunting groups retained their cohesiveness and identity, if such gatherings were prolonged serious strains began to develop within the local hunting groups. The larger group generated an unaccustomed sense of freedom and gregariousness -

a sense of being one among equals which was cutailed within the isolated hunting group. The division of labour within the local hunting group tended to breakdown and the pattern of authority within the local hunting group tended to become weakened. Further, it became impossible to satisfy all of the kinship obligations that were present in the larger group without at the same time neglecting the needs of one's own group. After a relatively short period of time then it became necessary to the well-being of the local hunting groups that the expanded residence unit break up and the smaller local hunting units return to a life of isolation.

It can be seen then that over the annual cycle of the Chipewyan a rather tenuous balance existed for the local hunting population between long periods of isolation and occasional relatively short periods of interaction with kindred of other hunting groups. An important question relating to the maintainence of this balance concerns the limiting factors which governed the size of the local hunting population. There would appear to have been both ecological and social constraints governing the size of the hunting group. Ecologically, the principal constraint was the distance that the hunters could reasonably travel from the base camp. Beyond a certain distance it simply became impractical and uneconomical to haul food back to the base camp. Thus the demands of feeding a larger population could not often be met by exploiting the resources of a territory within a workable distance of the base camp. Socially, two

factors would appear to have constrained group size. One was the factor of restricted access to group membership either through birth, marriage, or being a parent of an existing group member. The other, the periodic buildup of conflict and discontent within the group and the necessary loss of members through marriage. Of the numerous attempts that have been made to categorize Athapascan hunting groups on the basis of size and function, Helm's (1968) classification of Dogrib hunting units in terms of local bands, regional bands, and task groups has received the most attention. A similar classification has been espoused by Van Stone (1974:45) as being the general pattern for the people of the Mackenzie drainage system. Although it is difficult to quarrel with such classifications, it would seem prudent to view them in the context expressed by Steward (Damas, 1969:188):
"I think the most fruitful approach to bands by any definition is to analyse them in terms of those evolutionary processes which brought them into being rather than in terms of a static typology... One may note similarities in social structure, but the deeper understandings come from a knowledge of the processes which brought about these structures."

In this analysis we have come to view Chipewyan social organization as beingessentially based on the functioning of the local hunting group and of the kindred, and in terms of cohesiveness and flexibility of structure. The social system is seen to have functioned through the interaction of the sociocentric hunting group and the egocentric

kinship system. From an ecological point of view this scheme would appear to be sound. Through the functioning of the local hunting group and the maintainance of the kindred-based network of reciprocal obligation it established a subsistence pattern well-suited to the ecological niche of the Chipewyan. The weakness of this scheme, and it is one that cannot be avoided, rests in the fact that there exists no adequate understanding of the structural characteristics of the Chipewyan kinship system. We have accepted (after Sharp) the view of the local hunting group as a restricted cognatic descent group. As expressed by Helm (1968:124) and by Van Stone (1974:53), the bilateral primary linkage principle allows multiple residence alternatives to the conjugal pair, serves to enlarge the kindred network between different local hunting groups, and consequently has greater survival value in the difficult subarctic environment. Much the same view of Chipewyan social organization deriving flexibility from the multiple ties of consanguinity or affinity afforded by a bilateral kinship system is expressed by Smith (1976:12). In support of this view, Smith (1976:13) cites Eggan's claim for bilaterality as "the most common and basic adaptation of hunting societies, with patrilineal organization representing special developments." With respect to the Chipewyan, this issue is further in doubt on account of our lack of any clear understanding of marriage rules or residence rules. We are inclined then to accept the view of a bilateral kinship system coupled with a loosely-defined kinship terminology providing the structural basis for a necessary fluidity of social order and social alliance. Indeed, Chang (1962:34) goes so far as to claim that Chipewyan community structure was "kinship free" in the sense that there were no strict kinship bonds between members of the community.

Apart from the kinship structure, however, there were a number of other social processes which served to enhance the cohesiveness of the local hunting group. Principal among these were the mechanisms of leadership and authority within the group. As indicated above, leadership rested in the person of the most sucessful hunter in the group. Perhaps the most lucid account of leadership among the Chipewyan is to be found in Hearne's (1972:passim) description of his guide Matonabbee. The basis of leadership was threefold - personal qualities, economic productivity, and possession of magical power. The personal qualities on which a high value was placed included physical strength, courage, stamina, and hunting skill. Economic productivity was to a great extent related to the attainment of adulthood, being married, and having a family. Indeed, the practice of polygamy among the Chipewyan was primarily an expression of the hunter's productive ability. This fact is clearly stated by Hearne (1972:80): "It is not surprising that a plurality of wives is customary among the people, as it is so well-adapted to their situation and manner of life." Matonabbee (Hearne 1972:56) had seven wives.

If plurality of wives was a mark of economic success, an attribute of prestige, and an element of leadership, then the failure to marry or the loss of a wife was a serious threat to the economic well-being and to the social stature of a man. The essential role of women in pursuing subsistence activities is clearly expressed in Matonabbee's statement (Hearne 1972:35) that the principal cause of Hearne's failure to reach the Northern Ocean on his first two attempts was his failure to take women on his journies.

The third factor in leadership and influence among the Chipewyan was the possession of magical power. Perhaps no less than the kinship system, magic, which come unsought in dreams, contributed to the cohesiveness and survival of the hunting group. The central place of magic lay in its inseparability from economic success. The pervasiveness of magic was evident at the level of the individual successful hunter and also at the level of the successful hunting unit, expressed in the competitiveness which existed between different local hunting units (See Sharp, n.d.:52). As shown by Hearne (1972) magic also served the very important function of healing in the hands of shamans or conjurers, as Hearne called them. An even more dramatic expression of the power of magic lay in its use to dispose of one's enemies. As Hearne states it (1972:143), the uttering of a curse "...often proves fatal to that person; as, from a firm belief that the conjurer has power over his life, he permits the very thoughts of it to prey on his spirits, till by degrees it brings on a disorder which puts an end to his existence; and sometimes a threat of this kind causes the death of a whole family."

Although leaders among the Chipewyan assumed the stature of chiefs, the role had no corporate or hereditary basis. Moreover, the authority and influence of the chief was measured in relation to his success in hunting, in warfare, or, with the development of the fur trade, in trading. As discussed by Penard (1929), the lack of ownership of territory and the lack of hereditary chieftaincy in

precontact times were in accord with the fluid structure of the traditional hunting unit.

The basic mechanism of relating leadership and influence to economic and magical success is also evident in a number of other practices. Full stature as a hunter was denied to a man until he had married, and served a period of bride service in the hunting unit of his father-in-law until the birth of this first child. This occasion, on which the parents gave up their own childhood names and took on the name of their child, assumed the importance of a right of passage. With the birth of his first child the hunter attained a new stature within the hunting group.

Since power and influence tended to rest in the successful individual, the Chipewyan faced a rather serious problem of social control - how to constrain the individual who abused others within the hunting group. The not infrequent problem of a man abusing his wife appears to have been dealt with by the fairly common practice of men wrestling each other for women (see Hearne 1972:68). Although women were subject to the authority of their husbands, wrestling provided a mechanism which (at least some of the time) afforded some protection to women. On some occasions though it had the opposite effect.

Among their own people, the Chipewyan appear to have been little prone to violence. Children on the whole were treated with a fair

measure of restraint and indulgence. Disputes and deviant behaviour within the hunting group were handled by such sanctions as gossip and avoidance and in more serious cases by resort to magic. Their wrestling matches amounted to little more than hair-pulling and ear twisting, and one man forcing the other into submission. Even a murderer was dealt with by ostracism. According to Hearne (1972:69): "A murderer is shunned and detested by all the tribe, and is obliged to wander up and down, forlorn and forsaken even by his own relations and former friends."

If the Chipewyan were restrained and averse to violence among their own people, this was certainly not the case in their attitude to strangers and to traditional enemies. That the Chipewyan loved to fight is clear from the deliberate and calculating manner in which they built up to the massacre of the Eskimos at Bloody Falls on their Coppermine journey with Samuel Hearne (Hearne 1972:94-104). That warfare was very much a part of Chipewyan life is beyond doubt from the vital cleansing process that Hearne's companions observed after the massacre (Hearne 1972:132-134). The practice of attacking and plundering groups of strangers was commonplace in Hearne's experience. The depth of hostility and suspicion which characterized Chipewyan relations with the Cree and the Eskimo is indicated in Hearne's statement that: "When any of the principle Northern Indians die, it is generally believed that they are conjured to death, either by some of their own countrymen, by some of the Southern Indians, or by some

of the Esquimaux: too frequently the suspicion falls on the latter tribe, which is the grand reason of their never being at peace with those poor and distressed people." (Hearne 1972:217)

Old age and death in their subarctic environment were particularly distressing for the Chipewyan. Much as with the gradual onset of winter in the north, there is a sense of the solemnity of the remoresless working of things. With the loss of effectiveness as a hunter and consequent loss of magical power, life became increasingly burdensome. As Hearne states it (1972:221): "Old age is the greatest calamity that can befall a Northern Indian; for when he is past labour, he is neglected, and treated with great disrespect, even by his own children." The conditions of survival within their econiche forced on the Chipewyan this ambivalent attitude towards old age and death. Again, Hearne (1972:131) puts the issue in perspective: "...for when a grown person is so ill, especially in the summer, as not to be able to walk, and too heavy to be carried, they say it is better to leave one who is past recovery, than for the whole family to sit down by them and starve to death; well knowing that they cannot be of any service to the afflicted." The hunting group had to move on. And yet, says Hearne (1972:218-9): "The death of a near relation affects them so sensibly that they rend all their cloths from their backs, and go naked, till some persons less afflicted relieve them."

The overall dilemma of coping with the hardships and conflicting demands of their environment was given philosophic expression by Matonabbee (Hearne 1972:221): "...nothing to do but consult their won interest, inclinations, and passions, and to pass through this world with as much ease and contentment as possible, without any hopes of reward, or painful fear of punishment, in the next." A final note on the necessity of life moving on is the Chipewyan practice of ceasing to use the names of deceased relatives and in their place referring to them by kinship terms.

To this point we have treated the Chipewyan social organization in terms of a culture core based on the exploitation of caribou and wood within the forest-tundra ecotone. An extremely important question bearing on their social organization is that of what happened when the caribou failed. Although it must be kept in mind that the adaptive pattern of the Chipewyan was essentially unified and integrated, it is of some analytic value to distinguish other food resources from caribou. The reason for this analytic distinction is that as a matter of choice the Chipewyan were committed above all to the hunting of caribou and their whole social structure worked to that end. It is a mark of the resoursefulness and competence of Chipewyan hunters that they were well able to exploit all the other food resouces of the forest-tundra ecotone - fish, other game animals, fur-bearing animals, and birds at various times. As with the exploitation of caribou, hunting successs required an intimate knowledge of both the habitat and the behaviour of different species.

Although very much secondary to caribou, fish was of considerable importance to the exploitative pattern. Along with their skill as fishermen the Chipewyan had a well-developed fishing technology of lines, spears, and babiche nets. They also had powerful fishing magic which governed the success of new lines, hooks and nets (Hearne 1972:211-212). During the summer, when caribou were absent from the transition zone, fish became an important supplementary food. In winter, both line and net fishing under the ice were counted on when the caribou failed. However, if a caribou kill should be made, fish nets we often left unchecked, or even abandoned.

In the absence of fresh caribou meat, much of the time the Chipewyan were able to survive on their supplies of preserved meat, either dried or frozen, or in the form of pemmican. In different regions, other sources of meat became important subsistence items. In the more westerly region of Chipewyan territory, south of Great Slave Lake (Athapuscow Lake in Hearne's account) and along the Slave River, there was usually a ready supply of woodland caribou, moose, beaver, and on occasion bison. On the Barren Grounds in later spring and in winter isolated hunting units counted on the small herds of muskox when the caribou failed. It should be noted that for the Chipewyan in the absence of caribou meat the back-up subsistence food was either fish or the meat of other large game animals. But even here their commitment to caribou hunting is evident. Hearne (1972:89,167) notes, for example, that although they had a fondness for buffalo meat, moose meat, and muskox meat, none of it compared to caribou meat.

As a usually reliable part of their annual cycle, the Chipewyan exploited the huge flocks of migratory birds which had their nesting grounds in the northern tundra. Mackenzie (Lamb, 1970:131) fills inthe picture: "During a short period of the spring and fall, great numbers of wild fowl frequent this country, which prove a very gratifying food after such a long privation of flesh-meat." In the fall of the year the last flocks of geese and ducks flying south offered the chance to supplement the food supply for the winter. In the spring, the first flocks of Trumpeter Swans in mid march and the first flocks of Canada Geese in late April (Hearne 1972:280-281) were not infrequently the means of averting starvation. Throughout the summer months there was no threat of starvation. The presence of caribou, other game animals, a variety of smaller fur-bearing animals, flocks of birds, eggs, fish and a variety of berries and plants indicate a rather broad and relatively abundant resource base.

It was during the winter months, in particular January, February and March that the Chipewyan faced the threat of starvation. In the event of a large caribou kill early inthe frost season (October or November), the threat of starvation during the winter was minimal. In the absence of a large supply of preserved meat for the winter, however, life became much more tenuous. Given the unpredictability of food resources in the subarctic, the failure to accumulate a food supply for the winter was a serious matter indeed. In such circumstances the local hunting group faced the exceedingly tenuous

existence of having to exploit those few species of animals and birds which wintered in their territory along with whatever fish were to be had. The chance capture of one or two caribou, moose, or muskox, depending on where they were, in some years an abundant supply of arctic hares and snowshoe hares, the breaking open of beaver lodges and muskrat lodges, the trapping and snaring of smaller fur-bearing mammals, and the shooting, snaring and netting of the few birds species mainly grouse and ptarmigan - those few species held the hope of survival. It was when all these failed that the Chipewyan were reduced to the unhappy state of having to survive on lichen soup, old leather and the residual fat obtained from the boiling of old bones. At times even that was not to be had.

CHAPTER 5

INFLUENCE OF THE DEVELOPING FUR TRADE

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Over the years, one of the main preoccupations of ethno-historians has been the question of the degree to which European culture and the fur trade affected the traditional life-style of the Chipewyan. The conclusions have ranged from the view that the fur trade had a devastating effect on Chipewyan life to the view that the Chipewyan were well able to resist the encroachments and blandishments of the fur trade. Perhaps more than any other question, this one requires that we resist the temptation to generalize about Chipewyan life. From the earliest historical accounts, for example the efforts of Governor Knight of York Fort in 1715, it is clear that many Chipewyan were drawn to the promise of the fur trade, some in the role of middlemen trading between the Hudson Bay Company posts and the more remote Athapascan hunting groups. It is no less clear, however, that the fur traders faced great difficulties in claiming the allegiance of the Chipewyan and in persuading them to adopt a trapping and trading way of life.

From the reports of Samuel Hearne about the year 1770 a distinction can be made between those Chipewyan who chose to pursue the fur trade and those who chose to maintain their traditional caribou-hunting way of life. With reference to the attempts of the Hudson Bay Company to elist the Chipewyan in the fur trade, Hearne states (1972:52): "But I must at the same time confess, that such

conduct is by no means for the real benefit of the poor Indians: it being well known that those who have the least intercourse with the Factories, are by far the happiest." It is instructive to quote at some length Hearne's observations (1972:51-52):

> "The real wants of these people are few, and easily supplied; a hatchet, an ice-chissel, a file, and a knife, are all that is required to enable them, with a little industry, to procure a comfortable livelihood; and those who endeavour to possess more, are always the most unhappy, and may, in fact, he said to be only slaves and carriers to the rest, whose ambition never leads them to any thing beyond the means of procuring food and clothing. It is true the carriers pride themselves much on the respect which is shewn to them at the Factory; to obtain which they frequently run great risques of being starved to death in their way thither and back; and all that they can possibly get there for the furs they procure after a year's toil, seldom amounts to more than is sufficient to yield a bare subsistence, and a few furrs for the ensuing year's market; while those whom they call indolent and mean-spirited live generally in a state of plenty, without trouble or risque; and consequently must be the most happy, and, in truth, the most independent also. It must be allowed that they are by far the greatest philosophers, as they never give themselves the trouble to acquire what they can do well enough without. The deer they kill, furnishes them with food, and a variety of warm and comfortable clothing; either with or without the hair, according as the seasons require; and it must be very hard indeed, if they cannot get furrs enough in the course of two or three years, to purchase a hatchet, and such other edge-tools as are necessary for their purpose. Indeed, those who take no concern at all about procuring furrs, have generally an opportunity of providing themselves with all their real wants from their more industrious countrymen, in exchange for provisions, and ready-dressed skins for clothing."

In this context then, it appears to me that a strong case can be made for the essential conservatism of the Chipewyan. Their moral commitment to the hunting of caribou, their attachment to their land

in the transition zone which was relatively poor in fur-bearing animals, the relative self-sufficiency of their local hunting groups, and their powerful mythological and magical validation of their traditional way of life - all of these constituted a way of life which the Chipewyan did not readily surrender. This view of the early-contact Chipewyan is also expressed by Hearne's contemporary Andrew Graham (Williams 1969:194): "They are strong, able people, have three blue strokes on each cheek, always dressed in deerskins, drink no spiritous liquors, and barter their furs and pelts only for necessaries such as ammunition, iron, cutlery-ware; never purchasing much cloth, beads or any other superfluous articles."

This question of the degree to which the Chipewyan were drawn to the fur trade is dealt with at some length by Smith (1976:72-86). It is Smith's contention, drawn largely from Hearne it would appear, that the Caribou Eater Chipewyan in the main strongly resisted the lure of the fur trade. As evidence he cites the usually brief and infrequent Chipewyan visits to the trading posts, their relatively simple requirements in trade goods, and in particular their very strong attachment to the region around Nueltin Lake - a lake situated on the treeline and a very good fishing lake.

This is not to say, however, that over an extended period of time the Chipewyan did not increasingly come to accept European culture and European technology. There were in fact a number of acculturative breakthroughs which made it impossible for the Chipewyan to sustain their independent traditional way of life as caribou hunters.

What cannot be denied is the presence of European culture and technology in the territory of the Chipewyan from the early eighteenth century, and that over the years there occurred a fundamental restructuring of Chipewyan life, albeit that a good many of the Caribou Eater hunting groups were able to maintain their commitment to caribou hunting as a basis of social organization well into the present century.

From the historical record it would appear that the first significant intrusion of the Hudson Bay Company into Chipewyan territory was the journey of William Stewart and the Chipewyan woman Thanadelthur in the year 1715 (Davies 1965:410-417; Morton 1973:131-133; Rich, 1967:97). This contact was followed in 1717 by Governor Knight of York Factory establishing a new fort at Churchill and sending Richard Norton inland to further secure a peace between the Chipewyan and the Cree and to encourage the Chipewyan to begin trading furs at Churchill. This was the start of a Company policy of drawing the Indians to trade at the Bay that was to last some 60 years.

There was one event which particularly alarmed the Hudson Bay Company and brought home the realization that the hard-driving "pedlars" from Montreal were bent on taking over the Athabasca fur trade. That was the presence of Joseph Frobisher at Portage du Traite on the Churchill River in the winter of 1773-74 intercepting Cree and

some Chipewyan on their way to Churchill and trading for their furs. From that time until the absorption of the Northwest Company based in Montreal by the Hudson Bay Company operating under the 1670 charter from King Charles II in 1821 was the most turbulent period in the history of the Athabasca fur trade.

Although Samuel Hearne's journies (1769-72) to the Northern Ocean had given the Hudson Bay Company a clear picture of the extent and the resources of the Chipewyan territory, it also made them aware of the fact that the resources of the fur trade were to be found within the boreal forest much more than in the transition zone or the Barrens. This fact and the presence of the Northwesters in the interior forced the abandonment of the long-standing policy of sitting on Hudson Bay and waiting for the Indians to bring in their furs. Consequently in June 1774 Samuel Hearne and Matthew Cocking moved inland to establish Cumberland House on Pine Island Lake. Nevertheless, the Montreal traders with their strategy of wintering partners who lived among the Indians had seized the initiative and were nearly always a step ahead of the Bay traders. In 1775-76 Thomas Frobisher wintered at Lac-Ile-a-la-Crosse. In 1778 Peter Pond crossed over Portage la Loche (Methy Portage) from the Saskatchewan River drainage to the Mackenzie River drainage and established a post on the Elk (Athabasca River). The fact that in the course of the winter Pond was able to trade for more than twice as many furs as his canoes could carry generated

intense excitement and in the eyes of the fur traders gave the Athabasca region the appearance of being an Eldorado. There followed a proliferation of trading posts (many of them short-lived) throughout the Saskatchewan drainage and the Mackenzie drainage. One of the most prominent, Fort Chipewyan, was built by Roderick Mackenzie of the North West Company in 1788 on the south shore of Lake Athabasca. Some years later it was relocated at its present site on the north shore of the lake.

If the presence of trading posts on the edge of their territory was a challenge to the Chipewyan way of life, the smallpox epidemic of 1781-82 had a devastating effect on many hunting groups. Although Hearne's estimate of nine tenths of the Chipewyan population being wiped out might seem too high, Hearne's reliability as an observer commands some credence. A possibility, extremely difficult to verify, is that the more remote bands of Caribou Eaters managed to escape the smallpox epidemic.

What confronts us here is one of the most challenging problems of understanding Chipewyan life - that of the acculturative effects of a very strong European presence in the region. Within the broad question of the acculturative effects of the fur trade are contained a number of very significant specific questions. These are questions which call for much more historical analysis and are beyond the scope of this thesis. For many of these however the historical evidence is

such as to allow little more than a conjectural response based on a few fragments of evidence.

It has been our goal in this thesis to attempt to elucidate the ecological niche within which the Chipewyan traditionally survived in the subarctic, and to gain some understanding of the choices they made in relation to the resources and limitations of their econiche, and of the structures and processes which constituted their social organization.

Among the significant issues requiring further analysis which arose with the onset of the fur trade are the following. It is accepted that the late eighteenth century witnessed a great expansion of Chipewyan territory into the boreal forest. What effects did this shift have on the traditional annual cycle of the Chipewyan? To what extent did their adoption of a trapping economy interfere with their established caribou-hunting economy? What effects did the more aggressive, competitive and individualistic attitudes characteristic of the fur trade economy have on the highly integrated economic and magic systems of the Chipewyan? How did the credit-based accounting system of the fur trade affect the pattern of reciprocal obligation and sharing which existed between different local hunting groups? What was the impact of the practice of the fur traders taking native wives on the Chipewyan kinship system? What effects did the much more extensive use of dog teams and the establishment of

individual trap lines have on the freedom of movement of the hunter and on his ability to hunt caribou? How did the adoption of the larger Algonkian-style canoe affect their pattern of transportation? How did the adoption of steel traps and of the flint-lock musket and later the modern repeating rifle affect Chipewyan hunting practices? What of the question of the reliability and practicality of the trade goods supplied by the fur traders? And finally, what of the impact of European law and religion on the pattern of leadership and authority and on the oecumene of the Chipewyan?

CONCLUSION

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This thesis is concerned with the traditional adaptive pattern of the Chipewyan Indians of the Canadian subarctic. As a hunting people committed to exploiting the huge migratory caribou herds of the subarctic, the Chipewyan developed a culture and a social organization which enabled them to survive over many centuries in a harsh and unyielding environment.

The challenge of understanding the traditional life style of the Chipewyan is both historical and ecological. It is my view that these two perspectives have been developing more or less independently of each other and that a fuller understanding is to be gained from their convergence. Of particular importance for Athapascan studies, in my view, was the 1966 Ottawa Conference on Cultural Ecology, which gave a clear expression of the need for a more securely based ecological perspective on the social organization of hunting societies. In this thesis I have attempted to base my analysis essentially on ecological considerations.

The conceptual framework which has been adopted for this study focuses on the ecological population (p.11 above) or the local hunting group functioning in adaptation to its environment. The natural environment is perceived in ecosystem terms (p.10 above) as a system of material exchanges among the populations of the several species and the non-living substances occurring within a demarcated area. The

interaction of diverse species populations within the ecosystem is seen as the ecological community. The central concept relating the ecological population to the ecosystem and placing it within the ecological community is ecological niche. The definition adopted is as follows (p.12above): "The niche comprises all the bonds between the population and the community and ecosystem in which it is found. These bonds include factors such as the tolerance ranges and optima for all abiotic environmental variables, the sorts of organisms that can be utilized for food by the population, as well as the organisms that feed on it, the areas in which the population can live, and the population structure of the species." Closely tied to the central concept of niche is the notion of limiting factors acting within the niche (p.13 above). Chipewyan social organization then is viewed as essentially a patterned adaptive response to the ecological niche within which they have survived over a long period of time.

The ecosystem within which the Chipewyan lived was centred on the transition zone or taiga situated between the boreal forest and the tundra. Within this ecotone (p.11 above), the Chipewyan followed an annual cycle which was closely bound to the annual cycle of the migratory caribou herds and encompassed the summer and winter ranges of the caribou. The ability of the Chipewyan to exploit other resources when the caribou failed can be understood in terms of the fact that the transition zone possesses all the characteristics of an "edge community" (p.11above).

The adaptive pattern of the Chipewyan within their econiche is analyzed in terms of three components - the exploitative pattern, the community pattern, and the settlement pattern. Although our goal is to gain some understanding of the functioning of the ecological population or local hunting group within its niche, it is the food-production process which constitutes the core of the analysis. This focus seems all the more justified with the realization that the most difficult factor confronting a hunting group in the subarctic is the uneven and unpredictable distribution of resources both in space and in time. We have tried to elucidate the Chipewyan response in terms of the choices they made and in terms of the social structures and processes which they developed to cope with this uncertainty.

The underlying principles which shaped their social organization are seen to be a moral commitment to the hunting of caribou and a conviction that hunting success depended on the skill and mobility of the hunter and on hunting magic. These principles were translated into structural terms in two ways - within the local hunting group and in the pattern of kindred-based reciprocal obligation which linked different hunting units.

The local hunting group functioned as a base camp from which the hunters ranged widely in pursuit of caribou. This meant that practically all of the routine work in the camp and also the work of moving the camp had to be done by women. The problem of a limited

number of local hunting groups having to anticipate and intercept caribou herds and so maximize food production required a pattern of simultaneous concentration and dispersal of hunting groups (Sharp's term) and required that, given the chance, a hunting group killed caribou far in excess of its own needs. The kinship-based pattern of sharing served to distribute the food equitably.

The necessity for a relatively fluid structure within the hunting group was met by a loosely-defined kinship system and a pattern of leadership and authority based on hunting success, magic and influence. A most important dynamic force within the social system lay in the periodic tension and conflict between brothers within the local hunting group and in the tension generated in periodic larger residence units due to the number of kindred obligations which demanded to be satisfied. The value of these periodic tensions within the social system lay in the fact that siblings were forced out to join other groups through marriage, thereby extending the kindred network. The tensions within the larger residence group served the purpose of putting a limit on the length of time the extended group stayed together.

The survival of the Chipewyan within their ecological niche depended above all on the survival of the local hunting group. By its nature the hunting unit had a tenuous existence, facing uncertainty of resource availability, tensions within the group and obligations to

other groups. And yet, according to Samuel Hearne, the Chipewyan faced hardship and deprivation with great equanimity. In times of plenty they rejoiced in the notion that they lived in the finest place on earth. The system of magic which permeated the oecumene of the Chipewyan appears to have been tremendously reassuring and a powerful means of unifying and validating their existence. Perhaps an indication of their success can be gained from Alexander Mackenzie's letter to his cousin Roderick, written at Fort Chipewyan on January 13, 1794: "...For I think it unpardonable in any man to remain in this country who can afford to leave it. What a pretty situation I am in this winter. Starving and alone, without the power of doing myself or anybody else any Service."

In conclusion, it might be asked where this kind of research should lead. Having in mind the hazards and limitations of ecological and historical reconstruction, it was conceded in the introduction that a full understanding of the traditional adaptive pattern of the Chipewyan is beyond attainment. The position was also taken, after Geertz and in response to the Proceedings of the Ottawa Conference on Cultural Ecology, that the adoption of a more thoroughgoing ecological perspective affords a more explicitly delineated field of inquiry within which to pursue this kind of inquiry. In surveying the ecological and historical literature, I am persuaded that there is much ground for the further development and refinement of the ecological perspective in anthropology.

Beyond these possibilities, it would seem that the hope of gaining a clearer understanding of the traditional adaptive pattern of the Chipewyan lies in a multi-disciplinary approach - in a convergence of the analytic efforts of the ecologist, the historian, the archaeologist, the linguist and the anthropologist. In all of these areas, it seems to me, the urgent need is for a great deal more fieldwork. As expressed by Ritchie, for example, there is a great need for large scale vegetational and climatological mapping of the subarctic. In Kelsall's view, there is need for more extensive efforts to identify specific caribou herds and to investigate the factors which govern caribou movement. Noble points to the urgent need to identify and to analyse additional archaeological complexes in the region. From the historical literature, little appears to have been forthcoming on the annual cycle of trading posts. There are also the questions of acculturation mentioned above (p.201). For the linguist and the kinship specialist it would seem that the need for fieldwork is most urgent. For the historian, there is undoubtedly further material to be looked at in the Hudson Bay Company archives and in police and church records. Ultimately then, on the basis of such a range of additional fieldwork, the reconstructive task is to develop a composite picture of traditional Chipewyan life.

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